# *The* GALE ENCYCLOPEDIA *of* DIETS

A GUIDE TO HEALTH AND NUTRITION

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## A GUIDE TO HEALTH AND NUTRITION

## FIRST EDITION

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2 M–Z

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# PLEASE READ—IMPORTANT INFORMATION

The *Gale Encyclopedia of Diets: A Guide to Health and Nutrition* is a health reference product designed to inform and educate readers about a wide variety of diets, nutrition and dietary practices, and diseases and conditions associated with nutrition choices. The Gale Group believes the product to be comprehensive, but not necessarily definitive. It is intended to supplement, not replace, consultation with a physician or other healthcare practitioners. While The Gale Group has made substantial efforts to provide information that is accurate, comprehensive, and up-to-date, The Gale Group makes no representations or warranties of any kind, including without limitation, warranties of merchantability or fitness for a particular purpose, nor does it guarantee the accuracy, comprehensiveness, or timeliness of the information contained in this product. Readers should be aware that the universe of medical knowledge is constantly growing and changing, and that differences of opinion exist among authorities. Readers are also advised to seek professional diagnosis and treatment for any medical condition, and to discuss information obtained from this book with their healthcare provider.

# INTRODUCTION

The *Gale Encyclopedia of Diets: A Guide to Health and Nutrition* is a one-stop source for diet and nutrition information that covers popular and special diets, nutrition basics, and nutrition-related health conditions. It also particularly addresses health and nutrition concerns across all age groups from infancy through old age. This encyclopedia avoids medical jargon and uses language that laypersons can understand, while still providing thorough coverage of each topic. The *Gale Encyclopedia of Diets: A Guide to Health and Nutrition* is not meant to be an endorsement for any one diet or lifestyle but rather it presents authoritative, balanced information.

## SCOPE

Approximately 275 full-length articles are included in *The Gale Encyclopedia of Diets: A Guide to Health and Nutrition*. Articles follow a standardized format that provides information at a glance. Rubrics include:

**Special/Popular Diets**

- Definition
- Origins
- Description
- Function
- Benefits
- Precautions
- Risks
- Research and general acceptance
- Questions to ask your doctor
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- Treatment
- Nutrition/Dietetic concerns
- Therapy
- Prognosis
- Prevention
- Resources
- Key terms

## INCLUSION CRITERIA

A preliminary list of diets and nutrition topics was compiled from a wide variety of sources, including professional medical guides and textbooks, as well as consumer guides and encyclopedias. The advisory board evaluated the topics and made suggestions for inclusion. Final selection of topics to include was made by the advisors in conjunction with Gale Group editors.

## ABOUT THE CONTRIBUTORS

The essays were compiled by experienced medical writers, including registered dieticians, nutritionists, healthcare practitioners and educators, pharmacists, and other healthcare professionals. The advisors reviewed all of the completed essays to insure that they are appropriate, up-to-date, and medically accurate.

## HOW TO USE THIS BOOK

*The Gale Encyclopedia of Diets: A Guide to Health and Nutrition* has been designed with ready reference in mind:

- Straight **alphabetical arrangement** allows users to locate information quickly.
- Bold faced terms function as *print hyperlinks* that point the reader to related entries in the encyclopedia.
- A list of **key terms** is provided where appropriate to define unfamiliar words or concepts used within the context of the essay. Additional terms may be found in the **glossary**.
- **Cross-references** placed throughout the encyclopedia direct readers to where information on subjects without their own entries can be found. Synonyms are also cross-referenced.
- A **Resources section** directs users to sources of further information.
- A comprehensive **general index** allows users to easily target detailed aspects of any topic.

## GRAPHICS

*The Gale Encyclopedia of Diets: A Guide to Health and Nutrition* is enhanced with approximately 200 full-color images, including photos, tables, and customized line drawings.

# A

## Abs diet

### Definition

The Abs diet is a six-week plan that combines nutrition and exercise. It emphasizes twelve power foods that are the staples of the diet. It focuses on building muscle through strength training, aerobic exercises, and a dietary balance of proteins, **carbohydrates**, and fat.

### Origins

David Zinczenko, editor of *Men's Health*, developed the diet in 2004. He introduced it in the magazine and in his book, *The Abs Diet: The Six-Week Plan to Flatten Your Stomach and Keep You Lean for Life*. Zinczenko says he grew up as an overweight child and at age 14, he was five feet 10 inches tall and weighed 212 pounds. He learned about fitness while in the U.S. Naval Reserve and nutrition from his tenure at *Men's Health*.

Despite its name, the diet does not specifically target abdominal fat. Exercise helps the body burn excess fat but it is not possible to target specific areas of fat, such as the abdomen. Diet and exercise will help eliminate excess fat from all over. If the bulk of a person's fat is around the belly, then that is where the greatest amount of fat-burning will occur. The Abs diet is designed to provide the necessary **vitamins**, **minerals**, and **fiber** for good health, while it promotes building muscle that helps increase the body's fat burning process.

### Description

The Abs diet developer David Zinczenko says it will allow people to lose weight —primarily fat—while developing a leaner abdomen and increasing muscle tone, strength, general health, and sexual health. The diet has two components: exercise and nutrition. There are six general guidelines that are the basic principles of the diet. These are: eat six meals a day, drink smoothies regularly, know what to drink and what not to; do not count calories; eat anything you want for one meal a week; and focus on the Abs diet twelve power foods.

The diet strongly recommends its followers eat six meals a day since it helps to maintain what researchers call an energy balance. This is the number of calories burned in an hour versus the number of calories taken in. Georgia State University researchers found that if the hourly surplus or deficit of calories is 300–500 at any given time, the body is most susceptible to burning fat and building lean muscle mass. To stay within this range, Zinczenko recommends the following daily meal schedule: breakfast, mid-morning snack, lunch, mid-afternoon snack, dinner, and evening snack.

Another guideline is to drink smoothies regularly in place of a meal or snack. Smoothies are mixtures of low-fat milk and yogurt with ingredients such as ice, **protein** powder, fruits, and peanut butter, that are prepared in a blender. Although there are no definitive studies, some researchers suggest that the **calcium** in the milk and yogurt helps to burn body fat and restricts the amount of fat produced by the body.

A third guideline details what to drink and not drink. Drinking eight glasses of **water** daily is recommended. The benefits of 64-oz of water are that it helps to alleviate hunger pangs, it flushes waste products from the body, and it delivers nutrients to muscles. Other acceptable drinks are low-fat milk, **green tea**, and no more than two glasses of diet soda a day. Alcohol is not recommended at all since it does not help to make a person feel full. It also decreases by one-third the body's ability to burn fat and makes the body store more of the fat from food. In addition, it decreases production of testosterone and human growth hormone that help burn fat and increase muscle mass.

## KEY TERMS

**Aerobic exercise**—An exorcise that increases breathing and heart rates.

**Carbohydrates**—An organic compound that is an important source of energy in humans, found in foods such as pasta, cereal, and bread.

**Cardiovascular**—Relating to the heart and blood vessels.

**Endocrinologist**—A physician who specializes in disorders of the endocrine system

**Energy balance**— The number of calories burned in an hour versus the number of calories taken in.

**Erectile dysfunction**—The inability to get or maintain an erection.

**Human growth hormone**—An amino acid that stimulates growth and cell reproduction in humans.

**LDL**—Low-density lipoprotein (LDL), also known bad cholesterol, is a fat protein that is high in cholesterol and low in protein.

**Obliques**—Types of abdominal muscle.

**Testosterone**—A male sex hormone that is responsible for secondary sex characteristics.

**Transverse abdominis**—A muscle layer of the wall of the abdomen.

**Urologist**—A physician that specializes in disorders of the urinary tract and male genitals.

**Vegan**—A vegetarian who excludes all animal products from the diet.

Although burning calories is required to lose fat, Zinczenko says calorie counting makes people lose focus and motivation. The foods allowed on the diet are energy-efficient and will help dampen feelings of hunger, according to Zinczenko.

Another guideline is that dieters are allowed to cheat for one meal a week. The meal should include foods that the dieter misses most, including items high in carbohydrates and **fats**. This helps prevent diet fatigue that many people go though when dieting.

The last guideline is to focus on the twelve power foods of the diet to help meet core nutritional requirements. The twelve power foods are:

- almonds and other nuts (unsalted and unsmoked)
- beans (except refried and baked)
- green vegetables, including spinach, broccoli, brussels sprouts, and asparagus
- non-fat or low-fat dairy products
- instant oatmeal (unsweetened and unflavored)
- eggs and egg substitute products
- lean meats, including turkey, chicken, fish, and beef
- peanut butter
- olive oil
- whole-grain breads and cereals
- whey protein powder
- berries

Other foods that can be eaten often include almond butter, apples, avocados, bananas, bean dips, brown rice, Canadian bacon, canola oil, cashew butter, citrus fruit and juices, edamame, fruit juices (sugar-free), garlic, hummus, lentils, mushrooms, melons, pasta (whole-wheat), peaches, peanut oil, peas, peppers (green, yellow, and orange), popcorn (fat-free), pretzels (whole-wheat), pumpkin seeds, sesame oil, shellfish, soup (broth-based), sunflower seeds, sweet potatoes, tomatoes, and yellow wax beans.

### *Exercise*

Adequate exercise is as important as good nutrition in losing fat and flattening the stomach in the Abs diet. It includes strength training three times a week, abdominal exercises two or three days a week, and optional aerobic exercises two or three times a week. There are three basic principles to the exercise program: leave at least 48 hours between weights workouts of the same body part; do no exercises one day a week; and warm up for five minutes before exercising by jogging lightly, riding a stationary bike, jumping rope, or doing jumping jacks. There are three components of the plan that target different types of exercise:

- Strength training—Total-body workouts three days a week, with one workout placing extra emphasis on the leg muscles.
- Cardiovascular exercises—Do these twice a week in-between strength training days. Activities include cycling, running, swimming, brisk walking, and stair climbing.
- Abdominal (ab) exercises—Do ab exercises two or three times a week, before strength training workouts.

**GETTING STARTED.** People who are not already exercising should do light strengthening exercises three days a week for the first two weeks. One sample routine is to alternate between three sets of eight to 10 pushups and three sets of 15–20 squats with no weights. Rest for one minute between sets. When it

becomes easy to do 10 or more pushups and 20 or more squats, increase the number of pushups and add weights to the squats, using either a barbell or dumbbells. The weights routine should be followed by 30 minutes of brisk walking.

People who already exercise regularly should consider switching from their current workout routine to the Abs diet workout for at least the first few weeks, according to Zinczenko. For maximum results, it is best to change the workout routine every month to keep the body from adapting to a repetitious routine that can slow muscle development. The Abs diet suggests the basic workout be done on Mondays and Wednesdays, starting with one set of an ab exercise from each of the five categories of abdominal regions. Follow this with two circuits of one set of the core exercises in the order listed. On Tuesdays and Thursdays, do 20–30 minutes of cardiovascular exercise. On Friday, do the Monday through Wednesday workout but instead of the ab exercises, traveling lunges, 10–12 reps, and step-ups, 10–12 reps each leg. Do two complete circuits.

**ABDOMINAL EXERCISES.** These exercises strengthen the abdominal muscles in five regions: upper abs, 12–15 reps; lower abs, 6–12 reps; obliques, 10 each side; transverse abdominis, 5–10 reps; and lower back, 12–15 reps. The following are exercises for each of the five abdominal regions. Upper abs: traditional crunch and modified raised-feet crunch; lower abs: figure-eight crunch and bent-leg knee raise; transverse abdominis: two-point bridge and Swiss ball pull-in; obliques: medicine ball torso rotation and two-handed wood chop; lower back: twisting back extension and Swiss ball Superman.

**CORE EXERCISES.** These are the basic exercises that promote muscle strength: squat, 10–12 repetitions (reps); bench press, 10 reps; pulldown,10 reps; military press,10 reps; upright row,10 reps; triceps pushdown, 10–12 reps; leg extension, 10–12 reps; biceps curl, 10 reps; and leg curl,10–12 reps.

## Function

The primary purpose of the Abs diet is to help people, especially men, develop a lean, flat, and hard stomach—referred to in fitness circles as a 'six-pack'—and to maintain a healthy weight and lifestyle. The diet is designed to promote a longer and healthier life by helping prevent **cancer**, heart disease, high blood pressure, diabetes, and other diseases. These diseases are more prevalent in overweight and obese people compared to people who maintain a normal or below normal weight. The diet is also designed to promote a healthier sex life in men since some of the causes of erectile dysfunction are **obesity**, heart disease, and diabetes.

## Benefits

Excessive fat, especially around the belly, is a major risk factor for heart disease, high blood pressure, high LDL (bad cholesterol), diabetes, erectile dysfunction, and other diseases. By reducing or elimination excess body fat, people can live healthier and longer lives. The health benefits increase when regular exercise is added. People on the Abs diet can expect to lose up to 12 pounds in the first two weeks followed by 5–8 pounds in the next two weeks, according to Juliette Kellow, a registered dietician who reviews diets for the Website Weight Loss Resources (<http://www.weightlossresources.co.uk>).

Most diets include cardiovascular (aerobic) exercise as part of a weight loss routine. Studies have shown that people who engage in aerobic exercise burn more calories than people who did strength training, or weightlifting. However, additional research indicates that the fat-burning metabolic effects of aerobic exercise lasts 30–60 minutes while the metabolic effect of strength training lasts up to 48 hours. Also, the Abs diet promotes increased muscle mass, which increases **metabolism** so that the body burns up to 50 calories per day for every pound of muscle. So adding 10 pounds of muscle can burn up to 500 extra calories each day.

## Precautions

Overall, the diet is healthy and poses no known dangers. Some of the items listed in the 12 power foods can contain high amounts of **sodium**, such as canned and frozen vegetables, instant oatmeal, and peanut butter. People who want to limit salt intake or who have high blood pressure may want to avoid these food. Since exercise is a main component of the diet, people with arthritis or back, knee, or other joint problems should discuss the diet with their physicians before starting exercise. People who are allergic to peanuts or nuts should avoid food containing these products.

The diet does not address if it is suitable for vegetarians or vegans. Menus in the book do not have meatless options. However, eight of the 12 power foods do not contain meat or animal products. All of the protein required in the diet can be obtained by adding more beans and legumes to the diet and replacing meat with **soy** protein sources, such as tofu and meat substitutes that are high in protein. Brands

## QUESTIONS TO ASK YOUR DOCTOR

- Am I healthy enough to do the exercise routine required on the Abs Diet?
- Will I need any dietary supplements if I adopt the Abs Diet?
- Do you see any health risks for me in the diet?
- Are there any other diets you would recommend that would help me accomplish my goals?
- Have you treated other patients who are on the Abs Diet? If so, what has their response to the diet been?

Morningstar Farms, Boca, and Gardenburger make meatless burgers, hot dogs, chicken breasts and strips, and other items.

### Risks

Since the diet includes a rigorous and regular exercise program, people with heart disease or certain other health problems should consult their physicians before going on the diet. Men with erectile dysfunction should discuss their condition with their physicians, urologists, or endocrinologists. Also, one of the 12 power foods is nuts, so people with peanut or other nut allergies should eliminate or modify the nut component of the diet.

### Research and general acceptance

There is no specific research that proves the Abs diet delivers on what it promises: fat loss, muscle increase, increased sex drive, and six-pack abs. It is also unclear whether the diet will maintain a healthy weight once the initial weight is lost. The book contains many anecdotal stories of success but there are no scientific studies that document the claims.

In an article in the October 2004 issue of *Health*, registered dietician Maureen Callahan comments on the merits of the Abs diet, calling it an overall good diet and exercise plan. She adds that the diet is mostly healthy but she questions its promotion of protein powder, one of the diet's 12 power foods. She says people can get extra protein by eating low-fat cottage cheese or a few additional ounces of lean meat or fish.

### Resources

#### BOOKS


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Zinczenko, David. "Abs Diet." *Men's Health* (July-August 2004), 154.

**ORGANIZATIONS**

American College of Nutrition. 300 South Duncan Ave., Suite 225, Clearwater, FL 33755. Telephone: (727) 446-6086. Website: <http://www.amcollnutr.org>.

American Dietetic Association. 120 South Riverside Plaza, Suite 2000, Chicago, IL 60606-6995. Telephone: (800) 877-1600. Website: <http://www.eatright.org>.

American Society for Nutrition. 9650 Rockville Pike, Bethesda, MD 20814. Telephone: (301) 634-7050. Website: <http://www.nutrition.org>.

Center for Nutrition Policy and Promotion. 3101 Park Center Drive, 10th Floor, Alexandria, VA 22302-1594. Telephone" (703) 305-7600. Website: <http://www.cnpp.usda.gov>.

Ken R. Wells

**Possible causes of acne**

- The hormone increase in teenage years (this can cause the oil glands to plug up more often)
- Hormone changes during pregnancy
- Starting or stopping birth control pills
- Heredity
- Some types of medicine
- Greasy makeup

SOURCE: National Institute of Arthritis and Musculoskeletal and Skin Diseases, National Institutes of Health, U.S. Department of Health and Human Services

*(Illustration by GGS Information Services/Thomson Gale.)*

# Acne diet

## Definition

The acne diet or more accurately, the acne-free diet, is simply a way of eating claims to improves or eliminates acne. There is some debate in the medical community about the impact of diet on acne; however, there is a body of evidence to support the idea that what is eaten may affect the skin.

By reviewing research from over 40 years, doctors such as dermatologist, Dean Goodless have developed a set of recommendations regarding foods that may prevent acne. In his book *The Acne-Free Diet Plan*, Dr. Goodless presents his recommendations. He suggests eating a diet low in fat and high in **fiber** along with avoiding peanut product, fried foods, excessive salt, dairy products, foods that are high in refined sugars, and high carbohydrate foods.

## Origins

As long as people have had pimples, there have been attempts to clear them up quickly or prevent them all together. Most cultures have folk remedies to help clear the skin. It wasn't until the last 50 years that serious scientific research has been conducted to confirm or disprove these folk tales and myths. One of the earliest studies about food and acne focused on chocolate. This study found that chocolate did not increase acne breakouts. Other studies since have confirmed this finding.

For the most part, acne treatment has been the emphasis of research; however, there have been isolated studies that explored the effect of specific vitamin and mineral supplements on acne. Other studies have investigated ethnic groups and communities from the Pacific Islands to Africa where there is little or no incidence of acne, even during puberty. When the diets of these people are compared to the typical Western diet, there are nutritionally significant differences. The ethnic groups with very low incidence of acne ate predominately plant-based diets that were low in fat and virtually sugar-free. The typical Western diet is heavy in meats, saturated fat, refined sugar, and highly processed foods. By studying these differences, doctors and researchers have developed suggestions for dietary changes to improve or eliminate acne.

## Description

Integrating the results of many studies, dermatologists and nutritionists have developed a list of foods to avoid and beneficial **vitamins** and **minerals** to consume. The following acne diet has been proposed to help prevent acne breakouts:

- Eat 20 to 30 grams of fiber every day–Fiber helps keep the colon clean and may remove toxins from the body before they reach the skin.
- Eat a low fat diet–The cultures whose natural diet was low in fat, had less acne, and high fat consumption may elevate hormone levels in the body that cause blemishes on the skin.
- Avoid peanut products–Peanut products were found to cause acne flare ups in a study of 500 adolescents.
- Avoid fried foods—Fried foods were found to caused break outs.
- Limit salt intake especially table salt or iodized salt–Many people with acne have elevated levels of iodine, found in table salt, in their blood stream during acne flare ups.
- Avoid highly salty sacks such as chips, lunch meats, canned foods, and salted popcorn–These foods are high in salt and, in some cases, fat.

## KEY TERMS

**Acne Vulgaris**—An inflammatory disease of the skin characterized by pimples and cysts that may cause scarring in severe cases.

**Carbohydrate**—An organic compound that supplies energy to the body.

**Dermatologist**—A doctor who specializes in the treatment of the skin.

**Glycemic index**—A scale for rating how quickly foods are converted to glucose or sugar by the body. It describes the impact on insulin levels of foods as they are digested.

**Hormone**—Substances in the body that regulate a process such as metabolism or growth.

**Insulin**—A hormone that regulates the conversion of food into glucose or sugar so it can be used by the body for energy.

**Metabolism**—The process by which food is converted into energy.

**Nutritionist**—A specialist in the field of diet and nutrition.

**PreMenstrual**—The days prior to menstruation in a woman.

**Sebaceous glands**—Small glands in the skin, usually part of hair follicles, that produce a fatty substance called sebum.

**Sebum**—The fatty substance secreted by sebaceous glands. It helps moisturize and protect skin and hair.

- Avoid dairy products such as milk, cheese and ice cream
- Avoid highly processed carbohydrates such as sodas, candy, and baked goods–High carbohydrate foods raise the level of insulin in the blood and elevated insulevel may raise the levels of acne–causing hormones in the body.

In addition to following the acne diet suggestions, taking the following supplements are proposed to also help prevent acne:

- Vitamin A (may be toxic consult your doctor first)
- Vitamin E
- Vitamin $B_6$
- Selenium
- Zinc
- Omega-3 Fatty Acid
- Chromium

### Function

Opinions vary in the medical community as to whether or not diet plays a significant role in acne. Some common misconceptions about the connection between food and acne breakouts have been disproved. For example, according to several studies, chocolate does not cause acne.. Acne is caused when glands in the skin called sebaceous glands begin to form sticky oil called sebum. These glands are stimulated by hormones that become active at puberty which is why acne occurs most often in adolescence when these hormones are produced in abundance. The oils formed by the sebaceous glands hold dead skin cells preventing them form being sloughed off. As these cells die, they create the perfect environment for bacteria to grow. When these bacteria called Acne Vulgaris become too plentiful, they will attempt to erupt from the skin causing a pimple. Sometimes, when the bacteria grow, the body sends white blood cells to fight the infection. This natural reaction can cause painful, large cysts to form in the deeper layers of skin. Chocolate may not cause acne, but the fat and sugar that usually accompanies chocolate may.

Eliminating certain foods from the diet and increasing the amount of specific vitamins and minerals may help reduce the amount of sebum produced and prevent acne breakouts. However, the interaction between diet and acne is not a simple cause and effect relationship. If an oily food is eaten, the oil does not travel to the skin or cause it to be oily, but high levels of fat in the blood may effect the production of hormones such as testosterone. Higher levels of hormones may cause acne to worsen.

Many high carbohydrate foods are believed to worsen acne. Researchers have discovered that high carbohydrate foods increase the levels of insulin in the blood. High levels of insulin can raise hormone levels in the blood.

Researchers recognize that not all **carbohydrates** are bad. Some carbohydrates digest more slowly than others, causing a gradual rise in blood sugar after eating. Researchers have developed a glycemic index to rank carbohydrates and other foods according to the effect they have on blood sugar.

The glycemic index is a scale of 0–100. Foods with higher glycemic index ratings break down quickly and cause a sharp spike in blood sugar. When blood sugar rises quickly, the body produces a surge of insulin to lower the amount of glucose in the blood. Insulin is a hormone that helps the body take sugar (glucose) out of the bloodstream and put it into cells, where it can be

used for energy or stored in fat. Foods with lower glycemic index ratings break down more slowly. They cause a more gradual rise in blood sugar, which means less insulin will be needed.

Foods that have a high glycemic index rating include: white bread, white rice, white potatoes depending on how they are cooked, beer, corn products and some products containing refined sugars. Foods with moderate glycemic index ratings include: whole grain breads and pastas, brown rice, sweet potatoes, green peas, many fruits (especially when eaten alone) and yogurt. Many of these foods are on the list of foods to avoid in the acne diet.

Low glycemic index or no GI foods include: rye grain, nuts, legumes such as black beans and lentils, green vegetables, apricots, and cherries. These foods may be enjoyed an may not worsen acne.

Foods that are high in fiber tend to have lower glycemic index numbers, because fiber takes longer to digest. Studies have shown that the presence of other foods such as **fats** like olive oil, can also slow digestion and keep blood sugar from rising too quickly. The glycemic index can be used along with the acne diet, to help choose which carbohydrates can be eaten with the least effect on blood sugar.

## Benefits

Even if many dermatologists do not believe dietary changes will improve acne, they see little harm in adopting a diet that encourages eating fruits and vegetables and limits processed and high sugar foods.

Eating foods low on the glycemic index may help prevent other medical conditions such as diabetes, heart disease, and **obesity**.

## Precautions

Limiting the amount of dairy products in the diet may limit the amount of **calcium** consumed, for that reason, a calcium supplement may be needed to insure daily dietary calcium requirements are met. Poor intakes of calcium can be very damaging to one's health.

**Zinc** supplements can cause stomach upset. Authors of acne diet plans recommend no more than 30mg of zinc per day to avoid this.

**Vitamin A** is a fat soluble vitamin. That means that excess vitamin A is stored in your body rather than eliminated in your urine. Too much vitamin A can be harmful. Consult a doctor before taking vitamin A supplements.

## QUESTIONS TO ASK THE DOCTOR

- What type of acne do I have?
- Will this diet improve my acne?
- Can this diet hurt me?
- Will this diet make my acne worse?
- How long do I need to follow this diet?

Pregnant women or those who may become pregnant should not take vitamin A supplements. Excessive amounts of vitamin A may cause birth defects in the unborn children of women who consume too much vitamin A.

## Risks

There are few risks associated with an acne diet. Most relate to taking zinc, vitamin A, and calcium. Zinc may prevent the body from absorbing enough copper. To avoid this, take a supplement that specifically states that it does not prevent copper absorption.

High doses of vitamin A can be toxic. Many acne prescriptions contain concentrated forms of vitamin A. Consult a doctor before taking vitamin A supplements.

Limiting intake of calcium can cause deficiency and significant health problems. Supplementation may be necessary.

High doses of vitamin A can cause birth defects if taken during pregnancy. Pregnant women should, under no circumstances take vitamin A supplements or medications containing vitamin A.

## Research and general acceptance

### *General acceptance*

While most dermatologists will not confirm that altering diet may prevent acne, it is standard practice for many doctors to advice patients to avoid foods that seem to cause more severe breakouts.

It is widely accepted that supplements such as zinc and vitamin A help reduce the number and severity of acne breakouts. In fact, Acutane and Retin A, popular prescription medications used to treat acne are both made from forms of vitamin A.

### *Research*

Early studies about diet and acne focused on specific foods believed to trigger acne breakouts. Most of

these studies found no evidence that individual foods cause acne.

Studies of the diets of ethnic groups that have a low incidence of acne form the basis of most of the acne diets. Studies of the diets of tribes in New Guinea, Paraguay, and the Bantu of South Africa, all of whom have little or no acne, show that they eat a primarily plant-based diet. Similarly, in other countries where the diet is plant-based such as Japan, there is a relatively low occurrence of acne.

Studies have shown that half of acne patients tested had abnormal glucose levels, and in another study, 80%of premenstrual women with acne had abnormal glucose **metabolism**. These data and others that show a high carbohydrate diet increases the levels of testosterone in the blood of both men and women, have lead to the recommendation of reducing the amount high carbohydrate foods or foods containing high levels of refined sugar to treat acne.

Researchers have developed a method for measuring how quickly carbohydrates are converted into glucose. The more rapidly a food is converted to glucose, the higher the level of insulin is secreted into the blood. The scale is called the glycemic index. Eating lower glycemic index foods may help reduce the number and severity of acne breakouts.

A large study of over 45,000 nurses found a link between the amount of dairy products these women consumed and the severity of acne they experienced. Women who reported consuming higher amounts of dairy products reported more severe acne. Similarly, the two ethnic groups with little or no acne also consumed no dairy products.

Several studies have compared the results of zinc supplementation with oral antibiotic therapy to resolved acne and found zinc to be almost as effective as the antibiotic tetracycline.

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# ADHD diet

## Definition

Attention deficit **hyperactivity** disorder (ADHD) is defined as the combination of inattentive, hyperactive and impulsive behavior which are severe, developmentally inappropriate, and impair function at home and in school. Common features include mood swings, anxiety, impulsivity, hostility, poor concentration and sleeping disorders, along with physical complaints such as headaches, migraines, and stomach upsets. ADHD individuals are also more likely to have been of low birth weight and to have allergies or auto-immune problems. Proportionally more males than females are affected, with inattention tending to be a more female trait and hyperactivity more common in males.

ADHD does persist into adulthood, although symptoms tend to diminish with time, but the main focus relates to the problems of children with ADHD. Growing children are especially vulnerable to nutritional and environmental factors that influence brain development and function, which can have either a negative or positive impact. The symptoms of this difficult condition can also significantly compromise their education, making them challenging to teach and consequently having a deleterious effect on their

**Possible causes of ADHD-like behavior**

- A sudden change in the child's life—the death of a parent or grandparent; parents' divorce; a parent's job loss
- Undetected seizures, such as in petit mal or temporal lobe seizures
- A middle ear infection that causes intermittent hearing problems
- Vision problems
- Medical disorders that may affect brain functioning
- Underachievement caused by learning disability
- Anxiety or depression

SOURCE: National Institute of Mental Health, National Institutes of Health, U.S. Department of Health and Human Services

**Behaviors associated with ADHD can be caused by other factors. It is best to consult a medical professional to rule out these possibilities.** *(Illustration by GGS Information Services/ Thomson Gale.)*

life-potential. The daily challenges of living with ADHD place a huge strain on families and reduces overall quality of life for all involved.

## Origins

Back in 1981, Colquhoun and Bunday undertook a comprehensive survey of children with ADHD and discovered that many showed physical signs of essential fatty acid (EFA) deficiency, including excessive thirst, polyuria, dry hair and skin. These authors were the first to propose that fatty acid deficiency may be a factor in ADHD, and their ground-breaking work prompted more research studies and clinical trials designed to increase understanding of those nutritional factors involved in ADHD.

It has now been proposed that many developmental and psychiatric conditions, including ADHD along with dyslexia, dyspraxia, autism, depression, and schizophrenia, may involve deficiencies of certain long-chained **fats**, especially eicosapentaenoic acid ( EPA) and docosahexaenoic acid (DHA). Both **iron** deficiency and **zinc** deficiency have also been associated with the development of ADHD.

## Description

### *Dietary Fats*

Fats have a fundamental structural and functional role in the brain and central nervous system (CNS) and are a key factor in the development ADHD. The two fats that are thought to be especially important are EPA and DHA, not only because of their role in the brain and body but because of the relative lack of them in many people's diets. EPA is the precursor of a complex group of substances, called eicosanoids, which perform numerous regulatory functions in the brain and body. DHA is a major 'building block' of brain and neuronal membranes and as such has a profound influence on cell signalling. Both EPA and DHA are omega-3 fats and can be made from the omega-3 essential fatty acid, alpha linolenic acid (ALA). However, this conversion process can be problematic as genetic and environmental factors, including diet, can cause great variation in an individual's constitutional ability to convert ALA into EPA and DHA. Dietary factors known to adversely affect this conversion include low intakes of ALA, high intakes of omega-6 fats, saturated fat, hydrogenated fat and alcohol, in addition to vitamin and mineral deficiencies, testosterone and stress hormones. Unfortunately, many dietary surveys have revealed that a typical modern-day diet is rich in omega-6 fats, saturated fats and hydrogenated fats and often low in omega-3 fats and micronutrients. ADHD children are often found to be deficient in iron and zinc and the fact that more boys than girls tend to be affected may be partly explained by the negative effect of testosterone on this conversion process.

In order to avoid a functional deficiency of these important fats, the diet should have a smaller ratio of the omega-6 essential fat, linoleic acid (LA) to omega-3 essential fat (ALA), at an ideal ratio of no more than 5:1, as well as adequate amounts of pre-formed EPA and DHA. The richest dietary sources of LA are certain vegetable and seed oils, including sunflower, safflower, soya, palm, peanut and sesame, all of which should be eaten in good amounts along with oils that are rich in ALA such as rapeseed (canola), **flaxseed** (linseed) and walnut oil. Olive oil is also recommended, despite having quite a low ALA content, as it is rich in beneficial monounsaturated fats. Looking at types of spreading fat available, many margarines have been specifically formulated to be rich in ALA, although some brands still contain harmful hydrogenated fats, but it is worth remembering that butter actually has a low LA content and when mixed with equal quantities of rapeseed or olive oil, the saturated fat content is much reduced. Other sources of ALA include green, leafy vegetables such as rocket, watercress and spinach as well as fresh green herbs, such as basil, coriander, mint and parsley. Consequently, the food products of animals allowed to graze on open pasture will also be rich in ALA and so organic, free-range and outdoor-reared meat, milk and eggs are the best choice.

When it comes to sources of EPA and DHA, fish and seafood are the best sources with oily fish , such as salmon, trout, mackerel, sardines, herring and anchovies, being especially rich. Fresh tuna is classed as an

## KEY TERMS

**Autism**—Autism, or autistic spectrum disorder (ASD), is a serious developmental disorder, characterized by profound deficits in language, communication, socialisation and resistance to learning.

**Auto-immunity**—A response, involving the immune system, that results in a person's own tissues being attacked.

**Benzoic Acid**—A type of preservative used in processed foods known to cause food sensitivity in some individuals when consumed in the diet.

**Carnitine**—This is a naturally occurring substance, needed for the oxidation of fatty acids, a deficiency of which is known to have major adverse effects on the CNS.

**Dietitian**—A Healthcare Professional, qualified to degree or post-graduate level, who advises individuals on diet and nutrition as part of a treatment strategy for particular medical conditions or for disease prevention.

**Dyslexia**—An inherent dysfunction affecting the language centres of the brain which results in difficulties with reading and writing.

**Dyspraxia**—A developmental disorder that affects co-ordination and movement.

**Elimination Diet**—A diet consisting of a limited range of foods, classed as low risk in terms of causing food sensitivity or allergy.

**Essential Fatty Acid**—A type of fat that is necessary for the normal function of the brain and body and that the body is unable to produce itself, making them 'essential' to be taken through the diet and / or supplements.

**Ferritin**—Iron is stored in the body, mainly in the liver, spleen and bone marrow, as ferritin.

**Functional Deficiency**—The depleted state of a particular nutrient that precipitates compromised function within the brain or body.

**Hydrogenated Fats**—A type of fat made by the process of hydrogenation, which turns liquid oils into solid fat. Bio-hydrogenation occurs in ruminant animals (eg. cows) and so small amounts of hydrogenated fats are found in butter, dairy foods and meat but these are accepted as being harmless. The commercial hydrogenation of oils produces large quantities of hydrogenated fats and have been implicated in the development of coronary heart disease and impaired cell signalling in the brain.

**Lipid Peroxidation**—This refers to the chemical breakdown of fats.

**Neurotoxic**—A substance that has a specific toxic effect on the nervous system.

**Oxidative Injury**—Damage that occurs to the cells and tissues of the brain and body by highly reactive substances known as free radicals.

**Polyuria**—An excessive production of urine.

**Sodium Benzoate**—A type of preservative used in processed foods known to cause food sensitivity in some individuals when consumed in the diet.

**Sodium Metabisulphite**—A type of sulphite preservative used in processed foods known to cause food sensitivity in some individuals when consumed in the diet.

**Sulphites**—A type of preservative used in processed foods known to cause food sensitivity in some individuals when consumed in the diet.

**Sulphur Dioxide**—A type of preservative used in processed foods known to cause food sensitivity in some individuals when consumed in the diet.

**Vanillin**—A synthetic version of vanilla flavoring.

oily fish but the canning process causes a significant loss of fatty acids so tinned tuna has an EPA and DHA content comparable to white fish, such as cod, haddock and plaice. Certain varieties of fish are more likely to contain large amounts of pollutants such as mercury and lead which are known to be neurotoxic and so it is prudent for people with ADHD, and all children under 16 years of age, to avoid eating shark, marlin and swordfish. DHA can also be found in liver and egg yolks and so these foods should be incorporated into the diet regularly, unless you are taking a nutritional supplement that contains **vitamin A** in which case you should not eat liver or foods containing liver such as pâté.

A general recommendation of a combined daily dose of 500 mg EPA and DHA is needed to avoid functional deficiency of these important fats, although individuals with ADHD may have an even higher requirement. This weekly total of 3,500 mg is the equivalent of ~3 portions of salmon every week. In

the UK, the recommended amount per week for girls and women of childbearing age is two and for boys, men, and women past childbearing age is four. The relative amounts of EPA and DHA does vary greatly between varieties of fish , with mackerel providing 2700 mg per average portion and haddock providing a much lower 170 mg for a medium sized fillet. For many people this variability in EPA and DHA intake is unlikely to have significant consequences as long as fish is regularly consumed , but for individuals with ADHD it may compromise brain function. For this reason pure fish oil supplements that provide a daily standard dose of EPA and DHA are useful in addition to a diet containing fish and seafood. Increasing evidence from well designed clinical trials have indeed shown that supplementation with EPA and DHA alleviate ADHD-related symptoms in some children. These supplements also have the advantage of being relatively safe and offering general health benefits, specifically in terms of cardiovascular protection. Although pure fish oil supplements may be beneficial in some individuals with ADHD it is important to note that more research needs to be done to fully establish the durability of any treatment effects as well as optimal dosages and formulations.

### *Dietary Antioxidants*

If intakes of long-chained polyunsaturated fats (PUFAs), such as EPA and DHA, increase then so does the risk of lipid peroxidation by the action of harmful free radicals, smoking, and pollutants, etc.; substances produced in the body by normal processes such as breathing and **metabolism**. PUFAs are highly susceptible to attack from these reactive substances and need the protection of **antioxidants** to avoid getting damaged and thus affecting the structure of the lipid membranes of the brain and CNS. When free radical production is insufficiently countered by antioxidants the resultant damage to the brain and body is termed 'oxidative injury'.

Dietary antioxidants include nutrients such as **vitamin E** and **selenium** as well as biologically active substances such as flavonols, anthocyanins and **carotenoids**, found in highly colored fruits and vegetables, nuts, tea and red wine. Vitamin E is naturally found in PUFA-rich foods like oils and nuts whilst selenium is found in fish, seafood, liver, egg, brazil nuts, mushrooms and lentils. Eating the recommended daily minimum of 5 portions of fruit and / or vegetables should provide adequate amounts of complementary dietary antioxidants, especially if a wide range of colors and varieties are chosen.

### *Dietary Iron*

Iron deficiency has been associated with ADHD in children and tends to be worse even when compared with iron-deficient non-ADHD controls. Lower serum ferritin levels correlate with more severe ADHD symptoms and greater cognitive deficits.

Dietary sources of iron include red meat, fortified breakfast cereals, pulses and dried apricots and these foods should feature regularly in the ADHD diet. Additional supplementary iron may be required in cases of proven iron deficiency.

### *Dietary Zinc*

Zinc has a range of important functions in the body, including the metabolism of neurotransmitters and fatty acids, with zinc deficiency possibly having an effect on the development of ADHD. Children with ADHD who have been treated with supplementary zinc have exhibited reduced hyperactive, impulsive and impaired-socialisation symptoms.

Foods known to be rich in zinc include seafood, liver, pine nuts, cashew nuts and wholegrain cereals and so should be eaten regularly to help avoid deficiency.

### *Synthetic Food Additives*

Certain synthetic food colorings, flavorings and preservatives, have been linked to increase hyperactivity in some ADHD and non-ADHD children. Many of these additives are unnecessary and are frequently used to sell poor-quality foods, that are often marketed specifically at children.

The following additives have been implicated in adverse reactions:

- E102
- E104
- 107
- E110
- E122
- E123
- E124
- 128
- 133
- E142
- E150
- E151
- E154
- E155
- E180

- E220
- E221
- E222
- E223
- E224
- E226
- E227
- E228
- benzoic acid
- sodium benzoate
- sodium metabisulphite
- sulphur dioxide
- vanillin

### Function

The ADHD diet works by providing the right type and amount of fats needed for the brain and CNS as well as providing sufficient amounts of iron and zinc to avoid nutritional deficiencies that are known to be associated with worsening ADHD symptoms. Nutritional supplements should be taken upon the advice of a Doctor or Dietitian and taken in addition to a healthy, balanced diet. Dietary provision of antioxidants are needed to protect the long-chained fats from breakdown which would affect brain structure and compromise signalling within the brain and CNS. Finally, the ADHD diet excludes those synthetic food additives that have been identified as having the potential to adversely affect the behavior of ADHD, and non-ADHD children alike.

### Benefits

The key benefit of the ADHD diet is that it provides the correct types of foods needed to support the nutritional requirements of both the brain and body. It provides the nutrients needed to sustain good growth and development in children, as well as general health promotion for all, whilst excluding potential antagonistic additives. The diet supports other treatment strategies, including stimulant medication, and so helps to improve the quality of life and educational possibilities of those individuals affected.

### Precautions

Detailed, personalized advice should always be sought from a suitably qualified dietitian, especially when dealing with children. Any nutritional supplements should always be taken according to the manufacturers instructions and at the prescribed dosage. If other medication is being taken then advice should be sought from a doctor.

#### QUESTIONS TO ASK YOUR DOCTOR

- Which nutritional supplements are recommended for ADHD?
- What are the best food choices for ADHD?
- Which food additives should be avoided?
- What are the vegetarian sources of omega 3 fats?

### Risks

It has been reported that fish oil supplements when taken along side stimulant medication can exacerbate hyperactive behavior in some ADHD individuals. In these circumstances, the supplement should continue to be taken and the dosage of the medication be altered accordingly, under the supervision of a Doctor.

Fish oil supplements can also reduce blood clotting times and so should not be used if anti-coagulant medication is already being taken.

There is no risk attached to the ADHD diet in terms of foods chosen and the diet can be safely followed by ADHD and non-ADHD individuals alike.

### Research and general acceptance

Among the specialists working in this particular field, there is a general consensus that ADHD is a disorder that involves a functional deficiency of the long-chained fats, EPA and DHA that frequently coexists with zinc and iron deficiencies. Among the wider community there remains a great deal of scepticism about ADHD and the role that diet has in its development or management.

In terms of supplementation, insufficient data is available to formulate a standardized treatment strategy and it is unclear whether the micronutrient deficiencies are a cause of, or secondary to, ADHD. Other intervention studies have looked in to carnitine supplementation and **elimination diets** but their findings remain inconclusive.

It is certainly well accepted that there is still very much more to be learned about ADHD and how nutrients interact to either exacerbate or improve ADHD-related symptoms. More research is planned

and hopefully more useful findings will help improve the life of all those affected by this debilitating condition.

## Resources

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### ORGANIZATIONS

Brain and Body Nutrition www.brainandbody.co.uk

British Dietetic Association 5th Floor Charles House 148/9 Great Charles Street Queensway Birmingham B3 3HT www.bda.uk.com

Food Standards Agency www.food.gov.uk

Freelance Dietitians Group (UK) www.dietitiansunlimited.co.uk

Emma Mills, RD

# Adolescent nutrition

## Definition

Nutrition describes the processes by which all of the food a person eats are taken in and the nutrients that the body needs are absorbed. Good nutrition for adolescents can help prevent disease and promote proper health, growth, and development.

Adequate intakes of **vitamins** and **minerals** are an important part of nutrition. Vitamins are organic substances present in food. They are required by the body in small amounts to regulate **metabolism** and to maintain normal growth and functioning. Minerals are vital because they are the building blocks that make up the muscles, tissues, and bones. They also are

**Healthy eating at fast food restaurants**

- Skip "value-sized" or "super-sized" meals
- Choose a grilled chicken sandwich or a plain, small burger
- Use mustard instead of mayonnaise
- Limit fried foods or remove breading from fried chicken, which can cut half the fat
- Order garden or grilled chicken salads with light or reduced-calorie dressings
- Choose water or fat-free or low-fat milk instead of sweetened soda

SOURCE: National Institute of Diabetes and Digestive and Kidney Diseases, National Institutes of Health, U.S. Department of Health and Human Services

*(Illustration by GGS Information Services/Thomson Gale.)*

## KEY TERMS

**Anorexia nervosa**—A serious eating disorder characterized by a pathological fear of weight gain.

**Bulimia nervosa**—A serious eating disorder characterized by compulsive overeating followed by purging by self-induced vomiting or abuse of laxatives to induce diarrhea.

**Osteoporosis**—A condition that affects bone mass, usually later in life, making bones brittle and easily breakable.

important to many life-supporting systems, such as hormones, transport of oxygen, and enzyme systems.

There are many nutrients the body absorbs from food and each of the food groups supplies at least one nutrient. For example, oat bran, which is a whole grain, can supply **fiber** and a mineral called **magnesium**. A good nutrition plan will ensure that a balance of food groups, and adequate amounts of the nutrients supplied by each group, is eaten.

## Purpose

Proper nutrition is essential to keeping teens healthy and able to grow and develop properly. Eating right also helps teens participate better in school and athletic activities. The nutritional status and health of children and adolescents has declined in recent years. Government surveys have shown that at least 16% of children and adolescents age 6 to 19 years old are considered overweight and at least 11% of adolescents now are classified as obese. In 2000, more than 16% of the population under age 18 years lived in poverty, often receiving poor nutrition as a result.

Many adolescents consume more calories than they need, yet they don't meet recommended daily intakes for a number of nutrients. Of particular concern for children and adolescents are adequate levels of **calcium**, potassium, fiber, magnesium, and **vitamin E** from the diet.

**Eating disorders** lead to poor nutritional status and can affect growth and development for teenagers of both sexes. They rank as the third most common form of chronic illness in adolescent girls, affecting as many as 5% of teenage girls.

Studies have shown that eating habits and nutrition in adolescence can affect not only adult weight, but other health issues later in life. For instance, not eating enough calcium as a teenager can increase risk of **osteoporosis** as an older adult.

Finally, adolescent nutrition is important because some teens have health problems that require special diets. Type 1 diabetes, also called juvenile diabetes, is diagnosed in as many as 13,000 children a year, often during their teens. It requires, controlling both diet and lifestyle factors which can be particularly difficult for busy teenagers. Surprisingly, increases in **obesity** mean that Type 2 diabetes, which in the past has only been diagnosed in adults, now is diagnosed with increasing frequency in adolescents as well.

## Description

The United States Department of Agriculture (USDA) and the United States Department of Health and Human Services revised the *Dietary Guidelines for Americans* in 2005. The guidelines are science-based and outline advice for choosing a nutritious diet and maintaining a healthy weight. Although the guidelines are written for adults, the nutritional elements are the same for anyone over age two years old, with key recommendations for children and adolescents. The 2005 guidelines also address physical activity and **food safety**. The USDA revised the traditional food pyramid to make it customized for individuals.

### *Basic food groups*

The following are the basic food groups included in the pyramid provided by the USDA:

- Grains. The guidelines recommend eating at least three ounces of whole grain bread, cereal, crackers, rice, or pasta every day and adolescents should be encouraged to eat whole grains often. At least one-half of all grains should be whole grains, which can

be determined by looking for the word "whole" before the grain name on the list of ingredients.

- Vegetables. The pyramid recommends eating more dark green and orange vegetables, as well as more dry beans and peas.
- Fruits. A variety of fresh, frozen, or canned fruit is good, but the USDA recommends limiting consumption of fruit juices.
- Milk, yogurt, and cheeses. The USDA recommends getting plenty of calcium-rich food from low-fat or fat-free milk. Adolescents should consume three c. per day of fat-free or low-fat milk or equivalent milk products. Teens who can't drink milk should be given lactose-free products or other sources of calcium, such as hard cheeses and yogurt.
- Meat and beans. Lean protein should come from low-fat or lean meats and poultry that is prepared by grilling, baking, or broiling. Varying choices is recommended, so that more fish, beans, peas, nuts, and seeds that provide protein are part of the diet.
- Oils and fats. Most fat sources should come from fish, nuts, and vegetable oils. Solid fats such as butter, stick margarine, shortening, and lard should be limited. Adolescents should receive no more than 25% to 35% of calories from fats.

### *Adopting a balanced eating pattern*

The **Dietary Guidelines** recommend adopting a balanced eating pattern. Using the USDA's new pyramid can help customize a plan for teens that provides adequate nutrients for needed energy, growth, and development. Teenagers often report eating high levels of junk food, sweet sodas, especially when away from home. More than one-half of adolescents do not meet the Dietary Guidelines for fruit and vegetable consumption and nearly two-thirds consume more than the recommended amount of fat. Reports also show that at least two-thirds of adolescent boys and girls have tried to lose weight using unsuccessful methods. While many efforts have been made on national and local scales to improve the nutritional selections of school lunches and vending machines, the Dietary Guidelines offer a healthy way to provide a balanced diet at home and in lunch choices brought from home.

### *Fluid*

Many adolescents ignore the role that fluids play in nutrition. It is important to moderate drinking of high-sugar beverages and fruit juices especially between meals. **Caffeine** from sodas and coffee drinks can interfere with sleep if consumed late at night, which already is a health and school performance issue for many teens. The Dietary Guidelines also say that adolescents should not drink alcoholic beverages. Adolescents need to drink an adequate amount of **water**, though they do not need to overhydrate.

### *Nutrition for strength*

Adolescents who are physically active and play sports will have different nutrition needs than typical teenagers of the same age. For example, they will require more fluids while exercising. In general, those who are very active also require more **carbohydrates** in their diets than typical teens. Carbohydrates provide energy, but they should come from whole grains and fruits, not from refined sugars.

### *Vegetarian diets*

A minority of adolescents are vegetarians, though popularity of various vegetarian diets has increased among adolescents in recent years. For the most part, teenagers can meet most nutritional requirements and achieve adequate growth with a well-planned vegetarian diet. But the trend toward **vegetarianism** has contributed to nutrient deficiencies in American adolescents because of restrictive eating in the formative years. Teens have been reported to suffer stunted growth, fragile bones, and stress fractures from lack of nutrients on vegetarian diets.

The Dietary Guidelines are designed so that vegetarians can achieve recommended nutrient intakes through careful selection of certain foods. However, research has shown that teenage girls often have low levels of nutrients such as **zinc**, **iron**, and calcium, which can be more difficult to obtain from a vegetarian diet. Only one in four teenage girls eat the recommended quantity of meat on a daily basis. Vegan and macrobiotic diets may require supplementation of for teens.

### *Processed and prepared foods*

Americans are eating out more than ever and are buying foods in the grocery store that are prepackaged. Reading labels is encouraged. In general, fresh foods are healthier than those that are packaged. Highly processed foods do not contain significant amounts of essential minerals. They often contain high amounts of **fats** and sugar, as well as **artificial preservatives** and other additives. In recent years, a major emphasis has been placed on improving the nutritional value of lunch choices in schools. At one point, about 75% of junior high and high school

students had access to vending machines, school stores, canteens, or snack bars. Nutrition experts have worked with educators to present adolescents with healthier choices at school, to decrease or change the messages of food advertising, and to better educate students in the classroom about good nutritional choices.

### *Calories and weight management*

The new guidelines and pyramid focus on the basics of calorie management. It's all about balancing energy, or the amount of calories eaten vs. the amount of calories used by the body. By managing portions, eating a balanced diet from the food groups, and not taking in too many calories on high-sugar or high-fat foods, adolescents can maintain a reasonable intake of calories. Regular physical activity can help to balance energy. Research has shown that subtracting just 100 calories a day from the diet can help manage weight. The typical soda contains 150 calories. Adults need to help teens understand that balanced eating and calorie management help manage weight, not unhealthy stretches of fasting or reliance on **fad diets**. Physical activity also helps manage weight. Encouraging more participation in sports or just spending time outside with family and friends vs. "screen time" in front of the television, computer, and video games, also can help manage weight safely.

Dieting is an important predictor of eating disorders among adolescents. Girls who practiced rigid dieting are about 18 times more likely to have eating disorders such as **anorexia nervosa**, **bulimia nervosa**, or eating disorder not otherwise specified. Teen girls who have dieted moderately are five times more likely to be diagnosed with an eating disorder. If an eating disorder is diagnosed, the adolescent will receive therapy with behavioral and nutritional approaches.

Nutritional therapy for teens with eating disorders will first correct possible malnutrition caused by the eating disorder. Refeeding must be carefully planned to avoid complications brought on by sudden increased calories and weight gain. The meal plan will be based on the Dietary Guidelines with gradual increases in calories as the teen's lean body mass increases.

Some adolescents with diabetes have been known to use doses of insulin below those recommended by their physicians to promote weight loss. Teens with Type 1 diabetes will have nutritional counseling upon diagnosis and regular checks with a registered dietician. They will have to count carbohydrates and carefully plan diet around exercise to avoid weight gain. Teens with Type 2 diabetes also will be taught how to control blood glucose levels.

## Precautions

Like adults, adolescents need to understand that it is best to achieve recommended levels of nutrients through consumption of foods instead of through vitamins and supplements. Use of supplements should be done only under the supervision of a professional medical provider who understands adolescent nutrition needs. Adolescents should understand that the best way to manage weight is through a balanced approach to eating fresh foods and through remaining physically active, not through fasting, use of drugs or supplements, or through participation in fad diets.

## Complications

Failing to eat a nutritious diet can cause growth and developmental problems in adolescents and cause long-term complications such as obesity or osteoporosis. Eating disorders can lead to serious complications in teens, including malnutrition, changes to heart function caused by starvation, stomach bleeding, and may cause depression leading to suicide. Improper management of diabetes can lead to loss of consciousness and seizures, and in the longer term, eye disease, kidney and heart disease, or nerve damage.

## Parental concerns

Parents are up against the peer pressures and constant conflicting images that adolescents get from the media. On the one hand, teens see unrealistic images of body types on television and in magazines. On the other hand, they are bombarded with advertisements for processed, convenient, and unhealthy foods. Girls also frequently read magazine articles about dieting and weight loss, a practice that leads to unhealthy weight control behaviors. Internet Web sites even provide advice to teens on how to accomplish and hide their eating disorders and what sorts of products help people with bulimia nervosa in their purging of foods.

Parents can help by promoting healthy habits at home. Teens can be encouraged to snack on healthy foods. Parents can educate their teens about nutrition and the nutrients that are essential to them as they grow. Houses with teens should have fresh fruits and vegetables on hand to hold hunger off after school. Teens also should be encouraged to participate in

sport and recreational activities or at least to replace daily screen time with walking the family dog or joining the family or friends in physical activity.

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#### ORGANIZATIONS

American Dietetic Association. 120 South Riverside Plaza, Suite 2000. Chicago, IL 60605. (800) 877-1600. <http://www.eatright.org >

National Eating Disorders Association. 603 Stewart St., No. 803, Seattle, WA 98101. (206) 382-3587. <http://www.nationaleatingdisorders.org/>

Project EAT, Eating Among Teens. University of Minnesota, 1300 S. Second St., Suite 300, Minneapolis, MN 55454 (612) 624-1818. < http://www.epi.umn.edu/research/eat/index.shtm>

Teresa G. Odle

# Adult nutrition

## Definition

Nutrition describes the processes by which all of the food a person eats are taken in and the nutrients that the body needs are absorbed. Good nutrition can help prevent disease and promote health.

**Vitamins** and **minerals** are an important part of nutrition. Vitamins are organic substances present in food. They are required by the body in small amounts to regulate **metabolism** and to maintain normal growth and functioning. Minerals are vital because they are the building blocks that make up the muscles, tissues, and bones. They also are important to many life-supporting systems, such as hormones, transport of oxygen, and enzyme systems.

There are many nutrients the body absorbs from food and each of the food groups supplies at least one nutrient. For example, oat bran, which is a whole grain, can supply **fiber** and a mineral called **magnesium**. A good nutrition plan will ensure that a balance of food groups, and the nutrients supplied by each group, is eaten.

**Percentage of healthy, overweight, and obese adults in the United States**

| Age 20 ≥ yrs. | Healthy weight BMI 18.5 to 24.9 | Overweight BMI 25.0–29.9 | Obese BMI 30 and above |
|---|---|---|---|
| All Adults | 32.9% | 34.1% | 32.2% |
| Women | 35.4% | 28.6% | 34.6% |
| Men | 30.4% | 39.7% | 31.1% |

SOURCE: National Institute of Diabetes and Digestive and Kidney Diseases, National Institutes of Health, U.S. Department of Health and Human Services

*(Illustration by GGS Information Services/Thomson Gale.)*

## Purpose

As children, nutrition is important for normal growth and development. As adults, nutrition still promotes health and reduces risk of disease. Studies have shown that Americans have gained weight largely because they eat too much and because they choose to eat the wrong foods. Good nutrition can help prevent weight gain by focusing on consuming calories that are high in nutrients, not in sugars and fat. Nutrition also plays a role in preventing and controlling diseases. For example, poor nutrition can lead to high cholesterol, which causes **coronary heart disease**. Lowering salt in the diet can control high blood pressure. People with diabetes must follow special diets to control their blood glucose levels.

Examples of people with medical conditions and diseases show the effect that certain nutrients, or a lack of certain nutrients, can have on the human body. Some specific diseases linked to poor diet and physical inactivity are cardiovascular disease, type 2 diabetes, high blood pressure, **osteoporosis**, and certain types of **cancer**. Being overweight, and especially obese, also is linked to many health problems. Eating a poorly balanced diet that is low in nutrients but high in total calories can lead to weight gain.

Special diets or nutritional therapy may be used to complement other treatments subscribed by a physician to treat particular diseases and conditions. Examples include:

- High cholesterol. Eating a diet high in fiber and low in saturated fats and cholesterol can help keep cholesterol in check.
- High blood pressure. Reducing salt and certain fats, as well as reducing overall weight, helps lower blood pressure. Special diets have been developed to lower risk of high blood pressure and heart disease.

## KEY TERMS

**Monounsaturated fat**—Fats that contain one double or triple bond per molecule. Though these fats still have lots of calories, they can help lower blood cholesterol if used in place of saturated fats. Examples of monounsaturated fats are canola oil and olive oil.

**Polyunsaturated fat**—Fats that contain two or more double or triple bonds per molecule. Examples include fish, safflower, sunflower, corn, and soybean oils.

- Diabetes. Nutrition is critical to adults with type 2 diabetes. They will have to control portions, eat regularly and eat nutrient-rich foods, along with other dietary guidelines.
- Anemia. People with anemia need to get more iron from their diets and will be encouraged to eat more foods such as soybeans, spinach, and others.

Sometimes, people who are ill need artificial nutrition to help them receive the proper nutrients. The nutrition may come in the form of special drinks that supplement their diets or even be provided through intravenous (IV) injections in a hospital or other facility.

Nutrition is important throughout adults' lives. As younger adults, good nutrition helps keep people strong as they need energy for active lives that may involve athletic pursuits and busy days filled with work and raising children. Pregnant women will need to pay particular attention to nutrition. In the middle years, proper nutrition helps prevent disease and weight gain that normally is associated with aging and lives that may become more sedentary. And as people reach their mature years, nutrition becomes critical, as many people in their later years fail to eat properly due to medical conditions and medications or social factors.

## Description

The United States Department of Agriculture (USDA) and the United States Department of Health and Human Services revised the *Dietary Guidelines for Americans* in 2005. The guidelines are science-based and outline advice for choosing a nutritious diet and maintaining a healthy weight. The 2005 guidelines also address physical activity and **food safety** and make recommendations for special population groups. Finally, calorie requirements and servings are based more on gender, age, and level of physical activity, while in 2000, the servings were more uniform for all adults. The USDA also revised the traditional food pyramid to make it customized for individuals.

### *Basic food groups*

The following are the basic food groups included in the pyramid provided by the USDA:

- Grains. The guidelines recommend eating at least three ounces of whole grain bread, cereal, crackers, rice, or pasta every day. At least one-half of all grains should be whole grains, which can be determined by looking for the word "whole" before the grain name on the list of ingredients.
- Vegetables. The pyramid recommends eating more dark green and orange vegetables, as well as more dry beans and peas.
- Fruits. A variety of fresh, frozen, or canned fruit is good, but the USDA recommends taking it easy on fruit juices.
- Milk, yogurt, and cheeses. The USDA recommends getting plenty of calcium-rich food from low-fat or fat-free milk. People who can't drink milk should turn to lactose-free products or other sources of calcium, such as hard cheeses and yogurt.
- Meat and beans. Lean protein should come from low-fat or lean meats and poultry that is prepared by grilling, baking, or broiling. Varying choices is recommended, so that more fish, beans, peas, nuts, and seeds that provide protein are part of the diet.
- Oils and fats. Most fat sources should come from fish, nuts, and vegetable oils. Solid fats such as butter, stick margarine, shortening, and lard should be limited.

**FOOD GROUPS TO ENCOURAGE.** The new guidelines encourage eating enough fruits and vegetables to stay within energy needs. Two cups of fruit and about 2 and one-half cups of vegetables per day are adequate for a person consuming 2,000 calories per day. Those eating more or less than 2,000 calories can adjust their fruits and vegetables up or down.

**FOOD GROUPS TO MANAGE CAREFULLY.** Total fat should be between 20% and 35% of calories and most fat should come from polyunsaturated and monounsaturated **fats**. Most people should consume less than about 1 tsp. of salt per day. They also should choose food and beverages with little added sugars or high-calorie sweeteners. Alcohol should be consumed in moderation, about one drink per day for women and

two drinks per day for men. Drinking alcohol with meals helps.

### *Adopting a balanced eating pattern*

The **Dietary Guidelines** recommend adopting a balanced eating pattern. Using the USDA's pyramid can help customize a plan or adults can choose the DASH eating plan. DASH is a plan that was created to help prevent high blood pressure by minimizing salt in the diet, by providing a balance of nutrients, and by keeping weight down.

### *Recommendations for specific adult populations*

Not every adult has the same nutritional needs. In addition to specific nutritional needs related to diseases or activity, the following recommendations apply to certain groups:

- People over age 50. Guidelines recommend consuming vitamin $B_{12}$ in fortified foods or supplements.
- Women of childbearing age. If a woman many become pregnant, she should eat iron-rich plant foods or those that help absorb iron, such as vitamin-C rich foods. Women in their first trimester of pregnancy should consume adequate synthetic folic acid daily from fortified foods or supplements in addition to food forms from a varied diet.
- Older adults, people with dark skin, and people not exposed to sufficient sunlight. These individuals should consume extra vitamin D from vitamin-D fortified foods and/or from supplements.

### *Getting adequate nutrients*

The actual amount of any nutrient a person needs, as well as the amount each individual gets from his or her diet will vary. Many adults do not receive enough **calcium** from their diets, which can lead to osteoporosis later in life. Other nutrients of concern are potassium, fiber, magnesium, and **vitamin E**. Some population groups also need to get more **vitamin $B_{12}$**, **iron**, folic acid, and **vitamin D**. These nutrients should come from food when possible, then from supplements if necessary.

### *Fluid*

Many adults ignore the role that fluids play in nutrition. It is important to moderate drinking of high-sugar beverages and fruit juices, as well as alcoholic beverages. Most people will get adequate hydration from normal thirst and drinking behavior, especially by consuming fluids with meals.

### *Nutrition for strength*

Adults who are physically active and who strength train or pursue athletic activities will have different nutrition needs than typical adults of the same age. For example, they will require more fluids while exercising. In general, athletes and those who are very active also require more **carbohydrates** in their diets than typical Americans. Carbohydrates provide energy, but they should come from whole grains and fruits, not from refined sugars.

### *Vegetarian diets*

Vegetarians can achieve recommended nutrient intakes by carefully choosing foods from the basic food groups. They will need to pay special attention to intake of **protein**, iron, and other vitamins, depending on the type of vegetarian program they follow. Choosing nuts, seeds, and legumes from the meat and beans group, as well as eggs if they desire, can provide enough nutrients at the proper serving level.

### *Processed and prepared foods*

Americans are eating out more than ever and are buying foods in the grocery store that are prepackaged. It is more difficult to judge the nutrients and calories in many of these foods and in general, fresh foods are healthier than those that are packaged. Highly processed foods do not contain significant amounts of essential minerals. They often contain high amounts of fats and sugar, as well as **artificial preservatives** and other additives. Many restaurants, including fast food restaurants, are trying to offer healthier selections. The USDA offers tips for eating out to help people stay within their healthy pyramid servings and portions.

### *Calories and weight management*

The new guidelines and pyramid focus back on the basics of calorie management. It's all about balancing energy, or the amount of calories eaten vs. the amount of calories used by the body. By managing portions, eating a balanced diet from the food groups and not using discretionary calories on high-sugar or high-fat foods, people can maintain a reasonable intake of calories. Regular physical activity can help use calories to provide better balance. Research has shown that subtracting just 100 calories a day from the diet can help manage weight, and eating 500 fewer calories a day can result in losing one pound per week in weight. But every individual is different and it is recommended to involve a physician or dietician in a weight loss plan.

## Precautions

Though supplementation of nutrients sometimes is necessary, physicians and dieticians recommend that nutrients come from food, not from vitamins and supplements. Excessive use of vitamins and mineral supplements can lead to serious health problems and it is best to involve a physician to ensure that supplements are being used at appropriate and safe levels. It also is best not to change a diet without the advice of a nutritional expert or health care professional. People who are chronically ill, and women who are pregnant or **breastfeeding** only should change their diets under professional supervision.

## Parental concerns

The recommendations in the Dietary Guidelines are for Americans over two years of age.

### Resources


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**ORGANIZATIONS**

American Dietetic Association. 120 South Riverside Plaza, Suite 2000. Chicago, IL 60605. (800) 877-1600. <http://www.eatright.org >

U.S. Department of Agriculture. 1400 Independence Ave. SW, Washington, D.C. 20250. (800) 687-2258. <http://www.cnpp.usda.gov >


Teresa G. Odle

# African diet

## Definition

Africa, the second largest continent in the world, is rich in geographic and cultural diversity. It is a land populated by peoples with histories dating to ancient times and cultures shaped by innumerable tribes, languages, and traditions. Because it is the birthplace of *Homo sapiens* and the land of origin for much of the world's population, the culture of food and eating in the different regions of Africa is important to people throughout the world.

**Male and female life expectancy at birth in Africa, 2004**

| Country | Male | Female |
|---|---|---|
| Algeria | 69 | 72 |
| Angola | 38 | 42 |
| Botswana | 40 | 40 |
| Burkina Faso | 47 | 48 |
| Burundi | 42 | 47 |
| Chad | 45 | 48 |
| Congo | 53 | 55 |
| Ivory Coast | 41 | 47 |
| Ethiopia | 49 | 51 |
| Gambia | 55 | 59 |
| Ghana | 56 | 58 |
| Kenya | 51 | 50 |
| Liberia | 39 | 44 |
| Mozambique | 44 | 46 |
| Namibia | 52 | 55 |
| Nigeria | 45 | 46 |
| Rwanda | 44 | 47 |
| Senegal | 54 | 57 |
| Sierra Leone | 37 | 40 |
| South Africa | 47 | 49 |
| Uganda | 48 | 51 |
| Zimbabwe | 37 | 34 |

*(Illustration by GGS Information Services/Thomson Gale.)*

## Origins

### *Early History of Africa*

The early history of man is the story of food in Africa. *Homo sapiens* evolved apart from other apes in Africa, and the adaptation of humans has been shaped by adaptations to diet. For example, some anthropologists believe that the selection pressure that led to bipedalism (walking on two legs) was an adaptation to changing environments that involved travel in search of tubers (rounded underground plant stems, such as potatoes). Africa's history includes some of humankind's earliest food production, with one of the most fertile centers located in Northern Africa, the Nile Valley. The Nile Valley historically was and continues to be a rich source of fish, animal, and plant food. In the drier African savannas, especially after the Sahara region became arid after 6000 B.C.E., nomad tribes raised cattle, goats, or sheep, which served as part of the tribes' food source. Crops that were less affected by extreme weather like cereals (such as wheat, barley, millet, and sorghum) and tubers (such as yams) slowly became popular throughout the continent and have remained important staples in the African diet today.

The African Climate and Terrain. The historic influences on the African diet began in ancient times and continue to the present day. Great geographic differences across the African continent caused much of the variety in the African diet. In addition, many

tribes and peoples migrated or traded, bringing spices and foods from each other's culture into their own. However, though each region of Africa has its distinct cuisines, African food has its basic staples.

## Description

Throughout Africa, the main meal of the day is lunch, which usually consists of a mixture of vegetables, legumes, and sometimes meat. However, though different meats are considered staples in many areas, many Africans are not able to eat meat often, due to economic constraints. Beef, goat, and sheep (mutton) are quite expensive in Africa, so these foods are reserved for special days. However, fish is abundant in coastal regions and in many lakes.

The combination of various foods is called stew, soup, or sauce, depending on the region. This mixture is then served over a porridge or mash made from a root vegetable such as cassava or a grain such as rice, corn, millet, or teff. Regional differences are reflected in variations on this basic meal, primarily in the contents of the stew. The greatest variety of ingredients occurs in coastal areas and in the fertile highlands. Flavorings and spiciness have varied principally due to local histories of trade. In the traditional African diet, meat and fish are not the focus of a meal, but are instead used to enhance the stew that accompanies the mash or porridge. Meat is rarely eaten, though it is well-liked among carnivorous (meat-eating) Africans.

Traditional Cooking Methods. Traditional ways of cooking involve steaming food in leaf wrappers (banana or corn husks), boiling, frying in oil, grilling beside a fire, roasting in a fire, or baking in ashes. Africans normally cook outdoors or in a building separate from the living quarters. African kitchens commonly have a stew pot sitting on three stones arranged around a fire. In Africa, meals are normally eaten with the hands.

### *North Africa*

The countries of North Africa that border the Mediterranean Sea are largely Muslim countries. As a result, their diet reflects Islamic traditions. The **religion** of Islam does not permit eating pork or any animal product that has not been butchered in accordance with the traditions of the faith. Like other regions of Africa, much of the diet is based on grains. However, cooking with olive oil, onions, and garlic is more common in the countries of North Africa. Notable spices include cumin, caraway, clove, and cinnamon. Flat breads are a common staple and can accompany any meal, including breakfast, which is usually porridge prepared from millet or chickpea flour. *Couscous* (made from hard wheat and millet) is often the main dish at lunch, which is the primary meal. This may be accompanied by vegetable salads. Other main dishes include *tajine*, named for the conical clay pot in which a whole meal is prepared. Lamb is cooked in tajines as well as on kabobs (roasted on a skewer). Vegetables include okra, meloukhia (spinach-like greens), and radishes. Common fruits are oranges, lemons, pears, and mandrakes. Legumes such as broad beans (fava beans), lentils, yellow peas, and black-eyed peas are also important staples. Alcoholic drinks are forbidden by Islamic tradition. Mint tea and coffee are very popular beverages in this region.

## KEY TERMS

**Anemia**—Low level of red blood cells in the blood.

**Calorie**—Unit of food energy.

**Famine**—Extended period of food shortage.

### *West Africa*

Within West Africa, there is considerable variation in the staple food. Rice is predominant from Mauritania to Liberia and across to the Sahel, a region that stretches across the continent between the Sahara and the southern savannas. Couscous is the prevalent dish in the Sahara. Along the coast from Côte d'Ivoire (Ivory Coast) to Nigeria and Cameroon, root crops, primarily varieties of yam and cassava, are common. Cassava, imported from Brazil by the Portuguese, is boiled and then pounded into a nearly pure starch. Yam is the chief crop in West Africa and is served in a variety of dishes, including *amala* (pounded yam) and *egwansi* (melon) sauce. Millet is also used for making porridge or beer.

Palm oil is the base of stew in the Gambia, southern, and eastern regions. In the Sahalian area, groundnut paste (peanut butter) is the main ingredient for stew. Other stews are based on okra (a vegetable native to the rainforests of Africa), beans, sweet potato leaves, or cassava. Other vegetables are eggplant, cabbage, carrots, chilies, french beans, lettuce, okra, onions, and cherry tomatoes. All the stews in this territory tend to be heavily spiced, often with chilies.

West African Fruit. Plantain, a variety of banana, is abundant in the more tropical West Africa. Sweet plantains are normally fried, while hard plantains are boiled or pounded into *fufu*. Dates, bananas, guava,

melons, passionfruit, figs, jackfruit, mangos, pineapples, cashews, and wild lemons and oranges are also found here.

Protein Sources. Meat sources of protein include cattle, sheep, chicken, and goat, though beef is normally reserved for holidays and special occasions. Fish is eaten in the coastal areas. Because of the Islamic influence, pork is localized to non-Muslim areas. In these regions, "bush meat" is widely eaten, including bush rat, a large herbivorous rodent, antelope, and monkey. Giant snails are also eaten in various parts of West Africa.

### *East Africa*

Extensive trade and migrations with Arabic countries and South Asia has made East African culture unique, particularly on the coast. The main staples include potatoes, rice, *matake* (mashed plantains), and a maize meal that is cooked up into a thick porridge. Beans or a stew with meat, potatoes, or vegetables often accompany the porridge. Beef, goat, chicken, or sheep are the most common meats. Outside of Kenya and the horn of Africa, the stew is not as spicy, but the coastal area has spicy, coconut-based stews. This is quite unique in comparison to the central and southern parts of Africa.

Two herding tribes, the Maasai and Fulbe, have a notably different eating pattern. They do not eat very much meat, except for special occasions. Instead, they subsist on fresh and soured milk and butter as their staples. This is unusual because very few Africans consume milk or dairy products, primarily due to lactose intolerance.

The horn of Africa, which includes modern-day Somalia and Ethiopia, is characterized by its remarkably spicy food prepared with chilies and garlic. The staple grain, teff, has a considerably higher **iron** and nutrient content than other grain staples found in Africa. A common traditional food here is *injera*, a spongy flat bread that is eaten by tearing it, then using it to scoop up the meat or stew.

### *Southern Africa*

Outside of the temperate zones, in the southern part of the continent, a greater variety of fruits and vegetables are available. Fruits and vegetables in southern Africa include bananas, pineapples, pau-pau (papaya), mangoes, avocadoes, tomatoes, carrots, onions, potatoes, and cabbage. Nonetheless, the traditional meal in southern Africa is centered on a staple crop, usually rice or maize, served with a stew. The most common dish made from cornmeal is called *mealie meal*, or *pap* in South Africa. Also known as *nshima* or *nsima* further north, it is usually eaten with stew poured over it. The stew may include a few boiled vegetables, such as cabbage, spinach, or turnips, or on more special occasions, fish, beans, or chicken.

## Risks

### *Nutrition and Disease*

White South Africans (Dutch descendants called Afrikaaners), Europeans, and Asian Indians in Africa have diets similar to their countries of origin. In urban areas, however, the diet of (black) Africans is increasingly dependent on meat, much like the diet of some West African pastoral tribes, as well as on empty calories from prepackaged foods similar to those found in the West. The result is an unbalanced diet. In many parts of Africa, the traditional diets of indigenous peoples are often inadequate in essential **vitamins**, **minerals**, and protein, which can lead to a variety of diseases. Micronutrient deficiencies, particularly **vitamin A**, **iodine**, and iron deficiencies, which can result in vision impairment, goiter, and anemia, respectively, are prevalent throughout much of Africa, particularly in the arid areas where the soil is deficient either naturally or due to overuse.

### *Food Security*

A far greater threat comes from increasingly insecure food sources (a lack of consistent and affordable food staples) arising from adverse weather (drought and floods) and war. During the late 1900s, famine became increasingly frequent in Africa. In addition, a new threat to the food supply emerged due to the worsening HIV/AIDS epidemic. As adults fall ill and die, agricultural production declines. Rural communities are the hardest hit, and women are particularly at risk given their unique physiologic needs tied to their roles as mothers, as well as their vulnerability due to lower economic and social status.

With its immense population, resources, and growing population, Africa is a continent that struggles to keep its people and cultures healthy. African history, the proliferation of foods and spices across the land, and the preservation of land that can still be farmed, will continue to be important. Weather, geography, politics, culture, and religion are forces that have caused strife within Africa for centuries, and will continue to do so. A land that was once pure and fertile can only be restored through land preservation and food availability.

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**Increase in overweight and obesity prevalence among U.S. adults* by racial/ethnic group**

| Racial/ethnic group | Overweight (BMI ≥ 25) prevalence (%) | | Obesity (BMI ≥ 30) prevalence (%) | |
|---|---|---|---|---|
| | 1988 to 1994 | 1999 to 2000 | 1988 to 1994 | 1999 to 2000 |
| Black (non-Hispanic) | 62.5 | 69.6 | 30.2 | 39.9 |
| Mexican American | 67.4 | 73.4 | 28.4 | 34.4 |
| White (non-Hispanic) | 52.6 | 62.3 | 21.2 | 28.7 |

*Ages 20 and older for 1999 to 2000 and ages 20 to 74 for 1988 to 1994.

SOURCE: CDC, National Center for Health Statistics, National Health and Nutrition Examination Survey. Flegal et. al. JAMA. 2002; 288:1723-7 and IJO. 1998; 22:39-47

*(Illustration by GGS Information Services/Thomson Gale.)*

# African-American diet

## Definition

The 2000 U.S. Census revealed that there were almost 35 million African Americans, or about 13%of the total U.S. population. This small percentage of the populace has had a significant influence on American cuisine, not only because African-American food is diverse and flavorful, but also because of its historical beginnings. Despite their cultural, political, economic, and racial struggles, African Americans have retained a strong sense of their culture, which is, in part, reflected in their food.

## Origins

### *The After effects of Slavery*

The roots of the diversity of African-American cuisine may be traced back to 1619, when the first African slaves were sold in the New World. In a quest to build new cities in America, Europeans actively transported Africans and West Indians (people from the West Indies) to the new land. The West Indies (in the Caribbean Sea) was part of the slave route to America. Because the West Indians' skin color was similar to that of Africans, they were not treated any differently. As a result, some West Indian food traditions are similar to those of African Americans.

It is not surprising that African-American food has a distinctive culinary heritage with diverse flavors, as it includes traditions drawn from the African continent, the West Indies, and from North America. While the European nations were busy establishing new societies, they did not realize that the African and West Indian slaves who worked for them brought their own vibrant and and rich culture—a culture that would withstand and adapt to the harsh centuries of slavery.

Food historian Karen Hess writes about the struggle of African Americans to maintain some of their original culture through food. "The only thing that Africans brought with them "from Africa" was their memories." Slave traders attempted to craft culturally sensitive rations for the Africans by including yams, rice, corn, plantains, coconuts, and scraps of meat in the slaves' provisions.

Southern slaves established their own cooking culture using foods that were similar to foods that were part of their African and West Indian heritages, and many popular foods in the African-American diet are directly associated with foods in Africa. For instance, the African yam is similar to the American sweet potato. White rice is also popular because it was a major part of the diet in West Africa. African Americans infuse plain rice dishes with their own savory ingredients (popular rice dishes include gumbo and "hoppin' John," a dish made with rice, black-eyed peas, and salt pork or bacon).

## KEY TERMS

**Nutrient**—Dietary substance necessary for health.

**Type II diabetes**—inability to regulate level of sugar in the blood due to a reduction in the number of insulin receptors on the body's cells

### *The Legacy of African-American Cuisine*

Popular southern foods, such as the vegetable okra (brought to New Orleans by African slaves), are often attributed to the importation of goods from Africa, or by way of Africa, the West Indies, and the slave trade. Okra, which is the principal ingredient in the popular Creole stew referred to as gumbo, is believed to have spiritual and healthful properties. Rice and seafood (along with sausage or chicken), and filé (a sassafras powder inspired by the Choctaw Indians) are also key ingredients in gumbo. Other common foods that are rooted in African-American culture include black-eyed peas, benne seeds (sesame), eggplant, sorghum (a grain that produces sweet syrup and different types of flour), watermelon, and peanuts.

Though southern food is typically known as "soul food," many African Americans contend that soul food consists of African-American recipes that have been passed down from generation to generation, just like other African-American rituals. The legacy of African and West Indian culture is imbued in many of the recipes and food traditions that remain popular today. The staple foods of African Americans, such as rice, have remained largely unchanged since the first Africans and West Indians set foot in the New World, and the southern United States, where the slave population was most dense, has developed a cooking culture that remains true to the African-American tradition. This cooking is aptly named *southern cooking, the food*, or *soul food*. Over the years, many have interpreted the term *soul food* based on current social issues facing the African-American population, such as the civil rights movement. Many civil rights advocates believe that using this word perpetuates a negative connection between African Americans and slavery. However, as Doris Witt notes in her book *Black Hunger* (1999), the "soul" of the food refers loosely to the food's origins in Africa.

In his 1962 essay "Soul Food," Amiri Baraka makes a clear distinction between southern cooking and soul food. To Baraka, soul food includes chitterlings (pronounced chitlins), pork chops, fried porgies, potlikker, turnips, watermelon, black-eyed peas, grits, hoppin' John, hushpuppies, okra, and pancakes. Today, many of these foods are limited among African Americans to holidays and special occasions. Southern food, on the other hand, includes only fried chicken, sweet potato pie, collard greens, and barbecue, according to Baraka. The idea of what soul food is seems to differ greatly among African Americans.

## General Dietary Influences

In 1992 it was reported that there is little difference between the type of foods eaten by whites and African Americans. There have, however, been large changes in the overall quality of the diet of African Americans since the 1960s. In 1965, African Americans were more than twice as likely as whites to eat a diet that met the recommended guidelines for fat, **fiber**, and fruit and vegetable intakes. By 1996, however, 28%of African Americans were reported to have a poor-quality diet, compared to 16% of whites, and 14% of other racial groups. The diet of African Americans is particularly poor for children two to ten years old, for older adults, and for those from a low socioeconomic background. Of all racial groups, African Americans have the most difficulty in eating diets that are low in fat and high in fruits, vegetables, and whole grains. This represents an immense change in diet quality. Some explanations for this include: (1) the greater market availability of packaged and processed foods; (2) the high cost of fresh fruit, vegetables, and lean cuts of meat; (3) the common practice of frying food; and (4) using **fats** in cooking.

Regional differences. Although there is little overall variability in diets between whites and African Americans, there are many notable regional influences. Many regionally influenced cuisines emerged from the interactions of Native American, European, Caribbean, and African cultures. After emancipation, many slaves left the south and spread the influence of soul food to other parts of the United States. Barbecue is one example of Africaninfluenced cuisine that is still widely popular throughout the United States. The Africans who came to colonial South Carolina from the West Indies brought with them what is today considered signature southern cookery, known as *barbacoa*, or barbecue. The original barbecue recipe's main ingredient was roasted pig, which was heavily seasoned in red pepper and vinegar. But because of regional differences in livestock availability, pork barbecue became popular in the eastern United States, while beef barbecue became popular in the west of the country.

Other Ethnic Influences. Cajun and Creole cooking originated from the French and Spanish but were transformed by the influence of African cooks. African chefs brought with them specific skills in using various spices, and introduced okra and native American foodstuffs, such as crawfish, shrimp, oysters, crabs, and pecans, into both Cajun and Creole cuisine. Originally, Cajun meals were bland, and nearly all foods were boiled. Rice was used in Cajun dishes to stretch out meals to feed large families. Today, Cajun cooking tends to be spicier and more robust than Creole. Some popular Cajun dishes include pork-based sausages, jambalayas, gumbos, and coush-coush (a creamed corn dish). The symbol of Cajun cooking is, perhaps, the crawfish, but until the 1960s crawfish were used mainly as bait.

More recently, the immigration of people from the Caribbean and South America has influenced African-American cuisine in the south. New spices, ingredients, combinations, and cooking methods have produced popular dishes such as Jamaican jerk chicken, fried plantains, and bean dishes such as Puerto Rican *habichuelas* and Brazilian *feijoada*.

Holidays and Traditions. African-American meals are deeply rooted in traditions, holidays, and celebrations. For American slaves, after long hours working in the fields the evening meal was a time for families to gather, reflect, tell stories, and visit with loved ones and friends. Today, the Sunday meal after church continues to serve as a prime gathering time for friends and family.

Kwanzaa, which means "first fruits of the harvest," is a holiday observed by more than 18 million people worldwide. Kwanzaa is an African-American celebration that focuses on the traditional African values of family, community responsibility, commerce, and self-improvement. The Kwanzaa Feast, or Karamu, is traditionally held on December 31. This symbolizes the celebration that brings the community together to exchange and to give thanks for their accomplishments during the year. A typical menu includes a black-eyed pea dish, greens, sweet potato pudding, cornbread, fruit cobbler or compote dessert, and many other special family dishes.

Folk beliefs and remedies. Folk beliefs and remedies have also been passed down through generations, and they can still be observed today. The majority of African-American beliefs surrounding food concern the medicinal uses of various foods. For example, yellow root tea is believed to cure illness and lower blood sugar. The bitter yellow root contains the antihistamine berberine and may cause mild low blood pressure. One of the most popular folk beliefs is that excess blood will travel to the head when one eats large amounts of pork, thereby causing **hypertension**. However, it is not the fresh pork that should be blamed for this rise in blood pressure, but the salt-cured pork products that are commonly eaten. Today, folk beliefs and remedies are most often held in high regard and practiced by the elder and more traditional members of the population.

## Risks

### *Effects of Socioeconomic Status: Poverty and Health*

Many of the foods commonly eaten by African Americans, such as greens, yellow vegetables, legumes, beans, and rice, are rich in nutrients. Because of cooking methods and the consumption of meats and baked goods, however, the diet is also typically high in fat and low in fiber, **calcium**, and potassium. In 1989, 9.3 million of the black population (30.1%) had incomes below the poverty level. Individuals who are economically disadvantaged may have no choice but to eat what is available at the lowest cost. In comparison to other races, African Americans experience high rates of **obesity**, hypertension, type II diabetes, and heart disease, which are all associated with an unhealthful diet.

Obesity and hypertension are major causes of heart disease, diabetes, kidney disease, and certain cancers. African Americans experience disproportionately high rates of obesity and hypertension, compared to whites.

High blood pressureand obesity have known links to poor diet and a lack of physical activity. In the United States, the prevalence of high blood pressure in African Americans is among the highest in the world. The alarming rates of increase of obesity and high blood pressure, along with the deaths from diabetes-related complications, heart disease, and kidney failure, have spurred government agencies to take a harder look at these problems. As a result, many U.S. agencies have created national initiatives to improve the diet quality and the overall health of African Americans.

## Looking Forward to a Healthier Tomorrow

African-American food and its dietary evolvement since the beginning of American slavery provide a complicated, yet extremely descriptive, picture of the effects of politics, society, and the economy on culture. The deep-rooted dietary habits and economic issues that continue to affect African Americans present

great challenges regarding changing behaviors and lowering disease risk. In January 2000, the U.S. Department of Health and Human Services launched Healthy People 2010, a comprehensive, nationwide health promotion and disease prevention agenda. The overarching goal of this program is to increase quality and years of healthy life and eliminate health disparities between whites and minority populations, specifically African Americans. As national health initiatives and programs continue to improve and target African Americans and other populations in need, preventable diseases will be lowered, creating a healthier U.S. society.

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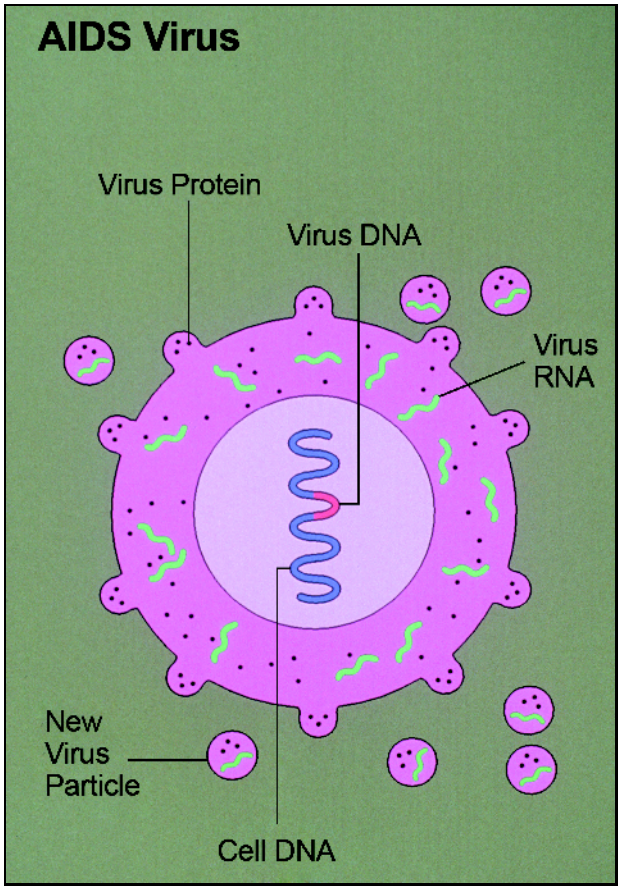
Aging and nutrition *see* **Senior nutrition**

# AIDS/HIV infection

## Definition

Human immunodeficiency virus (HIV) infection is a complex illness caused by a retrovirus, which is a single-strand virus that replicates by using reverse transcription to produce copies of DNA that become incorporated within the genome of the host cell. The HIV virus destroys a type of white blood cell known as CD4+ T lymphocytes, or T helper cells. These cells are important in maintaining the various functions of the human immune system. When the level of CD4+ T cells in the bloodstream falls, the patient loses the ability to fight off bacteria, viruses, and fungi that would not cause disease in a person with a strong immune system. Infections that occur in people with weakened immune systems are called opportunistic infections.

Acquired immunodeficiency syndrome (AIDS) is an advanced form of HIV infection in which the patient has developed opportunistic infections or certain types of **cancer** and/or the CD4+ T cell count has dropped below 200/μL. According to the Centers for Disease Control and Prevention (CDC), an estimated 1,039,000 to 1,185,000 persons in the United States were living with HIV/AIDS at the end of 2003, with 24–27% undiagnosed and unaware that they are infected. More than 40 million persons around the world are infected with HIV as of 2007, with approximately 14,000 new infections every day. The disease




**The AIDS virus.** *(National Institutes of Health.)*

causes 3 million deaths worldwide each year, 95% of them in developing countries.

Nutritional issues are common in patients with HIV infection. Some problems with diet and nutrition are caused by HIV infection directly while others are related to opportunistic infections or medication side effects. Maintaining adequate food intake and balanced nutrition in patients with HIV infection is complicated not only by the many ways in which the disease can affect the body—including the fact that the virus mutates rapidly—but also by frequent updating of treatment strategies for AIDS, including nutritional therapy. As a result, nutritional care of patients with AIDS must be tailored to each person and reviewed carefully every few months. In 2004, the American Dietetic Association (ADA) and the Dietitians of Canada (DC) issued a position statement on the care of persons with HIV infection that said, "Individualized nutrition care plans will be an essential feature of the medical management of persons with HIV infection and AIDS." The ADA has a specialized dietetic practice group (DPG) for AIDS and HIV patients that can be contacted from the website listed below.

## Origins

AIDS is a relative newcomer to the list of major infectious diseases. According to the National Institutes of Health (NIH), researchers think that HIV originated in a species of chimpanzees native to west equatorial Africa and jumped the species barrier into humans through hunters' contact with the blood of infected chimpanzees—most likely somewhere in western Africa in the second half of the twentieth century. The earliest known case of HIV infection was found in a blood sample collected from a man in Kinshasa in the Congo in 1959.

The first cases of AIDS were not diagnosed in the United States until June 1981, when the CDC reported a cluster of five cases of an opportunistic lung infection among homosexual men in Los Angeles. In the first 15 years of the epidemic, there were no effective treatments for HIV infection (there is still no cure as of 2007). As a result, many patients turned to alternative dietary treatments to help them manage the nausea, weight loss, and other symptoms associated with the infection. Alternative food-related therapies that were used in this period included:

- Herbal compounds used in traditional Chinese medicine (TCM) for the treatment of fevers or energy deficiency, particularly medicines containing astragalus (*Astragalus membranaceus*).
- Western herbal preparations recommended by naturopaths, including goldenseal (*Hydrastis canadensis*), licorice (*Glycyrrhiza glabra*), osha root (*Ligusticum porteri*), and echinacea.
- Detoxification diets, including the Master Cleanser lemon juice diet.
- Juice fasts, often taken together with laxatives or colonics.
- Nutritional supplements, particularly blue-green algae, zinc, vitamin C, beta-carotene, and catechin (an antioxidant).
- Vegetarian and raw food diets.

Prior to 1996, nutritional management of AIDS patients focused largely on weight loss and wasting, sometimes called the "slim disease." After the introduction of highly active antiretroviral therapy (HAART) in 1996, however, nutritionists were confronted with a range of other dietary problems related either to the new drugs or to prolonged survival itself.

## KEY TERMS

**Acquired immune deficiency syndrome (AIDS)**—HIV infection that has led to certain opportunistic infections, cancers, or a CD4+ T-lymphocyte (helper cell) blood cell count lower than 200/mL.

**Acute retroviral syndrome (ARS)**—A syndrome that develops in about 30% of HIV patients within a few weeks of infection. ARS is characterized by nausea, vomiting, fever, headache, general tiredness, and muscle cramps.

**Carrier**—A person who bears or carries a disease agent in or on their body and can transmit the disease to others, but is immune to the disease or has no symptoms of it.

**Colonic**—Sometimes called colonic hydrotherapy, a colonic is a procedure similar to an enema in which the patient's colon is irrigated (washed out) with large amounts of water. Some people undergoing a detoxification diet have one or more colonics to remove fecal matter remaining in the intestines during the diet; however, this procedure is discouraged by mainstream physicians because of its potential risks to health.

**Dietitian**—A health care professional who specializes in individual or group nutritional planning, public education in nutrition, or research in food science. To be licensed as a registered dietitian (RD) in the United States, a person must complete a bachelor's degree in a nutrition-related field and pass a state licensing examination. Dietitians are also called nutritionists.

**Highly active antiretroviral therapy (HAART)**—The major form of pharmacological treatment for HIV since 1996. HAART is a combination of several different antiretroviral drugs selected for patients on an individual basis. It is not a cure for HIV infection but acts to slow the replication of the virus and discourage new mutations. HAART has a number of side effects that complicate maintaining good nutrition in HIV patients.

**Lipodystrophy**—The medical term for redistribution of body fat in response to HAART, insulin injections in diabetics, or rare hereditary disorders.

**Malabsorption syndrome**—A condition characterized by indigestion, bloating, diarrhea, loss of appetite, and weakness, caused by poor absorption of nutrients from food as a result of HIV infection itself, giardiasis or other opportunistic infections of the digestive tract, or certain surgical procedures involving the stomach or intestines.

**Opportunistic infection**—An infection caused by a normally harmless organism that causes disease when the host's immune system in weakened. Opportunistic infections are a major problem in the medical and nutritional care of HIV patients.

**Retrovirus**—A single-stranded virus that replicates by reverse transcription to produce DNA copies that are incorporated into the genome of infected cells. AIDS is caused by a retrovirus.

**Wasting syndrome**—A combination of weight loss and change in composition of body tissues that occurs in patients with HIV infection. Typically, the patient's body loses lean muscle tissue and replaces it with fat as well as losing weight overall.

HAART is not one drug but a combination of various antiretroviral agents given to patients to prevent the virus from replicating and to discourage mutations of the virus. The drugs must be taken in combination because no medication by itself is able to suppress HIV for very long. One early problem with HAART was the complicated dosing schedules of the different drugs prescribed for an individual patient. To encourage adherence to treatment schedules (which must be at least 98% complete to protect the patient from developing a strain of the virus resistant to HAART), some pharmaceutical companies developed fixed-dose combinations. A fixed-dose combination is a medication in which several antiretroviral drugs that are known to work well together are combined in a single pill.

Guidelines for offering HAART treatment to patients were published in the late 1990s because the drugs have so many adverse effects (including hair loss, muscle cramps and pains, kidney or liver failure, insomnia, inflammation of the pancreas, dizziness and mental confusion, headache, nausea and vomiting, and numbness in hands or feet) that many patients were not compliant with dosage schedules and developed drug-resistant mutations of the HIV virus. Recommendations for HAART have been revised several

times by the U.S. Department of Health and Human Services. The following is the most recent set of standards, issued in October 2005:

- All patients with history of an AIDS-defining illness or severe symptoms of HIV infection should receive antiretroviral therapy regardless of CD4+ T cell count.
- Antiretroviral treatment is recommended for asymptomatic patients with less than 200 CD4+ T cells/mL.
- Asymptomatic patients with CD4+ T cell counts of 201—350 cells/mL should be offered antiretroviral treatment.
- For asymptomatic patients with CD4+ T cell of greater than 350 cells/mL and plasma HIV RNA greater than 100,000 copies/ml, most experienced clinicians defer therapy but some clinicians may consider initiating antiretroviral treatment.
- Antiretroviral therapy should be deferred for patients with CD4+ T cell counts of greater than 350 cells/mL and plasma HIV RNA less than 100,000 copies/ml.

It is this set of guidelines for HAART that nutritionists currently work with when planning healthful diets for patients with HIV infection and AIDS.

## Description

While there is no standard "HIV diet" or "AIDS diet" because patients' symptoms, medication regimens, and corresponding nutritional needs vary so widely, there are general practices followed by registered dietitians who work with doctors and other health care professionals to care for these patients.

### *Dietetics consultation and follow-up*

Patients with HIV infection should consult a registered dietitian (RD) as soon as possible after diagnosis, because good nutrition is essential to maintaining a normal level of activity and self-care as well as supporting the patient's immune system. RDs use several screening questionnaires to evaluate patients for potential nutritional problems. On the patient's first visit, he or she is given a quick nutrition screen or QNS to fill out. A sample QNS from a California medical center may be found online at http://www.rwca2006.com/presentation/workshop/Tuesday_08.29.06/Workshop_C/432_Quick%20Screen.pdf. The QNS identifies such problems as unintentional weight loss, nausea, difficulty swallowing, and diarrhea. The dietitian then measures the patient's height, weight, skinfold thickness, and the circumference of the muscles on the patient's midarm. These last two measurements are needed in order to monitor changes in body fat distribution and muscle wasting that often accompany HIV infection.

The next step in the initial assessment the patient's completion of a food intake record (FIR). The patient is asked to record everything he or she eats or drinks in a 24-hour period, including snacks and alcoholic beverages. If possible, the patient will fill out two FIRs, one for a working day and one for a weekend day or holiday. The FIR allows the dietitian to evaluate the patient's usual eating habits, portion sizes, food preferences, and average calorie intake. It also establishes a baseline for the individual patient, so that loss of appetite later on or other nutritional problems can be detected as quickly as possible.

Follow-up visits to the dietitian are scheduled according to the degree of the patient's nutritional risk. The American Dietetic Association and the Los Angeles County Commission on HIV Health Services use the following timelines for HIV patients at nutritional risk:

- Low risk: The patient's weight is stable, with a balanced and adequate food intake; normal blood levels of cholesterol, triglycerides, and glucose; no evidence of kidney or liver disorders; regular physical exercise; and low levels of psychosocial stress. Low-risk patients are evaluated by the RD as needed, but at least once a year.
- Moderate risk: The patient is obese or suffers from changing patterns of body fat distribution; has high blood cholesterol levels or high blood pressure; has developed an eating disorder, nausea, vomiting, or diarrhea; has been recently diagnosed with type 2 diabetes or food allergies; is in recovery from substance abuse; or is under psychosocial stress. Moderate-risk patients should be seen by the RD within a month.
- High risk: The patient is pregnant; suffers from poorly controlled diabetes; has lost 10% of body weight over the previous 4–6 months; has lost 5% of body weight in the previous 4 weeks; has dental problems, involvement of the central nervous system, severe nausea or vomiting, severe pain on swallowing, or chronic diarrhea; has one or more opportunistic infections; or is under severe psychosocial stress. These patients should be seen by an RD within one week.

In addition to assessment of the patient's nutritional needs, RDs also evaluate his or her living situation and other issues that may affect receiving adequate nutrition.

### *Specific issues in nutritional care of HIV patients*

**NAUSEA, VOMITING, AND DIARRHEA.** Nausea and vomiting are common symptoms of HIV infection as well as side effects of HAART. They can lead to long-term damage to the esophagus and dental problems as well as weight loss and inability to take needed medications. About 30% of patients develop nausea and vomiting within 1 to 4 weeks following infection as part of a condition called acute retroviral syndrome or ARS, which resembles influenza or mononucleosis. Most patients, however, develop nausea, vomiting, and diarrhea later on in the course of the disease as side effects of HAART or from opportunistic infections of the gastrointestinal system. Patients with HIV infection are highly susceptible to such diseases as **giardiasis**, cryptosporidiosis, listeriosis, *Campylobacter* infections, and *Salmonella* infections.

Treatment of nausea, vomiting, and diarrhea in patients with HIV infections may require a number of diagnostic tests and imaging studies as well as evaluation of the patient's medications in order to determine the cause(s) of the symptoms.

**LIPODYSTROPHY.** Lipodystrophy is the medical term for the redistribution of body fat that sometimes occurs in patients with HIV infection as a result of HAART, genetic factors, the length of time a person has been HIV-positive, and the severity of the disease. It is not completely understood as of the early 2000s why antiretroviral drugs and other factors have this effect. The patient may notice new deposits of fat at the back of the neck (sometimes called "buffalo humps") and around the abdomen. Conversely, fat may be lost under the skin of the face, resulting in sunken cheeks, or lost under the skin of the buttocks, arms, or legs. Lipodystrophy is not necessarily associated with weight loss.

Lipodystrophy may be accompanied by other changes in the patient's **metabolism**, particularly insulin resistance and higher levels of blood cholesterol and **triglycerides**. One recommendation nutritionists often give to patients with lipodystrophy and metabolic changes is to follow the **Mediterranean diet**, which is high in fiber-rich whole grains and vegetables and low in saturated **fats**. Another recommendation is to maintain a schedule of regular physical exercise (particularly weight training), which has been shown to lower insulin resistance and decrease abdominal fat deposits.

**WASTING.** Wasting refers to rapid unintentional weight loss (usually defined as 5% of body weight over a period of 6 months) combined with changes in the composition of body tissue. Specifically, the patient is losing lean muscle tissue and replacing it with fat. The patient's outward appearance may not be a reliable guide to wasting, particularly if he or she also has lipodystrophy. Weight loss associated with wasting may result from nausea and vomiting related to opportunistic infections of the digestive tract as well as from reactions to medication.

Nutrition is the first line of defense against wasting. To help the patient maintain weight, nutritionists recommend raising the daily calorie intake from 17–20 calories per pound of body weight (a guideline used for patients whose weight has been stable) to 25 calories per pound. Patients with wasting syndrome may require as much as 3500 calories per day to maintain their weight. Nutrient ratios should be 15–20% **protein**, 50–60% **carbohydrates**, and 25% fats to protect the body's muscle tissue. Patients who need more calories or protein may benefit from adding such supplements as Ensure or Instant Breakfast to their daily diet. In addition, weight training or other forms of regular exercise help to maintain muscle tissue.

Other treatments for wasting include the use of appetite stimulants to increase food intake and hormonal treatments to build lean muscle tissue, particularly in male patients.

**MEDICATION INTERACTIONS.** Most medications used in HAART have the potential to cause nausea and vomiting. Some antiretroviral medications should be taken with food to minimize these side effects. Digestive disturbances are the single most common reason given by patients for discontinuing antiretroviral therapy. In some cases, switching to a different combination of drugs helps to relieve nausea, vomiting, or diarrhea.

## Function

The function of nutritional education and dietary management in patients with HIV infection and AIDS is to maintain the patient's energy level and ability to carry out normal activities of daily life; lower the risk of opportunistic infections of the digestive system; and minimize the side effects of HAART on the patient's ability to eat and enjoy food.

## Benefits

The benefits of good nutritional care of patients with HIV infection are prolonged survival, improved quality of life, and fewer or less severe side effects from medical treatment.

## Precautions

### *Food safety issues*

**Food safety** is an important concern for patients with HIV infection because their immune systems have difficulty fighting off food- or water-borne disease organisms. While most people can get **food poisoning** or parasitic infections of the digestive tract if they drink contaminated **water** or do not prepare food properly, patients with HIV infection can get severely ill as a result of these diseases. Food-borne illnesses are also much more difficult to treat in persons with AIDS or HIV infection, and may lead to malabsorption syndrome, a condition in which the body cannot absorb and make use of needed nutrients in food. The CDC and NIH have brochures with detailed instructions for patients about safety issues in purchasing and preparing foods, particularly when traveling abroad. Basic safeguards include the following:

- Wash hands repeatedly in warm soapy water before and after preparing or eating food. Instant hand sanitizers should be used when away from home.
- Cook all meats, fish, and poultry to the well-done stage; do not eat sushi, raw oysters, or raw meat in any form.
- Do not use unpasteurized milk or dairy products.
- Do not eat raw, soft-boiled, or "wet" scrambled eggs, or Caesar salad made with raw egg in the dressing. Hard-boiled or hard-scrambled eggs are safe.
- Rinse all fruits and vegetables carefully in clean, safe water, and clean all cutting boards and knives that touch chicken and meat with soap and hot water before using these utensils with other food items.
- Keep all refrigerated foods below 40°F; check expiration dates on food packaging.
- Completely reheat leftovers before eating, and do not eat leftovers that have been stored in the refrigerator for longer than 3 days.
- Do not drink water that comes directly from lakes, streams, rivers, or springs, and ask for drinks without ice in restaurants.

### *HIV patients with special needs*

Patients with special needs include those with limited food budgets or without access to a kitchen for preparing their own food. Advice regarding community resources and other forms of assistance can be found on the website of the Tufts University School of Medicine Nutrition/Infection Unit at the URLs listed under "Other" below.

### *CAM dietary treatments*

In general, multivitamins, other **dietary supplements**, or herbal teas prepared by reliable manufacturers and approved by the patient's physician are useful complementary treatments for HIV patients. Traditional Chinese medicines made outside the United States, however, should be used with great caution as their purity cannot be guaranteed.

Patients interested in a vegetarian diet should consult their physician and nutritionist before starting one; raw-food vegetarian diets should be avoided because of the increased risk of contracting food-borne diseases. **Detoxification diets** and colonics are risky practices for HIV patients and should not be used.

## Risks

There are no known risks to nutritional management of patients with HIV infection by qualified professionals working with the patient's physicians and nurses. There are few risks to the use of naturopathic dietary supplements or herbal formulas provided that the patient reports the use of alternative therapies to the medical care team and does not use them as substitutes for HAART or other mainstream medications.

## Research and general acceptance

Research in the field of nutrition for HIV patients is ongoing and can be expected to produce revised guidelines for dietary management every few years for the foreseeable future. These changes will result as much from mutations in the disease organism as from discoveries of new drugs and other forms of treatment for HIV infection.

### Resources

#### BOOKS

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AIDS*info* (U.S. Department of Health and Human Services). P.O. Box 6303, Rockville, MD 20849-6303. Telephone: (800) HIV-0440 (Spanish-language health information specialists are available). Website: http://aidsinfo.nih.gov/

American Association of Naturopathic Physicians (AANP). 4435 Wisconsin Avenue NW, Suite 403, Washington, DC 20016. Telephone: (866) 538-2267 or (202) 237-8150. Website: http://www.naturopathic.org.

American Dietetic Association (ADA). 120 South Riverside Plaza, Suite 2000, Chicago, IL 60606-6995. Telephone: (800): 877-1600. Website: http://www.eatright.org.

Centers for Disease Control and Prevention (CDC). 1600 Clifton Road, Atlanta, GA 30333. Telephone: (404) 639-3311. Website: http://www.cdc.gov/.

Dietitians of Canada/Les diététistes du Canada (DC). 480 University Avenue, Suite 604, Toronto, Ontario, Canada M5G 1V2. Telephone: (416) 596-0857. Website: http://www.dietitians.ca.

HIV/AIDS Dietetic Practice Group (DPG) of the American Dietetic Association (ADA). Website: http://www.hivaidsdpg.org/

National Center for Complementary and Alternative Medicine (NCCAM). 9000 Rockville Pike, Bethesda, MD 20892. Telephone: (888) 644-6226. Website: http://nccam.nih.gov.

Tufts University School of Medicine Nutrition/Infection Unit. 150 Harrison Avenue, Jaharis 2, Boston, MA 02111. Telephone: (617) 636-3811. Website: http://www.tufts.edu/med/nutrition-infection/

U. S. Food and Drug Administration (FDA). 5600 Fishers Lane, Rockville, MD 20857-0001. Telephone: (888) INFO-FDA. Website: http://www.fda.gov/.

University of California San Francisco (UCSF) Center for HIV Information. 4150 Clement Street, Building 16, VAMC 111V-UCSF, San Francisco, CA 94121. Telephone: (415) 379-5601. Website: http://chi.ucsf.edu/chi?page=home-00-00.

Rebecca J. Frey, PhD

# Alcohol consumption

## Definition

Alcohol consumption is drinking beer, wine, or distilled spirits such as gin, whiskey, or vodka, that contains ethyl alcohol.

**Calories in alcohol**

| Beverage | Serving amount (ounce) | Average (calories) |
|---|---|---|
| **Beer** | | |
| Regular | 12 | 149 |
| Light | 12 | 110 |
| **Distilled (80 proof)** | | |
| Gin, rum, vodka, whisky, tequila | 1.0 | 65 |
| Brandy, cognac | 1.0 | 65 |
| Liqueurs (Drambuie, Cointreau, Kahlua) | 1.5 | 188 |
| **Wine** | | |
| Red | 4 | 80 |
| Dry white | 4 | 75 |
| Sweet | 4 | 105 |
| Sherry | 2 | 75 |
| Port | 2 | 90 |
| Champagne | 4 | 84 |
| Vermouth, sweet | 3 | 140 |
| Vermouth, dry | 3 | 105 |
| **Cocktails** | | |
| Martini | 3.5 | 140 |
| Manhattan | 3.5 | 164 |
| Daiquiri | 4 | 122 |
| Whiskey sour | 3 | 122 |
| Margarita cocktail | 4 | 168 |
| Coolers | 6 | 150 |

SOURCE: National Institute on Alcohol Abuse and Alcoholism, National Institutes of Health, U.S. Department of Health and Human Services

*(Illustration by GGS Information Services/Thomson Gale.)*

## Purpose

In earlier times, when subsistence agriculture was the norm, alcoholic beverages, usually beer or mead (fermented honey and **water**), provided a substantial percentage of calories in the diet. Today people drink alcohol to relax and socialize, to get high, or because they are physically addicted to it.

## Description

Ethyl alcohol, or ethanol, is produced by yeast fermentation of the natural sugars in plants, such as grapes (wine), hops (beer), sugar cane (rum), agave (tequila), or rice (saki). The process of fermenting plants to produce alcohol is at least 10,000 years old and appears to have developed independently in many cultures.

Alcohol affects almost every system of the body. Research suggests that when alcohol is consumed in moderation, there are some health benefits and some health risks. Heavy use of alcohol has no health benefits and many health risks. The federal *Dietary Guidelines for Americans 2005*. define moderate alcohol consumption as one drink per day for women and two drinks per day for men. This difference by gender is because women tend to be smaller than men, and their bodies contain a lower percentage of water, so an equivalent amount of alcohol in a woman's bloodstream will be more concentrated than in a man's. A "drink" according to these guidelines contains about 14 grams of alcohol and is defined as:

- 12 fluid ounces of regular beer
- 5 fluid ounces of wine
- 1.5 fluid ounces of 80 proof distilled spirits

Using this definition, one regular beer contains about 145 calories. One glass of red wine has 105 calories, and white wine has about 100 calories. One shot of distilled spirits has about 95 calories plus any calories in the mixer used mixed drinks.

### *Benefits of moderate alcohol consumption*

Good evidence based on more than 100 studies shows that moderate alcohol consumption can help prevent heart attack, sudden cardiac death, peripheral vascular disease, and stroke caused by blood clots (ischemic stroke). The risk of these diseases is reduced between 25% and 40% in both men and women. The reduction is seen in both people who have no apparent heart disease and those who are at high risk of heart disease because they have type 2 diabetes, high blood pressure (**hypertension**), angina (chest pain), or have already had one heart attack. Researchers suggest that this protective effect occurs because alcohol increases the amount of HDL or "good" cholesterol and also affects various proteins in ways that make blood clotting less likely.

In two other large studies, people who were moderate drinkers also were less likely to develop type 2 diabetes and **gallstones**. Gallstones are hard masses of cholesterol and **calcium** that form in the gallbladder. Finally, moderate drinking serves a social purpose that can provide psychological benefits.

### *Risks of moderate alcohol consumption*

Moderate alcohol consumption also carries with it some risks. In women, even moderate drinking is associated with a modest increase in the risk of developing breast **cancer**. However, researchers suggest that taking at least 600 mg of folic acid daily will counteract this increased risk.

Even moderate alcohol consumption by a pregnant woman can damage the developing fetus. Alcohol consumption can also alter sleep patterns and interact with many medications (see Interactions below). However, by far the greatest risk of moderate

## KEY TERMS

**B-complex vitamins**—a group of water-soluble vitamins that often work together in the body. These include thiamine ($B_1$), riboflavin ($B_2$), niacin ($B_3$), pantothenic acid ($B_5$), pyridoxine ($B_6$), biotin ($B_7$ or vitamin H), folate/folic acid ($B_9$), and cobalamin ($B_{12}$).

**Essential amino acid**—an amino acid that is necessary for health but that cannot be made by the body and must be acquired through diet.

**Folic acid**—also called vitamin $B_9$, a stable synthetic form of folate that is found in dietary supplements and is added to fortified foods such as flour and cereal.

**Mineral**—an inorganic substance found in the earth that is necessary in small quantities for the body to maintain a health. Examples: zinc, copper, iron.

**Peripheral vascular disease**—diseases of any blood vessels except those that supply blood to the heart.

**Tolerance**—adjustment of the body to a drug so that it takes more and more to produce the same physiological or psychological effect

**Type 2 diabetes**—sometime called adult-onset diabetes, this disease prevents the body from properly using glucose (sugar).

**Vitamin**—a nutrient that the body needs in small amounts to remain healthy but that the body cannot manufacture for itself and must acquire through diet

drinking is that for some people it will lead to heavy alcohol consumption, alcohol abuse, and alcohol dependency. Twin and family studies indicated that there is an inherited tendency for some individuals to develop alcohol abuse disorders.

### *Risks of heavy alcohol consumption*

Heavy alcohol consumption is defined for men as consuming 15 or more alcoholic drinks per week and for women as consuming 8 or more drinks per week. Between moderate and heavy alcohol consumption is a gray area of potentially problem drinking that includes binge drinking.

Binge drinking is heavy alcohol consumption that occurs intermittently. Bingeing for men means consuming 5 or more drinks in a period of about two hours. For women, it is consuming 4 or more drinks in the same time period. About 60% of men ages 18–25 binge drink.

Heavy alcohol consumption leads to two alcohol abuse disorders that are recognized in the *Diagnostic and Statistical Manual for Mental Disorders Fourth Edition (DSM-IV-TR)* published by the American Psychiatric Association. More men abuse alcohol than women, and these men begin drinking at an earlier age than women.

Alcohol dependence is diagnosed when one or more of the following occur within a 12-month period.

- Repeated alcohol use causes failure to fulfill obligations at work, home, or school.
- The individual repeatedly performs hazardous activities such as driving or operating machinery while under the influence of alcohol.
- Alcohol use causes legal problems.
- Alcohol use continues despite problems it causes in relationships.
- These symptoms do not rise to the level of alcohol dependence.

Alcohol abuse, or alcoholism, is diagnosed when three or more of the following occur within a 12-month period.

- Tolerance to the effects of alcohol develops.
- Stopping drinking causes, or would cause, physical symptoms of withdrawal.
- More alcohol is regularly drunk than is intended.
- Efforts to reduce alcohol consumption are unsuccessful
- Getting alcohol, drinking, and recovering from drinking alcohol consumes a great deal of time.
- Work, social, and recreational activities are replaced by drinking or recovering from drinking.
- Alcohol use continues despite its causing obvious physical and/or psychological problems.

On any given day, about 7% of Americans, or more than 17 million people, are alcohol dependent or have alcoholism. Costs related to alcohol disorders are estimated to be more than $185 billion annually. Alcohol disorders are related to increased rates of motor vehicle deaths, homicides, suicides, and domestic violence. About 34% of Americans never drink alcohol.

People with alcoholism do not eat healthy, balanced diets. When 30% or more of an individual's calories come from alcohol, serious nutritional deficiencies develop. Not only do people with alcoholism fail to get the **protein**, **vitamins**, and **minerals** they need, alcohol interferes with the absorption of the nutrients they do eat. People who abuse alcohol develop malnutrition

and deficiencies in essential amino acids, B-complex vitamins (especially vitamins $B_1$, $B_2$, and $B_6$), and **vitamin C**. They may develop either deficiencies or excesses of **vitamin A**. Along with nutritional deficiencies, the person with alcoholism often has liver damage. Cirrhosis, a disease in which the liver develops scar tissue and stops functioning, is the cause of death in about 32% of people with alcoholism worldwide. Alcoholism also substantially increases the chance of dying by violence or developing esophageal cancer, mouth cancer, and liver cancer or breast cancer in women. Heavy drinking increases the risk of stroke and cardiovascular disease and can cause brain damage, loss of judgment, loss of motor skills, and memory loss.

## Precautions

Some people who should never drink alcohol. These include:

- children and adolescents under age 21
- women who are pregnant, breastfeeding, or who could become pregnant
- people who cannot control their drinking and keep it at the level of moderate consumption
- people who plan to drive, fly a plane, operate dangerous equipment, act as a lifeguard, or perform any activity that requires quick reactions, good judgment, and coordination
- people who are unable to control their aggression when they drink
- people taking certain medications (see below)
- people with liver or kidney damage
- people who are recovering from alcoholism

## Interactions

Alcohol is a central nervous system depressant. More than 150 drugs interact with alcohol. Some of these interactions can be fatal, especially those that involve narcotic drugs that also depress the central nervous system. Categories of drugs that interact with alcohol include:

- narcotic drugs
- sleeping pills
- antidepressants
- anti-anxiety medications
- antihistamines

## Aftercare

The best-known treatment for alcohol abuse disorders is the 12-step program of Alcoholics Anonymous. This program uses social support, rewards, and mentoring to change behavior. For it to succeed, the person with alcoholism must want to recover and must be willing to work at achieving sobriety. Relapses are common. Families of alcoholics may be helped by Al-Non and teens by Alateen, whether or not their family member with alcoholism participates in Alcoholics Anonymous.

The United States Food and Drug Administration (FDA) approved three medications for the treatment of alcoholism. Disulfiram (Antabuse) makes the individual feel ill after drinking alcohol. Naltrexone (Depade, ReVia) act on the brain to reduce the craving for alcohol, and acamprosate (Canpral) reduces withdrawal symptoms. These medications are more effective with some people than others.

## Complications

Complications of moderate and heavy alcohol abuse are listed above. In addition to physical complications, alcohol consumption can take an emotional and psychological toll on relationships and families, especially on children who have a parent with alcoholism.

## Parental concerns

Alcohol consumption by adolescents substantially increases their risk of being in both fatal and nonfatal motor vehicle accidents. It also increases the chance of participating in risky sexual behavior, failing or dropping out of school, committing suicide, and being a homicide victim. Children who begin to drink before age 15 are four times more likely to develop alcoholism than people who begin drinking at age 21.

### Resources

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#### ORGANIZATIONS

American Dietetic Association. 120 South Riverside Plaza, Suite 2000, Chicago, Illinois 60606-6995. Telephone: (800) 877-1600. Website: <http://www.eatright.org>

Centers for Disease Control and Prevention. 1600 Clifton Road, Atlanta, GA. 30333. Telephone: (800) 311-3435 or (404) 639-3534. Website: <http://www.cdc.gov/>

Linus Pauling Institute. Oregon State University, 571 Weniger Hall, Corvallis, OR 97331-6512. Telephone: (541) 717-5075. Fax: (541) 737-5077. Website: <http://lpi.oregonstate.edu>

National Council on Alcoholism and Drug Dependence (NCADD). 22 Cortlandt Street, Suite 801, New York, NY 10007-3128. Telephone: (212) 269-7797. Fax: (212)

269-7510.HOPELINE: (800) NCA-CALL (24-hour Affiliate referral). Website: <http://www.ncadd.org>
National Institute on Alcohol Abuse and Alcoholism. 635 Fishers Lane, MSC 9304, Bethesda, MD 20892-9304. Telephone: (301) 443-3860. Website: <http://pubs.niaaa.nih.gov>

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Tish Davidson, A.M.

Algae *see* **Spirulina**

Alpha-tocopherol *see* **Vitamin E**

# American Diabetes Association

## Location

American Diabetes Association (ADA) PO Box 363 Mount Morris, IL 61054-0363 USA Toll-Free: (800) 342-2383 or 1-800-DIABETES E-mail: askada@diabetes.org Website: http://www.diabetes.org

## Description

Founded in 1940 The American Diabetes Association (ADA) is the nation's leading 501(C)3 nonprofit health organization. It boasts more than 280,000 Members and has a network of more than one million volunteers. The ADA serves 800 Local Groups within 53 State Groups.

## Mission

The mission of the ADA is to prevent and cure diabetes and to improve the lives of all people affected by diabetes.

To fulfill their mission, the ADA promotes research, information and advocates for finding a prevention and cure for diabetes. The ADA uses different techniques to educate people at risk of diabetes and with diabetes so they can improve their quality of life. They also disseminate information to the health care professionals, family and care givers of those with or at risk of diabetes. The ADA advocates for scientific research for finding a cure and prevention of the different types of diabetes. They are also one of the largest advocates for the rights of diabetics.

## ADA Members

Their members include but are not limited to Physicians, nurses, dietitians, physical/occupational therapists, other health professionals, and laypersons affected by **diabetes mellitus**. The ADA offers memberships to both consumers and health professionals who pay annual Membership dues.

## Consumer Membership

The consumer membership is for people with diabetes, their families and caregivers. Consumer members receive monthly issues of Diabetes Forecast(r) magazine, discounts on ADA books and cookbooks, and access to a network of diabetes support and informational resources. Consumer membership dues are $28 annually.

## Professional Membership

Professional membership provides health professionals, research scientists, and diabetes educators with recent information in diabetes research and treatment options. As members they receive, but not limited to, access to the ADA journal that is most relevant to their practice, registration discounts for ADA Scientific Sessions and for medical journals and books. Professional memberships can range from $50-350.00 annually.

## Resources

The ADA supports a variety of tools to educate its members and the public.

Their National Call Center provides diabetes information and referral for callers nationwide through their toll-free 800 number. The Call Center responds to approximately 350,000 inquiries each year.

The ADA also supports a website that is available for anyone with Internet access and links them to pertinent diabetes and diabetes prevention information, advocacy, membership information and community and local events.

## ADA Research

Founded in October 1994, the American Diabetes Association Research Foundation (ADARF) was created to raise money to directly fund diabetes research. This unique program is intended to complement the governments National Institutes of Health (NIH) diabetes research program through supporting new investigators and innovative research ideas. Through donations, the ADA has been able to provide nearly $40 million towards diabetes research in 2005.

Funds provided by ADARF support peer-reviewed basic and clinical diabetes research proposed to prevent, treat, and/or cure diabetes. Past research projects supported by the ADARF varied from the microcellular research to exploring education and psychological issues related to diabetes.

All ADARF grants become part of the Diabetes Research database that is accessible to anyone with access to the ADA website. This database provides brief descriptions of each funded project, and gives brief summaries on the value the study findings may have for the field of diabetes research. Database contents are updated at least every six months.

Other methods ADA uses to distribute research findings are through Access: Diabetes Research, and the Forefront Research Magazine. Both present summaries of diabetes research.

## Education Program Recognition

To ensure quality education for people with diabetes, the ADA endorses the National Standards for Diabetes Self-Management Education Programs. The Standards are designed to endorse any health care setting offering diabetes education, from physicians' offices and HMOs to clinics and hospitals. All applicants must meet the National Standards before they are awarded the endorsement from the ADA.

The National Diabetes Advisory Board (NDAB) developed the National Standards for Diabetes Patient Education Programs. The ADA then endorsed the Standards in 1983 while participating in the nationwide pilot testing of the Standards and review criteria in 1984. The first edition of the Standards was published in Diabetes Care in 1984. In 1986 an application and review process was established through the ADA to determine whether an education program met the Standards. Then in 1987, the first programs to meet the Standards were recognized by the ADA.

The Standards are reviewed and revised every five-year cycle. In 1995 and in 2000, a task force of representatives from the diabetes community completed a review of the Standards. The representatives are compiled from the American Association of Diabetes Educators, American Diabetes Association, American Dietetic Association, Centers for Disease Control and Prevention, Department of Veterans Affairs, Diabetes Research and Training Centers, Indian Health Service, Juvenile Diabetes Foundation and National Certification Board for Diabetes Educators.

The revised Standards are now called the National Standards for Diabetes Self-Management Education and are endorsed by all organizations involved in its development. When changes occur, the Education Program Recognition Committee of the ADA revises the application for Recognition, currently the 6th edition, to reflect the revised Standards.

## Professional Services

The Association provides educational and informative materials and programs for health professionals thru various media. Annually they sponsor a scientific sessions diabetes conference, in addition to other medical and scientific programs. The ADA publishes and updates their medical care guidelines and recommendations for health professionals. They also support special interest groups for professionals.

## Publications

The ADA is the world's foremost publisher in the field of diabetes literature, including Diabetes Forecast, a monthly consumer magazine, and a range of publications and journals for research and health care professionals, such as Diabetes, Diabetes Care, Diabetes Spectrum, Clinical Diabetes, and access to a comprehensive library of medical management guides.

## Fund Raising Activities

Each year, the ADA state chapters organize local events to increase awareness of diabetes within their

community, while at the same time help raise money for the ADA. The state chapters assist in organizing the ADA signature fund raising events. The signature events that occur annually are;

- America's Walk for Diabetes(r),
- Tour De Cure(r) a cycling event that takes place in over 70 cities nationwide,
- and School Walk for Diabetes(r) that is an educational, school based program that promotes community service, school spirit and healthy living to students.
- Another unique fund-raising campaign, Kiss-A-Pig(r), is a tribute to the pig for aiding in discovering the role of insulin for people with diabetes. It ends with the participant who raises the most money kissing the Kiss-A-Pig pig.

### *Public Awareness*

One of the goals of the ADA is to make the public aware of diabetes and the serious health effects it may have on a person. Throughout the year the ADA sponsors events to educate the public about diabetes and diabetes prevention. The National public awareness campaigns are:

American Diabetes Month is the Association's annual, month-long public awareness activity held each November. The goal is to raise awareness about serious and often preventable diabetes complications. A variety of events and educational activities are included in this awareness effort.

The American Diabetes Alert is conducted annually on the fourth Tuesday in March to raise awareness about the seriousness of pre-diabetes and diabetes and its risk factors. The centerpiece of the Alert is the diabetes risk test, which is widely distributed and promoted through community activities and national and local media.

## Program Services

The ethnic groups in the United States with the highest risk of developing type 2 diabetes are African Americans, Mexican Americans, and Pima Indians as well as Asian Americans and Pacific Islanders. The ADA reaches out to these communities through community campaigns.

### *The Diabetes Assistance and Resources Program (DAR)*

DAR, which means, "to give" in Spanish, provides valuable information in English and Spanish to the Latino/Hispanic community. The goal of the DAR program is to increase awareness about the seriousness of diabetes and the importance of prevention and control.

### *Diabetes Sunday and Get Up and Move.*

The African American Program's goal is to increase awareness about the seriousness of diabetes in the community and importance of early diagnosis and treatment. The program includes fun and informative church and community-based activities.

### *Awakening the Spirit: Pathways to Diabetes Prevention and Control*

Aimed at the Native American community, including American Indians, Alaska Natives, and Native Hawaiians. The program stresses the importance of choosing a healthy lifestyle for oneself and the generations that will follow.

### *Youth Programs*

The ADA is the largest provider of camps for children with diabetes in the world. Each year, more than 10,000 children benefit from camping programs provided through ADA funding.

They have developed a youth zone program that provides a web site especially for kids. It offers games, tips, links, and information to help kids manage their diabetes.

For the teen, the ADA provides information and resources directed to teens. It gives information on how diabetes may impact their lifestyle. It gives resources and tools to help the teen understand diabetes and how it impacts the choices they make and their health.

## Advocacy

Realizing a need for equality for those with diabetes, the ?ADA formed the Government Affairs & Advocacy program to help fulfill their mission of improving the lives of all those affected with diabetes. The main goals of this program are to:

- Improve access to quality medical care for people with diabetes
- Eliminate discrimination against people because of their diabetes
- Ensure the federal government is adequately funding diabetes research and programs.

Megan C.M. Porter, RD, LD

# American Dietetic Association

## Location

ADA Location Headquarters 120 South Riverside Plaza, Suite 2000 Chicago, Illinois 60606 Phone: 800/877-1600

Washington office 1120 Connecticut Avenue N.W., Suite 480 Washington, D.C. 20036 Phone: 800/877-0877

## ADA Website

http://www.eatright.org/

## Description

The American Dietetic Association (ADA) was founded in Cleveland, Ohio, in 1917 during WWI by a visionary group of women, led by Lenna F. Cooper and ADA's first president, Lulu C. Graves. It was intended to aid the government in food conservation and enhance the public's health and nutrition. With approximately 67,000 members, in 52 states including the District of Columbia and Puerto Rico, it has an annual budget of 26 million. The ADA has grown to become the nation's largest organization of food and nutrition professionals.

The ADA and its members are committed to helping the public benefit from a healthy lifestyle. To do this, the ADA focuses on five critical health areas facing all Americans: Obesity and overweight, with special emphasis on children, healthy aging, having a safe, sustainable and nutritious food supply, nutrigenetics and **nutrigenomics**, integrative medicine, including supplements and alternative medicine.

## Mission

The ADA's Mission is 'Leading the future of dietetics.' They envision the members of the ADA as the most valued source of food and nutrition services.

## ADA Members

Most of ADA's members are registered dietitians with a small percentage coming from dietetic technicians, registered. Other members include clinical and community dietetics professionals, consultants, food service managers, educators, researchers, dietetic technicians and students. ADA members are able to join focused Dietetic Practice groups within the American Dietetic Association. These groups represent a wide range of practice areas and interests including public health; **sports nutrition**; medical nutrition therapy; diet counseling, cholesterol reduction, diabetes, heart and kidney disease; **vegetarianism**; food service management in business, hospitals, restaurants, long-term care facilities and education systems; education of other health-care professionals, entrepreneurism and scientific research.

Professionals choose to belong to ADA to receive the membership benefits. ADA provides, but not limited to, continuing education opportunities, access to the ADA Evidence Analysis Library, subscription to the Journal of the American Dietetic Association and access to information and resources. Membership dues are paid annually and range from $45-206.

## Nutrition Resource for the Public

The ADA promotes nutrition information for consumers and the media through various media. They support a website filled with content from news releases and consumer tips to Nutrition Fact Sheets, consumer FAQs and the Good Nutrition Reading List. Consumers seeking the services of a registered dietitian can locate one through their website.

Another way they promote healthy eating to the public was developed in 1973. Each March the National Nutrition Month (r) campaign begins. During this month, the ADA offers food and nutrition information through numerous programs and services.

Relatively new to ADA are their position statements which are regularly produced by the association and it's members. These position statements encompass the multifaceted issues related to nutrition. And are the official opinions of the ADA on issues that affect the nutritional and health status of the public. These statements are based on the latest scientific research available and have a process where they are reviewed and updated.

## Journal of the American Dietetic Association

The ADA publishes the Journal of the American Dietetic Association. The Journal is peer-reviewed and written by and for dietetics professionals. The journal brings professional knowledge across the range of research and practice issues such as: nutritional science, medical nutrition therapy, public health nutrition, food science and biotechnology, foodservice systems, leadership and management, and dietetics education to nutrition and dietetics professionals throughout the world. It is the most popular peer-reviewed periodical in the dietetics field.

## Government and Public Policy

To help fulfill their mission, the ADA began an advocacy network based in Washington, D.C. This government affairs office negotiates with state and federal legislators and agencies on public policy issues that affect the public and the scope of dietetics. Through their efforts the ADA has influenced Medicare coverage of medical nutrition therapy; child nutrition; **obesity**; the Dietary Guidelines for Americans and other health and nutrition concerns.

## The American Dietetic Association Foundation (ADAF)

The ADAF was established in 1966 as a 501(C)(3) public charity and is the philanthropic arm of the American Dietetic Association. They provide money for research, education and public awareness programs. The Foundation's primary focus is for funding of scholarships for nutrition and dietetic students, supporting food and nutrition research and to be a leader in promoting and achieving healthy weight for children, and helping to reduce the growing prevalence of **childhood obesity**. To do this, their mission is to fund the future of the dietetics profession through research and education. They are the largest grantor of scholarships in the nutrition and dietetic fields by awarding graduate, undergraduate and continuing education scholarships.

A 13-member board of directors that includes the President-Elect, Financial Officer and CEO of the American Dietetic Association as well as up to five public members governs the ADA Foundation. They have an operating budget over $7 million in endowed support for their causes and operations. Both individuals and industry have donated these funds. Approximately $1.4 million of the operating budget goes to support fundraising and grant making activities.

## Credentialing

The ADA is involved in the process for accredited education programs for RD's and DTR's. They also are affiliated with the Commission on Dietetic Registration who oversees the registration of dietitians and diet technicians.

The development of a accreditation process was incorporated into the ADA to serve the publics best interest by creating and enforcing eligibility requirements and accreditation standards that ensure the quality and continued improvement of nutrition and dietetics education programs. The Commission on Accreditation for Dietetics Education (CADE) was formed and is ADA's accrediting agency for education programs that prepare dietetic students for careers as nutrition professionals. Recognized by the United States Department of Education and the Council for Higher Education Accreditation, CADE is a reliable authority on the quality of nutrition and dietetics education programs. All dietetic programs meeting their standards are accredited through CADE.

## What is a Registered Dietitian?

***A registered dietitian (RD) is a professional who has met academic training in the areas of food and nutrition. The requirements needed are:***

- Bachelor's degree with course work approved by ADA's Commission on Accreditation for Dietetics Education. Coursework typically includes food and nutrition sciences, foodservice systems management, business, economics, computer science, sociology, biochemistry, physiology, microbiology and chemistry.
- Completion of an accredited, supervised, experiential practice program at a health-care facility, community agency or foodservice corporation.
- Pass a national examination administered by the Commission on Dietetic Registration.
- Complete continuing professional educational requirements to maintain registration.

Some RDs hold additional certifications in specialized areas of practice, such as pediatric or **renal nutrition** and diabetes education.

## What is a Dietetic Technician, Registered?

Dietetic technicians, registered, (DTRs) must complete a two-year associate's degree in an approved dietetic technician program, have supervised practice experience and pass a nationwide examination administered by the ADA to earn the DTR credential and must complete continuing education courses throughout their careers.

## The Commission on Dietetic Registration

The Commission on Dietetic Registration (CDR) is the overseer of the Registered Dietitian (RD); Dietetic Technician, Registered (DTR); Board Certified Specialist in Renal Nutrition (CSR); and Board Certified Specialist in Pediatric Nutrition (CSP); Board Certified Specialist in Sports Dietetics (CSSD) and Board Certified Specialist in Gerontological Nutrition (CSG). Since the credentialing process began, over 78,000 dietitians and dietetic technicians worldwide have taken the CDR exams.

The Commission's RD/DTR certification programs are fully accredited by the National Commission for Certifying Agencies (NCAA), the accrediting arm of the National Organization for Competency Assurance (NOCA) based in Washington, D.C. This accreditation reflects achievement of the highest standards of professional credentialing for nutrition professionals.

The CDR consists of eleven members consisting of seven RDs, one RD Specialist, and one DTR who serve a five-year term. In addition, the CDR appoints a newly credentialed RD for a one-year term. A public representative, appointed by CDR members, has full rights and privileges for a five-year term. The Chair and Vice-Chair are elected by the Commission for a one-year term June 1 - May 31.

### Resources

**ORGANIZATION**

Commission on Dietetic Registration 120 South Riverside Plaza, Suite 2000 Chicago, Illinois 60606-6995 Phone: 312-899-0040 Ext. 5500 Fax: 312-899-4772 Website: www.cdrnet.org

Megan C.M. Porter, RD, LD

# Anne Collins weight loss program

## Definition

The Anne Collins weight loss program is a weight loss system accessed on-line after payment of a yearly subscription fee. The system consists of nine separate diet plans plus advice regarding nutrition, exercise, and specific physical disorders; an on-line support community; and personal advice available through e-mail. There are no diet foods, nutritional supplements, appetite suppressants, exercise equipment, or any other products sold as part of the system.

## Origins

Anne Collins is an Irish nutritionist who says about herself, "For 24 years I have been involved in the weight loss and fitness industry as a diet consultant, nutritionist, and personal adviser. I have written for many newspapers and magazines including a weekly weight loss and health column." She states that she first formulated her weight loss system in 1982 but does not mention the date that her Internet Web site opened.

The Anne Collins Web site claims that it has had nearly 7.5 million visitors and is ranked the eighth most popular online diet Web site by Hitwise (an online competitive intelligence service that researches market trends). However, a much lower number of people have actually tried the Anne Collins system. The Web site states that it helps "over 250,000 people all over the world to lose really stubborn fat deposits and to achieve a lean body." Therefore, it appears that most visitors to the Web site choose not to subscribe to the system.

## Description

### *Overview*

The Anne Collins system is available only through the author's Internet Web site (URL: <http://www.anne-collins.com>). Some parts of the Web site are available to the public, but most pages require a $19.97 US annual subscription. The subscription fee must be paid online by credit card, as there is no telephone number on the public portion of the Web site. A comment on the Web site encourages visitors to subscribe immediately and states that rates will be increasing due to the site's popularity. It is unknown on what date the promotion actually ends.

What the dieter obtains for the subscription fee is access to the following: any and all of the e-books for the nine specific diet plans; a community forum; updates to the existing diets and any new diet plans; advice about nutrition and exercise; shopping lists; advice and tips to stay motivated; and personal support either online or by telephone available any day of the year. The e-books average 55–60 pages in length; they contain daily meal plans for a 28-day period, including options for snacks and fast foods. The motivational articles, nutrition information, and other sections of the Web site come to about 600 pages of material.

The Anne Collins weight loss system is not available in a print edition, either paperback or hardcover, even though there is an illustration of what looks like a paperback book on the Web site. In addition, neither the Library of Congress nor the British Library has a record of any book on nutrition or weight loss written by Anne Collins.

### *Specific diets*

**LOW-CARBOHYDRATE DIET.** The Anne Collins low-carbohydrate diet is designed to be followed for 28 days, after which the dieter may repeat the 28-day cycle or switch to another Anne Collins plan. The four weeks are divided into two phases of 14 days each.

Phase one supplies meal plans for three meals a day, averaging 30 g of **carbohydrates** per day. In phase two, the day's carbohydrate allotment is raised to 55 g per day. This plan claims that the dieter loses as much as 10 lb during phase one.

This diet plan includes a number of food substitutes, advice on eating in fast-food restaurants, a shopping list, and a list of acceptable snack foods.

**LOW GLYCEMIC INDEX DIET.** The glycemic index (GI) is a measurement system devised at the University of Toronto in 1981 for ranking dietary carbohydrates. The GI measures carbohydrates in individual foods on a gram-for-gram basis in regard to their effect on blood glucose levels in the first two hours after a meal. The higher the index number, the more rapidly the carbohydrate breaks down in the digestive tract and the more rapidly it raises blood sugar levels. A lower GI number is thought to relate to a longer feeling of fullness in the stomach, better control over insulin and blood sugar levels, and lower levels of blood lipids.

The Anne Collins low glycemic index diet plan is designed for people with type 2 diabetes, insulin resistance, or women with polycystic ovarian syndrome (PCOS, an endocrine disorder associated with **obesity** and insulin resistance) who need or want to lose weight rapidly. Like the Anne Collins low-carbohydrate diet, the low GI diet has a 28-day cycle of meal plans and shopping lists, but is not divided into two phases. It is fundamentally a lean-protein with low-GI carbohydrate diet, intended to stabilize the dieter's blood glucose level during weight loss. The meal plans allow about 1,100 calories per day but may be adjusted upward to 2,000 calories for men (and for dieters who wish to lose weight more slowly) by adding calorie-controlled snacks.

**10-MINUTE MEALS DIET.** The Anne Collins 10-minute meals diet is geared for dieters who wish to lose weight rapidly but have little time to cook. This plan is also for 28 days and is not divided into phases. The lunch menus have fast-food, brown-bag, and quick-cook options. Dinners provide fast-food, quick-cook, and two-day meal options; which are dinners intended to last for two days, thus freeing the dieter from having to cook twice.

Like the meal plans for the low GI diet, the meal plans for the 10-minute meals diet allow about 1,100 calories per day, adjustable upward to 2,000 or 2,100 calories through a choice of snacks, including fast-food options. After four weeks, the dieter can either repeat the 28-day cycle or choose another Anne Collins diet plan.

**CHOLESTEROL-LOWERING DIET.** This diet is intended for people who must lower blood cholesterol levels while losing weight and/or who wish to lose weight rapidly. The 28-day cycle of meal plans shows the total fat, saturated fat, and cholesterol content of every food item on the diet as well as the calorie values. The diet allows about 1,200 calories per day, with an average content of 22 g total fat, 4 g saturated fat, and 120 mg cholesterol. The meal plans are rich in dietary **fiber**, particularly soluble fiber, which has a number of important health benefits that include lowering blood cholesterol levels. The cholesterol and fat values of this diet plan fall within the guidelines recommended by the U.S. Food and Drug Administration (FDA). As with other Anne Collins diet plans, the calorie level can be adjusted upward for men and people who desire to lose weight more slowly.

The e-book that comes with this plan contains suggestions about and guidelines for exercise as a way to further lower blood cholesterol levels. The diet plan suggests that cholesterol levels should begin to fall within two to three weeks of beginning the diet. After four weeks, the dieter may repeat the cycle if blood cholesterol has not fallen to the desired level, or choose another diet in the program to continue losing weight.

**14-DAY LOW-CALORIE BOOSTER DIET.** This diet plan has only a 14-day rather than a 28-day cycle. It is intended for dieters who have only a short-term weight-loss goal (such as fitting into a specific outfit for an important event) or feel unable to reach a long-term goal and want a quick breakthrough. The plan allows for six meals or snacks per day to promote rapid food **metabolism**. The meal plans include a number of quick-cook recipes and convenience food or fast-food options.

The basic diet plan allows about 1,000 calories a day to maximize weight loss but can be adjusted upward for men.

**VEGETARIAN QUICK-START DIET.** The Anne Collins vegetarian quick-start diet is a rapid weight-loss plan for committed vegetarians, those who would like to try a vegetarian lifestyle, and those who would simply like to lower their meat and poultry consumption. Technically, the diet is ovolactovegetarian, which means that it includes eggs and dairy products.

This diet plan is based on a 28-day cycle, and allows about 1,250 calories per day, adjustable upward to about 2,000 calories for men. It also contains about 90

recipes, advice about cooking whole grains, vegetarian fast-food options, and calorie counts for all menu items.

**NO-NONSENSE BALANCED DIET.** The no-nonsense diet plan is intended for dieters who want to lose weight rapidly but also want some flexibility in a diet plan. This diet also has a 28-day cycle, with meal plans averaging 1,100 calories per day. Flexibility includes home-cooked and convenience meal options for every lunch as well as every dinner.

As with the other Anne Collins plans, the calorie level can be adjusted upward for men. Sample menus from this diet are as follows:

- Breakfast: 2 low-fat pancakes; 1 tbsp maple syrup; 2 slices Canadian bacon; one-half cup berries. Alternate menu: 1 cup fat-free yogurt; 2 tbsp wheat germ; 1 medium banana; 1 tbsp sesame seeds.
- Lunch: Convenience option: Subway six-inch roasted chicken breast submarine sandwich and 1 serving fruit. Home-cooked option: 1 cup low-fat ready-to-serve soup; 2 slices whole wheat bread spread with 2 tbsp fat-free mayonnaise and filled with chopped vegetables; 1 oz fat-free cheese.
- Dinner: Convenience meal option: Lean Cuisine angel-hair pasta meal; 2 cup salad; 1 tbsp fat-free dressing; 2 graham crackers with 1 tbsp fat-free cream cheese; 1 serving fruit. Home recipe option: 1 oz (dry weight) pasta or thin spaghetti; 3 oz very lean ground beef; one-half cup sliced bell peppers; 1 large tomato, chopped; 1 clove garlic, minced; one-half tsp oregano, one-half tsp Italian seasoning.
- Snacks: Select from list included with diet plan.

**DIET FOR LIFE.** The diet for life is essentially a slow weight-loss or maintenance-level diet plan that contains a 14-day starter set of meal plans. The meal plans are low in fat, moderate in **protein**, and high in carbohydrates. In addition to the usual calorie counts, this plan contains guidelines for lifelong sensible eating habits. It can be continued indefinitely, or the dieter may switch to another Anne Collins plan.

The basic calorie allowance in the diet for life is 1,300 calories per day, adjustable upward to 2,000 or 2,100 calories.

**VEGETARIAN DIET FOR LIFE.** The vegetarian diet for life is similar to the general diet for life plan, with a 14-day set of starter menus, a large number of easy-to-prepare recipes, and advice about lifelong sensible eating habits. Like the diet for life, the vegetarian diet for life plan is low in fat and moderate in protein. The menu plans provide about 1,250 calories per day and can be adjusted upward.

## QUESTIONS TO ASK YOUR DOCTOR

- What is your professional opinion of the Anne Collins weight loss system?
- Do you know of any published clinical studies of the Anne Collins program?
- Have any of your other patients tried it?
- Which of the nine diets did they use?
- Were they able to lose weight and keep it off?

### Function

The Anne Collins weight loss system is intended for the dieter who is "looking for safe permanent weight loss without using pills, special foods, or gimmicks of any sort." Most of the nine specific plans are intended for more rapid weight loss, but several are maintenance diets including a maintenance diet for vegetarians. All the specific plans can be tailored to allow higher calorie intakes for men or for dieters less concerned to about losing weight rapidly.

### Benefits

The system's Web site claims the following benefits for the nine diets:

- The dieter can lose weight "without going hungry. . . . Have you ever felt that horrible gnawing feeling on other diets when you feel that your stomach is eating itself? Well you'll never feel this with my system. If you're feeling hungry my advice is always to go eat."
- The dieter will "stay motivated. . . . With the Anne Collins Weight Loss Program you will be supported every step of the way and if you happen to slip up at any stage I'll be there to pick you up, dust you down and get you back on track. You can say goodbye to yo-yo dieting forever."
- The system does not depend on appetite suppressants, dietary supplements, or other special products.
- There are no forbidden foods. The dieter can fit fast foods, chocolate, and other foods that are avoided on most diets into most of the specific diets.
- The dieter will lose the excess weight permanently. "With my system you will learn how to make realistic and sustainable changes to your eating habits for ever."

One benefit mentioned by several reviewers of the Anne Collins system as a whole is its accommodation of vegetarians—at least ovolactovegetarians. Of the

nine diets, two—a quick weight-loss diet and a maintenance diet—are designed for vegetarians who use eggs and dairy products. Another benefit noted by reviewers is the relatively low cost of the Anne Collins plans. The $19.97 subscription fee is roughly the same as the cost of most novels in e-book form, and subscribers may download all nine PDFs if they wish. The fact that the system is not associated with a line of potentially expensive diet products is also appealing to reviewers.

Many dieters seem to like the flexibility of the Anne Collins plans, in particular the option of using convenience foods and switching among the various plans to avoid monotony. Opinion is mixed, however, regarding the use of fast foods in the Collins plans. Some reviewers maintain that the fast-food options are a necessary adaptation to contemporary eating patterns, while others regard the fast-food choices as exposing dieters to a high degree of temptation to cheat on the diet together with a high level of unhealthy saturated **fats** and sugars.

## Precautions

Although none of the Anne Collins diet plans are very low calorie diets (VLCDs) or otherwise extreme, it is always a good idea for people who need to lose 30 pounds or more; are pregnant or nursing; are below the age of 18; or have such chronic disorders as diabetes, kidney disease, or liver disease to check with a physician before starting a weight-reduction diet.

## Risks

There do not appear to be any significant health risks associated with any of the nine plans for dieters who have been evaluated by a physician for any previously undiagnosed disorders.

## Research and general acceptance

Although three physicians are listed on the Web site as approving the Collins system, two are identified only by initials. The Anne Collins system does not appear to have been used in any clinical trials reported in the medical literature, possibly because of the sheer number of different diet plans included in the program. In addition, Collins's credentials as a nutritionist are not listed on her Web site, which makes it difficult to verify her qualifications as a weight loss expert. Existing feedback about this diet is informal as of early 2007, consisting solely of testimonials on the Web site itself and comments or reviews on various Internet diet Web sites and online chat groups.

## KEY TERMS

**Glycemic index (GI)**—A system that ranks carbohydrates in individual foods on a gram-for-gram basis in regard to their effect on blood glucose levels in the first two hours after a meal. There are two commonly used GIs, one based on pure glucose as the reference standard and the other based on white bread.

**Insulin resistance**—A condition in which normal amounts of insulin in a person's blood are not adequate to produce an insulin response from fat, muscle, and liver cells. Insulin resistance is often a precursor of type 2 (adult-onset) diabetes.

**Lipids**—Organic substances containing hydrocarbons that are relatively insoluble in water. Lipids in the blood include such substances as cholesterol and fatty acids.

**Ovolactovegetarian**—A vegetarian who consumes eggs and dairy products as well as plant-based foods.

**Polycystic ovarian syndrome (PCOS)**—An endocrine disorder characterized by irregular ovulation in women of childbearing age and excessive amounts of androgens (masculinizing hormones). It is a leading cause of infertility and thought to affect between 5 and 10% of women. PCOS is often associated with obesity and insulin resistance. PCOS is also known as Stein-Leventhal syndrome.

**Soluble fiber**—The part of a food plant that resists digestion and absorption in the human small intestine but is fermented partially or completely in the large intestine. This fermentation yields short-chain fatty acids, which are beneficial to health by stabilizing blood glucose levels, lowering blood cholesterol levels, and supporting the immune system.

**Very low -calorie diet (VLCD)**—A term used by nutritionists to classify weight-reduction diets that allow around 800 calories or fewer a day.

## Resources

### BOOKS

Scales, Mary Josephine. *Diets in a Nutshell: A Definitive Guide on Diets from A to Z*. Clifton, VA: Apex Publishers, 2005.

### ORGANIZATIONS

Anne Collins Weight Loss Program. [cited April 26, 2007]. <http://www.anne-collins.com>.

Rebecca J. Frey, PhD

# Anorexia nervosa

## Definition

Anorexia nervosa is an eating disorder that involves self-imposed starvation. The individual is obsessed with becoming increasingly thinner and limits food intake to the point where health is compromised. Anorexia nervosa can be fatal.

## Description

Anorexia is often thought of as a modern problem, but the English physician Richard Morton first described it in 1689. In the twenty-first century anorexia nervosa is recognized as a psychiatric disorder in the *Diagnostic and Statistical Manual for Mental Disorders Fourth Edition (DSM-IV-TR)* published by the American Psychiatric Association.

Individuals with anorexia are on an irrational, unrelenting quest to lose weight, and no matter how much they lose and how much their health is compromised, they want to lose more weight. Recognizing the development of anorexia can be difficult, especially in a society that values and glamorizes thinness. Dieting is often the trigger that starts a person down the road to anorexia. The future anorectic may begin by skipping meals or taking only tiny portions. She (most anorectics are female) always has an excuse for why she does not want to eat, whether it is not feeling hungry, feeling ill, having just eaten with someone else, or not liking the food served. She also begins to read food labels and knows exactly how many calories and how much fat are in everything she eats. Many anorectics practically eliminate fat and sugar from their diets and seem to live on diet soda and lettuce. Some future anorectics begin to exercise compulsively to burn extra calories. Eventually these practices have serious health consequences. At some point, the line between problem eating and an eating disorder is crossed.

Anorexia nervosa is diagnosed when most of the following conditions are present:

- an overriding obsession with food and thinness that controls activities and eating patterns every hour of every day
- the individual weighs less than 85% of the average weight for his or her age and height group and willfully and intentionally refuses to maintain an appropriate body weight
- extreme fear of gaining weight or becoming fat, even when the individual is significantly underweight.
- a distorted self-image that fuels a refusal to admit to being underweight, even when this is demonstrably true
- refusal to admit that being severely underweight is dangerous to health
- for women, three missed menstrual periods in a row after menstruation has been established

Anorectics spend a lot of time looking in the mirror, obsessing about clothing size, and practicing negative self-talk about their bodies. Some are secretive about eating and will avoid eating in front of other people. They may develop strange eating habits such as chewing their food and then spitting it out, or they may have rigid ideas about "good" and "bad" food. Anorectics will lie about their eating habits and their weight to friends, family, and healthcare providers. Many anorectics experience depression and anxiety disorders.

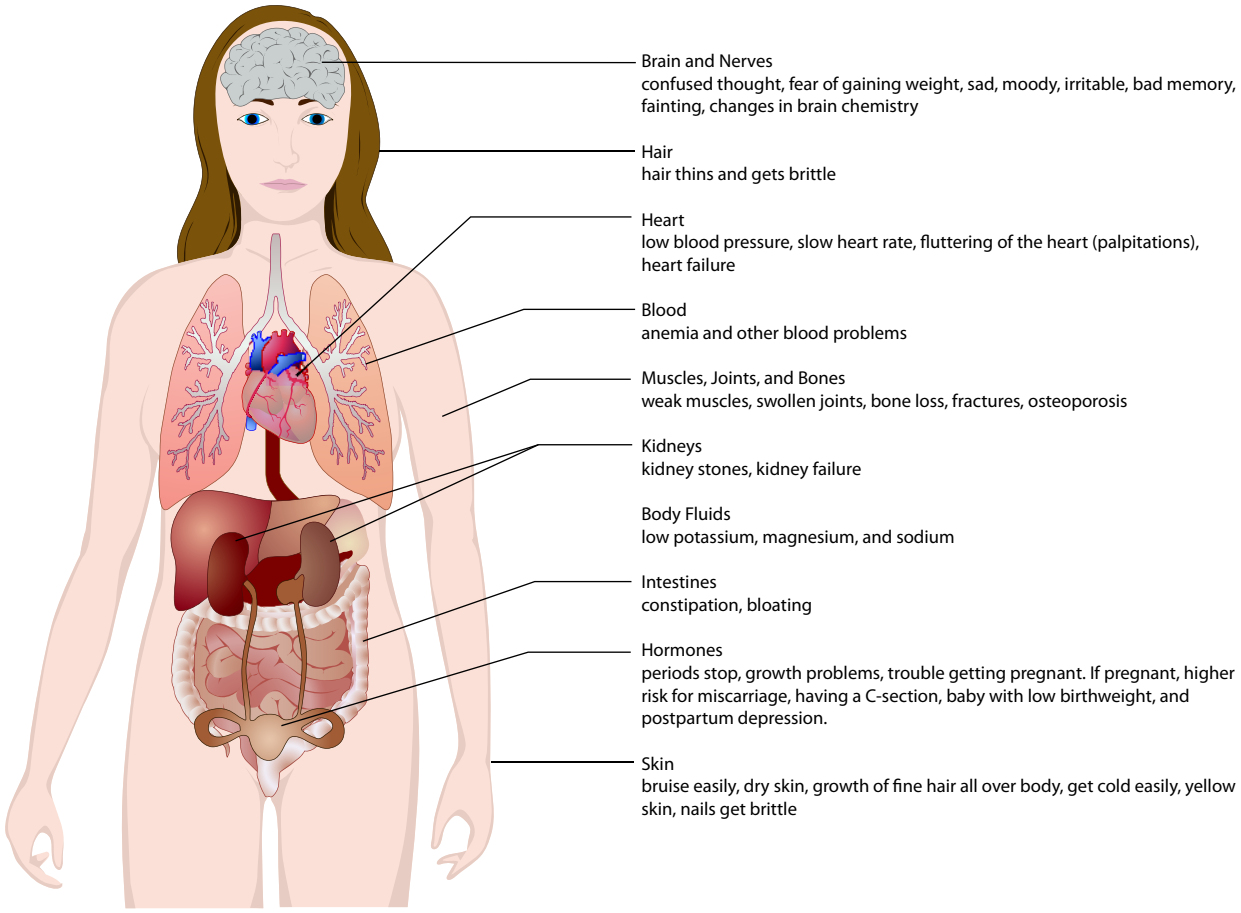
There are two major subtypes of anorectics. Restrictive anorectics control their weight by rigorously limiting the amount of calories they eat or by fasting. They may exercise excessively or abuse drugs or herbal remedies claim to increase the rate at which the body burns calories. Purge-type anorectics eat and then get rid of the calories and weight by self-induced vomiting, excessive laxative use, and abuse of **diuretics** or enemas.

## Demographics

Anorexia is a disorder of industrialized countries where food is abundant and the culture values a thin appearance. About 1% of Americans are anorectic and female anorectics outnumber males 10:1. In men, the disorder is more often diagnosed in homosexuals than in heterosexuals. Some experts believe that number of diagnosed anorectics represents only the most severe cases, and that many more people have anorexic tendencies, but their symptoms do not rise to the level needed for a medical diagnosis.

Anorexia has been characterized as a "rich white girl" disorder. Most anorectics are white, and about three-quarters of them come from households at the middle income level or above. However, in the 2000s, the number of blacks and Hispanics diagnosed with anorexia has increased. Competitive athletes of all races have an increased risk of developing anorexia nervosa, especially in sports where weight it tied to performance. Jockeys, wrestlers, figure skaters, cross-country runners, and gymnasts (especially female gymnasts) have higher than average rates of anorexia. People such as actors, models, cheerleaders, and dancers (especially ballet dancers) who are judged mainly on their appearance are also at high risk of developing the disorder.

Effects of anorexia on the body




SOURCE: Office on Women's Health, U.S. Department of Health and Human Services

*(Illustration by GGS Information Services/Thomson Gale.)*

Anorexia can occur to people as young as age 7. However, the disorder most usually begins during adolescence. It is most likely to start at one of two times, either age 14 or 18. Interestingly, this corresponds with the age of transitioning into and out of high school. The younger the age at which anorexic behavior starts, the more difficult it is to cure. Preteens who develop anorexia often show signs of compulsive behavior and depression in addition to anorexia.

## Causes and symptoms

### *Causes*

Anorexia is a complex disorder that does not have a single cause. Research suggests that some people have a predisposition toward anorexic and that something then triggers the behavior, which then becomes self-reinforcing. Hereditary, biological, psychological and social factors all appear to play a role.

- Heredity. Twin studies show that if one twin has anorexia nervosa, the other has a greater likelihood of developing the disorder. Having a close relative, usually a mother or a sister, with anorexia nervosa also increases the likelihood of other (usually female) family members developing the disorder. However, when compared to many other diseases, the inherited component of anorexia nervosa appears to be fairly small.
- Biological factors. There is some evidence that anorexia nervosa is linked to abnormal neurotransmitter activity in the part of the brain that controls pleasure and appetite. Neurotransmitters are also involved in

## KEY TERMS

**Diuretic**—A substance that removes water from the body by increasing urine production.

**Electrolyte**—Ions in the body that participate in metabolic reactions. The major human electrolytes are sodium (Na+), potassium (K+), calcium (Ca 2+), magnesium (Mg2+), chloride (Cl−), phosphate ($HPO_4$ 2−), bicarbonate ($HCO_3$−), and sulfate ($SO_4$ 2−).

**Neurotransmitter**—One of a group of chemicals secreted by a nerve cell (neuron) to carry a chemical message to another nerve cell, often as a way of transmitting a nerve impulse. Examples of neurotransmitters include acetylcholine, dopamine, serotonin, and norepinephrine.

other mental disorders such as depression. Research in this area is relatively new and the findings are unclear. People with anorexia tend to feel full sooner than other people. Some researchers believe that this is related to the fact that stomach of people with anorexia tends to empty more slowly than normal; others think it may be related to the appetite control mechanism of the brain.

- Psychological factors. Certain personality types appear to be more vulnerable to developing anorexia nervosa. Anorectics tend to be perfectionists who have unrealistic expectations about how they "should" look and perform. They tend to have a black-or-white, right-or-wrong, all-or-nothing way of seeing situations. Many anorectics lack a strong sense of identity and instead take their identity from pleasing others. Virtually all anorectics have low-self worth. Many experience depression and anxiety disorders, although researchers do not know if this is a cause or a result of the eating disorder.
- Social factors. Anorectics are more likely to come either from overprotective families or disordered families where there is a lot of conflict and inconsistency. Either way, the anorectic feels a need to be in control of something, and that something becomes body weight. The family often has high, sometimes unrealistic and rigid, expectations. Often something stressful or upsetting triggers the start of anorexic behaviors. This may be as simple as a family member as teasing about the person's weight, nagging about eating junk food, commenting on how clothes fit, or comparing the person unfavorably to someone who is thin. Life events such as moving, starting a new school, breaking up with a boyfriend, or even entering puberty and feeling awkward about one's changing body can trigger anorexic behavior. Overlaying the family situation is the unrelenting media message that thin is good and fat is bad; thin people are successful, glamorous, and happy, fat people are stupid, lazy, and failures.

### *Signs and Symptoms*

Anorexic behavior has physical and psychological consequences. These include:

- excessive weight loss; loss of muscle
- stunted growth and delayed sexual maturation in preteens
- gastrointestinal complications: liver damage, diarrhea, constipation, bloating, stomach pain
- cardiovascular complications: irregular heartbeat, low pulse rate, cardiac arrest
- urinary system complications: kidney damage, kidney failure, incontinence, urinary tract infections
- skeletal system complications: loss of bone mass, increased risk of fractures, teeth eroded by stomach acid from repeat vomiting
- reproductive system complications (women): missed menstrual periods, infertility
- reproductive system complications (men): loss of sex drive, infertility
- fatigue, irritation, headaches, depression, anxiety, impaired judgment and thinking
- fainting, seizures, low blood sugar
- chronically cold hands and feet
- weakened immune system, swollen glands, increased susceptibility to infections
- development of fine hair called lanugo on the shoulders, back, arms, and face, head hair loss, blotchy, dry skin
- potentially life-threatening electrolyte imbalances
- coma
- increased risk of self-mutilation (cutting)
- increased risk of suicide
- death

## Diagnosis

Diagnosis is based on several factors including a patient history, physical examination, laboratory tests, and a mental status evaluation. A patient history is less helpful in diagnosing anorexia than in diagnosing many diseases because many people with anorexia lie repeatedly about how much they eat and their use of laxatives, enemas, and medications. The patient

may, however, complain about related symptoms such as fatigue, headaches, dizziness, **constipation**, or frequent infections.

A physical examination begins with weight and blood pressure and moves through all the signs listed above. Based on the physical exam, the physician will order laboratory tests. In general these tests will include a complete blood count (CBC), urinalysis, blood chemistries (to determine electrolyte levels), and liver function tests. The physician may also order an electrocardiogram to look for heart abnormalities.

Several different mental status evaluations can be used. In general, the physician will evaluate things such as whether the person is oriented in time and space, appearance, observable state of emotion (affect), attitude toward food and weight, delusional thinking, and thoughts of self-harm or suicide.

## Treatment

Treatment choices depend on the degree to which anorexic behavior has resulted in physical damage and whether the person is a danger to him or herself. Medical treatment should be supplemented with psychiatric treatment (see Therapies below). Patients are frequently uncooperative and resist treatment, denying that their life may be endangered and insisting that the doctor only wants to "make them get fat."

Hospital impatient care is first geared toward correcting problems that present as immediate medical crises, such as severe malnutrition, severe electrolyte imbalance, irregular heart beat, pulse below 45 beats per minute, or low body temperature. Patients are hospitalized if they are a high suicide risk, have severe clinical depression, or exhibit signs of an altered mental state. They may also need to be hospitalized to interrupt weight loss, stop the cycle of vomiting, exercising and/or laxative abuse, treat substance disorders, or for additional medical evaluation.

Day treatment or partial hospitalization where the patient goes every day to an extensive treatment program provides structured mealtimes, nutrition education, intensive therapy, medical monitoring, and supervision. If day treatment fails, the patient may need to be hospitalized or enter a full-time residential treatment facility.

Anorexia nervosa is a chronic disease and relapses are common and to be expected. Outpatient treatment provides medical supervision, nutrition counseling, self-help strategies, and therapy after the patient has reached some weight goals and shows stability.

## Nutrition/dietetic concerns

A nutrition consultant or dietitian is an essential part of the team needed to successfully treat anorexia. The first treatment concern is to get the individual medically stable by increasing calorie intake and balancing **electrolytes**. After that, nutritional therapy is needed support the long process of recovery and stable weight gain. This is an intensive process involving of nutrition education, meal planning, nutrition monitoring, and helping the anorectic develop a healthy relationship with food.

## Therapy

Medical intervention helps alleviate the immediate physical problems associated with anorexia, but by itself, it rarely changes behavior. Psychotherapy plays a major role in the helping the anorectic understand and recover from anorexia. Several different types of psychotherapy are used depending on the individual's situation. Generally, the goal of psychotherapy is help the individual develop a healthy attitude toward their body and food. This may involve addressing at the root causes of anorexic behavior as well as addressing the behavior itself.

Some types of psychotherapy that have been successful in treating anorectics are listed below.

- Cognitive behavior therapy (CBT) is designed to change the individual's thoughts and feelings about his or her body and behaviors toward food, but it does not address why those thoughts or feelings exist. This therapy is relatively short-term.
- Psychodynamic therapy, also called psychoanalytic therapy, attempts to help the individual gain insight into the cause of the emotions that trigger their anorexic behavior. This therapy tends to be longer term that CBT.
- Interpersonal therapy is short-term therapy that helps the individual identify issues and problems in relationships. The individual may be asked to look back at his or her family history to try to recognize problem areas and work toward resolving them.
- Family and couples therapy is helpful in dealing with conflict or disorder that may be a factor in perpetuating anorexic behavior. Family therapy is especially useful in helping parents who are anorectics avoid passing on their attitudes and behaviors on to their children.

## Prognosis

Anorexia nervosa is difficult to treat successfully. Medical stabilization, nutrition therapy, continued

medical monitoring, and substantial psychiatric treatment give a person with anorexia the best chance of recovery. Estimates suggest that between 20% and 30% of people in treatment drop out too soon and have major relapses. Even those who stay in treatment relapse occasionally. Treating anorexia is often a long, slow, frustrating process that can cost many thousands of dollars. The earlier in life that the disorder starts and the longer the disorder continues untreated, the more difficult it is bring about recovery. Many individuals with anorexia are willfully uncooperative and do not want to recover.

About half the people treated for anorexia nervosa recover completely and are able (sometimes with difficulty) to maintain a normal weight. Of the remaining 50% between 6% and 20% die, usually of health complications related to starvation. About 20% remain dangerously underweight, and the rest remain thin.

## Prevention

Some ways to prevent anorexia nervosa from developing are as follows:

- If you are a parent, do not obsess about your own weight and appearance in front of your children.
- Do not tease your children about their body shapes or compare them to others.
- Make it clear that you love and accept your children as they are.
- Try to eat meals together as a family whenever possible.
- Remind children that the models they see on television and in fashion magazines have extreme, not normal or healthy bodies.
- Do not put your child on a diet unless advised to by your pediatrician.
- Block your child from visiting pro-anorexia Websites. These are sites where people with anorexia give advice on extreme weight loss techniques and support each other's distorted body image.
- If your child is a competitive athlete, get to know the coach and the coach's attitude toward weight.
- If you think your child has an eating disorder, do not wait to intervene and the professional help. The sooner the disorder is treated, the easier it is to cure.

Relapses happen to many people with anorexia. People who are recovering from anorexia can help prevent themselves from relapsing by:

- never dieting; instead plan healthy meals
- staying in treatment
- monitoring negative self-talk; practicing positive self-talk
- spending time doing something enjoyable every day
- staying busy, but not overly busy; getting at least seven hours of sleep each night
- spending time each day with people you care about and who care about you

## Resources

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### ORGANIZATIONS

American Psychological Association. 750 First Street, NE, Washington, DC 20002-4242. Telephone: (800) 374-2721; (202) 336-5500. TDD/TTY: (202)336-6123. Website: <http://www.apa.org>

National Association of Anorexia Nervosa and Associated Disorders (ANAD). P.O. Box 7 Highland Park, IL 60035. Telephone: (847) 831-3438. Website: <http://www.anad.org>

National Eating Disorders Association. 603 Stewart Street, Suite 803, Seattle, WA 98101. Help and Referral Line: (800) 931-2237. Office Telephone: (206) 382-3587. Website: <http://www.edap.org>

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Tish Davidson, A.M.

**Anti-Aging Diet**

| Benefits | Risks and disadvantages |
|---|---|
| Can improved health | Hunger, food cravings, and obsession with food |
| Research shows it adds years to the lifespan and extends youthful years | Loss of strength or stamina and loss of muscle mass, which can affect physical activities |
| Can prevent or forestall many diseases, including heart disease, cancer, stroke, diabetes, osteoporosis, Alzheimer's, and Parkinson's | Decreased levels of testosterone |
| Most physiologic functions and mental abilities of animals on reduced calorie diets correspond to those of much younger animals | Rapid weight loss (more than two pounds a week) which can have an overall negative impact on health |
| Shown to extend the maximum lifespan of most life forms it has been tested on | Slower wound healing |
| | Reduced bone mass |
| | Increased sensitivity to cold |
| | Reduced energy reserves |
| | Menstrual irregularity |
| | Drastic appearance changes from loss of fat and muscle, causing people to look thin or anorexic |
| | Problems can arise over family meals, eating in restaurants, workplace food, parties, and holidays |
| | Can cause psychological problems, including anorexia, binging, and obsessive thoughts about food |

*(Illustration by GGS Information Services/Thomson Gale.)*

# Anti-aging diet

## Definition

The anti-aging diet is one that restricts calorie intake by 30–50% of normal or recommended intake with the goal of increasing human lifespan by at least 30%. People on the diet also have improved health providing they consume adequate **vitamins**, **minerals**, and other essential nutrients.

## Origins

The idea that a calorie-restrictive diet can significantly increase lifespan has been around since the 1930s. In 1935, Cornell University food researchers Clive McCay and Leonard Maynard published their first in a series of studies of experiments in which laboratory rats were fed a diet that contained one-third less calories (compared to a control group of rats) but still contained adequate amounts of vitamins, minerals, **protein**, and other essential nutrients. This calorie-restrictive diet provided much less energy than researchers had previously thought rats needed to maintain growth and normal activities. The rats on the lower calorie diet lived 30–40% longer than the rats on a normal calorie diet. Since then, more than 2,000 studies have been done, mostly on animals, about the connection between **calorie restriction** and increased longevity.

A reduced calorie diet was taken a step further by the University of California, Los Angeles, pathologist Roy Walford who studied the biology of aging. In 1986 he published *The 120-Year Diet* and a follow-up in 2000, *Beyond the 120-Year Diet* in which he argued that human longevity can be significantly increased by adhering to a strict diet that contains all the nutrients needed by humans but with about one-third the calories. In 1994 he co-authored *The Anti-Aging Plan: Strategies and Recipes for Extending Your Healthy Years*. His anti-aging plan is based on his own research and that of other scientists. Included is his study of diet and aging conducted as chief physician of the Biosphere 2 project in Arizona in the early 1990s. Walford was one of eight people sealed in Biosphere 2 from 1991 to 1993 in an attempt to prove that an artificial closed ecological system could sustain human life. He also co-founded the Calorie Restriction Society in 1994.

## Description

Anti-aging diets are regimes that reduce the number of calories consumed by 30–50% while allowing

## KEY TERMS

**Alzheimer's disease**—A degenerative disorder that effects the brain, causing dementia and loss of memory usually late in life.

**Antioxidant**—Substance that inhibits the destructive effects of oxidation in the body.

**Body mass index (BMI)**—A scale that expresses a person's weight in relation to height.

**Calorie reduction**—A decrease in the number of calories that a person consumes.

**Deoxyribonucleic acid (DNA)**—A nucleic acid molecule in a twisted double strand, called a double helix, that is the major component of chromosomes. DNA carries genetic information and is the basis of life.

**Free radicals**—Highly reactive atoms or molecules that can damage DNA.

**Osteoporosis**—A disease that causes bones to become porous, break easily, and heal slowly.

**Parkinson's disease**—An incurable nervous disorder marked by symptoms of trembling hands and a slow, shuffling walk.

**Testosterone**—A male sex hormone responsible for secondary sex characteristics.

the necessary amounts of vitamins, minerals, and other nutrients the body needs to sustain itself and grow. This calorie restriction has been shown to increase the lifespan of various animals, including rats, fish, fruit flies, dogs, and monkeys, by 30–50%. Some human studies have also been done—and long-term studies are underway— but evidence of its impact on humans is very limited compared to results available from the animal studies. The completed studies indicate that calorie restriction can increase the maximum human lifespan by about 30%. The problem preventing scientists from offering substantive proof that humans can greatly increase their lifespan by restricting calories is that the current maximum human lifespan is 110–120 years and full compliance with the diet is difficult. A 30% increase would extend the human lifespan to 143–156. This is an exceptionally long time for a scientific study and requires involvement of several generations of scientists. Only several hundred people have ever been documented to lived past age 110 and there are only two people with confirmed documentation who have lived to at least age 120: Jeanne Louise Calmet (1875–1997) of France who lived 122 years and 164 days; and Shigechiyo Izumi (1865–1986) of Japan who lived 120 years and 237 days, according to *Guinness World Records*.

Since 1980, dozens of books have been published offering specific calorie reduction diets aimed at increasing lifespan. The most popular diets include the Okinawa Diet, Anti-Inflammation Diet, Longevity Diet, **Blood Type Diet**, Anti-Aging Plan, and the 120-Year Diet.

Calorie restriction is a lifelong approach to eating by significantly lowering daily calorie intake while still getting all the body's required nutrients. People who experience starvation or famine receive no longevity benefits since their low calorie intake contains little nutrition. The diet is believed to most benefit people who start in their mid-20s, with the beneficial effects decreasing proportionately with the age one begins the diet.

Although there are variations between anti-aging diets, most reduced calorie diets recommend a core set of foods. These include vegetables, fruits, fish, **soy**, low-fat or non-fat dairy products, nuts, avocados, and olive oil. The primary beverages recommended are **water** and green or black tea.

Guidelines on calorie reduction vary from diet to diet, ranging from a 10% reduction to a 50% reduction of normal intake. Roy L. Walford (1924–2004), author of several books on anti-aging diets, says a reasonable goal is to achieve a 10–25% reduction in a person's normal weight based on age, height, and body frame. The Anti-Aging Plan diet recommends men of normal weight lose up to 18% of their weight in the first six months of the diet. For a six-foot male weighing 175 lb, that means a loss of about 31 pounds. For a small-framed woman who is five-foot, six-inches tall and weighs 120 pounds, the plan recommends losing 10% of her weight in the first six months, a loss of 12 lb.

Walford's Anti-Aging Plan is a diet based on decades of animal experimentation. It consists of computer generated food combinations and meal menus containing all of the U.S. Department of Agriculture's Recommended Daily Allowances of vitamins and other essential nutrients using foods low in calories. On the diet, the maximum number of calories allowed is 1,800 per day. There are two methods for starting the diet: rapid orientation and gradual orientation.

The rapid orientation method allows people to eat low calorie meals rich in nutrients. This is a radical change for most people and requires a good deal of willpower. All foods low in nutrients are eliminated from the diet. The nutritional value and calories in

foods and meals is determined by a software program available for purchase from Walford's Calorie Restriction Society.

The gradual orientation method allows people to adopt the diet over time. The first week, people eat a high-nutrient meal on one day. This increases by one meal a week until participants are eating one meal high in nutrients every day at the end of seven weeks. Other meals during the day are low-calorie, healthy foods but there is no limit on the amount a person can eat. After two months, participants switch to eating low-calorie, high-nutrition foods for all meals.

On his Web site (http://www.walford.com), Walford states: "Going for longevity on the Anti-Aging Plan requires caloric limitation. We advise, however, that you view this as a lifestyle change and not a quick-fix program or a diet. Any person can physiologically adapt to this level of limitation and experience no physical hunger provided that nearly every calorie eaten is a nutrient-rich calorie."

A sample one-day low-calorie, high-nutrition menu developed by Walford is:

- Breakfast: One cup of orange juice, one poached egg, one slice of mixed whole-grain bread, and one cup of brewed coffee or tea.
- Lunch: One-half a cup of low-fat cottage cheese mixed with one-half a cup of non-fat yogurt and one tablespoon of toasted wheat germ, an apple, and one whole wheat English muffin.
- Dinner: Three ounces of roasted chicken breast without the skin, a baked potato, and one cup of steamed spinach.
- Snack: Five dates, an oat bran muffin, and one cup of low-fat milk.

The three meals and snack contain 1,472 calories, 92 g protein, 24 g fat, 234 g **carbohydrates**, 27 g **fiber**, and 310 g cholesterol.

## Function

The goal of the anti-aging diet is to slow the aging process, thereby extending the human lifespan. Even though it is not a weight loss diet, people taking in significantly fewer calories than what is considered normal by nutritionists are likely to lose weight. Exercise is not part of calorie reduction diets. Researchers suggest people gradually transition to a reduced calorie diet over one or two years since a sudden calorie reduction can be unhealthy and even shorten the lifespan.

There is no clear answer as to why severely reducing calorie intake results in a longer and healthier life. Researchers have various explanations and many suggest it may be due to a combination of factors. One theory is that calorie restriction protects DNA from damage, increases the enzyme repair of damaged DNA, and reduces the potential of genes being altered to become cancerous. Other calorie reduction (CR) theories suggest:

- CR helps reduce the production of free radicals; unstable molecules that attack healthy, stable molecules. Damage caused by free radicals increases as people age.
- CR delays the age-related decline of the human immune system and improved immune function may slow aging.
- CR slows metabolism, the body's use of energy. Some scientists propose that the higher a person's metabolism, the faster they age.

## Benefits

The primary benefits of the anti-aging diet are improved health and prevention or forestalling diseases such as heart disease, **cancer**, stroke, diabetes, **osteoporosis**, Alzheimer's, and Parkinson's. Studies show that most physiologic functions and mental abilities of animals on reduced calorie diets correspond to those of much younger animals. The diet has also demonstrated extension of the maximum lifespan for most life forms on which it has been tested.

## Precautions

A reduced calorie diet is not recommended for people under the age of 21 since it may impair physical growth. This impairment has been seen in research on young laboratory animals. In humans, mental development and physical changes to the brain occur in teenagers and people in their early 20s that may be negatively affected by a low-calorie diet.

Other individuals advised against starting a calorie-restricted diet include women who plan on getting pregnant, women who are pregnant, and those who are nursing babies. A low **body mass index** (BMI), which occurs with a low-calorie diet, is a risk factor in pregnancy and can result in dysfunctional ovaries and infertility. A low BMI also can cause premature birth and low birth weights in newborns. People with existing medical conditions or diseases are discouraged from reduced calorie diets. They should be especially cautious and consult with their physician before starting.

It is imperative that participants ensure that they continue to consume adequate levels of essential

nutrients. Nutritional supplements and other forms of nutritional help may be necessary.

### Risks

There are a wide range of risks associated with an anti-aging, reduced calorie diet. These risks include physical, mental, social, and lifestyle issues.

- Hunger, food cravings, and obsession with food.
- Loss of strength or stamina and loss of muscle mass, which can affect physical activities, such as sports.
- Decreased levels of testosterone, which can be compensated with testosterone supplementation.
- Rapid weight loss (more than two pounds a week), which can negatively impact health
- Slower wound healing
- Reduced bone mass, which increases the risk of fracture
- Increased sensitivity to cold
- Reduced energy reserves and fatigue
- Menstrual irregularity
- Headaches
- Drastic appearance changes from loss of fat and muscle, causing people to look thin or anorexic

Social issues can arise over family meals, since not all family members may be on a reduced calorie diet. Conflict related to the types of food served, the amount of food served and the number of meals in a day, and fasting may develop. Other social issues involve eating in restaurants, workplace food, parties, and holidays. The long-term psychological effects of a reduced calorie diet are unknown. However, since a low calorie diet represents a major change in a person's life, psychological problems can be expected, including anorexia, binging, and obsessive thoughts about food and eating.

### Research and general acceptance

An anti-aging diet that restricts calories may slow the aging of the heart and lengthen lifespan, according to a study by Washington University School of Medicine in St. Louis, Missouri. The small study, released in 2006, followed 25 people aged 41–65 who consumed only 1,400–2,000 calories a day for six years. Results of the study showed participants had heart functions that resembled people 15 years younger and their blood pressure was significantly lower than a control group who had a calorie intake of 2,000–3,000 per day, the amount of a normal Western diet.

A calorie-restrictive diet may reverse early stages of Parkinson's disease, according to a study released in 2005 by the Oregon Health and Science University and the Portland Veterans Affairs Medical Center in Portland, Oregon. Researchers said mice in the early stages of Parkinson's disease who had their calorie intake reduced by 50% had elevated levels of glutamate, an essential brain chemical that is lost due to Parkinson's disease. Results of this study are optimistic, but further research is necessary to prove any level of effectiveness in humans.

### QUESTIONS TO ASK YOUR DOCTOR

- Do I need to take any vitamin, mineral, or other nutritional supplements if I go on the diet?
- Will an anti-aging diet have any negative impacts on my health?
- Are there other diets you would recommend that would allow me to reach the same goals as the anti-aging diet?
- How will restricting my calorie intake effect my metabolism and energy level?

### Resources

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Stipp. David. "Researchers Seek Key to Anti-Aging in Calorie Cutback." *Wall Street Journal* (October 30, 2006): A-1.

**ORGANIZATIONS**

American Aging Association. The Sally Balin Medical Center, 110 Chesley Drive, Media, PA 19063. Telephone: (610) 627-2626. Website: <http://www.americanaging.org>.

American Dietetic Association. 120 South Riverside Plaza, Suite 2000, Chicago, IL 60606-6995. Telephone: (800) 877-1600. Website: <http://www.eatright.org>.

Calorie Restriction Society. 187 Ocean Drive, Newport, NC 28570. Telephone: (800) 929-6511. Website: <http://www.calorierestriction.org>.

National Institute on Aging. Building 31, Room 5C27, 31 Center Drive, MSC 2292, Bethesda, MD 20892. Telephone: (800) 222-2225. Website: <http://www.nia.nih.gov>.

Ken R. Wells

**Anti-inflammatory diet**

| Anti-inflammatory foods | |
|---|---|
| Fruits | Fresh fruits, berries, blueberries, blackberries, and strawberries |
| Legumes and beans | Pinto, kidney, borlotti, mung, cannelloni, adzuki, fava, and black beans; soybeans; garbanzo or chickpeas |
| Nuts and seeds | Walnuts, flax seeds, pumpkin seeds (raw, unsalted) |
| Oils | Expeller pressed canola oil, extra-virgin olive oil, or rice bran, grape seed, evening primrose and walnut oil |
| Poultry, lean | Grass fed, free of preservatives, sodium, nitrates or coloring |
| Soy products | Soybeans, edemame, tofu, tempeh, soymilk, other products from soybeans |
| Spices and herbs | Replaces salt, sugar, added saturated fat |
| Seafood and wild fish | Herring, mackerel, salmon, trout |
| Vegetables, fresh | Green leafy vegetables, brightly colored vegetables |
| Water | Free of toxic chemicals |
| Whole grains | Amaranth, barley, bulgur, wild rice, millet, oats, quinoa, rye, spelt, wheat berries, buckwheat, whole wheat |
| **Pro-inflammatory foods** | |
| Dairy products, high fat | Butter, cream, sour cream, whole milk |
| Processed meats | Lunch meats, hot dogs, sausages |
| Red meats | Beef, lamb, pork |
| Refined grains | White bread, white rice, pasta (unless whole grain), chips, products made with white flour, such as cake, cookies, crackers, pretzels, doughnuts, bagels, muffins |
| Saturated fats | Meats, dairy products, eggs |
| Sugars, refined, and high sugar foods | Sodas, pastries, presweetened cereals, candy, white and brown sugar, confectioners sugar, corn syrup, processed corn fructose |
| *Trans* fats | In meats, dairy products, cakes, cookies, crackers, pies, bread, margarine, fried potatoes, potato chips, corn chips, popcorn, household shortening, salad dressing |

*(Illustration by GGS Information Services/Thomson Gale.)*

# Anti-inflammatory diets

## Definition

There is no one anti-inflammatory diet, rather, there are diets designed around foods that are believed to decrease inflammation and which shun foods that aggravate the inflammatory processes. Many anti-inflammatory diets are based around whole grains, legumes, nuts, seeds, fresh vegetables and fruits, wild fish and seafood, grass-fed lean turkey and chicken which are thought to aid in the bodies healing of inflammation. They exclude foods that are thought to trigger inflammation such as refined grains, wheat, corn, full-fat dairy, red meat, **caffeine**, alcohol, peanuts, sugar, saturated and trans-saturated **fats**.

The common foundation of anti-inflammatory diets is the belief that low grades of inflammation are the precursor and/or antagonizer to many chronic diseases. Once removed, the body can begin healing itself.

## Origins

The philosophical genesis of anti-inflammatory diets dates back to the original healers throughout

history who have worked with foods, herbs, teas and other natural remedies to assist the body's own healing energy.

Beginning in the 1970s investigators began exploring physiological mechanisms of fever, weight loss, and acute phase responses to acute and chronic infection. Research results from these studies began to change the mainstream attitudes about disease pathogenesis. Accumulating evidence linked proteins, produced by macrophages and other immune cells, not pathogens, as formerly believed, to the cause of tissue damage and disease syndromes in experimental animals. Thus the medical profession began looking into original treatments for chronic diseases. Then in the 1980s, research showed that proteins, newly named cytokines, and hormone-like substances, named prostaglandins and leukotrienes, revealed that they possessed pleiotropic biological activities that were either beneficial or injurious to the bodies' tissues.

From this research emerged the cytokine theory of disease. The concept that cytokines produced by the immune system, can cause the signs, symptoms, and damaging after effects of chronic diseases. Change did not occur until the measurement of C-reactive **protein** (CRP), a marker of inflammation circulating in the blood, was proposed as a method to identify persons at risk of chronic diseases. As pioneering research began to show that higher levels of C-reactive protein was linked to heart disease, conventional thought among the medical profession began. Originally discovered by W. S. Tillett and T. Francis Jr. in 1930, C-reactive protein was discovered as a substance in the serum of patients diagnosed with acute inflammation that reacted with the C-polysaccharide of pneumoccocus.

Today, a growing consensus among medical professionals is that inflammation is believed to play a role in the pathogenesis of chronic diseases such as heart disease, stroke, diabetes, and colon **cancer** to name a few. Mainstream thinking is beginning to accept that treating the underlying cause may ameliorate cardiovascular disease, metabolic syndrome, **hypertension**, diabetes, and **hyperlipidemia**, inflammation caused by visceral adipose tissue.

## KEY TERMS

**Inflammation:**—Swelling, redness, heat, and pain produced in an area of the body as a reaction to injury or infection.

**Chronic disease:**— an illness or medical condition that lasts over a long period of time and sometimes causes a long-term change in the body.

**C-reactive protein (CRP):**— a marker of inflammation circulating in the blood has been proposed as a method to identify persons at risk of these diseases.

**Flavonoid:**—refers to compounds found in fruits, vegetables, and certain beverages that have diverse beneficial biochemical and antioxidant effects.

**Anti-oxidant:**—A chemical compound or substance that inhibits oxidation. A substance, such as vitamin E, vitamin C, or beta-carotene.

## Description

### *Inflammation*

Inflammation is a localized reaction of tissue to injury, whether caused by bacteria or viral infection, trauma, chemicals, heat or other phenomenon that causes irritation. The 'irritation' causes the tissues within the body to release multiple substances that cause changes within the tissues. This complex response is called inflammation. Inflammation is characterized by such symptoms that include (1) vasodilatation of the local blood vessels resulting in excess local blood flow, (2) increases in the permeability of the capillaries with leakage of large quantities of fluid into the interstitial spaces, (3) May include clotting of the fluid in the interstitial spaces due to excess amounts of fibrinogen and other proteins leaking from the capillaries, (4) relocation of granulocytes and monocytes into the tissue in large quantities, thus (5) swelling of the tissue cells.

The common substances released from the tissues that result in inflammation are histamine, bradykinin, serotonin, prostaglandins, multiple hormonal substances called lymphokines that are released by sensitized T-cells and various other reaction products of other systems within the body. Many of these substances activate the macrophage system, which are sent out to dispose of the damaged tissue but also which further injure the still-living tissue and cells.

### *Conditions with chronic inflammation*

Inflammation has been associated as a component of, but not limited to, arthritis, heart disease, diabetes, strokes, asthma, allergies, irritable bowel disease, **Celiac disease** or other digestive system diseases, **obesity**, chronic stress, sleep disorders such as sleep apnea,

Alzheimer's disease, high blood pressure, elevated lipids such as **triglycerides** and cholesterol.

### *Medical Anti-Inflammatory Treatments*

General anti-inflammatory medical treatments include relaxation, moderate exercise such as walking, weight maintenance or loss, and medications designed to reduce the inflammation and control the pain if present.

These medications may include: ibuprofen or aspirin, Non Steroidal Anti-Inflammatory Drugs (NSAIDs), or steroid medications. The NSAIDs are widely used as the initial form of therapy. Unfortunately, long-term use of these medications can irritate the stomach and lead to **ulcers**. And in some cases can lead to kidney, as well as other medical problems.

## Function

### *Diet and chronic inflammation*

Registered dietitians, and Naturopathic physicians often prescribe diets to lessen the inflammatory symptoms of diseases. Although these diets have not been compared to other treatments in many formal research settings to date, it is thought that anti-inflammatory diets result in a reduced amount of inflammation and a healthier response by the immune system.

Adding foods that reduce inflammation is thought to improve symptoms of chronic diseases and help decrease risk for chronic diseases. These foods help in supplying the nutrients that are needed to decrease inflammation. One example is **omega-3 fatty acids**. The human body uses these fats to manufacture prostaglandins, chemicals that play an important role in inflammation and a healthy immune response. Another beneficial component of fish oil that plays an important role is eicosapentaenoic acid (EPA), an essential fatty acid derived from omega-3 fatty acids. EPA promotes the production of certain forms of prostaglandins having anti-inflammatory properties by reducing inflammation and decreasing the production of inflammatory substances.

## Foods that reduce chronic inflammation

### *Whole grains*

Whole grains or foods made from them, whether cracked, crushed, rolled, extruded, and/or cooked, contain the essential parts and nutrients of the entire grain seed. Research has shown that diets high in whole grain products are associated with decreased concentrations of inflammatory markers and increased adiponectin levels. The protective effects of a diet high in whole grains on systemic inflammation may be explained, in part, by reduction in overproduction of oxidative stress that results in inflammation.

A whole grain will include the following parts of the grain kernel–the bran, germ and endosperm. Such whole grains are amaranth, barley, bulgur, wild rice, millet, oats, quinoa, rye, spelt, wheat berries, buckwheat, and whole wheat.

### *Legumes*

Diets high in legumes are inversely related to plasma concentrations of C-reactive protein (CRP). Among the many varieties of legumes are; pinto beans, lentils, kidney beans, borlotti beans, mung beans, soybeans, cannelloni beans, garbanzo or chickpeas, adzuki beans, fava beans, and black beans.

### *Nuts, seeds*

Nuts and seeds are rich in unsaturated fat and other nutrients that may reduce inflammation. Frequent nut consumption is associated with lower levels of inflammatory markers. This may explain why there is a lower risk of cardiovascular disease and type 2 diabetes with frequent nut and seed consumption. With the exception of peanuts, be sure to add in walnuts, flax seeds and pumpkin seeds. Nuts and seeds are best eaten when unsalted and raw.

### *Fresh vegetabless*

Green leafy vegetables, and brightly colored vegetables provide beta-carotene; **vitamin C** and other **antioxidants** have been shown to reduce cell damage and to have anti-inflammatory effects. Aim for 3 or more servings per day.

### *Fresh fruits*

Flavonoids found in fresh fruits among other substances are thought to increase the antioxidant effects of vitamin C. research has shown that fruits have an anti-inflammatory effect. Aim for two or more servings daily. Be sure to include berries in your weekly choices of fruits such as blueberries, blackberries, and strawberries.

### *Wild fish and seafood*

Oily fish such as Herring, Mackerel, Salmon and Trout are an excellent source of omega-3 fatty acids, as are shellfish such as mussels and clams. Including fish or seafood high in omega-3 fatty acids at least three times a week is recommended.

### *Lean poultry*

Protein is used in the body to repair and manufacture cells, make antibodies, enzymes and hormones. Lean protein has been associated with lower levels of inflammatory biomarkers.

When choosing poultry, choose grass-fed animals, which tend to have a higher amount of essential fatty acids. Select poultry with limited amounts of, or free of, preservatives, **sodium**, nitrates or coloring. Also, in an ideal diet, only 10-12% of daily calories should come from protein. On average, an adult needs 0.36 grams of protein per pound of body weight.

### *Soy products*

Anti-inflammatory properties of the isoflavones, a micronutrient component of **soy**, have been reported in several experimental models and disease conditions. Data suggests the possibility of beneficial effects of isoflavone-rich soy foods when added to the diet. Soy products include; soybeans, edema me, tofu, tempeh, soymilk, as well as many other products made from soybeans.

### *Oils*

Expeller pressed Canola oil and Extra Virgin Olive oil are types of oils that have been linked to reduced inflammation. Other oils thought to aid in reducing inflammation include rice bran, grape seed, evening primrose and walnut oil. It is suggested to use these oils in moderation when cooking, baking and flavoring of foods. Also, when purchasing oils, make sure they are pure oils rather than blended oils. Blended oil usually contains less healthful oils.

### *Water in the form of fresh drinking water free of toxic chemicals*

**Water** is an essential substance for every function of the body. It is a medium for chemical processes; a solvent for body wastes and dilutes their toxicity and aids in their excretion. Water aids in ingestion, absorption and transport of vital nutrients that have anti-inflammatory effects. Water is also needed for basic cell functioning, repairing of body tissues and is the base of all blood and fluid secretions.

### *Herbs and Spices*

A greater amount of research is emerging on the antioxidant properties of herbs and spices and their use in the management of chronic inflammation. Herbs and spices can be used in recipes to partially or wholly replace less desirable ingredients such as salt, sugar and added saturated fat, know for their inflammatory effects, thus reducing the damaging properties of these foods.

## Precautions

### *Foods that irritate inflammation*

Best referred to in research articles as 'the western dietary pattern', it credits a diet that is high in refined grains, red meat, butter, processed meats, high-fat dairy, sweets and desserts, pizza, potato, eggs, hydrogenated fats, and soft drinks. This pattern of eating is positively related to an increase in circulating blood CRP levels and higher risks for chronic diseases, obesity and cancers. These foods, termed 'pro-inflammatory' may increase inflammation, thus increasing a persons risk for chronic diseases as well as exacerbate symptoms from these chronic conditions.

There is some support for the belief that **food sensitivities** or allergens to foods may be a trigger for inflammation. Often hard to detect with common blood tests, some people have seen alleviation of symptoms of chronic diseases, such as arthritis, when the aggravating foods are removed from their diet. Common allergic foods are milk and dairy, wheat, corn, eggs, beef, yeast and soy.

Other pro-inflammatory foods have been shown to have substances that activate or support the inflammatory process. Unhealthy trans fats and saturated fats used in preparing and processing certain foods are linked to increased inflammation. Processed meats such as lunchmeats, hot dogs and sausages contain chemicals such as nitrites that are associated with increased inflammation and chronic disease.

Saturated fats naturally found in meats, dairy products and eggs contain fatty acids called arachidonic acid. While some arachidonic acid is essential for health, excess arachidonic acid in the diet has been shown to worsen inflammation.

Research supports that diets high in sugar produce acute oxidative stress within the cells, associating it with inflammation. Elimination of high sugar foods such as sodas, soft drinks, pastries, presweetened cereals and candy has been shown to be beneficial. As well as switching from refined grains to whole grains.

## Benefits

The effects of the anti-inflammatory diet are unobtrusive. There is a series of research articles that demonstrate a benefit in reduction of chronic diseases such as cardiovascular disease, neurodegenerative diseases, and cancers when following a dietary pattern associated with the anti-inflammatory diet. But the

## QUESTIONS TO ASK YOUR DOCTOR

- May any of my medical conditions be aided by adopting an anti-inflammatory diet?
- What foods can I eat to decrease my dosage of anti-inflammatory medications?
- How might the anti-inflammatory diet help me in reducing my risks of chronic diseases?
- Would you recommend that I adopt more anti-inflammatory foods into my diet?

benefits go beyond disease prevention. Studies have shown an alleviation of symptoms associated with chronic diseases. As well, a person may decrease or discontinue their dosage of medications prescribed to control symptoms related to inflammatory conditions, and reduce the side affects associated with anti-inflammatory agents.

It has also been documented that people who followed the anti-inflammatory diet stated they experienced loss of weight, had an elevation of energy, and reported better mental and emotional health.

### Risks

The risks associated with following the anti-inflammatory diet are limited and not supported by research. The general concern associated with following any diet without the consent of a primary physician would apply. Anyone attempting to follow the anti-inflammatory diet should discuss it with their primary care physician and get a referral to see a Registered Dietitian, educated in the diet for maximal benefit and decreased risk of following a diet that eliminates certain foods from the dietary pattern to ensure proper intake of all macro and micro-nutrients.

### Research and general acceptance

As stated previously, there is no one anti-inflammatory diet but rather there are foods that are thought to increase the inflammatory process and ones that are beneficial to the inflammatory processed within the body. Because of this, many medical professionals and other health providers may not support the concept of a diet that decreases the anti-inflammatory response within the body.

There is substantial evidence supported through research that shows the beneficial effects on the body in reducing markers of inflammation such as CPH and reduction in chronic disease and its symptoms. Most medical professionals have an easier time accepting the **Mediterranean diet** which includes many of the foods found in the anti-inflammatory diet, and is the closest termed dietary eating pattern to the anti-inflammatory diet.

Megan C.M. Porter, RD, LD

# Antioxidants

### Definition

Antioxidants are molecules that prevent oxygen molecules from interacting with other molecules in a process called oxidation. In the body, antioxidants combine with potentially damaging molecules called free radicals to prevent the free radicals from causing damage to cell membranes, DNA, and proteins in the cell. Common antioxidants important to human health are **vitamins** A, C, E, beta-carotene, and **selenium**. In the mid-2000s, about 20% of North Americans and Europeans were taking at least one antioxidant dietary supplement.

### Purpose

The role of antioxidants in the body is complex and not completely understood. Antioxidants combine with free radicals so that the free radicals cannot react with, or oxidize, other molecules. In this way, antioxidants help slow or prevent damage to cells. Damage caused by free radicals is thought to cause or contribute to cardiovascular disease, **cancer**, Alzheimer's disease, age-related changes in vision, and other signs of aging. However, no direct cause and effect relationship between antioxidant intake and disease prevention has been proven. Antioxidants unrelated to those of importance in the body have commercial uses in the preservation of processed food and in many industrial processes.

### Description

Oxygen is essential to many reactions that occur within cells. Free radicals form mainly as a result of normal cellular **metabolism** involving oxygen. They can also form in abnormally large amounts when the body is exposed to radiation, ultraviolet light, and toxins such as cigarette smoke or certain chemicals.

**Health benefits of antioxidants and their food sources**

| Antioxidant | Health benefits | Food sources |
|---|---|---|
| Selenium | Helps maintain healthy hair and nails, enhances immunity, works with vitamin E to protect cells from damage. Reduces the risk of cancer, particularly lung, prostate, and colorectal. | Garlic, seeds, Brazil nuts, meat, eggs, poultry, seafood, whole grains. The amount in plant sources varies according to the content of the soil. |
| Beta-carotene | Keeps skin healthy, helps prevent night blindness and infections, promotes growth and bone development. | Red, yellow-orange, and leafy green vegetables and fruits, including carrots, apricots, cantaloupe, peppers, tomatoes, spinach, broccoli, sweet potatoes, and pumpkin. |
| Vitamin E | Acts as the protector of essential fats in cell membranes and red blood cells. Reduces risk of cancer, heart disease, and other age-associated diseases. | Peanut butter, nuts, seeds, vegetable oils and margarine, wheat germ, avocado, whole grains, salad dressings. |
| Vitamin C | Destroys free radicals inside and outside cells. Helps in the formation of connective tissue, the healing of wounds, and iron absorption, and also helps to prevent bruising and keep gums healthy. May reduce risk of cataracts, heart disease, and cancer. | Peppers, tomatoes, citrus fruits and juices, berries, broccoli, spinach, cabbage, potatoes, mango, papaya. |

SOURCE: The American Dietetic Association

*(Illustration by GGS Information Services/Thomson Gale.)*

The common feature of free radicals is that their molecular structure contains and unpaired electron. Free radical molecules with an unpaired electron are unstable and have a strong tendency to react with other molecules by "stealing" an electron from them to form a more stable electron pair. This reaction is called oxidation (even when it happens with molecules other than oxygen). In the body, free radicals cause damage when they react with deoxyribonucleic acid (DNA—genetic material), proteins, and lipids (**fats**). Antioxidants are molecules that react with free radicals in ways that neutralize them so they no longer are able to "steal" electrons and cause damage.

Some important human antioxidants must be acquired through diet, while others can be made by the body. **Vitamin C** (ascorbic acid), **vitamin E** (alpha-tocopherol), **vitamin A** (retinol), and beta-carotene are the most important antioxidants the body must obtain from food sources. Flavonoids found in tea, chocolate, grapes, berries, onions, and wine also appear to have antioxidant activity, although their role in health is unclear. Selenium is sometimes classified as an antioxidant, although strictly, it is not. Selenium is a mineral that must be acquired through diet. Plants grown in geographic locations with selenium rich soil provide a rich source of this mineral. Brazil nuts and tuna also have high levels of selenium. It is a necessary part of enzymes involved in antioxidant reactions. Glutathione and coenzyme Q (ubiquinone) are the most important antioxidants the body can make for itself.

### *Antioxidants and health*

When free radicals build up faster than antioxidants can neutralize them, the body develops a condition called oxidative stress. Oxidative stress reduces the body's ability to deal with damage to cells and is thought to play a role in the development of chronic diseases such as cardiovascular disease, cancer, and Alzheimer's disease. Researchers know that a diet high in fruits and vegetables containing antioxidants promotes health and decreases the risk of developing some chronic diseases such as atherosclerosis (hardening of the arteries). In the early 2000s, **dietary supplements** containing antioxidants were popularized as a way to reduce oxidative stress, prevent health problems such as cancer, stroke, heart attack, and dementia, and live longer. Research has since shown that although there are relationships between antioxidant levels and health, antioxidant dietary supplements are not magic bullets to prevent age-related diseases.

One problem in determining whether there is a cause and effect relationship between oxidative stress and disease is that often it is not possible to tell if oxidative stress causes a disease or if the disease brings about oxidative stress as a result of biochemical changes in diseased cells. Also, everyone develops oxidative stress as they age, but not everyone develops the same diseases. The interactions between an individual's diet, environment, genetic make-up, and health are complex and still not well understood. Antioxidants remain of great interest to researchers seeking ways to prevent and cure chronic disease. Many clinical trials are underway to determine safety and effectiveness of different antioxidants, both alone and in combination with other drugs and supplements.

**CARDIOVASCULAR DISEASE.** The strongest link between antioxidant levels and health is related to the development of cardiovascular disease. Low-density

lipoprotein cholesterol (LDL or "bad cholesterol") appears to react with free radicals. This changes the LDL cholesterol in a way that allows it to accumulate in cells lining the blood vessels. These cholesterol-loaded cells are precursors to the development of plaque, hard deposits that line blood vessels and cause cardiovascular disease, heart attack, and stroke.

Researchers thought increasing the amount of antioxidants in the blood by taking supplements would decrease the number of free radicals available to interact with LDL cholesterol and thus lower the risk of developing cardiovascular disease. This theory has not been proved. In fact, a paper published in the *Journal of the American Medical Association* on February 28, 2007, analyzed 68 trials of antioxidant supplements involving about 232,600 patients. The authors concluded that antioxidant supplements did not prolong life. In fact, when only rigorous, well-controlled studies were analyzed, the risk of dying increased 5%. This analysis is quite controversial, with some experts questioning the analytical methods used. However, the American Heart Association and similar organizations in other countries advocate cardiovascular disease prevention through consumption of fruits, vegetables, whole grains and nuts high in antioxidants and other heart-protecting nutrients instead of antioxidant supplements.

**CANCER.** Free radicals damage DNA, and sometimes this damage leads to development of cancer. In laboratory cell cultures and animal studies, antioxidants appear to slow the development of cancer. The results have been mixed in studies where humans took antioxidant dietary supplements. A large study of 29,000 men showed that when a beta-carotene dietary supplement was taken by men who smoked, they developed lung cancer at a rate 18% higher and died at a rate 8% higher than men who did not receive the supplement. Another study that gave men dietary supplements of beta-carotene and vitamin A was stopped when researchers found the men receiving the beta-carotene had a 46% greater chance of dying from lung cancer than those who did not receive the supplement. Other large studies have shown either no or only slight protective effects against cancer. The position of the American Cancer Society, the National Cancer Institute, and several international health organizations is that antioxidants should come from a healthy diet high in fruits and vegetables and low in fat and not from dietary supplements.

**AGE-RELATED VISION IMPAIRMENT.** Cataracts and age-related macular degeneration are two types of vision impairment common in older individuals. Cataracts develop because of changes in the **protein** in the lens of the eye. These changes cause the lens to become cloudy and limit vision. The changes may be due to damage by free radicals. Age-related macular degeneration is an irreversible disease of the retina that causes blindness. Two carotenoid antioxidants, zeaxanthin and lutein, are found in the retina and are essential to vision. However, study participants who took antioxidant supplements over several years did not have a reduced risk of developing these diseases.

## KEY TERMS

**Coenzyme**—Also called a cofactor; a small non-protein molecule that binds to an enzyme and catalyzes (stimulates) enzyme-mediated reactions.

**Dietary supplement**—A product, such as a vitamin, mineral, herb, amino acid, or enzyme, intended to be consumed in addition to an individual's diet with the expectation that it will improve health.

**Enzyme**—A protein that changes the rate of a chemical reaction within the body without themselves being used up in the reaction.

**Free radical**—A molecule with an unpaired electron that has a strong tendency to react with other molecules in deoxyribonucleic acid (DNA), proteins, and lipids (fats), resulting in damage to cells. Free radicals are neutralized by antioxidants.

**Mineral**—An inorganic substance found in the earth that is necessary in small quantities for the body to maintain a health. Examples: zinc, copper, iron.

**Oxidation**—Interaction in which one molecule removes an electron from another molecule to stabilize itself.

**Retina**—The layer of light-sensitive cells on the back of the eyeball that function in converting light into nerve impulses.

**Vitamin**—An essential nutrient the body needs in small amounts to remain healthy but that the body cannot manufacture for itself and must acquire through diet.

### Precautions

The mixed results obtained in human studies of antioxidant supplements suggests that all antioxidants should come from foods and not from dietary

supplements. There is also little information on the safety of antioxidant supplements in children and women who are pregnant or **breastfeeding**.

## Interactions

The interaction among various antioxidants, enzymes, coenzymes, drugs, herbal and dietary supplements is complex and incompletely understood. Specific antioxidants may have known interactions and should be discussed with a physician.

## Complications

Antioxidants acquired by eating fruits and vegetables promote health. No complications are expected from antioxidants in food. Antioxidant dietary supplements may interact with other supplements, prescription drugs, over-the-counter drugs, and herbal supplements in ways that cause undesirable side effects. Consult a physician prior to taking an antioxidant supplement.

## Parental concerns

Parents should encourage their children to eat a healthy and varied diet high in fruits, vegetables, and whole grains. There is no need to give children antioxidant dietary supplements. The safety of these supplements in children has not been studied.

### Resources

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#### ORGANIZATIONS

American Cancer Society. 1599 Clifton Road NE, Atlanta GA 30329-4251. Telephone: 800 ACS-2345. Website: <http://www.cancer.org>.

American Dietetic Association. 120 South Riverside Plaza, Suite 2000, Chicago, IL 60606-6995. Telephone: (800) 877-1600. Website: <http://www.eatright.org>.

American Heart Association. 7272 Greenville Avenue, Dallas, TX 75231. Telephone: (800) 242-8721. Website: <http://www.americanheart.org>.

Linus Pauling Institute. Oregon State University. 571 Weniger Hall, Corvallis, OR 97331-6512. Telephone: (541) 717-5075. Fax: (541) 737-5077. Website: <http://lpi.oregonstate.edu>.

Office of Dietary Supplements, National Institutes of Health. 6100 Executive Blvd., Room 3B01, MSC 7517, Bethesda, MD 20892-7517 Telephone: (301)435-2920. Fax: (301)480-1845. Website: <http://dietary-supplements.info.nih.gov>.

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Tish Davidson, A.M.

Antiscorbutic vitamin *see* **Vitamin C**

# Arthritis diet

## Definition

Arthritis is the general medical term for the inflammation of a joint or a disorder characterized by such inflammation. There are a number of different arthritides (the plural form of arthritis), and therefore there is no "arthritis diet" as such that has been proposed as a treatment for all these different joint disorders. Dietary therapies for osteoarthritis (OA) and rheumatoid arthritis (RA), the two most common forms of arthritis, fall into three major categories: mainstream management strategies that focus on weight reduction and well-balanced diets as a way to relieve stress on damaged joints and slow the progression of arthritis; **dietary supplements** of various types that have been evaluated in clinical trials and have been found to benefit at least some patients; and alternative medical approaches that rely on dietary adjustments (including **elimination diets**) and/or traditional herbal remedies to treat arthritis.

### *Osteoarthritis*

The reader should be aware of the differences between OA and RA in order to understand both mainstream and alternative approaches to these disorders. Osteoarthritis (OA) is the more common of the two in the general North American population, particularly among middle-aged and older adults. It is estimated to affect about 21 million adults in the United States, and to account for $86 billion in health care costs each year. It is also the single most common condition for which people seek help from complementary and alternative medical (CAM) treatments. The rate of OA increases in older age groups; about 70% of people over 70 are found to have some evidence of OA when they are X-rayed. Only half of these elderly adults, however, are affected severely enough to develop noticeable symptoms. OA is not usually a disease that completely disables people; most patients can manage its symptoms by watching their weight, staying active, avoiding overuse of affected joints, and taking over-the-counter or prescription pain relievers. OA most commonly affects the weight-bearing joints in the hips, knees, and spine, although some people first notice its symptoms in their fingers or neck. It is often unilateral, which means that it affects the joints on only one side of the body. The symptoms of OA vary considerably in severity from one patient to another; some people are only mildly affected by the disorder.

**Differences between Osteoarthritis and Rheumatoid Arthritis**

| | Osteoarthritis | Rheumatoid Arthritis |
|---|---|---|
| **Risk factors** | | |
| Age-related | ✔ | |
| Family history | ✔ | ✔ |
| Overuse of joints | ✔ | |
| Excessive weight | ✔ | |
| **Physical effects** | | |
| Affects joints | ✔ | ✔ |
| Autoimmune disease | | ✔ |
| Bony spurs | ✔ | ✔ |
| Enlarged or malformed joints | ✔ | ✔ |
| **Treatment options** | | |
| Weight management | ✔ | |
| Glucocorticoids | | ✔ |
| Non-steroidal anti-inflammatory drugs | ✔ | ✔ |
| MethotreXate | | ✔ |
| Disease-modifying antirheumatic drugs | | ✔ |
| **Pain management** | | |
| Support groups | ✔ | ✔ |
| Exercise | ✔ | ✔ |
| Joint splitting | ✔ | ✔ |
| Physical therapy | ✔ | ✔ |
| Passive exercise | ✔ | ✔ |
| Joint replacement | ✔ | ✔ |
| Heat and cold | ✔ | ✔ |
| Massage therapy | ✔ | ✔ |
| Acupuncture | ✔ | ✔ |
| Psychological approaches (relaxation, visualization) | ✔ | ✔ |
| Tai chi | ✔ | ✔ |
| Low stress yoga | ✔ | ✔ |

*(Illustration by GGS Information Services/Thomson Gale.)*

OA results from progressive damage to the cartilage that cushions the joints of the long bones. As the cartilage deteriorates, fluid accumulates in the joints, bony overgrowths develop, and the muscles and tendons may weaken, leading to stiffness on arising, pain, swelling, and limitation of movement. OA is gradual in onset, often taking years to develop before the person notices pain or a limited range of motion in the joint. OA is most likely to be diagnosed in people over 45 or 50, although younger adults are occasionally affected. OA affects more men than women under age 45 while more women than men are affected in the age group over 55. As of the early 2000s, OA is thought to result from a combination of factors, including heredity (possibly related to a mutation on chromosome 12); traumatic damage to joints from accidents, type of employment, or sports injuries; and **obesity**. It is not, however, caused by the aging process itself. Race does not appear to be a factor in

## KEY TERMS

**Arthritis (plural, arthritides)**—A general term for the inflammation of a joint or a condition characterized by joint inflammation.

**Avocado soybean unsaponifiables (ASU)**—A compound of the fractions of avocado oil and soybean oil that cannot be used in the production of soap. ASU shows promise in the treatment of OA. It is available only by prescription in France, where it was first studied, but can be purchased over the counter in the United States.

**Ayurveda**—The traditional system of natural medicine that originated in India around 3500 BC. Its name is Sanskrit for "science of long life." Some people have tried Ayurvedic medicines and dietary recommendations in the treatment of arthritis.

**Chondroitin sulfate**—A compound found naturally in the body that is part of a large protein molecule (proteoglycan) helping cartilage to retain its elasticity. Chondroitin sulfate derived from animal or shark cartilage can be taken as a dietary supplement by people with OA.

**Disease-modifying antirheumatic drugs (DMARDs)**—A class of prescription medications given to patients with rheumatoid arthritis that suppress the immune system and slow the progression of RA.

**Elimination diet**—A diet in which the patient excludes a specific food (or group of foods) for a period of time in order to determine whether the food is responsible for symptoms of an allergy or other disorder. Elimination diets are also known as food challenge diets.

**Glucosamine**—A type of amino sugar that is thought to help in the formation and repair of cartilage. It can be extracted from crab or shrimp shells and used as a dietary supplement by people with OA.

**Naturopathy**—A system of disease treatment that emphasizes natural means of health care, as water, natural foods, dietary adjustments, massage and manipulation, and electrotherapy, rather than conventional drugs and surgery. Naturopaths (practitioners of naturopathy) often recommend dietary therapy in the treatment of arthritis.

**Nonsteroidal anti-inflammatory drugs (NSAIDs)**—A class of drugs commonly given to treat the inflammation and pain associated with both RA and OA. NSAIDs work by blocking prostaglandins, which are hormone-like compounds that cause pain, fever, muscle cramps, and inflammation. Some NSAIDs are prescription drugs while others are available in over-the-counter (OTC) formulations.

**Osteoarthritis (OA)**—The most common form of arthritis, characterized by erosion of the cartilage layer that lies between the bones in weight-bearing joints. OA is also known as degenerative joint disease or DJD.

**Rheumatoid arthritis (RA)**—An autoimmune disorder that can affect organ systems as well as the joints. It is much less common that OA but is potentially much more serious.

**Rheumatologist**—A physician, usually a pediatrician or internist, who has additional specialized training in the diagnosis and treatment of diseases that affect the bones, muscles, and joints.

**Turmeric**—A perennial herb of the ginger family used as a coloring agent as well as a spice in food preparation. It is used in some traditional Ayurvedic medicines for the relief of joint pain and inflammation.

**Vegan**—A vegetarian who excludes all animal products from the diet, including those that can be obtained without killing the animal. Vegans are also known as strict vegetarians. Some people believe that a vegan diet is helpful in managing arthritis.

OA, although some studies indicate that African American women have a higher risk of developing OA in the knee joints. Other risk factors for OA include **osteoporosis** and **vitamin D** deficiency.

RA, by contrast, is most likely to be diagnosed in adults between the ages of 30 and 50, two-thirds of whom are women. RA affects about 0.8% of adults worldwide, or 25 in every 100,000 men and 54 in every 100,000 women. Unlike OA, which is caused by degeneration of a body tissue, RA is an autoimmune disorder—one in which the body's immune system attacks some of its own tissues. It is often sudden in onset and may affect other organ systems, not just the joints. RA is a more serious disease than OA; 30% of patients with RA will become permanently disabled within two to three years of diagnosis if they are not treated. In addition, patients with RA have a higher

risk of heart attacks and stroke. RA differs from OA, too, in the joints that it most commonly affects—often the fingers, wrists, knuckles, elbows, and shoulders. RA is typically a bilateral disorder, which means that both sides of the patient's body are affected. In addition, patients with RA often feel sick, feverish, or generally unwell, while patients with OA usually feel normal except for the stiffness or discomfort in the affected joints.

## Origins

The role of diet and nutrition in both OA and RA has been studied since the 1930s, but there is little agreement as of 2007 regarding the details of dietary therapy for these disorders. One clear finding that has emerged from seven decades of research is the importance of weight reduction or maintenance in the treatment of patients with OA, and the need for nutritional balance and healthy eating patterns in the treatment of either form of arthritis. Findings regarding the use of dietary supplements or CAM therapies will be discussed in more detail below.

Various elimination diets (diets that exclude specific foods from the diet) have been proposed since the 1960s as treatments for OA. The best-known of these is the Dong diet, introduced by Dr. Collin Dong in a book published in 1975. This diet is based on traditional Chinese beliefs about the effects of certain foods in increasing the pain of arthritis. The Dong diet requires the patient to cut out all fruits, red meat, alcohol, dairy products, herbs, and all foods containing additives or preservatives. There is, however, no clinical evidence as of 2007 that this diet is effective.

Another type of elimination diet, still recommended by naturopaths and some vegetarians in the early 2000s, is the so-called nightshade elimination diet, which takes its name from a group of plants belonging to the family Solanaceae. There are over 1700 plants in this category, including various herbs, potatoes, tomatoes, bell peppers, and eggplant as well as nightshade itself, a poisonous plant also known as belladonna. The nightshade elimination diet began in the 1960s when a researcher in horticulture at Rutgers University noticed that his joint pains increased after eating vegetables belonging to the nightshade family. He eventually published a book recommending the elimination of vegetables and herbs in the nightshade family from the diet. There is again, however, no clinical evidence that people with OA will benefit from avoiding these foods.

## Description

### *Osteoarthritis*

**WEIGHT REDUCTION.** The major dietary recommendation approved by mainstream physicians for patients with OA is keeping one's weight at a healthy level. The reason is that OA primarily affects the weight-bearing joints of the body, and even a few pounds of extra weight can increase the pressure on damaged joints when the person moves or uses the joint. It is estimated that that a force of three to six times the weight of the body is exerted across the knee joint when a person walks or runs; thus being only 10 pounds overweight increases the forces on the knee by 30 to 60 pounds with each step. Conversely, even a modest amount of weight reduction lowers the pain level in persons with OA affecting the knee or foot joints. Obesity is a definite risk factor for developing OA; data from the National Institutes of Health (NIH) indicate that obese women are 4 times as likely to develop OA as non-obese women, while for obese men the risk is 5 times as great.

Although some doctors recommend trying a vegetarian or vegan diet as a safe approach to weight loss for patients with OA, most will approve any nutritionally sound calorie-reduction diet that works well for the individual patient.

**DIETARY SUPPLEMENTS.** Dietary supplements are commonly recommended for managing the discomfort of OA and/or slowing the rate of cartilage deterioration:

- Chondroitin sulfate. Chondroitin sulfate is a compound found naturally in the body that is part of a large protein molecule called a proteoglycan, which imparts elasticity to cartilage. The supplemental form is derived from animal or shark cartilage. Recommended daily dose is 1200 mg.
- Glucosamine. Glucosamine is a form of amino sugar that is thought to support the formation and repair of cartilage. It can be extracted from crab, shrimp, or lobster shells. The recommended daily dose is 1500 mg. Dietary supplements that combine chondroitin sulfate and glucosamine can be obtained over the counter in most pharmacies or health food stores.
- Botanical preparations: Some naturopaths recommend extracts of yucca, devil's claw, hawthorn berries, blueberries, and cherries. These extracts are thought to reduce inflammation in the joints and enhance the formation of cartilage. Powdered ginger has also been used to treat joint pain associated with OA.
- Vitamin therapy. Some doctors recommend increasing one's daily intake of vitamins C, E, A, and $B_6$, which are required to maintain cartilage structure.

- Avocado soybean unsaponifiables (ASU). ASU is a compound of the fractions of avocado oil and soybean oil that are left over from the process of making soap. It contains one part avocado oil to two parts soybean oil. ASU was first developed in France, where it is available by prescription only under the name Piasclédine, and used as a treatment for OA in the 1990s. It appears to work by reducing inflammation and helping cartilage to repair itself. ASU can be purchased in the United States as an over-the-counter dietary supplement. The recommended daily dose is 300 mg.

**CAM DIETARY THERAPIES.** Two traditional alternative medical systems have been recommended in the treatment of OA. The first is Ayurveda, the traditional medical system of India. Practitioners of Ayurveda regard OA as caused by an imbalance among the three *doshas*, or subtle energies, in the human body. This imbalance produces toxic byproducts during digestion, known as *ama*, which lodges in the joints of the body instead of being eliminated through the colon. To remove these toxins from the joints, the digestive fire, or *agni*, must be increased. The Ayurvedic practitioner typically recommends adding such spices as turmeric, cayenne pepper, and ginger to food, and undergoing a three-to five-day detoxification diet followed by a cleansing enema to purify the body.

Traditional Chinese medicine (TCM) treats OA with various compounds containing **ephedra**, cinnamon, aconite, and coix. A combination herbal medicine that has been used for at least 1200 years in TCM is known as *Du Huo Ji Sheng Wan*, or Joint Strength. Most Westerners who try TCM for relief of OA, however, seem to find acupuncture more helpful as an alternative therapy than Chinese herbal medicines.

### *Rheumatoid arthritis*

**DIETARY ALTERATIONS.** There is some indication that patients with RA benefit from cutting back on meat consumption or switching entirely to a vegetarian or vegan diet. One follow-up study of RA patients on a vegetarian diet showed that improvement continued after one and two years on the diet.

Another dietary adjustment that appears to benefit some people with RA is switching from cooking oils that are high in omega-6 fatty acids (which increase inflammation) to oils that are high in **omega-3 fatty acids** (which reduce inflammation. This second group includes olive oil, canola oil, and **flaxseed** oil.

**DIETARY SUPPLEMENTS.** The most common dietary supplements recommended for patients with RA are as follows:

- Fish oil. The oils from cold-water fish have been reported to reduce inflammation and relieve joint pain in some patients with RA. The recommended daily dose is 1 to 2 teaspoons.
- Plant oils that are high in gamma-linoleic acid (GLA), which reduces inflammation in the joints. These plant oils include evening primrose oil, borage oil, and black current oil. The recommended daily dose is 200 to 300 mg.
- Green tea. Drinking 3 to 4 cups of green tea per day is thought to benefit RA patients by reducing inflammation in the joints.

**CAM DIETARY THERAPIES.** Ayurvedic medicine recommends a compound of ginger, turmeric, boswellia, and ashwaganda to relieve the pain and fever associated with RA.

Traditional Chinese medicine (TCM) uses such plants as hare's ear (*Bupleurum falcatum*) and thunder god vine (*Tripterygium wilfordii*) to reduce fever and joint pain in patients with RA.

## Function

### *Osteoarthritis*

The function of dietary treatment for OA is to lower (or maintain) the patient's weight to a healthy level in order to minimize stress on damaged weight-bearing joints; to maintain the structure and composition of the cartilage in the joints; to protect the general health of tissues by including bioflavonoids and **antioxidants** in the diet; and by conducting food challenges when appropriate to determine whether specific foods are affecting the patient's symptoms.

### *Rheumatoid arthritis*

Dietary treatment of RA is primarily adjunctive, as the disease cannot be managed by nutritional changes alone. Patients with RA must take a combination of medications, usually a combination of disease-modifying anti-rheumatic drugs (DMARDs) and nonsteroidal anti-inflammatory drugs (NSAIDs), to control pain, inflammation, and slow the progression of the disease. A well-balanced and healthful diet, however, can help to offset the emotional depression that often accompanies RA and to enable patients to maintain a normal schedule of activities. It also helps to prevent nutritional deficiencies in these patients that may be caused by the use of prescription drugs to control the disease.

## Benefits

### *Osteoarthritis*

The benefits of weight reduction in overweight patients with OA are a noticeable reduction in discomfort and improved range of motion in the affected joints. The benefits of dietary supplements vary from patient to patient depending on the specific joints affected and the degree of erosion of the joint cartilage.

### *Rheumatoid arthritis*

The benefits of dietary adjustments or dietary supplements for RA vary considerably from patient to patient. Maintenance of a balanced diet, however, is valuable in preventing the nutritional deficiencies that sometimes occur in patients with RA as side effects of high dosages of DMARDs and NSAIDs.

## Precautions

Some general precautions for all persons with arthritis:

- Before beginning any form of dietary treatment for joint pain, consult a physician to obtain an accurate diagnosis of the type of arthritis that is causing the pain. When RA is suspected, it is vital to get systemic treatment as soon as possible to minimize long-term damage to health.
- Consult a physician before taking any dietary supplements, as certain OTCs and prescription medications can interact with these compounds. Chondroitin sulfate, for example, may increase bleeding time in some people, particularly if it is taken together with aspirin.
- Purchase dietary supplements only from well-established companies that can be held accountable for the quality of their products.
- Do not stop taking any medications currently prescribed by a doctor without consulting him or her.
- If maintaining a primarily vegetarian diet, be aware of the potential for iron deficiency.

People with either form of arthritis who are more than 30 pounds overweight; are pregnant, nursing, or under the age of 18; or diagnosed with type 2 diabetes, kidney disorders, or liver disorders should consult a physician before attempting a weight-reduction program.

### *Osteoarthritis*

People with diabetes should monitor blood sugar levels more frequently if they are taking **glucosamine**, because it is an amino sugar. Similarly, persons who are taking blood thinners should have their blood clotting time checked periodically if they are taking chondroitin sulfate. ASU has not been reported to cause drug interactions as of 2007.

### *Rheumatoid arthritis*

Plant oils containing GLA have been reported to cause intestinal gas, bloating, diarrhea, and nausea in some persons. In addition, these oils may interact with other prescription medications, particularly blood thinners. Some borage seed oil preparations contain ingredients known pyrrolizidine alkaloids, or PAs, that can harm the liver or worsen liver disease. Only forms of borage oil that are certified to be PA-free should be used. Last, evening primrose oil may interact with a group of tranquilizers used in the treatment of schizophrenia known as phenothiazines. This group of drugs includes chlorpromazine and prochlorperazine.

Fish oil may affect the rate of blood clotting and cause nausea or a fishy odor to the breath in some persons. Some fish oil supplements may also contain overly high levels of **vitamin A** or mercury. In addition, patients who take fish oil supplements must usually take them for several months before they experience any benefits.

## Risks

### *Osteoarthritis*

Most dietary supplements for OA appear to be safe when purchased from reputable manufacturers and used as directed. Glucosamine and chondroitin sulfate have been reported to cause intestinal gas or mild diarrhea in some people. ASU causes nausea and skin rashes in some people.

Cost may be a consideration for some people, as these supplements cost between $1.50 and $3 per day, and are not usually covered by health insurance.

### *Rheumatoid arthritis*

Chinese thunder god vine is reported to weaken bone structure and increase the risk of osteoporosis in patients with RA. Fish oils with high levels of vitamin A have been reported to cause vitamin A toxicity in some people.

## Research and general acceptance

### *Osteoarthritis*

No mainstream clinical studies have found that patients with OA benefit from elimination diets. With regard to dietary supplements, findings are mixed. A major 4-year study of glucosamine and chondroitin sulfate supplements, the Glucosamine/chrondoitin

## QUESTIONS TO ASK YOUR DOCTOR

- Would you recommend glucosamine and chondroitin supplements for mild OA?
- Have any of your other patients benefited from taking ASU or other dietary supplements for arthritis?
- What is your opinion of elimination diets as treatment for arthritis?
- Would you recommend a vegetarian diet for patients with OA as well as patients with RA?

Arthritis Intervention Trial (GAIT), reported in 2006 that these supplements appear to be more beneficial to a small subgroup of patients with severe pain from OA than to a larger group with only mild to moderate levels of discomfort. There is better evidence that ASU is beneficial, but only limited evidence for the usefulness of Du Huo Ji Sheng Wan. Some clinical studies carried out in India report that an Ayurvedic compound that combines ginger, turmeric, and **zinc** reduced pain in patients with OA of the knees even when other aspects of Ayurvedic practice were not followed.

### *Rheumatoid arthritis*

The National Center for Complementary and Alternative Medicine (NCCAM) has noted in a recent review of alternative treatments of RA that few high-quality studies of these treatments have been published as of 2006. Several studies indicate that vegetarian or vegan diets and the **Mediterranean diet** do in fact benefit patients with RA. Fish oil has been reported to reduce the risk of heart attacks in patients with RA as well as reduce joint pain and inflammation. **Green tea** has been tested on mice with RA but has not yet been tested on human subjects. A study conducted at the University of Arizona reported in 2006 that turmeric by itself inhibits the destruction of joint tissue in rats with RA as well as reducing joint inflammation; but as with green tea, turmeric supplements have not yet been used in clinical trials with human subjects with RA.

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**ORGANIZATIONS**

American Association of Naturopathic Physicians (AANP). 4435 Wisconsin Avenue NW, Suite 403, Washington, DC 20016. Telephone: (866) 538-2267 or (202) 237-8150. Website: http://www.naturopathic.org.

American College of Rheumatology (ACR). 1800 Century Place, Suite 250, Atlanta, GA 30345-4300. Telephone: (404) 633-3777. Website: http://www.rheumatology.org.

American Vegan Society (AVS). 56 Dinshah Lane, P. O. Box 369, Malaga, NJ 08328. Telephone: (856) 694-2887. Website: http://www.americanvegan.org/index.htm.

Arthritis Foundation. P.O. Box 7669, Atlanta, GA 30357-0669. Telephone: (404) 872-7100 or (800) 568-4045. Website: http://www.arthritis.org.

Arthritis Research Campaign (ARC). Copeman House, St. Mary's Court, St. Mary's Gate, Chesterfield, Derbyshire S41 7TD United Kingdom. Telephone: +44 (0) 1246 558007. Website: http://www.arc.org.uk.

National Center for Complementary and Alternative Medicine (NCCAM). 9000 Rockville Pike, Bethesda, MD 20892. Telephone: (888) 644-6226. Website: http://nccam.nih.gov.

National Institute of Arthritis and Musculoskeletal and Skin Diseases (NIAMS) Information Clearinghouse. National Institutes of Health, 1 AMS Circle, Bethesda, MD 20892-3675. Telephone: (877) 22-NIAMS or (301) 495-4484. Website: http://www.niams.nih.gov.

National Institute of Ayurvedic Medicine (NIAM). 584 Milltown Road, Brewster, NY 10509. Telephone: (845) 278-8700. Website: http://niam.com.

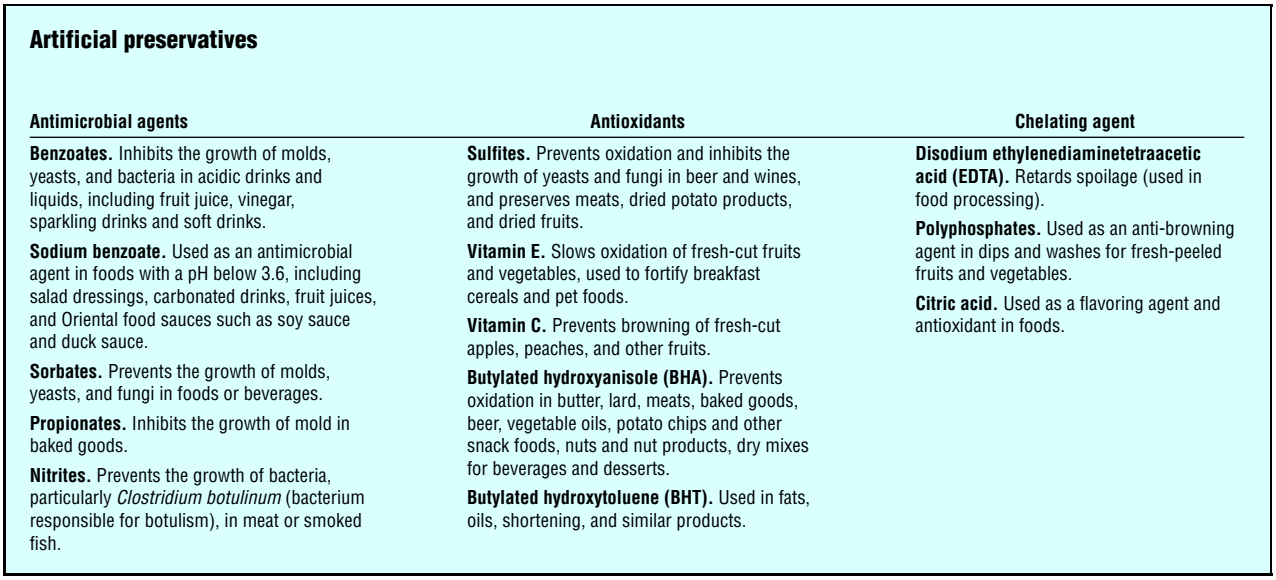
Rebecca J. Frey, Ph.D.

# Artificial preservatives

## Definition

Artificial preservatives are a group of chemical substances added to food, sprayed on the outside of food, or added to certain medications to retard spoilage, discoloration, or contamination by bacteria and other disease organisms. Most preservatives are categorized by the federal government as *food additives*, which are defined by the Federal Food, Drug, and Cosmetic Act (FD&C) of 1938 as "any substance, the intended use of which results directly or indirectly, in its becoming a component or otherwise affecting the characteristics of food." A subcategory of food preservatives are classified as *generally recognized as safe* (GRAS), which means that the government accepts the current scientific consensus on their safety, based on either their use prior to 1958 or to well-known scientific information.

The categorization of any artificial preservative is never permanent; it may change as new information about the preservative's safety is reported and analyzed. Certain preservatives that were once considered safe—most notably sulfites and nitrites—have been banned in recent years or greatly restricted in their permissible uses. Information about the current status of more than three thousand substances (including coloring and flavoring agents as well as preservatives) that the FDA has either approved as food additives or listed or affirmed as GRAS may be obtained from EAFUS, an online database maintained by the FDA's Center for **Food Safety** and Applied Nutrition




**The types of artificial preservatives, their role in food preservation, and foods containing preservatives.** *(Illustration by GGS Information Services/Thomson Gale.)*

(CFSAN). EAFUS is an acronym for "Everything Added to Food in the United States."

Artificial preservatives as used in the early 2000s are an extension of centuries-old methods of food preservation, some of which involved adding naturally occurring chemicals to food. To keep food from spoiling before it could be eaten, early humans found ways to dry it or (in colder climates) freeze it. Drying or dehydrating foods, a process known as desiccation, worked well with fruits, herbs, some meats, and some vegetables. Another method for preserving fruit was sugar preservation, which involved cooking the fruit in a high concentration of sugar that discouraged the growth of bacteria. In terms of natural chemicals, vinegar, ethanol (beverage alcohol), olive oil, and salt have been used for centuries to preserve foods by pickling, while meats and some types of fish have been preserved by smoking and curing, which draws moisture from the meat without cooking it. Smoking introduces **antioxidants** into meat or fish, while some spices used to flavor foods, such as curries and hot chilies, contain antimicrobial compounds.

## Purpose

The purpose of the major groups of artificial preservatives is to prevent food from spoiling or discoloring during the time it takes to transport the food from the producer to the consumer—including storage time in a restaurant or the individual consumer's home. Spoilage usually involves one of two processes: contamination by microorganisms (bacteria, molds, fungi, and yeasts are the primary offenders) or oxidation. Oxidation is the scientific name for the process that takes place in some foods when they combine with the oxygen in the atmosphere in the presence of heat, light, or certain metals. Oxidized foods typically turn brown, develop black spots, or acquire a bad or "off" smell. Cooking oils, oily foods like potato chips, sausage, or nuts, or buttery spreads that develop an unpleasant taste or smell are said to have gone rancid. Some **minerals** in food—particularly **iron** and copper—can also speed up the process of food spoilage through oxidation. Preservatives added to food to prevent oxidation related to these minerals are called chelating agents.

Some antimicrobial preservatives are added to medications to prevent the growth of bacteria in them. Most of these preparations are topical, which means that they are intended for use on the outside of the body—the skin, the eyes, or the ears. Eye drops formulated to relieve dry eyes are the most common topical medications that may contain artificial preservatives, but some asthma drugs also contain benzoates or other antimicrobials. Sulfites (sometimes spelled sulphites) are added to asthma inhalers, injectable epinephrine, and some other medications to prevent browning of the solution.

## Description

Artificial food preservatives can be divided into three major groups, antimicrobial agents, antioxidants, and chelating agents.

## KEY TERMS

**Anaphylaxis**—A severe and potentially fatal systemic allergic reaction characterized by itching, hives, fainting, and respiratory symptoms. Sulfites may trigger anaphylaxis in a small number of people who are unusually sensitive to them.

**Antimicrobial**—A type of food preservative that works by preventing the growth of bacteria, fungi, molds, or yeast in foods.

**Antioxidant**—A type of food preservative that prevents rancidity in oils and fatty foods.

**Botulism**—A potentially deadly disease characterized by respiratory and musculoskeletal paralysis caused by a bacterium called *Clostridium botulinum*. Botulism is a medical emergency. Nitrites are sometimes used to prevent the growth of *C. botulinum* spores in meat and smoked fish.

**Carcinogen**—A substance or other agent that causes cancer. Some artificial preservatives have been banned in the United States on the grounds that they may be carcinogens or produce carcinogenic substances when added to food.

**Chelating agent**—A type of food preservative that works by binding (or sequestering) metal ions (usually iron or copper) in certain foods in order to prevent the metals from oxidizing and speeding up spoilage. The name comes from the Greek word for a crab's claw, because chelating agents have two groups of atoms that encircle the metal ion like the claws of a crab. Chelating agents are also known as sequestrants.

**Desiccation**—Drying or dehydrating food as a method of preservation,

**Food additive**—Defined by the Federal Food, Drug, and Cosmetic Act (FD&C) of 1938 as "any substance, the intended use of which results directly or indirectly, in its becoming a component or otherwise affecting the characteristics of food." Food additives include flavoring and coloring agents as well as artificial preservatives.

**Generally recognized as safe (GRAS)**—A phrase used by the federal government to refer to exceptions to the FD&C Act of 1938 as modified by the Food Additives Amendment of 1958. Artificial food preservatives that have a scientific consensus on their safety based on either their use prior to 1958 or to well-known scientific information may be given GRAS status.

**Nitrosamine**—Any of various organic compounds produced by the interaction of nitrites in food with the breakdown products of amino acids. Nitrosamines are also found in tobacco smoke. Some nitrosamines are powerful carcinogens.

**Oxidation**—In food chemistry, the process that takes place in some foods when they combine with the oxygen in the atmosphere in the presence of heat, light, or such metals as iron or copper.

**pH**—A measure of the acidity or alkalinity of a solution. Solutions with a pH below 7 are considered acidic while those above 7 are alkaline. A pH of exactly 7 (pure water) is neutral.

**Rancid**—Having a bad or "off" smell or taste as a result of oxidation.

**Salt**—In chemistry, an ionic crystalline compound of positively charged ions and negatively charged ions such that the product is neutral (without a net charge).

**Topical**—Referring to a type of medication that is applied to the surface of the body or instilled into the eye or ear. Some topical medications contain artificial preservatives.

### *Antimicrobials*

Antimicrobial preservatives are added to food to destroy bacteria or to inhibit the growth of mold on foods.

**BENZOATES.** Benzoates are salts of benzoic acid, a weak acid that was at one time derived from benzoin resin, a gum obtained from the bark of trees native to Thailand and Indonesia. The benzoates used as food preservatives are potassium benzoate and **sodium** benzoate. Potassium benzoate works best in products with a low pH (below 4.5); it is used to inhibit the growth of molds, yeasts, and bacteria in acidic drinks and liquids, including fruit juice, vinegar, sparkling drinks, and soft drinks.

Sodium benzoate can be produced commercially by reacting sodium hydroxide with benzoic acid. It is used as an antimicrobial agent in foods with a pH below 3.6, including salad dressings, carbonated drinks, fruit juices, and such Oriental food sauces as **soy** sauce and duck sauce. It is also used as a preservative in some mouthwashes. Sodium benzoate occurs naturally in cranberries, prunes, greengage plums,

cloves, cinnamon, and apples. Although the FDA limits the concentration of sodium benzoate as a preservative to 0.1% of the food by weight, organically grown cranberries and prunes may contain levels of this benzoate above this limit.

**SORBATES.** The sorbates are a group of antimicrobial food preservatives comprising sorbic acid and its three mineral salts, potassium sorbate, **calcium** sorbate, and sodium sorbate. The name of the group comes from the botanical name of the rowan tree, *Sorbus aucuparia*, because sorbic acid was first isolated from unripe rowan berries. In general, food manufacturers prefer the three salts of sorbic acid to the acid itself because they are easier to dissolve in **water**.

The sorbates are used to prevent the growth of molds, yeasts, and fungi in foods or beverages with a pH below 6.5. They are generally used at concentrations of 0.025 percent–0.10 percent. Potassium sorbate, which is made by reacting sorbic acid with potassium hydroxide, is a mild preservative that is often used to stabilize wine as well as to prevent the growth of molds in cheese, yogurt, and baked goods. Allergic reactions to the sorbates are uncommon and limited to minor skin rashes or itching.

**PROPIONATES.** Propionates are salts of propionic acid. The three propionates most commonly used as food preservatives are calcium propionate, sodium propionate, and potassium propionate, used to inhibit the growth of mold in baked goods. Calcium propionate is also added to animal feed to prevent milk fever in cows. The propionates are often used instead of benzoates in bakery products because they do not require an acidic environment to be effective.

**NITRITES.** Nitrites are salts of nitrous acid that were used more often in the past for curing meat than they are now. The most commonly used nitrite in food preservation is sodium nitrite. When added to meat or smoked fish, it prevents the growth of bacteria, particularly *Clostridium botulinum*, the bacterium responsible for botulism, a potentially deadly disease. Sodium nitrite also turns meat an appealing dark red color when it interacts with myoglobin, the primary oxygen-carrying pigment in muscle tissue.

Nitrites are being gradually phased out of food processing for two reasons. First, they are themselves toxic in large amounts; a lethal dose of nitrites for a human being is 22 mg per kg of body weight. Second, nitrites in meat can react with the breakdown products of amino acids in the acidic environment of the human stomach to form nitrosamines, substances that are known to be carcinogenic. To be permitted to use sodium nitrite to prevent the growth of *C. botulinum* in smoked fish or meat, the manufacturer must show that the maximum amount of nitrite in the food will be no more than 200 parts per million (ppm). Sodium ascorbate, a salt of ascorbic acid (**vitamin C**), is often added to foods containing nitrites to inhibit or prevent the formation of nitrosamines.

### *Antioxidants*

**SULFITES.** The sulfites are a group of compounds containing charged molecules of sulfur compounded with oxygen. There are five used as antioxidant preservatives: sodium sulfite, sodium bisulfite, sodium metabisulfite, potassium bisulfite, and potassium metabisulfite. They are applied to foods as dips or sprays. Sodium metabisulfite and potassium metabisulfite are commonly used to stabilize wine or beer. When added to these fluids, the sulfite compounds release sulfur dioxide gas, which prevents oxidation and also inhibits the growth of yeasts and fungi. Sodium sulfite is used to preserve meats, dried potato products, and dried fruits.

Sulfites have been used for centuries as food preservatives, since they occur naturally in almost all wines. Of all the groups of food preservatives, however, sulfites are the most likely to produce hypersensitivity reactions. Asthmatics and people with allergies to aspirin are at an elevated risk for this type of reaction to sulfites. A severe systemic reaction known as anaphylaxis or anaphylactic shock may be fatal and requires immediate treatment at an emergency room. Anaphylaxis is characterized by hives, difficulty breathing, and cardiovascular collapse.

**VITAMIN E.** **Vitamin E** (tocopherol) is a fat-soluble vitamin that occurs as a natural antioxidant in many foods, particularly vegetable oils, whole grains, nuts, wheat germ, and green leafy vegetables. It may be added to fresh-cut fruits and vegetables to slow oxidation. It is also used to fortify some breakfast cereals and pet foods.

**VITAMIN C.** Vitamin C (ascorbic acid) also occurs naturally in many fruits and vegetables, particularly citrus fruits. It is a water-soluble vitamin. The salts of ascorbic acid—sodium ascorbate, calcium ascorbate, and potassium ascorbate—are also water-soluble and are often added to fresh-cut apples, peaches, and other fruits to prevent browning. These three compounds are not fat-soluble and cannot be used to prevent **fats** from going rancid. To protect fats or oils from oxidation, a fat-soluble ester of ascorbic acid known as ascorbyl palmitate must be used.

**BUTYLATED HYDROXYANISOLE (BHA).** BHA, which is a white or slightly yellow waxy solid in its pure form, is widely used in the food industry to prevent oxidation in butter, lard, meats, baked goods, beer, vegetable oils, potato chips and other snack foods, nuts and nut products, dry mixes for beverages and desserts, and many other foods. BHA is also used in cosmetics, particularly lipsticks and eye shadows. It is effective as an antioxidant because oxygen reacts preferentially with it rather than with the fats or oils containing it, thereby protecting them from spoilage. Although the FDA considers BHA a GRAS substance when its content is no greater than 0.02% of the total fat content of the product by weight (200 ppm), the National Toxicology Program (NTP) listed it in 2005 as "reasonably anticipated to be a human carcinogen" on the basis of experimental findings in animals. The NTP stated that the maximum content of BHA in various foods that it sampled ranged from 2 to 1000 ppm.

**BUTYLATED HYDROXYTOLUENE (BHT).** BHT is similar to BHA in its structure and uses as an antioxidant, although it is ordinarily a white powder rather than a waxy substance at room temperature. BHT is often added to packaging materials as well as directly to fats, oils, shortening, and similar products. It was first approved by the FDA as a food preservative in 1954. BHT has been banned in Japan, Romania, Sweden, and Australia though not in the United States. Although the use of BHT is controversial, it has not been shown conclusively to be carcinogenic as of 2007.

### *Chelating agents*

Chelating agents work by binding (or sequestering) metal ions (usually iron or copper) in certain foods in order to prevent the metals from oxidizing and speeding up spoilage of the food.

**DISODIUM ETHYLENEDIAMINETETRAACETIC ACID (EDTA).** EDTA is used in food processing to bind **manganese**, cobalt, iron, or copper ions in order to retard spoilage. It is sometimes added to eye drops to reinforce the action of other preservatives. It is also used in dentistry to wash out teeth during root canal procedures and in medicine to treat mercury or lead poisoning. Last, EDTA is added to soft drinks containing both ascorbic acid (vitamin C) and sodium benzoate to prevent the formation of benzene, which is a carcinogen.

**POLYPHOSPHATES.** Polyphosphates are chelating agents with limited solubility in cold water that are used as antibrowning agents in dips and washes for fresh-peeled fruits and vegetables, in low concentrations of 0.5 to 2 percent. They are also used to soften water and to remove mineral deposits from beverage production equipment. Polyphosphates are considered nontoxic.

**CITRIC ACID.** Citric acid, which is found naturally in citrus fruits, can be used not only as a flavoring agent and antioxidant in foods but also as a chelating agent in soaps and detergents. By chelating the minerals that are present in hard water, citric acid allows the cleaning agents to produce foam without the need for added water softeners. Allergic reactions to citric acid are rare; it is regarded as a safe food additive by all major international food regulatory organizations as well as by the FDA, because excess citric acid is easily metabolized by the body and excreted.

## Precautions

### *Government regulations of artificial preservatives*

Artificial preservatives, like other food additives, are strictly regulated by the U.S. Food and Drug Administration (FDA). In 1958 an amendment regarding all categories of food additives was attached to the Food, Drug, and Cosmetic Act of 1938. The 1958 amendment stipulates that a food manufacturer must apply for FDA approval before adding a new preservative to food, before using a different amount of a previously approved preservative, or before using an approved preservative in a different way. The application must show:

- That the amount of the preservative that will be eaten with the food, or the amount of any substance formed in or on the food as a result of using the preservative, is a safe amount.
- That the preservative will not have a harmful cumulative effect in the diet.
- Whether the preservative is carcinogenic or has other toxic effects in humans or animals.

In addition, the application for approval must show that the preservative does not deceive consumers by changing the appearance of food. For example, sulfites may not be added to meat because they restore its red color, thus making it look fresh when it may not be in fact.

### *Consumer precautions*

**PURCHASING FOOD.** Allergic reactions to artificial preservatives (or coloring or flavoring additives) in food may involve the skin (flushing, itching, or rashes), the digestive system (nausea, vomiting, or diarrhea), the respiratory system (wheezing, cough, or runny nose), or the muscles (cramping or aching sensations). Some doctors think that reactions to food

additives are underdiagnosed because they are not often suspected; most maintain, however, that hypersensitivity to food additives involves at most 1% of the adult population and perhaps 2% of children.

Consumers who are concerned about a specific artificial preservative in their food can check for its presence by reading the labels of processed foods, which are required by law to state the ingredients in order by weight from the greatest amount to the least. Those who wish to cut down on their intake of preservatives in general can try growing some of their own produce, or purchase fresh fruits and vegetables only from local farmers during the growing season.

**EATING OUT.** Some hypersensitivity reactions to food preservatives occur in relation to food eaten at restaurants. Restaurant foods are most likely to be the culprit when the person has a reaction to a specific dish served in a restaurant but not to that same food when made at home. People who already know that they are sensitive to sulfites may need to ask about specific dishes at a restaurant ahead of time to inquire whether they are made from foods containing high levels of sulfites.

People allergic to high levels of sulfites should avoid anything containing or garnished with bottled (non-frozen) lemon or lime juice, wine, molasses, grape juices, pickled cocktail onions, dried potatoes, wine vinegar, gravies or sauces, Maraschino cherries, fruit toppings, and sauerkraut. People who are sensitive to moderate or low levels of sulfites should also avoid fresh mushrooms, canned clams, avocado dip or guacamole, pickles and relishes, maple syrup, corn syrup, fresh shrimp, apple cider, and cider vinegar.

**MEDICATIONS.** People who suspect that they are sensitive to artificial preservatives in eye drops can ask their doctor or pharmacist for a formula made without preservatives. Asthma inhalers that do not contain sulfites are available for asthmatics with sulfite allergies.

## Interactions

No negative interactions between food preservatives and prescription medications have been reported. Some researchers in dentistry, however, are testing the hypothesis that benzoates interact positively with **fluoride** by reinforcing the effects of fluoride in preventing dental cavities.

## Aftercare

Hypersensitivity to food preservatives is usually tested by a food challenge. The patient is given a diet free of the suspected additive for a week or two and then given foods containing the additive to see whether the symptoms previously reported by the patient recur. If they do, the advice of physicians and researchers in the field is to simply avoid foods or other products containing that preservative.

Testing for sulfite allergy should be done only by a physician who has been trained in this procedure and has some experience in using it. The test involves administering increasing amounts of sulfites by mouth to the patient while the doctor monitors the patient's lung function and other vital signs (blood pressure, pulse rate, etc.) A sudden and significant drop in lung function indicates that the patient is sensitive to sulfites.

## Complications

There are no known complications to testing people for hypersensitivity to artificial preservatives in foods or to treating such hypersensitivity by avoiding the additive in question.

## Parental concerns

### *Allergies*

In general, food preservatives are no more likely to cause allergic reactions in children than either coloring agents or flavoring agents, which are the other major categories of food additives. Some people develop hives, itching, or nasal congestion when exposed to one particular type of yellow food coloring, FD&C 5, known as tartrazine. Monosodium glutamate (MSG), a food additive sold under the trade name of Accent, is also added to soups, broths, and some restaurant dishes to intensify the flavors already present in the food. Although MSG was reported to cause headaches, dry mouth, and asthma attacks in some people—a group of symptoms referred to as "Chinese restaurant syndrome" since the late 1960s, recent double-blind studies indicate that there is no causal connection between MSG and the reported symptoms.

The food preservatives most likely to cause allergic reactions are the sulfites and the benzoates. Prior to 1986, sulfites were commonly added to fresh produce in supermarkets and on restaurant salad bars to prevent browning. Reports of sensitivity reactions, however, led the FDA to ban the use of sulfites on fresh produce, especially lettuce put out on salad bars. As of 2007, the FDA requires all foods containing more than 10 ppm of sulfites to declare sulfites on the label. Foods containing less than 10 ppm of sulfites have not been shown to cause allergic symptoms even in people who are hypersensitive to sulfites.

Sodium benzoate has been reported to cause skin rashes or facial swelling in some people when used as a preservative in acidic foods and beverages, and to worsen asthma attacks in some patients taking asthma medications. Reactions to benzoates, however, are a very low percentage of food allergies; one team of physicians in Italy rated reactions to benzoates as no more than 2% of all allergic responses to foods or drugs.

### *Reporting food-related problems*

To report allergic reactions to preservatives or other food additives, consumers should contact the FDA's consumer complaint coordinator in their geographic area. Links to those persons can be found on the FDA's website at http://www.fda.gov/opacom/backgrounders/problem.htmlndashfood. If the problem concerns food eaten in or purchased from a restaurant, however, it should be reported to the local or state health department.

### *Toxicity*

With the exception of large quantities of nitrites, no food preservatives approved for use by the FDA or its international counterparts are directly toxic to human beings.

## Resources


#### BOOKS

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Center for Food Safety and Applied Nutrition (CFSAN). *EAFUS: A Food Additive Database*. Available online at http://www.foodsafety.gov/~dms/eafus.html. EAFUS stands for "Everything Added to Food in the United States; it presently includes about 3000 substances that the FDA has either approved as food additives or listed or affirmed as GRAS.

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National Toxicology Program (NTP). "Butylated Hydroxyanisole (BHA), CAS No. 25013-16-5." *Report on Carcinogens/emphasis>, 11th ed. Research Triangle Park, NC: NTP, 2005. Available online in PDF format at http://ntp.niehs.nih.gov/ntp/roc/eleventh/profiles/s027bha.pdf.*

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#### ORGANIZATIONS

American Dietetic Association (ADA). 120 South Riverside Plaza, Suite 2000, Chicago, IL 60606-6995. Telephone: (800): 877-1600. Website: http://www.eatright.org.

Dietitians of Canada/Les diététistes du Canada (DC). 480 University Avenue, Suite 604, Toronto, Ontario, Canada M5G 1V2. Telephone: (416) 596-0857. Website: http://www.dietitians.ca.

Institute of Food Technologists (IFT). 525 West Van Buren, Suite 1000, Chicago, IL 60607. Telephone: (312) 782-8424. Website: http://www.ift.org.

National Cancer Institute (NCI). NCI Public Inquiries Office, 6116 Executive Boulevard, Room 3036A, Bethesda, MD 20892-8322. Telephone: (800) 4-CANCER. Website: http://www.cancer.gov/.

National Toxicology Program (NTP). Report on Carcinogens. P.O. Box 12233, MD EC-14, Research Triangle Park, NC 27709. Telephone: (919) 541-4096. Website: http://ntp.niehs.nih.gov/ntpweb/index.cfm?objectid = 7182FF48-BDB7-CEBA-F8980E5DD01A1E2D.

Office of Food Additive Safety, HFS-200, Center for Food Safety and Applied Nutrition, Food and Drug Administration, 5100 Paint Branch Parkway, College Park, MD 20740. Telephone: (301) 436-1200. Website: http://www.cfsan.fda.gov/list.html.

U.S. Department of Agriculture (USDA). 1400 Independence Avenue, SW, Washington, DC 20250. USDA Food Safety and Inspection Service Meat and Poultry Hotline: (888) 674-6854. The hotline answers consumers' questions about food safety and provides resources for educators.

U. S. Food and Drug Administration (FDA). 5600 Fishers Lane, Rockville, MD 20857-0001. Telephone: (888) INFO-FDA. Website: http://www.fda.gov/default.htm.

Rebecca J. Frey, PhD

# Artificial sweeteners

## Definition

Artificial sweeteners, which are also called sugar substitutes, alternative sweeteners, or non-sugar sweeteners, are substances used to replace sugar in foods and beverages. They can be divided into two large groups: nutritive sweeteners, which add some energy value (calories) to food; and nonnutritive sweeteners, which are also called high-intensity sweeteners because they are used in very small quantities as well as adding no energy value to food. Nutritive sweeteners include the natural sugars—sucrose (table sugar; a compound of glucose and fructose), fructose (found in fruit as well as table sugar), and galactose (milk sugar)—as well as the polyols, which are a group of carbohydrate compounds that are not sugars but provide about half the calories of the natural sugars. The polyols are sometimes called sugar replacers, sugar-free sweeteners, sugar alcohols, or novel sugars. Polyols occur naturally in plants but can also be produced commercially. They include such compounds as sorbitol, mannitol, xylitol, and hydrogenated starch hydrolysates.

**Artificial sweeteners**

| Sweetener | Times sweeter than sugar | Calories | Brand name(s) |
|---|---|---|---|
| aspartame | 200 | 4 kcal/g | Nutrasweet and Equal |
| saccharin | 200–700 | 0 | Sweet'N Low, Twin, and Necta Sweet |
| acesulfame-K (potassium) | 200 | 0 | Sunett and Sweet One |
| neotame | 7,000–13,000 | 0 | Neotame |
| sucralose | 600 | 0 | Splenda |

SOURCE: Food and Drug Administration, U.S. Department of Health and Human Services

*(Illustration by GGS Information Services/Thomson Gale.)*

Nonnutritive sweeteners are synthetic compounds that range between 160 and 13,000 times as sweet as sucrose, which is the standard for the measurement of sweetness. There are five nonnutritive sweeteners approved by the Food and Drug Administration (FDA) for use in the United States as of 2007. They are saccharin, aspartame, acesulfame potassium (or acesulfame-K), sucralose, and neotame. There are other nonnutritive sweeteners that have been approved for use elsewhere in the world by the Scientific Committee on Food (SCF) of the European Commission, the Joint Expert Committee of Food Additions (JECFA) of the United Nations Food and Agricultural Organization, and the World Health Organization (WHO) but have not been approved by the FDA. These substances are alitame, cyclamate, neohesperidine dihydrochalcone, stevia, and thaumatin. All of these will be described in further detail below.

The FDA uses two categories to classify both nutritive and nonnutritive sweeteners for regulatory purposes. Some are classified as *food additives*, which is a term that was introduced by the Federal Food, Drug, and Cosmetic (FD&C) Act of 1938. This legislation was passed by Congress in response to a mass poisoning tragedy that took the lives of over a hundred people in 1937. A company in Tennessee that manufactured an antibacterial drug known as sulfanilamide, which had been used safely in powdered or pill form to treat childhood infections, dissolved the sulfanilamide in diethylene glycol—related to the active ingredient in automobile antifreeze—in order to market it as a liquid medicine. Diethylene glycol is highly

## KEY TERMS

**Acceptable daily intake level (ADI)**—The level of a substance that a person can consume every day over a lifetime without risk. The ADIs for artificial sweeteners are very conservative measurements.

**Carcinogen**—A substance or other agent that causes cancer. Some artificial sweeteners have been banned in the United States on the grounds that they may be carcinogens.

**Food additive**—Defined by the Federal Food, Drug, and Cosmetic Act (FD&C) of 1938 as "any substance, the intended use of which results directly or indirectly, in its becoming a component or otherwise affecting the characteristics of food."

**Excipient**—An inert substance, such as certain gums or starches, used to make drugs easier to take by allowing them to be formulated into tablets or liquids. Some artificial sweeteners are used as excipients.

**Fructose**—A simple sugar that occurs naturally in sucrose and fruit. It can be added in combination with sucrose in the form of high-fructose corn syrup (HFCS) to sweeten foods because it is sweeter than sucrose. Large amounts of fructose can cause diarrhea in infants and young children.

**Generally recognized as safe (GRAS)**—A phrase used by the federal government to refer to exceptions to the FD&C Act of 1938 as modified by the Food Additives Amendment of 1958. Sweeteners that have a scientific consensus on their safety, based on either their use prior to 1958 or to well-known scientific information, may be given GRAS status.

**Gulf war syndrome (GWS)**—A disorder characterized by a wide range of symptoms, including skin rashes, migraine headaches, chronic fatigue, arthritis, and muscle cramps, possibly related to military service in the Persian Gulf war of 1991. GWS was briefly attributed to the troops' high consumption of beverages containing aspartame, but this explanation has been discredited.

**High-intensity sweetener**—Another term for nonnutritive sweetener, used because these substances add sweetness to food with very little volume.

**Nonnutritive sweetener**—Any sweetener that offers little or no energy value when added to food.

**Nutritive sweetener**—Any sweetener that adds some energy value to food.

**Phenylketonuria (PKU)**—A rare inherited metabolic disorder resulting in accumulation of phenylalanine, an amino acid, in the body. It can lead to mental retardation and seizures. People with PKU should not use products containing the artificial sweetener aspartame because it is broken down into phenylalanine (and other products) during digestion.

**Sucrose**—The natural sweetener commonly used as table sugar; sucrose is a compound of two simple sugars, glucose and fructose. It is used as the standard for measuring the sweetening power of high-intensity artificial sweeteners.

toxic to human beings and household pets, causing painful death from kidney failure. In 1937 there was no requirement for medications to be tested for toxicity before being placed on the market. The FD&C Act of 1938 thus included a legal definition of a food additive "any substance, the intended use of which results directly or indirectly, in its becoming a component or otherwise affecting the characteristics of food"

The FDA asks the following questions in evaluating a proposed new sweetener as a food additive:

- How is the sweetener made?
- What are its properties when it is added to foods or beverages?
- How much of the sweetener will be digested or otherwise absorbed by the body?
- Are certain groups of people likely to be more susceptible than others to the additive?
- Does the sweetener have any known toxic effects, including hereditary disorders or cancer?

Other sweeteners are classified as *generally regarded as safe* or GRAS, and are not defined for legal purposes as food additives. The GRAS category was created in 1958 when the FD&C Act was modified by the passage of the Food Additives Amendment. A sweetener, whether nutritive or nonnutritive, can be given GRAS status on the basis of "experience based on common use in food" or a scientific consensus represented by published studies. Sorbitol and a few other polyols have GRAS status along with the natural sugars. Most artificial sweeteners, however, are considered food additives by the FDA.

## Purpose

Artificial sweeteners are used in food products for several reasons: to lower the calorie content of soda pop and other sweet treats as part of weight reduction and weight maintenance diets; to assist patients with diabetes in controlling blood sugar levels more effectively; and to lower the risk of tooth decay. They are also added as excipients (inert substances used to make drugs easier to take in tablet or liquid form) to some prescription medications to disguise unpleasant tastes because they do not react with the active drug ingredients as natural sugars sometimes do. Sorbitol and mannitol are commonly added to toothpaste, mouthwash, breath mints, cough drops, cough syrups, sugarless gum, over-the-counter liquid antacids, and similar personal oral care products to add bulk to the product's texture as well as minimize the risk of tooth decay.

In addition to adding a sweet flavor, artificial sweeteners are also used in the manufacture of baked goods, beverages, syrups, and other food products to improve texture, add bulk, retard spoilage, or as part of a fermentation process. The polyols in particular are used to retard spoilage because they do not support the growth of mold or bacteria to the same extent as natural sugars.

## Description

### *Nutritive sweeteners*

- Natural sugars. Natural sugars, which are also called primary sweeteners, include sucrose, a compound of glucose and fructose commonly used in crystalline form as table sugar; and fructose, which is a simple sugar found in sucrose and fruit, and is added to foods and beverages in combination with sucrose as high-fructose corn syrup or HFCS. These sweeteners provide about 4 calories per gram. Fructose is sweeter than sucrose; thus smaller amounts of it can be used to sweeten foods and drinks, which allows for some reduction in calories.
- Polyols. Polyols provide between 1.6 calories per gram (mannitol) and 3 calories per gram (hydrogenated starch hydrolysates). They are absorbed very slowly and incompletely during digestion, which is why they can be beneficial to patients with diabetes who want to avoid sudden or sharp increases in blood sugar levels.

### *Nonnutritive sweeteners approved by the FDA*

There are five nonnutritive sweeteners approved by the FDA for use in the United States as of 2007:

- Acesulfame potassium (acesulfame-K). Acesulfame potassium is a high-intensity nonnutritive sweetener that is about 200 times sweeter than sucrose; 95% of it is excreted from the body unchanged. It was discovered by a German company, Hoechst AG, in 1967. It was first approved by the FDA for use in nonalcoholic beverages in 1998 and for general use in 2003. In addition to its usefulness in reducing the calorie content of foods, in diabetic diets, and in not promoting tooth decay, acesulfame potassium remains stable at the high temperatures used for cooking and baking, has a long shelf life, does not leave any bitter aftertaste, and combines well with other sweeteners. It is sold under the brand names ACK, Sunett, Sweet & Safe, and Sweet One.
- Aspartame. Aspartame, which is also about 200 times sweeter than sugar, was discovered in 1965 by a researcher at Searle Laboratories working on antiulcer medications. It is unusual among nonnutritive sweeteners in that it is completely broken down during digestion into its basic components—the amino acids aspartic acid and phenylalanine plus a small amount of methanol. Aspartame was approved by the FDA for tabletop use in 1981 and for use in carbonated beverages in 1983. As of the early 2000s, the United States uses 75% of the aspartame produced in the world, 70% of this amount consumed in diet beverages. Aspartame is the nonnutritive sweetener that has received the greatest amount of negative attention in the mass media because of a rumor that it caused Gulf War syndrome (GWS) in veterans of the Persian Gulf conflict of 1991, and because of a study done in Europe in 2005 that linked aspartame to two types of cancer (leukemia and lymphomas) in female laboratory rats. In response to the 2005 European study, the National Cancer Institute (NCI) conducted a study of half a million people in the United States in 2006 and found no connection between cancer rates and aspartame consumption. The details of this study can be found in a fact sheet available on the NCI website. Another study conducted by the National Toxicology Program (NTP) of the National Institute of Environmental Health Sciences (NIEHS) of aspartame as a possible carcinogen found no evidence that the sweetener causes cancer in humans. Aspartame is sold under the brand names NutraSweet, Equal, and Sugar Twin (blue box).
- Neotame. Neotame is similar chemically to aspartame but is between 7000 and 13,000 times sweeter than sugar. In July 2002, neotame was approved as a general-purpose sweetener by the FDA. Neotame is partially absorbed in the small intestine, the remainder

excreted in urine and feces. It is not concentrated in any body organs and has not been identified as a cancer risk. Like acesulfame potassium, neotame has a clean taste with no bitter aftertaste, combines well with other sweeteners, and is stable when used in cooking and baking. It is also used to enhance the flavors of fruit and other ingredients in food. Neotame is manufactured in the United States by the NutraSweet Company of Mount Prospect, Illinois, but does not have a commercial or brand name as of early 2007.

- Saccharin. Saccharin is the oldest nonnutritive sweetener, having been discovered in 1879 by a chemist working at Johns Hopkins University. It is about 200 to 700 times as sweet as sugar. It was used extensively during World Wars I and II, when sugar was rationed in the United States as well as in Europe. It is still the least expensive high-intensity sweetener used around the world—about 65 million pounds per year in the late 1990s. Saccharin passes through the body essentially unchanged. It was so widely used in the United States that it was considered a GRAS substance when the Food Additives Amendment was passed in 1958, but it lost that status when studies performed on laboratory rats in the 1970s indicated that it might cause bladder cancer. At that point Congress mandated that all foods containing saccharin must carry a warning label that they might be hazardous to health. Later studies indicated that the bladder tumors in rats are caused by a mechanism that does not operate in humans, and that there is no evidence that saccharin is unsafe for humans. In 2000 the NTP took saccharin off its list of carcinogens and the saccharin-warning label was removed from food. Details of the controversy over saccharin and cancer can be found on the NCI website. Saccharin is presently sold under the trade names of Sweet 'N Low, Sweet Twin, and Necta Sweet.
- Sucralose. Sucralose is unusual in that it is the only nonnutritive sweetener made from sugar, but it is about 600 times as sweet as table sugar. Sucralose is manufactured from sugar by substituting three chlorine atoms for three hydroxyl groups in the sugar molecule. Only about 11% of sucralose is absorbed during digestion; the remainder is excreted unchanged. The FDA approved sucralose in 1998 as a tabletop sweetener and in 1999 as a general-purpose sweetener. The acceptable daily intake (ADI) for sucralose is 5 mg per kilogram of body weight per day. Like acesulfame potassium, sucralose is highly heat-stable and works well in foods that must be baked or cooked. Sucralose is sold under the trade name Splenda for table use.

***Nonnutritive sweeteners not approved for use in the United States***

- Alitame. Alitame is a compound of aspartic acid, D-alanine, and an amide; it is 2000 times sweeter than sugar. In 1986 it was reviewed by the FDA, which found the application to be deficient. As of 2007, alitame is approved for use only in Australia, New Zealand, Mexico, Colombia, and China.
- Cyclamate. Cyclamate, which is about 30 times sweeter than sugar, was used as a nonnutritive sweetener in the United States until 1969, when it was shown to cause cancer in laboratory rats when combined with saccharin. Although cyclamate by itself was found by the National Academy of Sciences not to be a carcinogen in 1985 and is approved for use in over 50 countries, it has not been reinstated by the FDA for use in the United States as of 2007.
- Neohesperidine dihydrochalcone. Neohesperidine dihydrochalcone is a compound that is about 1500 times sweeter than sugar and adds a slight licorice flavor to foods and beverages. The FDA considers neohesperidone GRAS as a flavoring but not as a sweetener.
- Stevia. Stevia is a sweetener derived from a shrub native to South America. The FDA has not received sufficient scientific evidence to indicate that stevia is safe for use as a food additive.
- Thaumatin. Thaumatin is an intensely sweet mixture of proteins that also acts as a flavor enhancer. The FDA has given thaumatin GRAS status as a flavor adjunct but has not approved it as a sweetener as of 2007.

## Precautions

Artificial sweeteners are generally regarded as safe when used appropriately. The official position of the American Dietetic Association is that nutritive and nonnutritive sweeteners are safe as long as one's diet follows the current federation recommendations for nutrition.

The Institute of Medicine (IOM) maintains measurements of acceptable daily intake (ADI) levels for artificial sweeteners approved for use in the United States. The ADI is a regulatory definition that is often misunderstood. It is a very conservative estimate of the amount of a sweetener that can be safely consumed on a daily basis over the course of a person's lifetime. The ADI is *not* intended to be used as a specific point at which safe use ends and health risks begin, as occasional use of an artificial sweetener over the ADI is not of concern. To use aspartame as an

example, its ADI is 50 mg per kilogram of body weight per day. An adult weighing 150 pounds would have to drink 20 12-ounce containers of diet soft drink containing aspartame, eat 42 servings of gelatin, or use 97 packets of tabletop sweetener to reach the ADI.

Some specific artificial sweeteners must be used cautiously by certain groups of people:

- Polyols: Some polyols—most commonly mannitol and sorbitol—have a laxative effect in some people if they are consumed in large amounts (more than 50 g/day of sorbitol or 20 g/day of mannitol). Persons with diabetes may wish to limit their consumption of products containing polyols or increase their use gradually until they see how their bodies react to these sweeteners.
- Aspartame: Because aspartame is broken down in the body to the amino acid phenylalanine, foods or beverages containing aspartame should not be used by persons with phenylketonuria (PKU), a rare inherited disease that causes phenylalanine to accumulate in the body. The FDA requires all products containing aspartame sold in the United States to be labeled with the following warning: "Phenylketonurics: Contains Phenylalanine." Although the breakdown products of neotame also include phenylalanine, the amount is so small that it does not affect people with PKU.

## Interactions

There are no known interactions with prescription drugs caused by the use of nutritive or nonnutritive sweeteners. As was noted above, some nonnutritive sweeteners are considered useful excipients for medications precisely because they are chemically inert.

## Parental concerns

There have been concerns expressed about the use of artificial sweeteners by children because children consume more sweeteners, both nutritive and nonnutritive, per pound of body weight on a daily basis than adults. The use of fruit juice and other sweet beverages by children has greatly increased since the 1980s; however, studies indicate that even children who drink large amounts of diet soda and other beverages usually remain well below the ADI levels for aspartame and other nonnutritive sweeteners. The chief risk to children's digestive health is fructose, which is found in such popular children's drinks as apple juice. Fructose is incompletely digested by children below the age of 18 months and may cause diarrhea in older children. Children diagnosed with nonspecific diarrhea may benefit from being given smaller amounts of fruit juice to drink.

During the early 1990s, some researchers identified a possible connection between high levels of aspartame consumption and attention-deficit **hyperactivity** disorder (ADHD) in children. Two studies published in 1994 in *Pediatrics* and the *New England Journal of Medicine* respectively, however, found no connection between aspartame and ADHD, even when the children were given 10 times the normal daily amount of aspartame. Aspartame and other nonnutritive sweeteners, however, may have an additive effect on nerve cell development when they are combined with food colorings. This possibility was suggested by a 2006 study of laboratory mice in the United Kingdom, but the implications for humans are far from clear.

High intake of sweeteners added to food is of greatest concern during adolescence. As people age, they generally lower their intake of calories from added sugars. Fewer than 10% of adults over age 50 derive more than 25% of their daily calories from sugars, which is the maximal intake value established by the IOM. Nearly a third of adolescent females exceed this level, however, with almost a third of the extra sugar intake coming from carbonated beverages sweetened with high-fructose corn syrup. Although the rise in **obesity** in children and adolescents is a complex problem that cannot be attributed to a single factor, preliminary studies suggest that nonnutritive sweeteners may be useful in reducing adolescents' consumption of drinks sweetened with HFCS.

## Resources

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**ORGANIZATIONS**

American Dietetic Association (ADA). 120 South Riverside Plaza, Suite 2000, Chicago, IL 60606-6995. Telephone: (800): 877-1600. Website: http://www.eatright.org.

Dietitians of Canada/Les diététistes du Canada (DC). 480 University Avenue, Suite 604, Toronto, Ontario, Canada M5G 1V2. Telephone: (416) 596-0857. Website: http://www.dietitians.ca.

Institute of Medicine (IOM). 500 Fifth Street NW, Washington, DC 20001. Telephone: (202) 334-2352. Website: http://www.iom.edu.

National Cancer Institute (NCI). NCI Public Inquiries Office, 6116 Executive Boulevard, Room 3036A, Bethesda, MD 20892-8322. Telephone: (800) 4-CANCER. Website: http://www.cancer.gov/.

National Toxicology Program (NTP). Report on Carcinogens. P.O. Box 12233, MD EC-14, Research Triangle Park, NC 27709. Telephone: (919) 541-4096. Website: http://ntp.niehs.nih.gov/ntpweb/index.cfm?objectid=7182FF48-BDB7-CEBA-F8980E5DD01A1E2D.

Office of Food Additive Safety, HFS-200, Center for Food Safety and Applied Nutrition, Food and Drug Administration, 5100 Paint Branch Parkway, College Park, MD 20740. Telephone: (301) 436-1200. Website: http://www.cfsan.fda.gov/list.html.

U. S. Food and Drug Administration (FDA). 5600 Fishers Lane, Rockville, MD 20857-0001. Telephone: (888) INFO-FDA. Website: http://www.fda.gov/default.htm.

Rebecca J. Frey, Ph.D.

Ascorbic acid *see* **Vitamin C**

# Asian diet

## Definition

The Asian diet is an ancient and time honored way of eating. For thousands of years people of the Asian world have eaten a diet based on plant foods such as rice, vegetables, and fresh fruits. Unlike Western diets, meat is rarely the main dish of any meal but rather an accent and flavor compliment. Fish is often eaten in main courses.

In many Asian cultures diet is closely related to religious practices and tradition. It is an extremely healthful diet. Asian populations who have access to a sufficient variety of traditional foods are some of the healthiest and longest lived people on Earth. Many chronic illnesses that plague Western cultures such as heart disease, **cancer**, and **obesity** occur rarely in these cultures.

## Origins

Over 43 countries follow a form of Asian diet. Nearly half the world's population may be considered Asian. Food is an important part of daily life. Religious practices often dictate the type of foods eaten and the meal is an essential part of family relationships. The diet is based on fresh food prepared primarily raw, steamed, stir-fried, or deep fried.

There are four major types of Asian diets:

***East Asian Food: China, Japan, and Korea.***

China is the largest country in the world and has many different cuisines. Although China stretches across mid-Asia as well as to the east, Chinese food as a whole is considered East Asian food. Throughout most of China, rice is an important food staple. However, in some regions, noodles rather than rice are the foundation of the diet. Most food is prepared by mincing and cooking it, along with a small amount of oil, in a wok.

**Merits of traditional Asian diets**

| | Staple foods | Merits of diet |
|---|---|---|
| Cambodian | Rice<br>Fish<br>Tea | Low in fat<br>Low in sugar |
| Chinese | Rice<br>Vegetables<br>Green Tea | Reduces risk for heart disease and certain cancers |
| Filipino | Rice<br>Vegetables<br>Seafood<br>Fruit | Reduces risk for heart disease and cancers |
| Hmong | Rice<br>Vegetables<br>Meat<br>Fish | Low in fat<br>Low in sugar |
| Asian Indian | Cereals<br>Rice<br>Vegetables | Low in fat<br>Low in sugar |
| Laotian | Rice<br>Vegetables<br>Fish | Low in fat<br>Low in sugar |
| Vietnamese | Rice<br>Fish<br>Fruit | Low in fat<br>Low in sugar |

*(Illustration by GGS Information Services/Thomson Gale.)*

## KEY TERMS

**Antioxidants**—Substances believed to protect the body from the damage of oxidation.

**Diabetes**— A disease that causes an abnormally high level of glucose (sugar), to build up in the blood.

**Hinduism**—A broad group of religious and philosophical beliefs from India. It is characterized by belief in reincarnation, one God with many forms, and the pursuit of transcending the evils of earth.

**Hypertension**—High blood pressure.

**Menopause**—The time in a woman's life when menstruation stops.

**Obesity**—Over weight.

**Osteoporosis**—A weakening of the bones that is caused by calcium deficiency.

Within China there are three distinct regional cuisines: Shanghainese, whose regional food is known for its hot and spicy chili pepper flavoring and distinctive red-colored meats. Cantonese and Chaozhao regions associated with flavorful meat and vegetable combinations. Beijing, Mandarin, and Shandong regions serve noodles and steamed bread dumplings used instead of rice as the foundation of most meals.

Japan is an island nation and much of its food uses fish and fish-based ingredients. Rice is a staple in Japanese cooking as are sliced, salted vegetables. **Soy** products such as tofu, soy sauce and soy paste called miso are used in many dishes. Foods of Japan also include sushi, meats flavored with teriyaki sauce, and lightly battered and fried meats, fish, and shellfish called tempura.

Korean food is a blend of Chinese and Japanese influence, yet it has its own distinct flavors including soy sauces, garlic, ginger, chilies, pine nuts, and sesame seeds among other spices and foods. Traditional Korean meals include meats and seafood. Most meals include a vegetable dish called gimchi made of grated vegetables pickled with garlic, chili, and ginger.

### *Southeast Asian Food: Vietnam, the Philippines, Malaysia, and Singapore.*

Vietnamese cuisine relies on rice and vegetables as its foundation with meat and fish used sparingly. Fish sauces called *nuocmam* is the main flavoring. Fruits such as bananas, mangoes, papayas, coconut, and pineapple are also an important part of each meal.

Philippines cuisine is a unique blend of Spanish, Japanese, Chinese, Islamic, and American influences. The typical day includes four meals, three main meals and a light afternoon snack. Unlike other Asian diets, meat is very important. Favorite meats include pork, beef chicken, and **water** buffalo in the rural provinces. Rice and noodles are served with most meals and vegetables such as broccoli, bitter melon, mung bean, bean sprouts, and okra.

Malaysia and Singapore share a spicy cuisine incorporating Chinese, Muslim, and Indian influences. Traditional foods include meat kebabs called Satays which are served with a spicy peanut sauce. Curry is a favorite spice and is mixed with meat and marinades. Rice and Chinese noodles are eaten daily. Deserts made from coconut milk, green noodles, sugar syrup, and sweet beans are local favorites.

### *Southern Asian Food: India.*

Indian cuisine has influenced food from the Indian peninsula, across the regions to the West including Afghanistan, Pakistan, Sri Lanka, and as far south as Indonesia. Indian cuisine is the only Asian diet that includes dairy products usually in the form of yogurt and cheese. Known for its spicy seasoning, Indian cuisine uses a variety of spices such as curry, saffron, cumin, cardamom, ginger turmeric, coriander, tamarind,

mustard, and aniseed. Fruit and vegetables comprise the majority of the diet. Much of India practices Hinduism. For the Hindu, the cow is a sacred symbol and is never eaten. For this reason beef is rarely found in Indian cuisine. Most of the **protein** content in the diet comes from dairy products, legumes, and nuts. Rice is also a staple of the Indian diet.

## Origins

In general, the Asian diet is not measured and does not include exact portion sizes, but rather guidelines for what should be eaten daily, weekly, and monthly. Rather than prohibitions and prescriptions, the Asian diet suggests balance. The typical daily calorie content is approximately 1200 to 1400.

Suggested daily foods include :

- Grains and Breads: Grains form the basis of the Asian diet. Rice is the predominant grain and is eaten daily. Other grains include noodles, corn, millet, and bread. Also included in this category are potatoes and cereals.
- Vegetables: Many fresh vegetables are eaten daily and in large quantities. There are many vegetables to be enjoyed following the Asian diet such as carrots, cabbage, green leafy vegetables, onions, sprouts, and many others. Vegetables provide necessary daily vitamins and fiber.
- Fruit: Many fruits are used as flavoring, ingredients, deserts, and enjoyed raw. Eating a variety of fruits insures proper vitamin and minerals in the diet.
- Nuts and Legumes: In the Asian diet, nuts and legumes or beans provide the primary source of protein. Soy beans in many forms such as tofu, soy milk, and soy flour are used almost daily. Nuts and seeds also play a vital role in the diet providing necessary protein and minerals. Tofu, nuts, seeds and beans are used in soups, salads, main dishes and even deserts.
- Vegetable Oils: Essential fats come from the vegetable oils used in cooking. Some of the oils used are high is saturated fat and are a very small part of the Asian diet used primarily for cooking.
- Optional Daily Foods: Daily products that could be consumed daily are dairy products and fish. Dairy products are not a part of most Asian diets. If dairy is included on a daily diet it should be low fat and eaten in moderation.

Fish is a staple in many Asian diets and eaten very little in others. Geography has historically determined whether or not fish is in the diet. Fish is a very healthy food linked with the prevention of chronic diseases such as heart disease and cancer.

Suggested weekly foods include:

- Sweets: Sweets are eaten rarely in the Asian diet as a treat. They are high in sugar and usually high in fat. Fruit is an excellent substitute for high fat and high sugar deserts.
- Poultry and Eggs: Eggs, chicken , and turkey are used weekly as ingredients to main dishes.

Suggested monthly foods include:

- Red Meat: Meat is eaten very sparingly in the Asian diet. It may be eaten a few times a monthly or more frequently if in small servings.

Diana My Tran in her book, *The Asian Diet*, provides 18 days of menus. Her interpretation of the Asian diet is influenced by her Vietnamese heritage, but it incorporates recipes and flavors from many other Asian cuisines. Her diet plan encourages a diet rich in fruits and vegetables. Grains such as rice and cereal are eaten daily and at most meals. Meat is offered in the daily recipes, but a vegetarian option is also included. Her plan recommends an ounce of cereal or rice along with fruit and coffee or tea for breakfast. Lunch options are lighter meals including grain, protein (either meat or tofu dishes), vegetables, and tea. The plan presents one snack a day, usually fruit. Dinner is the largest meal of the day and it includes grain, meat, vegetables and fruit-based desert. Her meal plan provide 1300–1400 calories per day.

Eating the Asian way, according to Tran, involves the benefits of fresh fruits and vegetables and uses vivid flavors and spices to enhance the eating experience. Asian eating uses vegetables, broths, and spices to make the calories filling so that eating few calories is still very satisfying.

## Function

Asian diets are influenced by culture, **religion**, and agriculture. Research has shown that this way of eating is extremely healthful. Low in fat, high in **fiber** and full of fresh fruits and vegetables, many believe it is the secret to a long and healthy life.

By eating a diet that is predominantly plant-based, the calories are low. The spices and manner of cooking provide the palate with a stimulating eating experience and help the dieter feel satisfied.

## Benefits

Countries that eat a traditional Asian diet have lower rates of many illnesses that plague the Western

world such as diabetes, heart disease, **hypertension**, cancer, and obesity. The Asian diet is plant-based. Most calories come from grains, vegetables, and fruit. The benefits of a diet rich in fruits and vegetables are well documented. Full of **vitamins**, **minerals**, and **antioxidants**, the Asian diet is very healthful.

Antioxidants are a category of vitamins and minerals that help to prevent damage to the body caused by substances called free radicals. Free radicals are the by-products of molecular functions in the body and environmental toxins ingested such as tobacco smoke and radiation. Antioxidants are believed to reduce the negative impact of these free radicals and reduce the risk of certain forms of cancer and heart disease.

Fruits and vegetables also provide fiber. Many studies have shown that adequate amounts of fiber in the diet may reduce the risk of several forms of cancer including colon cancer, the third most prevalent cancer among both men and women in the United States.

The Asian diet limits fat in general and almost completely eliminates saturated fat. A diet high in saturated fat has been shown to cause chronic illnesses such as coronary artery disease, obesity, and cancer. Many researchers believe this is the primary reason such diets are so healthy.

## Precautions

Traditional Asian diets include little or no dairy products. This limits the amount of **calcium** consumed since milk and other dairy products contain high amounts of calcium and are the usual food group to provide this essential nutrient. Modern version of this diet presented to the Western world generally include low-fat or reduced-fat dairy products in moderation. Pregnant or nursing women will need to take calcium supplements to insure that they have enough calcium. Dieters who do not wish to consume dairy products may also decide to take calcium supplements. In Asia, most people are far more active than typical Westerners. Their activities often involve lifting heavy objects and manual labor. Weight bearing exercise has been shown to strengthen bones and my offset the lower amounts of calcium consumed.

The Asian diet is a wholesome option for most healthy adults. However, children and pregnant women may not receive the proper balance of nutrition needed. Children may need the calcium dairy products provide and increased fat consumption during stages of rapid growth and development. Pregnant women need to insure sufficient intake of calories and other nutrients that meats, **fats** and dairy products provide.

### QUESTIONS TO ASK YOUR DOCTOR

- Is this diet appropriate for me?
- What are the potential benefits for a person of my age, sex, and lifestyle in adopting an Asian diet?
- What are the potential health risks, if any, of this diet for me as an individual?
- Will I need any dietary supplements if I follow the Asian diet?
- How much exercise should I do each week in conjunction with this diet?

## Risks

A traditional Asian diet is low in dairy products and may, therefore, be low in calcium. Diets low in calcium can lead to **osteoporosis**, a weakening or the bones. Women are especially vulnerable to this disease after menopause when lower levels of hormones weaken bones as well. Similarly, pregnant women and children have higher calcium requirements. To insure that adequate amounts of calcium are in the diet, a calcium supplement may be needed or the addition of low-fat dairy products.

Attempting to follow an Asian diet by eating at Asian style restaurants in the West may not be successful or healthy since many of these restaurants have adapted to Western tastes by adding high levels of fats and **sodium**. To enjoy the benefits of Asian style eating, it may be necessary to prepare the foods at home. Though many communities enjoy authentic Asian restaurants and it may be possible to find healthy Asian cuisine.

## Research and general acceptance

### *General acceptance*

Asian style diets are considered by many nutritionists and doctors to be the model of healthy eating. Low in fat and high in vitamins, minerals, and antioxidants, the Asian diet is believed to prevent many illnesses of the Western world such as diabetes, coronary artery disease, hypertension, cancer, and obesity.

### *Research*

In 2000, The American Heart Association issued revised **dietary guidelines** for reducing the risk of heart disease and stroke. These recommendations include eating a diet low in fat and full vegetables and fruits. They also recommend increasing the consumption of fish. All of these recommendations are found in the Asian diet.

Many studies show the benefit of eating a diet such as the Asian diet. These studies show that lipid (fat) levels in the blood, a major risk factor for heart disease and stroke, may be dramatically reduced by following a low fat, plant-centered diet. The effects of years of unhealthy eating habits may be reversed by altering the diet to limit intake of high fat foods and increasing the amount of low fat foods, fruits, and vegetables.

In 2000, one study confirmed the results of previous research that a diet low in saturated fat and high in fruits and vegetables lowers blood pressure in patients with untreated hypertension. Doctors believe following such as the Asian diet could prevent hypertension.

### Resources

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# Atkins diet

## Definition

The Atkins diet is named for Robert C. Atkins, M.D., the diet's founder. It is based on restrictions of **carbohydrates** and focuses on eating mostly **protein** and fat, along with use of vitamin and mineral supplements.

The Atkins diet has been one of the most popular **fad diets** in the United States. It started a "low-carb revolution," leading to development of low carbohydrate choices in grocery stores and restaurants around the world. The diet's founder, Robert C. Atkins, died in February 2003.

## Origins

Dr. Atkins introduced his *Diet Revolution* in 1972. From the beginning, Dr. Atkins, a cardiologist, said that limiting intake of carbohydrates (sugars and starches) would improve health and aid in weight control. The original premise for developing the diet came about because of Atkins' frustration with the increasing rates of **obesity** and chronic diseases such as diabetes.

## Description

Throughout the diet, Dr. Atkins recommended drinking at least eight 8-oz. glasses of **water** each day to avoid **dehydration** and **constipation**. He also recommended daily intake of nutrients through a good multi-vitamin supplement. Finally, Dr. Atkins mentioned getting plenty of exercise to speed weight loss. The Atkins diet consists of four distinct phases that participants should go through to achieve and maintain weight loss.

### *Induction*

The induction phase is not required, but that doing so jump starts weight loss as dieters cut back significantly on carbohydrate consumption. According to Atkins Advantage notes, the induction phase can make people feel revitalized, since carbohydrates cause blood sugar spikes that lead to fatigue and other symptoms. The diet also claims that the induction phase will help dieters see the benefits of fat-burning and strengthen their immune systems.

This is by far the most restrictive of the four phases, allowing no more than 20 net carbohydrates per day. This equals roughly three cups of salad greens or other non-starchy vegetables. Participants can eat

**Phases of the Atkins Diet**

**Induction—At least two weeks**
No more than 20 net carbohydrates per day
Liberal amounts of protein, including meats, fish, poultry, and eggs, as well as healthy fats
Fatty condiments (mayonnaise, sour cream, guacamole, and butter) are allowed in unlimited quantities
Weight loss during the induction phase may be significant

**Ongoing weight loss—Begin after two weeks**
Slow introduction of foods with carbohydrates that are considered nutrient dense (green beans, Brazil nuts, avocados, berries, and whole grains)
In week one, add 25 grams of carbohydrates per day
In week two, 30 grams of carbohydrates are allowed
The addition of five grams per week continues until weight loss stalls, then drop back to the previous gram level

**Pre-maintenance goal—Begin when within 5 to 10 pounds of weight-loss goal**
Gradually increase carbohydrate intake by 10 grams per week until weight is gained, then drop back to the previous carbohydrate gram level
Level weight loss to less than one pound per week

**Lifetime maintenance—Begin one month after weight-loss goal is achieved**
May be able to consume from 90 to 120 grams of carbohydrates a day, depending on age, gender, and activity level
Maintaining weight goal is more likely if carbohydrate intake remains at the level discovered in pre-maintenance

*(Illustration by GGS Information Services/Thomson Gale.)*

liberal amounts of protein, including meats, fish, poultry, and eggs, as well as healthy **fats**. Healthy fats include vegetable and seed oils. High fat condiments such as mayonnaise, sour cream, guacamole, and butter are allowed in virtually unlimited quantities. The Atkins theory is that these high fat foods enhance the flavor of meals, making the Atkins diet easier to maintain. Atkins has reminded dieters that while unlimited quantities of fats and proteins are allowed, the advice is not a license to gorge. Dieters are said to feel hungry for the first 48 hours as their bodies adjust to the abrupt reduction in carbohydrates. Weight loss during the induction phase is said to be significant. The phase is recommended to last at least two weeks.

### *Ongoing weight loss*

The second phase of the Atkins diet moves into ongoing weight loss. It involves slow introduction of foods with carbohydrates that also are considered nutrient dense. Most of the carbohydrate calories come from vegetables. Atkins dieters still eat a higher proportion of proteins and fat, but they gradually add more carbohydrates into the diet. According to Atkins, the purpose of the phase is to continue to burn and dissolve fat while maintaining appetite and craving control. This phase also introduces the dieter to a broader range of foods and helps to determine the dieter's threshold level of carbohydrate consumption. It is the intention of this phase to deliberately slow weight loss.

If weight loss continues, carbohydrate intake is gradually increased each week. In week one, the dieter can add 25 grams of carbohydrates per day. In week two, 30 grams of carbohydrates are allowed. This addition of five grams per week continues until weight loss stalls, then the dieter drops back to the previous gram level. Typical tolerance levels may range anywhere from 30 grams to 90 grams per day. Atkins literature says that the more a dieter exercises, the more carbohydrates he or she can tolerate. The Atkins diet recommends choosing carbohydrates first from vegetables that are low in carbohydrates, then from other sources that are fresh foods high in nutrients and **fiber**. Examples of low-carbohydrate vegetables are lettuce, raw celery, and cucumbers. Nutrient-rich carbohydrates are green beans, Brazil nuts, avocados, berries, and whole grains.

### *Pre-maintenance*

The Atkins diet considers the third phase a practice for lifetime maintenance of goal weight and "healthy eating habits". When the goal weight is within five to 10 pounds, the dieter gradually begins to increase carbohydrate intake by 10 grams per week until weight is gained, then drops back to the previous carbohydrate gram level. The purpose is to level weight loss to less than one pound per week. The dieter should continue at this rate until the goal weight is reached, then for one month past that time. The goal is to achieve a level at which weight is neither gained nor lost and to internalize the habits that become part of a permanent lifestyle.

Examples of vegetables that contain about 10 grams of carbohydrates are 3/4 c. of carrots, 1/2 c. of acorn squash, 1 c. of beets, and 1/4 c. of white potatoes. Legumes and fruit are the next preferred food groups for adding 10 grams daily. One-half apple contains 10 grams of carbohydrates, as does 1/3 c. of kidney beans.

## KEY TERMS

**Ketoacidosis**—An imbalance in the makeup of body fluids caused by the increased production of ketone bodies. Ketones are caused by fat breakdown.

*Lifetime maintenance*

This final phase of the Atkins diet occurs when a dieter reaches goal weight. Although an adult may be able to consume from 90 to 120 grams of carbohydrates a day, depending on age, gender, and activity level, maintaining goal weight is more likely if carbohydrate intake remains at the level discovered in pre-maintenance. The key, according to Atkins, is never letting weight vary by more than three to five pounds before making corrections.

## Function

From the beginning, Dr. Atkins said that the traditional approach to weight loss of counting calories and cutting fat must not be working. He blamed carbohydrates for adding to the expanding waistlines and declining health of Americans. Through several updates of the Atkins diet, the same basic premise held with minor revisions. The function of the diet is to enjoy eating while severely limiting carbohydrates. Atkins Advantage mostly makes a distinction between trans fats and other fats. A more clear distinction also is made in the later version between carbohydrates in general and sugar in particular. All along, Atkins has emphasized that a focus on protein builds energy, repairs muscles and bones, and boosts the **metabolism**.

## Benefits

Some dieters have had at least initial success with the diet and have found the liberal rules regarding protein and fats more tasteful and filling than other diets, Advice from the Atkins plan concerning behavioral changes can be helpful, such as shopping the perimeter of the grocery store, where the unprocessed foods are located. In recent years, the program has attempted to modify some of its advice to more closely fit traditional advice from registered dieticians. For example, more clearly defining the types of fats to emphasize in the diet may help avoid mistakes by some who follow the diet to overeat unhealthy fats and increase risk for heart disease. However, experts have said that the diet still contradicts mainstream views concerning health promotion and disease prevention.

## Precautions

The average carbohydrate intake recommended by the Atkins diet is well below averages generally recommended by other experts. Studies have shown that even though people may lose weight on the Atkins plan, they do not necessarily keep the weight off long-term because the diet does not teach sustainable lifestyle changes.

Like many fad diets, the Atkins plan produces and promotes many food products associated with its diet plan. As of 2007, these products included bars, shakes, and candy. So although the plan argues against processed foods and snacking, the company also heavily promotes use of its nutritional products to support weight loss or maintenance.

Most importantly, followers of the Atkins diet have reported suffering from muscle cramps, diarrhea, general weakness, and rashes more frequently than people on low-fat diets. Others have reported constipation, bad breath, headache, and fatigue. The American Dietetic Association has warned that any diet that severely limits one food group should raise a red flag to dieters.

## Risks

Beyond the reported side effects and concerns about the diet's long-term effectiveness, some serious problems may arise for Atkins diet followers. One problem that has been documented is called ketoacidosis. This occurs when there is a buildup of the by-products of fat breakdown because the body does not have enough glucose available. The condition can be dangerous, resulting in cell damage, severe illness, and even death. The low carbohydrates eaten by those on the diet are below those needed to supply the brain and muscles with sugar. Critics of the diet have also long focused on the risks of unlimited fat intake that the Atkins diet allows. Eating large amounts of saturated fat, even if weight is dropping, can lead to high levels of cholesterol and heart disease. However, this is not necessarily always the case. Cholesterol levels tend to decrease in many individuals when they lose weight, even if eating an unbalanced diet. Long-term research remains to be done in this area.

## Research and general acceptance

Research results have varied over the years concerning the Atkins diet. The research has tended to support that Atkins followers have experienced comparable or higher weight loss than people on traditional low-fat diets with higher amounts of carbohydrates, but for only a six-month period. After 12 months, weight loss was about equal. Some research also has shown that the diet has not produced damaging cholesterol or heart effects, but these studies have not been large, long-term trials. For example, effects of increased fat consumption on diet followers' hearts may take years to

## QUESTIONS TO ASK YOUR DOCTOR

- What aspects of the Atkins diet do you feel are appropriate for weight loss?
- How often would I need to be seen by a physician or registered dietitian while following the atkins diet?

surface and in any medical research, large numbers of participants are needed to account for many variables.

In 2004, Jody Gorran, a 53-year-old businessman from Florida, sued the promoters of the Atkins diet, saying that the plan clogged his arteries and nearly killed him. Mr. Gorran claimed that he was seduced by the plan and that by eating the high levels of protein and fats touted by the plan, his cholesterol soared. His lawsuit was backed by the Washington-based advocacy group called Physicians Committee for Responsible Medicine. Mr. Gorran sought damages and to seek an injunction preventing the sale of Atkins' books and products without fair and adequate warnings about the dangers of the diet. The lawsuit was dismissed late in 2006 by a judge, but an appeals continue.

Atkins' company filed for Chapter 11 bankruptcy protection in July 2005. The company completed its Chapter 11 reorganization by January 2006, having streamlined some operations, and continued to operate early in 2007, making Dr. Atkins' diet run more than 35 years long.

Controversy even surrounded Atkins' death in 2003. Though he died when he slipped on the ice outside his office in February 2003. He spent eight days in a coma before dying, and a copy of the medical examiner's report showed that his weight upon death was 258 pounds. Critics of Atkins's diet said that this was considered obese for a man who was six feet tall. His allies said that most of the pounds were gained in Atkins' time in a coma because of fluid retention. But even while Atkins was alive, he had reported problems with his heart, though his physician's council said the trouble was from an enlarged heart, which had stemmed from a viral infection, not from his diet.

Though Dr. Atkins added that numerous studies pointed to the fact that carbohydrates were to blame for weight gain, an explanation for how his diet program worked was never really offered by researchers. Numerous studies continued throughout the 1990s and even after Dr. Atkins' death. Though some studies showed that people on the Atkins diet often lost weight faster in six months than those on other weight loss programs, the long-term effectiveness and possible harmful effects of the Atkins diet required more study.

In 1992, Dr. Atkins updated his *Diet Revolution* and by 2004 *Dr. Atkins' New Diet Revolution* had sold more than 45 million copies and been translated into 25 languages. The new plan was the same, but the maintenance portion of the diet was made a little more liberal. The diet was extremely popular, as were Atkins Nutritionals products, such as vitamin supplements and numerous food items. A later Web-based version called the Atkins Advantage emphasized the products of Atkins Nutritionals and offered additional books, software, and information on a company Website to support the program's goals and products.

### Resources

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Physicians Committee for Responsible Medicine. 5100 Wisconsin Ave NW, Suite 400, Washington, D.C. 20016. 202-686-2210. <http://www.atkinsdietalert.org>

Teresa G. Odle

## Attention Deficit Hyperactivity Disorder diet

*see* **ADHD diet**

# B

## Bariatric surgery

### Definition

Bariatric surgery is a surgical weight-loss procedure that reduces or bypasses the stomach or small intestine so that severely overweight people can achieve significant and permanent weight loss.

### Purpose

Bariatric surgery, is performed only on severely overweight people who are more than twice their ideal weight. This level of **obesity** often is referred to as morbid obesity since it can result in many serious, and potentially deadly, health problems, including **hypertension**, Type II **diabetes mellitus** (non-insulin dependent diabetes), increased risk for coronary disease, increased unexplained heart attack, **hyperlipidemia**, and a higher prevalence of colon, **prostate**, endometrial, and, possibly, breast **cancer**. In 2003, researchers concluded that obesity surgery could cure Type II diabetes in many people who were not yet morbidly obese. Therefore, this surgery is performed on people whose risk of complications of surgery is outweighed by the need to lose weight to prevent health complications, and for whom supervised weight-loss and exercise programs have repeatedly failed. Obesity surgery, however, does not make people thin. Most people lose about 60% of their excess weight through this treatment. Changes in diet and exercise still are required to maintain a normal weight.

The theory behind obesity surgery is that if the volume the stomach holds is reduced and the entrance into the intestine is made smaller to slow stomach emptying, or part of the small intestine is bypassed or shortened, people will not be able to consume and/or absorb as many calories. With obesity surgery the volume of food the stomach can hold is reduced from about four cups to about 1/2 cup.

Insurers may consider obesity surgery elective surgery and not cover it under their policies. Documentation of the necessity for surgery and approval from the insurer should be sought before this operation is performed.

### Precautions

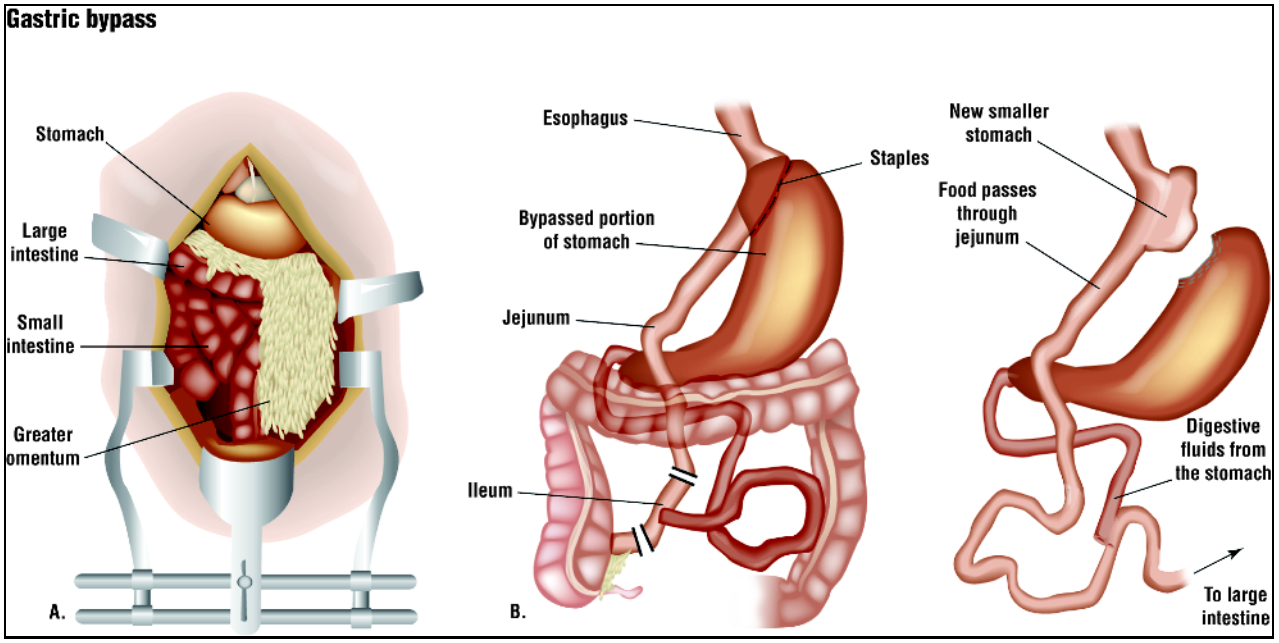
Obesity surgery should not be performed on people who are less than twice their ideal weight. It also is not appropriate for people who have substance addictions or who have psychological disorders. Other considerations in choosing candidates for obesity surgery include the general health of the person and his or her willingness to comply with follow-up treatment.

### Description

Obesity surgery is usually performed in a hospital by a surgeon who has experience with obesity surgery or at a center that specializes in the procedure. General anesthesia is used, and the operation takes 2–3 hours. The hospital stay lasts about a week.

Three procedures are currently used for obesity surgery:

- Gastric bypass surgery. Probably the most common type of obesity surgery, gastric bypass surgery has been performed in the United States for about 25 years. In this procedure, the volume of the stomach is reduced by four rows of stainless steel staples that separate the main body of the stomach from a small, newly created pouch. The pouch is attached at one end to the esophagus. At the other end is a very small opening into the small intestine. Food flows through this pouch, bypassing the main portion of the stomach and emptying slowly into the small intestine where it is absorbed.
- Vertical banding gastroplasty. In this procedure, an artificial pouch is created using staples in a different section of the stomach. Plastic mesh is sutured into




**In this Roux-en-Y gastric bypass, the stomach is separated into two sections. Food is bypassed from the larger stomach to the smaller stomach.** *(Illustration by GGS Information Services/Thomson Gale.)*

part of the pouch to prevent it from dilating. In both surgeries the food enters the small intestine farther along that it would enter if exiting the stomach normally. This reduces the time available for absorption of nutrients. The procedure is normally done laparoscopically, meaning that the surgeon makes one or more small incisions in the abdomen and inserts the necessary tools and instruments through the tiny holes. He or she can view the patient's organs via an inserted camera that displays pictures on a monitor. This method makes for a faster and easier recovery than a large incision.

- Jejunoileal bypass. Now a rarely performed procedure, jejunoileal bypass involves shortening the small intestine. Because of the high occurance of serious complications involving chronic diarrhea and liver disease, it has largely been abandoned for the other, safer procedures

## Preparation

After patients are carefully selected as appropriate for obesity surgery, they receive standard preoperative blood and urine tests and meet with an anesthesiologist to discuss how their health may affect the administration of anesthesia. Pre-surgery counseling is done to help patients anticipate what to expect after the operation.

## Aftercare

Immediately after the operation, most patients are restricted to a liquid diet for 2–3 weeks; however, some may remain on it for up to 12 weeks. Patients then move on to a diet of pureed food for about a month, and, after about two months, most can tolerate solid food. High fat food is restricted because it is hard to digest and causes diarrhea. Patients are expected to work on changing their eating and exercise habits to assist in weight loss. Most people eat 3–4 small meals a day once they return to solid food. Eating too quickly or too much after obesity surgery can cause nausea and vomiting as well as intestinal "dumping," a condition in which undigested food is shunted too quickly into the small intestine, causing pain, diarrhea, weakness, and dizziness.

## Risks

As in any abdominal surgery, there is always a risk of excessive bleeding, infection, and allergic reaction to anesthesia. Specific risks associated with obesity surgery include leaking or stretching of the pouch and loosening of the gastric staples. Although the average death rate associated with this procedure is less than one percent, the rate varies from center to center, ranging from 0–4%. Long-term failure rates can reach 50%, sometimes making additional surgery necessary. Other complications of obesity surgery

include an intolerance to foods high in **fats**, lactose intolerance, bouts of vomiting, diarrhea, and intestinal discomfort

Studies on the risks of these surgeries continue. A 2003 report showed that gastric bypass surgery risk increases with age, weight and male gender. Patients age 55 and older experienced more complications than did younger patients and male patients had more life-threatening complications than female patients, particularly those who were more severely obese.

### Normal results

Many people lose about 60% of the weight they need to reach their ideal weight through obesity surgery. However, surgery is not a magic weight-loss operation, and success also depends on the patient's willingness to exercise and eat low-calorie foods. A 2003 report showed that super obese patients had a lower success rate with laparoscopic vertical banding gastroplasty than those considered morbidly obese. However, the overall success rate was nearly 77% of patients carrying less than 50% excess weight four years after the procedure.

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Tish Davidson, A.M.

## Bernstein diet

### Definition

The Bernstein diet is a low-carbohydrate, **high-fat diet** for people with diabetes (diabetics). It goes against the conventional high-carbohydrate, low-fat diabetic diet recommended by much of the medical community.

### Origins

The diet was developed by endocrinologist and Type I diabetic Richard K. Bernstein and first published in his 1997 book *Dr. Bernstein's Diabetes Solution: A Complete Guide to Achieving Normal Blood Sugars*. It is intended for diabetics and people with insulin resistance syndrome. Diabetes is a disease in which the body does not produce or properly use insulin. Insulin is a hormone that is needed to convert sugar, starches and other food into energy. Insulin resistance often goes along with other health problems, like diabetes, high cholesterol, high blood pressure and heart attack. When a person has many of these problems together, it is called insulin resistance syndrome.

Bernstein was diagnosed with diabetes in 1946 at the age of twelve. He was put on the standard low-fat, high-carbohydrate diet for diabetics. He remained on this diet, even though his condition worsened and he developed many complications of the disease, until 1969. During this time, he experienced frequent bouts of hypoglycemia (excessively low blood sugar) along with headaches and fatigue, which he said was caused by the large doses of insulin he was taking to help regulate his blood sugar levels. He blames this cycle of hypoglycemia followed by insulin injections on his high-carbohydrate diet. Doctors recommend a high-carbohydrate diet for diabetics because it raises blood sugar. When blood sugar levels get too high in Type I diabetics, they must be brought down with insulin injections. In 1969, Bernstein, an engineer, began adjusting his insulin regimen from one injection a day to two and cut down on **carbohydrates** in his diet. The changes had only minimal effect. In 1972, he began checking his blood sugar levels five to eight times a day, making small changes to his insulin regimen and diet to see what the effects would be. Within a year, Bernstein said he had refined his diet and insulin injection schedule to the point of having nearly constant normal blood sugar levels. His health improved considerably. He spent the next few years trying to convince the major medical journals and physicians who treated diabetes that his method of closely monitoring his blood sugar levels and maintaining a relatively constant, normal blood sugar level could help other diabetics. The attempts failed. So in 1979, Bernstein quit his engineering job and entered medical school. In 1983, he opened his own medical practice in New York. After that, he began formulating his diet plan that became the focus of his 1997 book.

### Description

The Bernstein diet is designed as a medical diet rather than for weight loss, although people can lose weight on it as it is similar in many respects to the **Atkins diet**. Both diets stress foods that are high in **fats** and **protein** and low in carbohydrates. That formula is

controversial in weight loss and health circles but the Bernstein diet is also controversial in the diabetic community. That is because the Bernstein diet, designed for people with diabetes, goes against the conventional low-fat, high-carbohydrate diet advocated by health professionals for more than 50 years.

The Bernstein diet doesn't recommend a specific ratio of the three main food groups: proteins, fats, and carbohydrates. Instead, he advocates an individualized approach to a diabetic's diet. At the center of the diet is the need for diabetics to test their blood sugar levels at least five to eight times a day. On his Website, (http://www.diabetes-normalsugars.com) Bernstein states, "There is simply no way to determine objectively how any given food at any given time is going to behave in any given individual, unless blood sugar is tested before and for a number of hours after its consumption." In his books and on his Website, Bernstein details how each of the three primary food groups, protein, fats, and carbohydrates, fit into his diet.

Bernstein has three basic rules for diabetics when developing meal plans that normalize blood sugar levels. They are:

- Eliminate all foods from the diet that contain simple sugars, which are fast-acting carbohydrates. These foods include table sugar, most starchy foods such as breads and pasta, grains, and potatoes.
- Limit total carbohydrate intake to an amount that will work with insulin, either injected or produced naturally by the body. This will avoid a post-meal blood sugar increase, and will avoid any remaining insulin-producing beta cells of the pancreas.
- Stop eating when there is no longer a feeling of hunger. He says people should not leave the table while they are still hungry but should also not wait until they feel stuffed to stop eating.

Bernstein tells diabetics to avoid hidden dangers in foods, especially sugar-free foods, that can cause blood sugar levels to rise too much and too rapidly. Food labels should be carefully checked for these substances and foods containing any of them should be avoided. These include carob, honey, saccharose, corn syrup, lactose, sorbitol, dextrin, levulose, sorghum, dextrose, maltodextrin, treacle, dulcitol, maltose, turbinado, fructose, mannitol, xylitol, glucose, mannose, xylose, and molasses.

The Bernstein diet recommends diabetics avoid eating the following foods: breakfast cereals, snack foods (candy, cookies, cakes, potato and tortilla chips, popcorn, and pretzels), protein bars, milk and cottage cheese (except for **soy** milk), fruits and fruit juices, certain vegetables (beans, beets, carrots, corn, potatoes, tomatoes (including tomato sauce and paste), canned and packaged soups, and most 'health' foods.

## KEY TERMS

**Carbohydrates**—An organic compound that is an important source of food and energy.

**Diabetes**—A disease in which the blood glucose (sugar) levels are too high and the body does not make insulin (which helps regulate blood sugar) or does not make or use insulin well.

**Endocrinologist**—A medical specialist who treats diseases of the endocrine (glands) system, including diabetes.

**Hypoglycemia**—Abnormally low blood sugar levels.

**Insulin**—A hormone that regulates the level of glucose (sugar) in the blood.

**Insulin resistance syndrome**—A medical condition in which insulin fails to function normally in regulating blood glucose (sugar) levels.

**Ketoacidosis**—Dangerously high blood sugar levels.

**Monounsaturated fat**—A type of fat found in vegetable oils such as olive, peanut, and canola.

**Polyunsaturated fat**—A type of fat found in some vegetable oils, such as sunflower, safflower, and corn.

Foods that are allowed under the Bernstein diet include meat, fish and seafood, poultry, eggs, tofu, soy meat substitutes, cheese, butter, margarine, cream, yogurt, soy milk, soy flour, and bran crackers. Other food items allowed include toasted nori (seaweed), **artificial sweeteners** (Equal, Sweet'n Low, NutraSweet, and Splenda), No-Cal brand syrups, Da Vinci Gourmet brand syrups, flavor extracts, herbs and spices, low-carbohydrate salad dressings, nuts, and sugar-free gelatin and puddings.

Bernstein admits his diet is somewhat restrictive and that people will still have **cravings** for sweets and bakery items. "Most of my patients initially feel somewhat deprived, but also grateful because they feel more alert and healthier," he says in his book and on his Website. "I fall into this category myself. My mouth waters whenever I pass a bakery shop and

sniff the aroma of fresh bread, but I am also grateful simply to be alive and sniffing."

## Function

The main function of the Bernstein diet is to help people with diabetes to maintain constant, normal blood sugar levels throughout the day. Maintaining control of their blood sugar levels can help diabetics avoid long-term complications of the disease, including neuropathy of the feet, amputation, cataracts and blindness, heart disease, erectile dysfunction, glaucoma, **ulcers** of the feet, high blood pressure, and high cholesterol. Since the diet is similar to the Atkins diet in that it emphasizes low-carbohydrate foods, people who are overweight or obese can lose weight on the Bernstein diet.

## Benefits

The primary benefits of the Bernstein diet come from diabetics being able to maintain constant, normal blood sugar levels. Doing this over the long-term can help reduce the number of diabetics who develop complications from the disease. These complications include heart disease, high blood pressure, eye problems, serious conditions affecting the feet that sometimes lead to amputation, gastroparesis (a condition in which the stomach requires significantly longer than its normal time to empty), kidney disease, and fatigue. The importance of maintaining constant, normal blood sugar levels (by checking the levels at least five to eight times a day with home glucose monitors and then adjusting insulin levels accordingly) was proven by the Diabetes Control and Complications Trial, a study of diabetics from 1983–1993, the most comprehensive large-scale diabetes study ever conducted. The study found that in diabetics who intensely controlled their blood sugar levels, the risk for eye disease was reduced by 76 percent, nerve disease by 60 percent, and kidney disease by 50 percent. The diet can also help diabetics who are overweight or obese to lose weight.

## Precautions

There are no major precautions associated with the diet, although it is not recommended for diabetics by major medical organizations including the American Medical Association, American Dietary Association, and American Diabetes Association. Diabetics should discuss the diet with their doctor or a specialist in diabetes called an endocrinologist, who may refer the person to a diabetic dietician or nutritionist. The diet is high in fat so people on it should use fats from monounsaturated and polyunsaturated sources such as olive and canola oils.

### QUESTIONS TO ASK YOUR DOCTOR

- Will I need any dietary supplements if I adopt the Bernstein diet?
- Do you see any health risks for me in the diet?
- Are there any other diets you would recommend that would help me accomplish my weight loss goals?
- Have you treated other patients who are on a low-carbohydrate, high-fat diet? If so, what has their response to the diet been?
- How will the Bernstein diet affect my diabetes or insulin resistance syndrome?
- How important is it for me to maintain constant normal blood sugar levels throughout the day?

## Risks

There are no general health risks associated with the Bernstein diet. Critics of the diet say it contains too much fat, is not nutritionally balanced, and is not a long-term solution for losing weight and keeping it off. They also say it is difficult for many people to maintain a **low-carb diet** over the long-term. Also, people with type 1 diabetes who take insulin are at a high risk of hypoglycemia (abnormally low blood sugar levels) and ketoacidosis (dangerously high blood sugar levels) if they remove too much carbohydrate from their meals.

## Research and general acceptance

Critics of the Bernstein diet for diabetics are quick to point out that there are no major long-term scientific studies on the effectiveness of the low-carbohydrate, high-fat diet. However, the same can be said for the traditional low-fat, high-carbohydrate diet that has been the standard diabetic diet for more than 50 years. In one review of Bernstein's 1997 book, *Dr. Bernstein's Diabetes Solution: A Complete Guide to Achieving Normal Blood Sugars*, the diet was criticized because it required diabetics to be meticulous in self-managing the disease. But there are major long-term scientific studies that show that there is significant benefit in such meticulous self-management, including the landmark Diabetes Control and Complications Trial and the United Kingdom Prospective Diabetes Study.

Among the critics of the Bernstein diabetic diet are the American Diabetes Association, American Dietary Association, American Medical Association, American Heart Association, United States Department of Agriculture, and the Physicians Committee for Responsible Medicine. They say that high-fat, low-carbohydrate diets are generally unhealthy because they are low in **fiber**, **calcium**, fruits, and vegetables, and high in cholesterol, fat, and saturated fat. On the surface, it would seem that a diet that is the opposite of what the world's leading diabetes organization recommends would not be acceptable for diabetics. However, since 2002, a number of scientific studies that compared high- and low-carbohydrate diets concluded that a low-carbohydrate diet reduces blood sugars and risk factors for heart disease. That is why many practicing endocrinologists endorse the Bernstein diet and other low-carbohydrate diets for their patients. They point out that the American Diabetes Association (ADA) has always been very slow in reacting and adjusting to new development in diabetes monitoring and treatment. For example, the ADA did not endorse patient blood glucose monitors until 1983, about 10 years after they were developed. What is lacking in the low-carb versus high-carb diet controversy is major long-term studies that track patients for longer than a year.

People with Type II diabetes may be able to improve control of their blood sugar levels, lose weight, and lower cholesterol levels significantly with a low-carbohydrate diet, such as the Bernstein diet, that with diets that restrict calorie intake, according to two studies presented in 2006 at the American Diabetes Association annual scientific sessions. One of the studies, conducted by Duke University researchers, was funded by the Robert C. Atkins Foundation. Atkins authored a number of popular books on the Atkins low-carbohydrate diet.

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#### ORGANIZATIONS


American College of Nutrition. 300 South Duncan Ave., Suite 225, Clearwater, FL 33755. Telephone: (727) 446-6086. Website: http://www.amcollnutr.org.

American Diabetes Association. 1701 N. Beauregard St., Alexandria, VA 22311. Telephone: (800) 342-2383. Website: http://www.diabetes.org.

American Dietetic Association. 120 South Riverside Plaza, Suite 2000, Chicago, IL 60606-6995. Telephone: (800) 877-1600. Website: http://www.eatright.org.

American Society for Nutrition. 9650 Rockville Pike, Bethesda, MD 20814. Telephone: (301) 634-7050. Website: http://www.nutrition.org.

Center for Nutrition Policy and Promotion. 3101 Park Center Drive, 10th Floor, Alexandria, VA 22302-1594. Telephone: (703) 305-7600. Website: http://www.cnpp.usda.gov.


Ken R. Wells

# Beverly Hills diet

## Definition

The Beverly Hills diet is a diet created by Judy Mazel. She believes that weight loss can be achieved by eating foods in the proper combinations and in the correct order.

## Origins

Judy Mazel says that she was always an overweight child, and beginning when she was nine years old, she went to see doctor after doctor trying to find out why she could not be thin. For 20 years she continued to struggle with her weight and was finally told by a doctor that she was destined to always be fat. Six months after this pronouncement, she went skiing and broke her leg. While she was recuperating, she read a book on nutrition that a friend had given her. From this she developed her ideas about how the body works and what is needed to lose weight and stay thin.

Mazel reports that she used her new theories to lose 72 lb (29 kg), and has kept off the weight ever since. In 1981, she published her diet in a book *The Beverley Hills Diet*. The original book reportedly sold more than a million copies, and in 1996 Mazel published a revised and updated version of the diet called *The New Beverly Hills Diet*. Mazel has also written a cookbook designed to go with the diet and *The New Beverly Hills Diet Skinny Little Companion*, a slim volume designed to provide inspiration and tips to help dieters through their first 35 days on the diet.

## Description

The Beverly Hills diet is a food combination diet. It is based on the idea that it is not what a person eats, or even how much food is eaten that causes a person to gain weight. Mazel believes the combinations in which foods are eaten and the order in which they are eaten causes weight gain. She says that eating foods in the wrong order can stop some foods from being digested, and it is the undigested foods that cause fat build-up.

The groups into which Mazel divides foods are **carbohydrates**, proteins, fruits, and **fats**. She believes that fruit must be eaten alone and must be eaten before anything else is consumed during the day. She also says that for correct digestion, each type of fruit must be eaten alone. This means that if a dieter eats an orange, the dieter must wait at least one full hour before eating another type of fruit, such as a pear. If the dieter eats a different type of food, such as a **protein**, the dieter must wait until the next day to eat fruit again.

On the Beverly Hills diet, protein and carbohydrates cannot be eaten together. Most dairy products go into the protein group for purposes of categorization. This means that dieters can drink milk with protein meals, but not with carbohydrate meals. Fat is allowed to be eaten with either group, but may not be eaten with fruit.

### KEY TERMS

**Dietary supplement**—A product, such as a vitamin, mineral, herb, amino acid, or enzyme, that is intended to be consumed in addition to an individual's diet with the expectation that it will improve health.

**Mineral**—An inorganic substance found in the earth that is necessary in small quantities for the body to maintain a health. Examples: zinc, copper, iron.

**Type 2 diabetes**—sometime called adult-onset diabetes, this disease prevents the body from properly using glucose (sugar), but can often be controlled with diet and exercise.

**Vitamin**—A nutrient that the body needs in small amounts to remain healthy but that the body cannot manufacture for itself and must acquire through diet.

The order throughout the day in which food is eaten is very important on the Beverly Hills diet. Mazel says that each day fruit should be eaten first. After fruit, the carbohydrate group can be eaten. After carbohydrates comes food from the protein group. Once a dieter has changed food groups, he or she cannot eat from the previous groups again until the next day. Dieters must wait two hours between eating foods from different food groups.

During the diet, Mazel says that dieters must not consume diet sodas or anything with **artificial sweeteners**. Because milk is considered a protein, the dieter is very limited in when it can be consumed. Unlike many other diets, alcohol is not as restricted on the Beverly Hills diet. Mazel categorizes most alcoholic drinks, such as beer, vodka, and rum, as carbohydrates, and says they must only be consumed with carbohydrates. Wine is categorized as a fruit, and unlike the rules for eating other fruits, wine does not have to be consumed alone but can be drunk with another fruit. Mazel says that champagne is a neutral food and can be drunk with anything.

Mazel provides dieters with a 35-day plan for losing weight. Every day dieters are told what foods are allowed, and in what order they must be eaten. Most foods do not have a quantity limit. Instead, dieters may consume as much of a given food as desired until they move on to the next food. Dieters must eat the foods in the order listed and cannot go back or make substitutions. The diet is very restrictive,

with most days allowing no more than two or three types of foods.

For example, on the first day of the diet, dieters are instructed to eat pineapple, corn on the cob, and a salad made of lettuce, tomatoes, and onions with Mazel dressing. (Mazel dressing is a recipe included in the book, and shows up frequently throughout the 35-day diet.) This means that dieters may eat as much pineapple as desired in the morning, but once they beginning eating corn on the cob they cannot go back and eat more pineapple. Once the salad is eaten, both corn on the cob and pineapple are no longer allowed. Dieters are instructed to wait between changing foods to ensure proper digestion.

Some days on the diet only one type of food is permitted during the entire day. Day three of the diet allows the dieter only to consume grapes. On other days the dieter is only allowed to eat watermelon. Although these rules are extremely restrictive, they are not as restrictive as the rules set out in the original Beverly Hills diet. On that diet, dieters were only allowed to eat fruit for the first 10 days of the diet. No animal protein was allowed at all until the 19th day. The New Beverly Hills diet includes vegetables and carbohydrates occasionally during the first week, and includes lamb chops and shrimp on the sixth day.

## Function

The Beverly Hills diet promises dieters that they will lose up to 25 lb (11.5 kg) in 35 days. The diet's Website claims that the average dieter will lose 15–20 lb (7–9 kg). Mazel promises that by following the guidelines set out by her diet, dieters will be able to eat anything they want, including foods forbidden on most diets, such as cheesecake and hamburgers. They only have to ensure that they eat them at the right times, in the right combinations, and in the right order. Doing this, Mazel claims, will let dieters become thin and stay thin, all while eating fatty foods forbidden by other diets. The Beverly Hills diet is intended to be a life changing diet, and dieters are expected to continue to follow the rules of the diet after the 35 days of meal plans are finished. Mazel does not provide exercise recommendations, nor does she provide information to help dieters improve other aspects of their lives, such as advice on stress reduction.

## Benefits

The Beverly Hills diet claims that dieters can lose 20 lb (9 kg) in 35 days. Many health benefits are associated with significant weight loss if it is achieved through healthy eating and exercise and occurs at a moderate pace. These benefits can include a decreased risk of Type II diabetes, cardiovascular disease, **hypertension**, and other **obesity** related diseases and conditions.

There may be some benefits to following the Beverly Hills diet. The diet emphasizes eating a wide variety of fruit. Fruits contain many **vitamins** and **minerals** that are necessary for good health. Eating a diet with more fruits and vegetables can help dieters stick to an otherwise well-balanced, reduced-calorie diet because fruits and vegetables generally contain fewer calories per volume than other foods. This means that a dieter can feel full while eating fewer calories. The diet also restricts prepared foods and foods with **artificial preservatives**, sweeteners, and flavors. Eating a diet that contains mainly fresh foods can be very healthy because prepared foods are often very high in **sodium** and have fewer vitamins and minerals than fresh foods.

## Precautions

The New Beverly Hills diet's website cautions dieters that there are some people for whom the diet is not appropriate. These include women who are pregnant or **breastfeeding** and anyone with diabetes, **ulcers**, spastic colon, and various forms of irritable bowel disease. The website also cautions that anyone with serious illness or chronic disease should only begin this diet under medical supervision.

Even dieters who do not have serious illness should consult a doctor or other medical professional when considering this diet. Daily requirements of calories, vitamins, minerals, and other nutrients can differ from person to person depending on age, weight, sex, activity level, and the presence of certain diseases or conditions. A physician can help the dieter determine if this diet will be safe given a dieter's specific nutritional requirements, so that the dieter can reach his or her weight loss goals without risking good health.

## Risks

This diet requires that dieters eat only a small variety of foods each day, and on some days only one type of food is allowed. No protein is allowed until the sixth day of the diet, and it is not included regularly after that. This means that it will be extremely hard for dieters to get the vitamins, minerals, and nutrients that are needed each day for good health. If dieters are considering this diet, they should consult a physician about taking a multivitamin or other dietary supplement to reduce the risk of serious nutritional deficiencies. However, no vitamin or supplement can replace eating a healthy, balanced diet.

## QUESTIONS TO ASK THE DOCTOR

- Is this diet safe for me?
- Is this the best diet to meet my long term weight loss goals?
- Do I have any dietary requirements this diet might not meet?
- Would a multivitamin or other dietary supplement be appropriate for me if I were to begin this diet?
- Are there any sign or symptoms that might indicate a problem while on this diet?

Although the New Beverly Hills diet does include more foods than the original diet, which only allowed fruit for the first 10 days, the diet still contains a significant amount of fruit. Fruit is required as the first food each day, and on many days only fruit is allowed. In the first week of the diet there are two days that only allow fruit: day three only allows grapes, and day five allows pineapple, then papaya, then more pineapple. Because of this excessive consumption of fruit and the limited consumption of other foods, there is a significant risk of diarrhea, which can lead to severe **dehydration** and malnutrition. Dieters thinking of beginning this diet should be extremely cautious.

### Research and general acceptance

There have been no significant scholarly studies done showing the effectiveness of the food combining theory of eating in general, or the effectiveness of this diet in particular.

In 1981 the *Journal of the American Medical Association* published an article stressing the dangers of the original Beverly Hills diet. It called the diet "the latest, and perhaps worst, entry in the diet-fad derby," and said that the diet could cause severe enough diarrhea to cause fever, muscle weakness, and in the most severe cases might be able to cause extreme drops in blood pressure that could lead to death. The article told physicians to discourage their patients from trying this diet.

Although the New Beverly Hills diet has been updated, and more foods have been included, experts are not much more enthusiastic. David W. Grotto, a spokesman for the American Dietetic Association, is quoted on WebMD.com as saying that "sustaining the diet...would be a concern because of a lack of nutritional adequacy," and even went on to say "I would almost lump [the] dietary program in with the obscure and useless programs—like Alexander the Great's nothing-but-alcohol diet. It's nutritionally incomplete and there's better programs out there."

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Tish Davidson, M.A.

# Binge eating

## Definition

Binge eating an abnormal eating pattern in which an individual eats significantly more food in a limited time than most people typically would eat. The timeframe for a binge is usually 1–2 hours.

## Description

The **eating disorders anorexia nervosa** and **bulimia nervosa** are considered psychiatric disorders and have formal diagnostic criteria that are define in the

**Possible health consequences of binge-eating**

- Anxiety
- Depression
- Obesity
- Obesity-related diseases
- Poor self-esteem
- Sleep problems
- Stress
- Substance abuse
- Suicidal thoughts
- Weight gain
- Weight obsession

*(Illustration by GGS Information Services/Thomson Gale.)*

*Diagnostic and Statistical Manual for Mental Disorders Fourth Edition-Text Revision (DSM-IV-TR)* published by the American Psychiatric Association (APA). Binge eating is an acknowledged problem, but it has not risen to the level a separate psychiatric disorder as defined by the APA. Some experts believe binge eating is a subtype of bulimia, an eating disorder characterized by episodes of binge eating followed by purging the body of calories. Other experts believe that binge eating should be classified as an obesity-related behavior. Some healthcare providers place binge-eating disorder in the APA category of eating disorders not otherwise specified. Although the way a healthcare professional views binge eating does not change the behavior, it may influence the type of therapy recommended and affect the degree to which treatment is covered by heath insurance providers.

Everyone eats too much occasionally, but people with binge-eaters disorder have an abnormal eating pattern that occurs frequently. Many eating disorder specialists define binge-eating disorder as binge eating behavior that occurs at least twice a week for three months and has a negative effect on the individual's relationships and daily activities.

Binge eaters exhibit many of the following behaviors.

- They eat abnormally large amounts of food at one sitting, often consuming 3,000–10,000 calories in a short period.
- They gobble their food, eating much faster than usual.
- During a binge, they feel out of control and unable to stop eating, even though they may want to.
- Despite feeling full or even painfully uncomfortable, they continue to eat.
- Binge eaters tend to diet constantly but never lose weight.
- Then often eat alone and hide empty food containers to disguise from others how much they eat.
- They are ashamed and embarrassed about their bingeing.
- Food hoarding is common.
- After a binge, they feel guilty, upset, disgusted and/or depressed about how much they have eaten.
- They vow to themselves never to binge again, but cannot keep this promise.

Binge-eating disorder is different from bulimia. The two disorders are similar in their bingeing behavior, but people with bulimia follow a binge by purging the body of calories. They do this by some combination of self-induced vomiting, laxative, diuretic, or enema abuse, fasting, and compulsive exercising beyond reasonable levels. People with binge-eating disorder do nothing to purge the body of the extra calories they have eaten, although they often try to diet between binges. Many people who are bulimic also

## KEY TERMS

**Electrolyte**—ions in the body that participate in metabolic reactions. The major human electrolytes are sodium (Na+), potassium (K+), calcium (Ca 2+), magnesium (Mg2+), chloride (Cl-), phosphate ($HPO_4$ 2-), bicarbonate ($HCO_3$-), and sulfate ($SO_4$ 2-).

**Neurotransmitter**—One of a group of chemicals secreted by a nerve cell (neuron) to carry a chemical message to another nerve cell, often as a way of transmitting a nerve impulse. Examples of neurotransmitters include acetylcholine, dopamine, serotonin, and norepinephrine.

**Obese**—more than 20% over the individual's ideal weight for their height and age or having a body mass index (BMI) of 30 or greater.

**Placebo**—a pill or liquid given during the study of a drug or dietary supplement that contains no medication or active ingredient. Usually study participants do not know if they are receiving a pill containing the drug or an identical-appearing placebo.

**Triglycerides**—a type of fat found in the blood. High levels of triglycerides can increase the risk of coronary artery disease

**Type 2 diabetes**—sometime called adult-onset diabetes, this disease prevents the body from properly using glucose (sugar).

have anorexic behaviors. There is no overlap between binge-eating disorder and anorexia. Most people who have binge-eating disorder are obese, but not all obese people have binge eating behaviors.

## Demographics

Estimates of the number of Americans who have binge-eating disorder range from less than 1% to 4%, with 2% being the most commonly cited figure. Although women with binge-eating disorder outnumber men 3:2, binge eating is the most common male eating disorder. The disorder affects blacks and whites equally; little research as been done on other racial or ethnic groups. Unlike the eating disorders anorexia nervosa or bulimia nervosa that start in the teenage or young adult years, binge eating disorder is more likely to occur in middle-aged adults between the ages of 46 and 55. Although binge eaters may be of normal weight, binge eating is a common disorder among people who are obese. Some estimates suggest that up to half the obese people in formal weight loss programs have problems with binge-eating.

People at higher risk of developing binge-eating disorder share certain characteristics. These include:

- frequent dieting. People who go on rigorous diets or who frequently gain and lose large amounts of weight (weight cycling) are more likely to become binge eaters.
- impulsiveness. Binge eaters, like bulimics, have problems with impulse control.
- low self-worth and negative self-talk. This occurs almost universally among people with all types of eating disorders.
- difficulty managing anger and appropriately expressing feelings.
- preoccupation with body image and weight.
- sexual abuse. Some, but by no means all, people with binge eating disorder report being sexually abused as children. This is an area of ongoing research.
- depression. It is not clear whether depression causes binge eating or if binge eating causes depression, but the two are often found together.

## Causes and symptoms

Binge eating is a relatively new area of research. Like all eating disorders, binge eating appears to have multiple causes. Some people seem to be genetically predisposed to become binge eaters. Researchers think this may be related to abnormalities in neurotransmitters in the brain that help to regulate appetite. Research continues actively in this area.

For many binge eaters, stress is the factor that triggers a binge. Stress can be caused by very restrictive dieting, but it is often caused by social and cultural factors, such as family conflict, job-related stress, dysfunctional relationships, and the repeated message from the media that a thin body is a sign of success, while being obese results in failure to find a mate or succeed in life.

Symptoms of binge eating may be difficult to detect. Binge eating is different from continuously snacking, and it is often done in private. **Obesity** and obesity-related diseases such as **hypertension** (high blood pressure) Type II diabetes, and joint pain are signs that binge-eating disorder could be present, but not all obese people are binge-eaters. Behaviors such as secretive eating, constant dieting without losing weight, obsessive concern about weight, depression, anxiety, and substance abuse are all clues, but none of these signs are definitive. The individual may complain about symptoms related to obesity, such as fatigue and shortness of breath, or mention unsuccessful dieting, but again, these signs are not definitive.

## Diagnosis

Binge eating can be hard for healthcare providers to diagnose. Binge eaters often go out of their way to hide how much they eat. They may, for example, buy snack food at the grocery store and eat it in the car before they go home, or they may buy food in secret and hoard it, so that people close to them will not know they are bingeing. Normally healthcare professionals begin diagnosis with a family and personal history. However, people with binge-eating disorder often lie about their eating habits.

A physician will begin with a physical examination and usually order standard laboratory tests such as a complete blood count (CBC), urinalysis, and blood tests to check the level of cholesterol, **triglycerides**, and **electrolytes**. Additional tests, such as a thyroid function test, may be ordered to rule out other disorders. If the individual is obese, tests may be done check for obesity-related diseases such as diabetes, cardiovascular disease, and sleep apnea.

Several different evaluations can be used to examine a person's mental state. A doctor or **mental health** professional will assess the individual's thoughts and feelings about themselves, their body, their relationships with others, and their risk for self-harm.

## Treatment

The medical community does not completely agree on the best treatment for binge eating. Medical

specialists are more likely first to treat weight control issues with drugs, diet, and nutrition counseling in order to reduce the health risks of obesity-related diseases. Although there are no drugs specifically approved by the United States Food and Drug Administration for treating binge-eating disorder, the FDA has approved selective serotonin reuptake inhibitors (SSRIs) such as fluoxetine (Prozac) and sertraline (Zoloft) for the treatment of bulimia. Bulimia also involves binge-eating behavior. These medications increase serotonin levels in the brain and are thought to affect the body's sense of fullness. They are used whether or not the patient shows signs of depression. SSRIs are often prescribed for people with binge-eating disorder. Appetitive suppressants are also sometimes prescribed to help control binge eating. Treatment is most successful when group therapy occurs in conjunction with psychotherapy (see Therapies below).

## Nutrition/Dietetic concerns

People with binge-eating disorder understand that their eating pattern is abnormal and unhealthy. Nutrition counseling and meal planning can help bring weight under control, but they do not address the inability to control the impulse to binge. Nutrition counseling needs to be part of a broader treatment program that includes psychotherapy and possibly drug therapy.

## Therapy

Psychologists are more likely to approach the problem of binge eating by using therapy that helps the individual change his or her behavior and by treating emotional and psychological problems that cause it. For them, treating obesity is secondary to treating the behavior and the thought patterns that cause it. Psychologists tend to think that once the individual understands and can control bingeing behavior, obesity will be easier to treat.

Some types of psychotherapy that have been successful in treating people with binge-eating disorder are listed below.

- Cognitive behavior therapy (CBT) is designed to confront and then change the individual's thoughts and feelings about his or her body and behaviors toward food, but it does not address why those thoughts or feelings exist. Strategies to maintain self-control may be explored. This therapy is relatively short-term.
- Interpersonal therapy is short-term therapy that helps the individual identify specific issues and problems in relationships. The individual may be asked to look at his or her family and personal history to try to recognize problem areas and to work toward resolving them.
- Dialectical behavior therapy consists of structured private and group sessions in which the therapist and patient(s) work at reducing behaviors that interfere with quality of live, finding alternate solutions to current problem situations, and learning to regulate emotions.
- Family therapy is helpful in treating children who are binge eaters. It teaches strategies to reduce conflict, disorder, and stress that may be factors in triggering binge eating.
- Some people with binge-eating disorder find self-help groups and structured weight-loss programs useful, while others do not.

## Prognosis

There is no clear prognosis for binge eating disorder. Since stress often triggers bingeing, relapses are apt to occur in response to stressful life events. Some individuals find that simply seeking help improves their control over binge eating. For example, some studies have found that receiving a placebo is as effective as receiving medication. This is one reason why some parts of the medical community refuse to accept binge eating as a genuine disorder. Many studies are underway to test different approaches to treating binge eating. Individuals interested in participating in a clinical trial at no cost can find a list of studies currently enrolling volunteers at <http://www.clinicaltrials.gov>

## Prevention

Since binge eating is difficult to detect, it is also difficult to prevent. Some prevention strategies are listed below.

- Parent should not obsess about their weight, appearance, and diet in front of their children.
- Do not tease people about their body shapes or compare them to others.
- Make it clear that family members are loved and accepted as they are.
- Try to eat meals together as a family whenever possible; avoid eating alone.
- Avoid using food for comfort in times of stress.
- Monitoring negative self-talk; practice positive self-talk
- Spend time doing something enjoyable every day
- Stay busy, but not overly busy

- Become aware of the situations that make you want to binge and look for ways to avoid or defuse them. Do not go on extreme diets.
- Be alert to signs of low self-worth, anxiety, depression, and drug or alcohol abuse and seek help as soon as these signs appear.

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American Psychological Association. 750 First Street, NE, Washington, DC 20002-4242. Telephone: (800) 374-2721; (202) 336-5500. TDD/TTY: (202)336-6123. Website: <http://www.apa.org>

National Association of Anorexia Nervosa and Associated Disorders (ANAD). P.O. Box 7 Highland Park, IL 60035. Telephone: (847) 831-3438. Website: <http://www.anad.org>

National Eating Disorders Association. 603 Stewart Street, Suite 803, Seattle, WA 98101. Help and Referral Line: (800) 931-2237. Office Telephone: (206) 382-3587. Website: <http://www.edap.org>


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Tish Davidson, A.M.

# Bioengineered foods

## Definition

Bioengineered foods are foods that have had a gene from a different species of plant or other organism introduced to produce desired characteristics or traits.

## Purpose

The general purpose of bioengineering is to create plants that are in some way superior to the current plant breed being used. Some genetically engineered plants are engineered to resist specific insects or diseases. This means that these plants are more likely to grow big and stay healthy. Because most farming uses pesticides or insecticides to protect plants, plants that are bioengineered to be pest resistant allow farmers to use less of these chemicals. This is positive for the environment, as well as possibly less costly for the farmer, and can often provide cheaper products for the consumer.

In addition to producing heartier crops, some bioengineering is done to improve the taste of crops. Other bioengineering is done to introduce traits that will help the crops get to the consumer in better

condition or have a longer period of freshness. In 1994, the first bioengineered food to be introduced to the consumer market in the United States was the Flavr Savr tomato. This tomato was bioengineered to ripen more slowly and to remain on the vine longer so that it would be available to consumers later in the year than other tomatoes.

Bioengineering can also be used to increase the nutrient content of foods, or to add **vitamins** that are not usually found in a certain food. A variety of rice, sometimes referred to as "golden rice," that includes beta-carotene has been developed. Beta-carotene is a provitamin to **vitamin A**, which means that the body can use it to produce vitamin A. Rice is a staple of the diet of many Asians, and because rice does not normally contain vitamin A, many people in Asia are vitamin A deficient. This deficiency is believed to have resulted in blindness in a quarter of a million children in southeast Asia alone. If the new strain of rice that contains beta-carotene is introduced to the area, it could help to eliminate vitamin A deficiency and significantly reduce childhood blindness.

## Description

All people have deoxyribonucleic acid (DNA) in their cells. DNA is where all of the information needed to produce and sustain life is stored. DNA is made up of strands of nucleic acids that are grouped to form individual genes. Each gene contains the information about how to synthesize a particular **protein**. The proteins synthesized lead to individual characteristics, such as hair and eye color in humans.

Plants also contain DNA, as do almost all other living things. When scientists genetically engineer a plant, they take a gene from another plant or organism such as a bacterium and insert it into the original plant or trade it for a gene in the original plant. This trading of genes is called transposing.

Scientists did not learn how to insert and transpose genes successful until the 1980s. However, long before this people had been trying to create better, heartier plants and animals through selective breeding. For hundreds of years farmers had selected and bred animals based on characterizes that they wanted the offspring to have. Farmers might decide to breed a cow that gave a higher quantity of milk than other cows in the hopes of producing more cows that gave an above average quantity of milk. Farmers also planted the seeds of plants that had desirable characteristics hoping to produce more plants with those same traits.

Although many people were engaged in trying to make new, better, plants and animals for many years it was not until the work of Gregor Mendel in the nineteenth century that people began to be understood how traits were passed from one generation to the next. He did research on pea plants and discovered that traits were passed from one generation to the next in a way that could be predicated. Peas had a much simpler inheritance pattern than most organisms, so even with this knowledge it was very difficult for scientists to produce plants with the exact traits they wanted. Plants with the desired trait had to be cross bred, and then plants from the resulting generation that had the desired traits had to be selected and cross bred again and again. It takes many generations of plants to produce offspring that regularly have the desired trait.

Today, scientists do not have to cross breed plants repeatedly to get a new variety of plant that has the traits or characteristics they desire. Instead, they search for a gene in another plant that will produce the desired characteristics and insert it into the DNA of the original plant. Often two or three different genes are inserted, sometimes each from different plants or animals. Plants that have had this done are considered bioengineered. It is estimated that more than 50% of the soybeans grown in the United States, and more than 25% of the corn have been bioengineered in some way. About two-thirds of processed foods contain some form of bioengineered crop.

Bioengineered foods are regulated and monitored by three different government agencies: the United States Food and Drug Administration (FDA) the United States Department of Agriculture (USDA) and the Environmental Protection Agency (EPA). The FDA is responsible for the regulation and labeling of the bioengineered foods, the USDA oversees the safety and completeness of test fields used by bioengineering companies to test their new plants, and the EPA regulates any bioengineered plants that contain pesticide-related genes.

Before companies can put a genetically engineered food on the market they need to prove that it is safe for consumers. The FDA requires that companies prove that the bioengineered food is just as safe and nutritious as the non-bioengineered equivalent. This includes providing information for the FDA to review about the kinds of proteins synthesized by the new gene or genes, nutritional content, toxicology reports, and other information. Labeling of bioengineered foods is voluntary, and is left to the discretion of the company.

## Precautions

There is a small chance that some people might have an unexpected allergic reaction to proteins

## KEY TERMS

**Gene**—A section of DNA that includes information about how to create certain proteins

**Provitamin**—a substance that the body can convert into a vitamin

synthesized by plants that have been genetically modified. This is unlikely, however, as the FDA regulates bioengineered foods and requires tests for safety and the presence of known allergens before the food is allowed on the market.

### Interactions

There are no expected interactions between bioengineered foods and any other foods, medicines, or products.

### Complications

There are no complications expected from consuming bioengineered foods.

### Parental concerns

Some parents might be concerned that allergens that could affect their child might be introduced into unexpected plant species. Ninety percent of food allergies in the United States are to milk, eggs, fish, shellfish, nuts, wheat, and legumes (including peanuts and soybeans). The FDA ensures that each bioengineered food is tested to ensure that none of the common proteins that cause reactions before these foods can be sold to consumers. They also test for additional, less common, proteins that have been known to cause allergic reactions. It is extremely unlikely that a child who is allergic to one food would have a spontaneous reaction to another food product.

### Resources

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#### ORGANIZATIONS

United States Department of Agriculture. 1400 Independence Avenue SW, Washington, DC 20250. Website: <http://www.usda.gov>

United States Food and Drug Administration. 5600 Fishers Lane, Rockville, MD 20857-0001. Telephone: (888) 463-6332. Website: <http://www.fda.gov>

World Health Organization. Telephone: +41-22-791-2222. Website: <http://www.who.int/en/>

Tish Davidson, M.A.

# Biotin

## Definition

Biotin, also known as vitamin H or vitamin $B_7$, belongs to the group of B-complex water-soluble **vitamins**. Humans make only a small amount of biotin, so most biotin must come from the foods they eat. Biotin is involved in conversion of **carbohydrates**, **fats**, and **protein** into usable energy in the body.

## Purpose

Biotin joins with enzymes that regulate the breakdown of foods and their use in the body. Some researchers believe that biotin also plays a role in the duplication and "reading" (replication and transcription) of deoxyribonucleic acid (DNA—genetic material). Biotin is often promoted as a dietary supplement to help improve the strength of fingernails and prevent hair loss. These claims are unproven.

## Description

Biotin is one of the less familiar B vitamins. It was discovered in the 1930s by researchers experimenting with different diets for chickens and rats, and later it was discovered to be essential to human health. Bacteria, yeasts, mold, algae, and some plants make biotin. The human large intestine (colon) contains some bacteria that synthesize biotin. Researchers believe that a portion of this biotin is absorbed into the bloodstream, but they are uncertain how much or how available it is to the body.

Biotin is essential to life because it combines with four different enzymes that control different metabolic reactions related to energy production and building new molecules from simple nutrients. These are:

- Forming glucose from fats and amino acids (but not from carbohydrates)
- Building fatty acids
- Synthesizing leucine, an amino acid necessary for health
- Metabolizing amino acids, cholesterol, and some fatty acids

**Biotin**

| Age | Recommended dietary allowance (mcg/day) |
|---|---|
| Children 0–6 mos. | 5 |
| Children 7–12 mos. | 6 |
| Children 1–3 yrs. | 8 |
| Children 4–8 yrs. | 12 |
| Children 9–13 yrs. | 20 |
| Children 14–-18 yrs. | 25 |
| Adults 19≥ yrs. | 30 |
| Pregnant women | 30 |
| Breastfeeding women | 35 |

| Food | Biotin (mcg) |
|---|---|
| Liver, cooked, 3 oz. | 27 |
| Egg, 1 cooked | 25 |
| Bread, whole wheat, 1 slice | 6 |
| Swiss chard, cooked, ½ cup | 5.2 |
| Salmon, cooked, 3 oz. | 4 |
| Chicken, cooked, 3 oz. | 3 |
| Cauliflower, raw, ½ cup | 2 |
| Pork, cooked, 3 oz. | 2 |

mcg = microgram

*(Illustration by GGS Information Services/Thomson Gale.)*

## KEY TERMS

**B-complex vitamins**—A group of water-soluble vitamins that often work together in the body. These include thiamine ($B_1$), riboflavin ($B_2$), niacin ($B_3$), pantothenic acid ($B_5$), pyridoxine ($B_6$), biotin ($B_7$ or vitamin H), folate/folic acid ($B_9$), and cobalamin ($B_{12}$).

**Coenzyme**—Also called a cofactor; a small non-protein molecule that binds to an enzyme and catalyzes (stimulates) enzyme-mediated reactions.

**Dietary supplement**—A product, such as a vitamin, mineral, herb, amino acid, or enzyme, intended to be consumed in addition to an individual's diet with the expectation that it will improve health.

**Enzyme**—A protein that changes the rate of a chemical reaction within the body without themselves being used up in the reaction.

**Fatty acids**—Complex molecules found in fats and oils. Essential fatty acids are fatty acids the body needs but cannot synthesize. They are made by plants and must be present in the diet to maintain health.

**Glucose**—A simple sugar resulting from the breakdown of carbohydrates. Glucose circulates in the blood and is the main source of energy for the body.

**Vitamin**—A nutrient the body needs in small amounts to remain healthy but that the body cannot manufacture for itself and must acquire through diet.

**Water-soluble vitamin**—A vitamin that dissolves in water and can be removed from the body in urine.

Some researchers have found that biotin binds to proteins called histones that open up chromosomes so that their DNA becomes accessible and can be copied. If this is true, then biotin could play a role in gene expression.

Dietary supplement makers promote biotin to treat brittle fingernails, dry skin, and to prevent hair loss. It is sold as a dietary supplement in capsules or tablets, either alone, in a multivitamin, or combined with brewer's yeast. Biotin is also added to cosmetics and skin creams. In animal studies, biotin improves the condition of horse hooves, but no controlled studies have shown the same effect on human fingernails. Biotin deficiency does cause hair loss, but there is no proof that supplemental biotin prevents hair loss.

### *Normal biotin requirements*

The United States Institute of Medicine (IOM) of the National Academy of Sciences has developed values called **Dietary Reference Intakes** (DRIs) for vitamins and **minerals**. The DRIs consist of three sets of numbers. The Recommended Dietary Allowance (RDA) defines the average daily amount of the nutrient needed to meet the health needs of 97–98% of the population. The Adequate Intake (AI) is an estimate set when there is not enough information to determine an RDA. The Tolerable Upper Intake Level (UL) is the average maximum amount that can be taken daily without risking negative side effects. The DRIs are calculated for children, adult men, adult women, pregnant women, and **breastfeeding** women.

The IOM has not set RDA values for biotin because of incomplete scientific information. Instead, it has set AI levels for all age groups. AI levels for biotin are measured by weight (micrograms or mcg). No UL levels have been set for biotin because large doses of biotin do not appear to cause any side effects.

The following are the AIs for biotin for healthy individuals:

- Children birth–6 months: 5 mcg
- Children 7–12 months: 6 mcg
- Children 1–3 years: 8 mcg
- Children 4–8 years: 12 mcg

- Children 9–13 years: 20 mcg
- Children 14–18 years: 25 mcg
- Adults age 19 and older: 30 mcg
- Pregnant women: 30 mcg
- Breastfeeding women: 35 mcg

### *Sources of biotin*

Biotin is found in small quantities in many foods. Bacteria in the large intestine also make biotin. Unlike some vitamins, biotin is recycled and reused by the body. Daily intake does not need to be high because only small amounts are lost in urine. Biotin is stable and little is lost when foods are exposed to heat, light, or air.

The approximate biotin content in common foods is:

- Bread, whole wheat, 1 slice: 6 mcg
- Egg, 1 cooked: 25 mcg
- Liver, cooked, 3 ounces: 27 mcg
- Chicken, cooked, 3 ounces: 3 mcg
- Pork, cooked, 3 ounces: 2 mcg
- Salmon, cooked, 3 ounces: 4 mcg
- Swiss chard, cooked, 1/2 cup: 5.2 mcg
- Cauliflower, raw, 1/2 cup: 2 mcg

### *Biotin deficiency*

Biotin deficiency is very rare worldwide. Only a few conditions are known to cause biotin deficiency. Two rare inherited genetic disorders cause the body to need excessive amounts of biotin. These disorders are treated with high-dose biotin supplements. Prolonged (months or years) consumption of raw egg whitescan also cause a deficiency. A protein in raw egg whites binds biotin and makes it unavailable to the body. Cooking the egg releases the biotin. Receiving all nutrition through intravenous feeding (total parenteral nutrition or TPN) for an extended period may also lead to a shortage of biotin in the body.

Symptoms of biotin deficiency include skin and hair problems, such as a red scaly rash on the face, increased susceptibility to fungal infections, brittle hair, and hair loss. Individuals may also develop seizures, problems with coordination, and muscle cramps. Biotin deficiency has not been known to cause death. These symptoms have many other causes that should be considered first because biotin deficiency is so rare.

## Precautions

In many species, pregnant animals who are biotin deficient give birth to offspring with birth defects at a higher rate than animals who have adequate levels of biotin. The same effect has not been seen in humans. However, blood levels of biotin tend to drop in pregnant women, causing concern among researchers that pregnant women may develop marginal biotin deficiency with no visible symptoms. **Dietary supplements** of biotin are not routinely recommended for women who are pregnant, but these women should make a special effort to get an adequate intake of 30 mcg biotin daily through diet. Pregnant and breastfeeding women should not take a biotin dietary supplement unless directed by their healthcare provider.

## Interactions

Biotin is known to interact with a few drugs and dietary supplements.

- Antibiotics taken over a long period may reduce the amount of bacteria in the large intestine that synthesize biotin.
- Long-term use of drugs used to prevent seizures such as phenytoin (Dilantin), primidone (Mysoline), carbamazepine (Tegretol), phenobarbitol (Solfoton) and possibly valproic acid cause a reduction in the blood level of biotin.
- High doses of pantothenic acid may decrease the amount of biotin absorbed from the large intestine.

## Complications

No complications are expected from biotin. Even when large doses are taken for long periods, there are no reported side effects.

## Parental concerns

Biotin deficiency is rare and biotin excess is so benign that parents should have almost no concern about their children's biotin needs being met by diet.

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**ORGANIZATIONS**

Linus Pauling Institute. Oregon State University, 571 Weniger Hall, Corvallis, OR 97331-6512. Telephone: (541) 717-5075. Fax: (541) 737-5077. Website: <http://lpi.oregonstate.edu>.

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Tish Davidson, A.M.

**Purported benefits of the Blood Type diet**

**Blood type O**
Weight loss
Prevents blood clotting disorder and inflammatory diseases, including arthritis, hypothyroidism, ulcers, and asthma

**Blood type A**
Weight loss
Reduced risk of heart disease, cancer, anemia, liver and gallbladder disorders, and type I diabetes

**Blood type B**
Weight loss
Reduction of the risk of type I diabetes, chronic fatigue syndrome, and autoimmune disorders such as Lou Gehrig's disease, lupus, and multiple sclerosis

**Blood type AB**
Weight loss
Reduction in the risk of developing heart disease, cancer, or anemia

*(Illustration by GGS Information Services/Thomson Gale.)*

# Blood type diet

## Definition

The Blood Type diet is a way of eating that relies on an individual's blood type (A, B, AB, or O) to dictate one's diet. In his book, *Eat Right for Your Blood Type*, naturopathic doctor Peter D'Adamo, presents the idea that an individual's blood type determines which foods are healthy for him and which foods are not. The book presents the anthropological origins of each of the four blood types and explains why each blood type developed specific antibodies against certain foods.

Antibodies are proteins within the blood that identify and attack substances that are foreign to the body. Specific proteins called lectins are found in all foods. During digestion, lectins are released from the foods eaten. When they enter the blood stream, some of these lectins can bind to red blood cells causing them to stick together. This process is called agglutination. Dr. D'Adamo suggests this process causes many health problems such as stomach pains, poor digestion, headaches, diarrhea, liver disease, and kidney problems, and more.

The Blood Type diet includes extensive lists of foods that are beneficial for each blood type. The food lists also include foods that each blood type should avoid and foods that are neutral or benign. Dr. D'Adamo reports that following this diet will not only improve health but will help achieve an ideal weight.

## Origins

In 1901, Dr. Karl Landsteiner discovered that there were four types of human blood. He named them A, B, AB, and O. He discovered that blood types are not compatible with each other because of antibodies. These antibodies cause blood to clump together if a different blood type is mixed with it. According to Dr. D'Adamo, it was also discovered that foods can cause blood cells to become sticky and clump together in a process called agglutination.

Dr. D'Adamo's father, James, is also a naturopathic physician noticed that different diets worked better with some patients than others. In his book, *One Man's Food—Is Someone Else's Poison*, he attributed this to the differences in blood type.

Dr. Peter D'Adamo continued his father's research by studying the agglutination process that occurs between specific blood types and certain foods. He believes it is the result of the evolution of the unique blood types.

Anthropologists have traced the origins of each blood type. The earliest human blood type was type O. Since these people were ancient hunter-gatherers and ate a diet dominated by meat, blood type O individuals developed antibodies against the lectins found in agricultural foods such as wheat and other grains. Dr. D'Adamo suggests that individuals with type O blood should eat a diet more similar to their ancient ancestors—that is a diet with more meats and fewer grains.

## KEY TERMS

**Agglutination**—The clumping or clotting of cells.

**Anthropological**—Pertaining to anthropology or the study or the natural and cultural history of humans.

**Antibodies**—Proteins within blood that seek and destroy foreign bodies or substances in the body.

**Lectins**—Protein substances found in foods that bind with carbohydrates in blood causing it to clot.

**Naturopathy (naturopathic)**—An approach to medicine that does not use pharmaceuticals and surgery to treat disease but rather uses alternative therapies, supplements, special diets, and other natural remedies to help the body heal itself.

**Rh Factor**—Rh factor is a subset of blood type it may be either positive or negative.

The next blood type to evolve was type A. As the environmental conditions changed, humans began to grow food rather than hunt it. The diet shifted from predominantly meat to plant-based. As the diet changed and the blood type A evolved, antibodies for lectins to meat were formed. According to Dr. D'Adamo, individuals with blood type A have antibodies against many lectins found in meat and will benefit from a largely vegetarian or plant-based diet.

The next blood type to emerge was type B. As ancient peoples migrated and adapted to further climate change blood type B evolved. The diet included both meats and plants as well as dairy products. Dr. D'Adamo believes this is the reason individuals with blood type B developed fewer antibodies against lectins found in meat and grain. He also believes this is why people with blood type B are more tolerant of milk products than other blood types.

The final blood type to evolve was type AB. It is a rare blood type even today with fewer than 5% of the world's population having type AB blood. Type AB evolved when the A and B blood types intermingled. Dr D'Adamo describes this blood type as a complex blood type with many strengths and many contradictions.

### Description

D'Adamo divides all foods into sixteen food groups.

The food groups are:

- Meats and poultry, pork, and chicken Seafood-fish and shellfish
- Dairy and eggs—milk, yogurt, ice cream, cheese, and eggs
- Oils and fats—all oils such as peanut oil, linseed oil, sesame oil, etc.
- Nuts and seeds—all nuts or seeds
- Beans and legumes—all beans and peas
- Cereals—oats, barley, cream of wheat, corn flakes, puffed rice, etc.
- Breads and muffins—all baked goods such as loaf breads, crackers, etc.
- Grains and pasta—all flour, buckwheat, all noodles, spaghetti, etc.
- Vegetables—all vegetables, olives, peppers, and avocado
- Fruit—fresh fruits, dried fruits, and canned fruits
- Juices and fluids—all fruit juices fresh and concentrate
- Spices—all spices fresh and dried, syrups, miso, soy sauce, and other sauces that are not dairy based
- Condiments—mayonnaise, mustard, ketchup, jellies and jams, pickles, pickle relish,and salad dressing
- Herbal teas—all herbal teas
- Miscellaneous beverages—coffee, black tea, green tea, seltzer waters, colas, wine, beer, and liquor

Within each of the sixteen food groups, he describes individual foods as foods that encourage weight gain, foods that encourage weight loss, beneficial foods, neutral foods, and foods to avoid. In this way the diet is unique and individual for each blood type. For example, chicken is considered neutral for individuals with blood type O and blood type A and is found on the foods to avoid list for individuals with blood type B and blood type AB. Another example is grains such as wheat. Dr. D'Adamo reports there are no wheat products that are beneficial for people with type O blood. They are to be avoided. Similarly, he advises individuals with type B blood to avoid wheat as well. On the other hand wheat is highly beneficial for people with blood type A and neutral for those with blood type AB. There are recipes and sample menus for each blood type as well.

In addition to specific and detailed **dietary guidelines**, *Eat Right for Your Blood Type* also includes advice for each blood type concerning the impact of stress on the body and strategies for coping with stress.

Dr. D'Adamo outlines the best supplements for each blood type and addresses the best form of exercise for individuals of each blood type.

## Function

The Blood Type diet is based on the fact that all foods have lectins, or proteins that can interact with antibodies in blood. Dr. D'Adamo has tested most foods and determined which blood types react adversely to lectins in most foods.

When a specific food's lectin reacts with a specific blood type (A, B, AB, or O), it causes a process called agglutination to occur. In agglutination, the lectins cause the blood to become sticky. Dr. D'Adamo believes these sticky blood cells can lead to medical conditions such as impaired digestion, kidney and liver problems, headache, diabetes, **obesity**, and many others.

In order to reverse the problems caused by agglutination, an individual must avoid or limit the consumption of foods that cause it. Dr. D'Adamo has tested foods to determine which foods react adversely with which blood types. By following the Blood Type diet, these foods and the offending lectins may be avoided, and health may be improved.

In addition to the main blood types of A, B, AB, and O, there are many subtypes. These are other factors that are contained within your blood. These additional subtypes include secretor status and Rh. Rh is the part of blood that determines if a blood type is positive or negative. The Rh factor of blood type is not affected by diet; however, when blood type is reported, it is usually given as well.

Secretor status does influence the role diet plays in the functions of the body. Secretor status refers to whether or not blood type antigens, the part of the blood that determines type, are in other fluids of your body such as saliva and urine. Approximately 80% of all people are secretors. For these people, blood type can be determined by testing other bodily fluids. In the remaining 20% of the population, blood type antigens are found only in the blood. According to Dr. D'Adamo, secretors are more sensitive to interactions with food lectins. Secretors would have a more severe reaction over more systems in the body than non-sectretors. There is a test to determine if an individual is a secretor; however, since 80% of the population are secretors, chances are that most people who attempt the Blood Type diet are secretors.

## Benefits

Dr. D'Adamo reports health benefits in his patients that follow the Blood Type diet. His official website is full of testimonials from satisfied Blood Type diet followers. Not only do they report weight loss, but, according to Dr. D'Adamo, each blood type is more susceptible to certain illnesses than the others.

According to Dr. D'Adamo, the benefits of following the Blood Type diet for people with blood type A include weight loss and a reduced risk of heart disease, **cancer**, anemia, liver and gallbladder disorders, and type I diabetes.

For individuals with blood type B, the benefits if following the Blood Type diet include weight loss and a reduction of the risk of type I diabetes, chronic fatigue syndrome, and auto immune disorders such as Lou Gehrig's disease, lupus, and multiple sclerosis.

People with blood type AB who follow the Blood Type diet may lose weight and have a reduction in the risk of developing heart disease, cancer, or anemia.

For individuals with blood type O, following the Blood Type diet may help them lose weight and may prevent blood clotting disorder, inflammatory diseases such as arthritis, hypothyroidism, **ulcers**, and asthma.

Even critics of the diet suggest that features of the diet such as limiting the amount of saturated fat and highly processed "junk foods" will benefit most people.

## Precautions

Since blood type is a fixed characteristic of an individual, it never changes. Following a diet based on blood type would theoretically never need to change. However, there are many medical conditions that change as a person ages. Diseases may develop such as diabetes, **hypertension** (high blood pressure), and heart disease that may require an individual with type O blood to reduce consumption of meat and increase intake of fruits and vegetables. Following this diet may be harmful if variations in the diet necessary for health maintenance are not allowed.

Encouraging a specific blood type to gradually increase dairy consumption may cause discomfort to individuals with a natural lactose intolerance, regardless of blood type. Conversely limiting diary can lead to poor **calcium** intakes and bone related diseases

Certain individuals with **protein** deficiency or anemia may need to consume more meat to insure sufficient protein consumption, regardless of blood type.

## Risks

Unbalanced diets put one at risk of nutritional deficiencies or long term poor intakes that will affect

## QUESTIONS TO ASK YOUR DOCTOR

- Is this diet appropriate for me?
- How long should I follow this diet?
- Are there any special precautions I should follow?
- What are the potential health risks, if any, for me as an individual?
- Are there any drug precautions I should be aware of while following this diet?
- Will I need any dietary supplements if I adopt a this diet?
- In light of my other medical conditions, is this diet safe for me to follow?

one's health. This risk and the fact that there is no scientific evidence to back up the claims needs to be emphasized more strongly Since there is no data that confirms the efficacy of this diet for individuals with medical conditions that require careful monitoring of diet. Individuals with diseases such as diabetes, coronary artery disease, compromised liver function, or any kidney disease may not be able to follow a diet tailored for blood type alone.

## Research and general acceptance

### *General acceptance*

While many followers of the Blood Type diet report improved health and weight loss, the Blood Type diet is not widely accepted. Dr. D'Adamo cites many anthropological and microbiological studies to support his theories. However, critics argue there is virtually no data to support his diet plan. They charge that he has no well designed, well control studies to validate his claims that blood type is critical to the impact of diet. Noting that he has not conducted simple before and after blood studies to demonstrate his claim that lectin protein in foods cause blood cells to agglutinate or stick together.

Furthermore, they argue, if agglutination were as wide spread and common as Dr. D'Adamo claims, thousands of people would die each year from organ failure caused by this process and that pathologists would easily see evidence of this. Yet, no such evidence is presented or found in a review of the literature.

Additionally, critics argue that reducing people to a set of criteria based solely on blood type is tantamount to biological astrology. Characterizing all blood type O individuals as hunter-gatherers who need meat and blood type A individuals as more passive agrarians who will benefit most from a nearly vegetarian diet, they argue is far too simplistic for beings as genetically diverse and complex as humans.

### *Research*

There have been no controlled studies comparing those who follow the Blood Type diet with those who do not, or those who follow other diets. Dr. D'Adamo cites studies that demonstrate the effect of specific food lectin on animals such as rabbits which develop symptoms similar to arthritis when lentil lectins are injected into the knees of those sensitive to lentil lectins.

Dr. D'Adamo reports he has tested lectins from most common foods against individual blood types to determine which blood types are sensitive to the lectins of which foods.

Similarly, he reports measuring the impact of lectins on his patients by using the Indian Scale, a measure of the effectiveness of the bowels. Higher values on the Indian Scale indicate reduced function of the liver and intestines and increased levels of toxins. Dr. D'Adamo reports that the Indian Scale scores of his patients have decreased significantly after following the correct Blood Type diet.

Dr. D'Adamo cites multiple individual case studies of patients he has treated using the Blood Type diet with great success.

## Resources

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The Institute for Human Individuality. The official Website of the Blood Type Diet, it contains more information about the diet, forums, email access to Dr. D'Adamo, scientific data, training opportunities for nutritionists and doctors, and a listing of Blood Type Diet practitioners. April 19, 2007, URL: http://www.dadamo.com.

Deborah L. Nurmi, MS

Blue-green algae *see* **Spirulina**

BMI *see* **Body Mass Index**

# Bob Greene's diet

## Definition

Bob Greene's diet is two separate but similar programs with two different websites *Get with the Program! (GWTP!)* and *The Best Life Diet*. *GWTP!* is divided into four phases: Truth, commitment, and self-control; Revving up your **metabolism**; Getting real about emotional eating; and Securing a life of health and emotional well-being. The Best Life Diet is comprised of three phases: establishing a regular pattern of exercise and eating; exploring the physical and emotional reasons for hunger; and learning weight management for life. Both programs are moderate and nutritionally balanced weight loss regimens combined with an exercise program and psychological introspection.

## Origins

Greene is a personal trainer with educational and professional credentials in physical education and exercise physiology. He maintains that his interest in health and fitness began as early as seven, when he was told that the reason his great-grandmother was bedridden was her excess weight. He noticed that many of his other relatives were overweight and began to read articles about food and nutrition in the daily newspaper.

After high school, Greene majored in physical education at the University of Delaware and completed a master's degree in exercise physiology at the University of Arizona. He worked as the director of exercise physiology for a medical management company and as the manager and trainer of the fitness staff at a health spa in Telluride, Colorado.

Both GWTP! and the Best Life program were preceded by Greene's first book, *Make the Connection: 10 Steps to a Better Body—And a Better Life*, which he co-authored with talk show host Oprah Winfrey and published in 1996. He met Winfrey while working at the spa in Telluride, later moving to Chicago to set up a training practice and make regular appearances on her television show.

## Description

### *Get with the Program!*

*GWTP!* is a four-phase program that focuses on the user's slow and gradual development of new eating and exercise habits. Dieters proceed through the phases of the program at their own pace. *GWTP!* emphasizes the importance of organization in personal weight loss.

**PHASE 1: TRUTH, COMMITMENT, AND SELF-CONTROL.** The theory behind this phase is that an individual will make healthier lifestyle choices if they care about their well-being. The program offers participants a contract they can use to make a commitment to themselves for a healthier lifestyle. The participant is encouraged to post it where it can be seen every day as a reminder of commitment. Physical exercise in this phase consists of flexibility, stretching, and range-of-motion exercises. Phase one should be completed in one to three weeks. Completion of the Phase 1 checklist signifies preparation for the next phase.

**PHASE 2: REVVING UP YOUR METABOLISM.** Many participants make the mistake of trying to cut back on calories too quickly rather than increasing their level of physical activity. Phase 2 introduces the participant to a physical fitness program that increases their body's rate of food metabolism. Exercise has an effect known as after-burn— the body burns calories at a higher rate for several hours after an exercise session, not only during the workout. It also reinforces the participant's commitment to more healthful eating because physical changes usually present fairly rapidly. Cardiovascular workouts average 50 to 75

## KEY TERMS

**After-burn**—The increased rate of body metabolism that lasts for several hours after a session of vigorous exercise.

**Emotional eating**—Term for eating to alter mood or relieve stress, boredom, or loneliness.

**Ovolactovegetarian**—A vegetarian who consumes eggs and dairy products as well as plant-based foods.

**Personal trainer**—An individual specializing in diet and exercise who works with clients on an individual basis.

**Pesce/pollo vegetarian**—A vegetarian who avoids the use of red meat but will include fish (*pesce* in Italian) or chicken (*pollo* in Italian) in the diet.

minutes per week in this phase. After one to three months, participants should be ready for Phase 3.

**PHASE 3: GETTING REAL ABOUT EMOTIONAL EATING.** The primary component of Phase 3 is recognizing emotional eating habits. The focus on this behavior is a distinctive feature of Greene's overall approach to health and fitness. A participant needs to understand the distinction between physical hunger and eating for such emotional reasons as boredom, loneliness, job-related stress, or general anxiety. In order to learn how to tell the difference, the participant is asked to choose a specific day and delay their normal meal times for several hours so that they can experience real physical hunger. (Diabetics are advised to consult their physician before undertaking this step). After reestablishing an awareness of physical hunger, the participant is advised to keep a journal in which events or other stimuli (television advertising, eating out, the smell of food from a nearby restaurant, assignment deadlines at work or school, etc.) that trigger episodes of emotional eating are recorded. In time, the person is encouraged to identify counterproductive patterns and behaviors of which they were previously unaware and take steps to modify the behavior. One such behavior modification involves substituting other activities for eating. Suggested activities include reading, taking a class, working on a hobby or craft, or going for a walk. Exercise during phase three is increased to 100 to 125 minutes per week. Phase 3 typically lasts one to three months.

**PHASE 4: SECURING A LIFE OF HEALTH AND EMOTIONAL WELL-BEING.** Phase four is focuses on enhancing the changes in activity level and conscious food choices made in the first three phases. By phase four the participant's exercise program has been scaled up to include weight training and advice is provided for continuing healthy eating habits. A checklist verifies that the participant met the major program goals. No specific timeline is provided for this phase since it leads to a lifetime of weight management using the tools acquired throughout the program.

*GWTP!* stresses many of the same themes in all four phases. Participants are continuously encouraged to increase their activity level, drink more **water**, become aware of what triggers their hunger, and eat sensibly. Guidelines for exercise are provided at each phase. Information about nutrition and making healthy food selections is also provided. Greene believes that many people overeat because they eat haphazardly, without any meal planning, and that this lack of structure is conducive to poor nutrition and exercise habits. He recommends a schedule of three meals and two snacks a day, with a cutoff point for stopping food consumption, namely two hours before bedtime.

### *The Best Life diet*

**PHASE 1: THE REV-UP.** The chief objective in the Best Life diet is to establish a regular pattern of exercise and eating. Phase 1 begins with an initial weigh-in followed by an increase in physical activity. The participant is allowed three meals plus one or two snacks daily, but no alcohol, and no eating for a minimum of two hours before bedtime. If the overall weight loss has been a pound or more per week and the daily objectives outlined in the plan are met consistently, the participant may move on to Phase 2 at the end of four weeks or continue in this phase until the objectives are met.

**PHASE 2: THE SWITCH.** Phase 2 emphasizes significant and consistent weight loss through controlling hunger and implementing changes in eating patterns. The participant is expected to explore the physical and emotional reasons for hunger, and to use a 10-point scale to rate feelings of hunger (1 = Your stomach acid is churning, 6 = You feel satisfied, and 10 = You are so full you feel nauseous). Participants are also expected to eat smaller food portions and remove six foods from their diet that lack nutritional value or are problem foods. Physical activity may be increased. Weight is checked every week for four weeks. When the participant is within 20 lb of their goal weight and the weight loss has stopped it is time to begin phase 3.

**PHASE 3: HAPPILY EVER AFTER.** This is the lifetime maintenance phase. The objective is to continue

improving the quality of the participant's diet for good health and long-term weight maintenance. The participant is asked to weigh themselves a minimum of once a month but no more than once a week. Additional nutritious foods should replace less wholesome foods on shopping lists and menus. Physical activity remains a focus and levels should be increased as the participant improves their fitness.

**SAMPLE MENUS.** Week 1, Day 1

- Breakfast: Skim milk, pear muffin, 1 fresh apple
- Snack: Low-fat yogurt
- Lunch: Walnut cannelini wrap + chopped green salad
- High-calcium snack: Whole-grain crackers with reduced-fat cheddar cheese
- Dinner: Pasta with chicken or shrimp + mixed green salad
- "Anytime treat": 1 oz piece of dark chocolate

Week 1, Day 2

- Breakfast: Best Life Kashi Go Lean Mix with pecans and skim milk, plus one half grapefruit
- Snack: Iced vanilla soy latte with graham cracker
- Lunch: Nut butter and pear whole-wheat sandwich + carrot sticks
- High-calcium snack: Maple-nut yogurt
- Dinner: Lemon and herb grilled trout + corn + sautéed sugar peas with ginger
- "Anytime treat":Low-fat ice cream

Both the *GWTP!* and *The Best Life Diet* programs are available either in book format or by joining the specific online program through Greene's Web sites. Both online programs are affiliated with eDiets.com and charge a weekly fee for membership, approximately US$5 per week. *GWTP!* is available in audio CD or audiotape formats as well.

The print editions of both books contain the core of Greene's diet plan. They are roughly 300 pages long and contain recipes, meal plans, and suggestions for reexamining and making changes in one's food choices. Many participants find the information in the books adequate for their needs. A daily journal is available for purchase with either program. Two additional books can be used with *GWTP!*: *Get with the Program! Guide to Good Eating* containing supplementary recipes and menu plans, and *Get with the Program! Guide to Fast Food and Family Restaurants* covering over 75 restaurants and how eat healthy off their menus.

Dieters who choose to pay a weekly fee for online membership in either *GWTP!* or the Best Life diet receive customized advice tailored to their age, weight, height, sex, and level of physical activity. The home page of each website invites the user to fill out an online form with this personal information as well as their goal weight. The online fee for *GWTP!* "Basic Training" includes the following:

- A workout plan based on the customer's general fitness needs and current activity level.
- 3-D animated exercises.
- 24/7 advice and support from experts
- Access to a support group moderated by eDiets.com nutrition and fitness experts.
- Menus, recipes, and shopping lists.
- Online tracking of the customer's progress.
- Current news articles on topics related to health, fitness, diet, nutrition, and emotional well-being

A personalized diet plan in addition to the fitness plan is available for an additional fee.

## Function

The function of Greene's diet plan is a restructuring of the participant's present eating and exercise habits, phased in gradually at the participant's own pace. This restructuring requires a committed intention to lose weight based on a willingness to look honestly at one's patterns of food consumption, including emotional as well as physical reasons for eating.

## Benefits

The benefits of Bob Greene's diet program are its commonsense approach to the necessity of personal commitment to change as well as lifestyle modifications if people wish to lose weight and keep it off. Many users find the plan's emphasis on introspection and emotional honesty helpful in breaking the psychological patterns that cause them to regain the pounds after a period of successful weight loss.

The flexibility of food choices built into the program makes it easier for participants with food allergies or those who must cook for or share meals with a family to use this plan. The foods Greene recommends are moderate in cost; there are no pricey recipes or ingredients in his plan. Vegetarians also find it easy to adjust for an ovolactovegetarian or pesce/pollo vegetarian diet.

## Precautions

Dieters who select the individualized programs offered on Greene's websites should check with their primary care physician to verify the physical exercises suggested for them are appropriate. Diabetics and

## QUESTIONS TO ASK YOUR DOCTOR

- What do you like and dislike about Bob Greene's programs?
- What is your opinion regarding the amount of exercise recommended?
- What aspects of these programs worked for other patients?

individuals with other medical conditions should also note Greene's warning regarding the importance of consulting their physician before undertaking the physical hunger experiment.

### Risks

Greene's diet plan does not pose any risks to health for users who have had a recent medical checkup and have consulted their health care provider about specific forms of exercise.

### Research and general acceptance

His educational background in exercise physiology adds credibility to his insistence on physical activity as an integral part of a long-term weight loss or weight maintenance regimen.

Most references to Bob Greene's diet are in popular print media—daily newspapers and monthly women's magazines with wide circulations—rather than medical or nutritional journals. Although Greene does not publicize his associations with celebrities, his websites as well as newspaper and magazine articles always emphasize that he is Oprah Winfrey's personal trainer. Crediting Winfrey as the co-author of his first book is generally regarded as the key to Greene's rapid success in the late 1990s.

There are no published reports on clinical trials of Bob Greene's diet plan as of 2007. Reviews of the diet plan by professional nutritionists are generally favorable; they typically describe it as a simple program that establishes the groundwork for a lifetime of healthy living. The programs are easy to follow and include **dietary guidelines** aligned with those recommended by the USDA. Greene is realistic about the difficulty of long-term weight loss and up-front about the commitment required to make long-term changes.

On the other hand, some nutritionists point out that Greene's diets require a greater time commitment for journaling and exercise than most people can manage on a regular basis.

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#### ORGANIZATIONS

American College of Sports Medicine (ACSM). P.O. Box 1440, Indianapolis, IN 46206-1440. Telephone: (317) 637-9200. Website: <http://www.acsm.org>.

American Council on Exercise (ACE). 4851 Paramount Drive, San Diego, CA 92123. Telephone: (858) 279-8227. Website: <http://www.acefitness.org>.


Rebecca J. Frey, PhD

# Body for Life diet

### Definition

Body for Life is a 12-week diet and rigorous exercise program designed by former competitive bodybuilder Bill Phillips. The program promises those who follow it faithfully that after 12 weeks they will not only have lost about 25 lb (10 kg) if they are

**Body for Life diet**

| 5–6 meals a day | Foods approved |
|---|---|
| Lean protein-rich food<br>Portion equal to dieter's hand | Lean poultry, most fish and seafood, egg whites, low-fat cottage cheese, and lean beef and ham<br>For vegetarians, approved proteins include tempeh, soy, textured vegetable protein, and seitan |
| Unrefined or whole-grain carbohydrates<br>Portion equal to dieter's fist | Baked potato, sweet potato, brown and white rice, pasta, whole-wheat bread, whole-wheat tortillas, dried beans, oatmeal, and whole grains such as quinoa. Approved carbohydrates include apples, melon, strawberries, oranges, and corn |
| Vegetable portion (eaten a least two meals)<br>Portion equal to dieter's fist | Lettuce, tomato, carrots, broccoli, cauliflower, asparagus, spinach, mushrooms, zucchini, peas, bell peppers, celery, and onions. Served plain, without sauce |
| Water | 10 or more glasses daily |

Supplement diet with 1 tbsp. daily of oil high in monounsaturated fats (can include unsaturated oils such as canola, olive, safflower, or flaxseed); salmon three times a week; or avocados, natural peanut butter, or a handful of nuts or seeds daily

*(Illustration by GGS Information Services/Thomson Gale.)*

overweight, but they have a new shape and more muscular body.

## Origins

Bill Phillips, the originator of the Body for Life program, is a former bodybuilder and was the founder of EAS, a dietary supplement manufacturer. In Body for Life, he has taken some of the principles of bodybuilding and incorporated them into a motivational program that is easily understandable to the general public. In 1996, when Phillips still owned EAS (he has since sold the company), he began the "EAS Grand Spokesperson Challenge." The following year he changed its name to the Body for Life Challenge. This is a self-improvement competition based on the Body for Life program.

The Body for Life program became widely known with the publication of *Body for Life: 12 Weeks to Mental and Physical Strength*. in 1999. Other books, videos, and a Web site have followed. Phillips claims that in a decade more than 2 million people have successfully changed their bodies and their lives through the Body for Life program.

## Description

Body for Life is both a diet and a rigorous exercise program served up with a big helping of motivational psychology. The diet part of the plan is relatively simple and offers some benefits over other plans in that it does not require calorie counting or careful measuring of food.

### *Diet*

The Body for Life diet works this way. For 12 weeks, people eat five or six small meals a day. The meals consist of a portion of lean, protein-rich food, and a portion of unrefined or whole-grain **carbohydrates**. In addition, at least two meals daily must include a vegetable portion, and the diet should be supplemented by one tablespoon daily of oil high in monounsaturated **fats**. A portion is defined as the being equal to the size and thickness of the dieter's hand (**protein**) or fist (carbohydrates and vegetables). Dieters estimate portion size rather than measuring.

Approved proteins include lean poultry, most fish and seafood, egg whites, low-fat cottage cheese, and, unlike many diets, lean beef and ham. For vegetarians, approved proteins include tempeh, **soy**, textured vegetable protein, and seitan. Vegetarians will have a hard time meeting the protein requirements of this diet. Vegans will most likely not be able to.

Approved carbohydrates include baked potato, sweet potato, both brown and white rice, pasta, whole wheat bread, whole wheat tortillas, dried beans, oatmeal, and whole grains such as quinoa. Also included in the approved carbohydrates list are apples, melon, strawberries, oranges, and corn. This is a much less restrictive list of carbohydrates than appears in many diets.

Approved vegetables include lettuce, tomato, carrots, broccoli, cauliflower, asparagus, spinach, mushrooms, zucchini, peas, bell peppers, celery, and onions. All are to be served as plain vegetables without sauce. The daily oil allotment can come from salad dressing.

The fats requirement of this diet can be met with unsaturated oils such as canola, olive, safflower, or **flaxseed**, but also through eating salmon three times a week or with avocados, natural peanut butter, or a handful of nuts or seeds daily.

In addition to allowed foods, the dieter is required to drink 10 or more glasses of **water** daily. The diet is to be followed rigorously for six days. On the seventh day, the dieter can eat anything he or she wants. Overall, this diet allows more different foods than many diets, but it is a high protein, **low fat diet** with about half the calories consumed coming from protein and very few from fats. Generally dietitians recommend a diet that is about 55% carbohydrates, with emphasis on whole-grain carbohydrates, 15–20% protein, and

## KEY TERMS

**Dietary supplement**—a product, such as a vitamin, mineral, herb, amino acid, or enzyme, that is intended to be consumed in addition to an individual's diet with the expectation that it will improve health

**Glycogen**—A compound made when the level of glucose (sugar) in the blood is too high. Glycogen is stored in the liver and muscles for release when blood glucose levels are too low.

**Hormone**—a chemical messenger that is produced by one type of cell and travels through the bloodstream to change the metabolism of a different type of cell

**Insulin**—a hormone made by the pancreas that controls blood glucose (sugar) levels by moving excess glucose into muscle, liver, and other cells for storage.

**Pancreas**—a gland near the liver and stomach that secretes digestive fluid into the intestine and the hormones insulin and glucagon into the bloodstream.

**Quinoa**—a high-protein grain native to South America (pronounced keen-wah)

no more than 30% fat. On the positive side, the diet recommends unsaturated fats and restricts sweets, junk food, and empty calories that add few nutrients. One troubling thing about the diet is that Phillips repeatedly recommends **dietary supplements** made by his former company.

### *Exercise*

The exercise portion of Body for Life is more complicated than the food portion. It consists of a two-week block of exercises. Forty-five minute weight-training exercises for either the upper or lower body alternate with a minimum of 20-minute aerobic exercises with every seventh day as a day of rest.

Exercises are to be done at specific levels of exertion using a 10-point rating scale developed by the American College of Sports Medicine. This scale allows the level of difficulty to be personalized to the individual. Most exercises consist of multiple repetitions beginning around level 5, (hard, but with plenty of reserves to continue). They move on to a completely flat effort at level 10 where the individual is putting out the maximal effort possible. These exercises are difficult, and they are intended to be that way. Phillips believes that short bursts of maximal exercise burn more calories than longer exercise periods at lower intensities. Another drawback is that these exercises are best done in a gym with equipment and a supervised environment because of their intensity.

### *Motivation*

Bill Phillips uses strong motivational techniques to help people succeed in the Body for Life Program. The program asks the dieter to determine his or her reasons for wanting to change and then set a goal for that change. Phillips then applies the psychology of competition by encouraging people to become involved in the Body for Life Challenge. This is a contest to see which dieter can improve his or her body the most using the program. Prizes in 2007 were substantial. The grand prize was $50,000, a home gym, and a $5,000 gift certificate for EAS supplement products. Eight category champions receive $20,000, a home gym, and a $2,500 gift certificate for EAS products. The official Body for Life Web site offers inspiring stories and pictures of former champions and plenty of tips and information on how to succeed.

## Function

The theory behind the Body for Life diet is that eating may small meals high in protein during the day helps keep insulin levels steady and boosts **metabolism** so that the body burns calories at a higher rate. Insulin is a hormone that regulates blood glucose (sugar) levels in the body. When blood glucose is too high, cells store the extra glucose as glycogen or fat. In addition, Phillips says that protein suppresses energy and is essential for building muscle mass. The goal of the Body for Life plan is not just to lose weight, but to develop a sculpted body.

## Benefits

With increased exercise, a low fat, **high protein diet**, and reduced portion sizes, Body for Life does help people lose weight rapidly. People do gain muscle and strength through exercise. The main drawback to achieving these benefits is the rigorousness of the program and the difficulty people have staying on it. Eating five or six times a day and finding time to exercise daily requires a major lifestyle change. The committed will see benefits, but this program is definitely not for everyone.

## QUESTIONS TO ASK THE DOCTOR

- Are there health risks to me caused by the level of exercise Body for Life requires?
- Is there another diet and exercise program that would meet my needs better?
- Will following this rigorous diet for 12 weeks help me achieve long-term weight loss?
- How much will I have to exercise to maintain my muscle mass and strength after the diet ends?
- Do I really need dietary supplements? Are EAS supplements the best for my needs?
- Would you recommend someone in your family going on this diet?

### Precautions

Because of the high level of exercise involved in this program, dieters should talk to their doctor about whether their physical condition will allow them to participate. This is probably not a good program for people with heart or respiratory problems. Children and teens who are still growing, and pregnant women also are unlikely candidates for this program. People with kidney disease should discuss the diet aspect of the program with their doctor since their kidneys may not be able to handle a high protein diet. Anecdotally, the program appears to be most successful with out-of-shape athletes who want to lose weight and get back in shape.

### Risks

People who are not used to the level of exercise required by Body for Life are at high risk for develop injuries as a result of the exercise component of the program. In addition, many **obesity** experts feel that rapid weight loss, that is loss of more than 1–1.5 lb (0.5–7 kg) per week, increases the chance of **weight cycling** or putting the weight back on once the dieter begins eating a regular diet. Weight cycling is thought to have some harmful cardiovascular effects.

### Research and general acceptance

No scholarly research has been done on Body for Life. However, bodybuilders have used the diet and exercise principles behind the program for many years. Nutritionists like the idea of eating many small meals during the day and of using only unsaturated fats. They tend to dislike the high protein content of the diet. The thing nutritionists tend to criticize most strongly, however, is the need for dietary supplements in this program. Body for Life unabashedly pushes dieters to use EAS supplements. Many nutritionists feel that a good, healthy diet should not require protein shakes and other supplements beyond perhaps a multivitamin for certain dieters.

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Tish Davidson, A.M.

# Body image

### Definition

Body image is a person's mental opinion or description of his or her own physical appearance. It also involves the reactions of others toward that person's physical body based on what is perceived by that person. The concept of body image slowly develops

**Steps to help your child develop a positive body image**

- Make sure your child understands that weight gain is a normal part of development, especially during puberty
- Avoid negative statements about food, weight, and body size and shape
- Allow your child to make decisions about food, while making sure that plenty of healthy and nutritious meals and snacks are available
- Compliment your child on her or his efforts, talents, accomplishments, and personal values
- Restrict television viewing, and watch television with your child and discuss the media images you see
- Encourage your school to enact policies against size and sexual discrimination, harassment, teasing, and name-calling; and support the elimination of public weigh-ins and fat measurements
- Keep the communication lines with your child open

SOURCE: National Women's Health Information Center, U.S. Department of Health and Human Services

*(Illustration by GGS Information Services/Thomson Gale.)*

over time, generally beginning in infancy. Perception of body image among people can widely range from very negative to very positive. Depending on age and other factors, the degree of concern with body image can also widely vary among an individual.

A person who has a poor body image perceives their body as unattractive to others, while someone with a good body image views their body as being attractive to others. Body image is studied within the area of psychoanalysis, which is a psychological theory that involves mental functions of humans both consciously and unconsciously.

Generally, within psychoanalytic study, body image is not related to any objective measure (based on facts) but is subjective (based on opinions and feelings) in nature. Consequently, one's opinion of their own body image may or may not parallel how others judge that person's body image. For instance, people judging a person may view that person as attractive, however, that person may judge themselves as having an unattractive body image. On the other hand, a person may perceive their body image as attractive but be judged unattractive by most people who come in contact with the person.

Body image, especially with young people going through puberty (a stage of physical and mental development that begins sexual reproduction), can become a problem especially when parents are overly concerned with their children's weights and appearances; parents, especially mothers, are very self aware with their own weights and appearance; other children use excess pressure on their peers (fellow children) to look or act a particular way; and mass media advertisements and other such means that try to actively imply a certain body look (such as, thin is an ideal body image). Body image is also closely associated with self-esteem, which is defined as the amount of value and worthiness a person inwardly feels.

## KEY TERMS

**Anorexia nervosa**—A mental eating disorder that features an extreme fear and obsession of becoming overweight, which leads to extreme forms of dieting even with incidences that result in sickness and sometimes even death.

**Binge eating disorder**—A mental eating disorder that features the consumption of large amounts of food in short periods of time.

**Body dysmorphic disorder**—A mental disorder that features a distorted or disturbed body image by the subject who is very critical of their physical body and body image even though no defect is easily visible.

**Bulimia**—A mental eating disorder that is characterized by periods of overeating followed with periods of undereating.

**Narcissism**—Excessive admiration of one's self.

**Objective**—Based on facts.

**Obsessive compulsive disorder**—A mental disorder that is characterized by obsessive thoughts and related compulsive activities that in the subject's mind are attempts to counter and remove the unusual thoughts.

**Psychoanalysis**—A psychological theory that concerns the mental functions of humans both on the conscious and unconscious levels.

**Puberty**—A stage of physiological maturity that marks the start of being capable of sexual reproduction.

**Subjective**—Based on feelings and opinions.

Older children and young adults are more concerned about how other people view them than other age groups, so are much more sensitive with body image and vulnerable to external pressures. This can affect their self-esteem as their body goes through dramatic changes from adolescence to adulthood (puberty). Boys may be overly concerned with height when seeing girls of their same age growing upward faster. Girls may feel sensitive about their height, weight, or other noticeable changes happening within their body.

Statistically, according to the National Eating Disorders Association, 91% of young college women

report having been on at least one diet. Seventy percent of young college men report being unhappy with their body image—with 32% of all college men stating that they have been on one or more diets. Other studies show similar percentages in older children and young adults, which help to support the contention that young people are very concerned with body image—a body image where the ideal is to be very slim.

## Purpose

Scientists have found that body image is first formed as an infant during contact, or lack of contact, with people such as parents and family members. Personal contacts in the form of hugs, kisses, and other forms of affection can help develop an early positive body image. Lack of such contact, can have the opposite effect, forming an early negative body image.

The purpose of body image is generally used as a way for individuals to compare themselves against a model (ideal) image and for people to compare others through physical traits and characteristics. It is usually measured against an ideal body shape with respect to various physical characterizations such as facial features and overall body weight of the human body including fatness and muscle mass.

Within the field of psychoanalysis, a person's body image is often measured by asking a person to rate parts of his/her current body (such as face, stomach, and buttocks) with respect to a series of pictures representing an ideal body image. The difference in rating between a person's current body image and a perceived idea body image is generally considered the amount a person is dissatisfied with their body.

## Description

Concern with body image is generally more important with women than it is with men. Women usually are more critical of their overall body and individual parts of their body than are men. However, the gap between the two genders has been narrowing over recent years as men become more concerned with their body image.

A perception of a poor body image often relates with a feeling of being overweight, especially with women. Men, on the other hand, desire more muscle mass when considering their body image. Their feeling to be more masculine parallels this desire to add additional muscle mass and to produce more definition in their current muscles.

Generally, a poor body image can lead to constant and fad dieting, **obesity**, and eating disorders, along with low self-esteem, depression, anxiety, and overall emotional distress. However, for the most part, people with good exercise habits, positive personal and sexual experiences, and excellent emotional and mental states have better and more accurate perceptions of their body image than people without those characteristics and experiences. These people also have fewer problems associated with a poor body image.

## Precautions

Exaggerated and distorted concerns with body image have been linked in medical studies with decreases in self esteem and increases in dieting and eating disorders, including **anorexia nervosa**, **binge eating** disorder, and bulimia. People with body image problems can also have a condition called body dysmorphic disorder, which involves a distorted body image without any eating disorders. Excessive preoccupation with body image and an exaggerated obsession on positive body image has, in the past, been associated with the personality disorder called narcissism (self-admiration, or an overestimation about one's appearance).

## Interactions

Body image can be affected by outside influences. Media sources, such as television, the Internet, and magazines, often portray people closer to the commonly accepted ideal body type than the average body image in order to sell their products and services. Consequently, people, especially older children and young adults, are overly influenced and swayed by such depictions of body image. For instance, according to Association Body Image for Disordered Eating (ABIDE), the average U.S. citizen was exposed to about 5,000 advertising messages each and every day in 2003. Studies of network television commercials have shown that attractiveness is a desirable trait that advertisers regularly use to convince viewers to purchase their products.

Family life can also affect a person's perception of their body image. Parents that criticize their children, such as in the way they look, talk, or act, often may have a negative effect on the development of self-esteem in their offspring.

Young people may also be affected by the comments of classmates and peers when it comes to their body image. Teasing is often a method used by young people to convey negative comments and hurtful words. Teasing can come in a form of being too small or too large; too smart or too dumb; too popular or not very popular; and any of a number of other

characterizations. Racial, sexual, and other types of teasing are mores serious and can have a negative impact on body image and self-esteem. Children often try to pressure their peers to conform to what is currently popular in clothing styles, language, and other characteristics—all that can potentially hurt one's perception of their body image.

### Complications

Without a healthy regard for one's self, people can often become very self-conscious of their body image. Sometimes feelings of depression, anxiety, and isolation occur. With low self-esteem and body image problems, some people use alcohol or drugs to offset those negative feelings. Others turn away from their regular activities and their usual friends—becoming withdrawn and showing lack of interest in themselves and the world around them.

Sometimes, a person can recover from such feelings by re-focusing their life on good qualities, accepting things that cannot be changed, and realistically working on things can could be improved. In some cases, outside help is needed in the form of a guidance counselor, parent, coach, religious leader, or someone else that is trusted and accepting of personal feelings. Crisis hotlines are also available to help with such problems.

### Parental concerns

Parents should be concerned if their children have excessive concerns about their appearance and looks. All children will be concerned with some aspect of their body. This concern is normal and is not a medical problem. However, an obsession with one's physical body and appearance is not normal. In fact, an obsession with one's body image is called body dysmorphic disorder (BDD).

The mental disorder called BDD usually appears in adolescence, already a period in one's life that causes sensitivities in one's appearance and body image. In BDD, the person is very critical of their body image even though nothing out of the ordinary is seen by anyone looking at the person. The major criteria for BDD involve a preoccupation with an imagined defect in one's appearance or an excessive concern with a minor physical blemish or flaw; a reaction that produces excessive distress in one's social and personal life and/or impairs one's professional life; and a medical diagnosis that eliminates the cause from being other mental disorders.

Symptoms of BDD include compulsive use of mirrors and other reflective objects, social withdrawal, abnormal grooming behaviors, compulsive touching of one's skin and body, obsession with plastic surgery, lowered self-esteem, and compulsive attraction toward one or more celebrity figures (often with features that the subject feels they are lacking). The body parts most often the topic of a BDD person's attention are skin and hair, general face (especially nose, chin, teeth, and lips), stomach, breasts/chest/nipples, eyes and eyebrows, general legs (especially thighs), and buttocks. The person is often concerned with their weight, body build, and bone structure.

BDD can often leads to depression, anxiety (especially when in social situations), obsessive compulsive disorder, and suicide. Parents should be aware of any BDD symptoms in their children and consult with their family doctor about their concerns for the health and well-being of their children.

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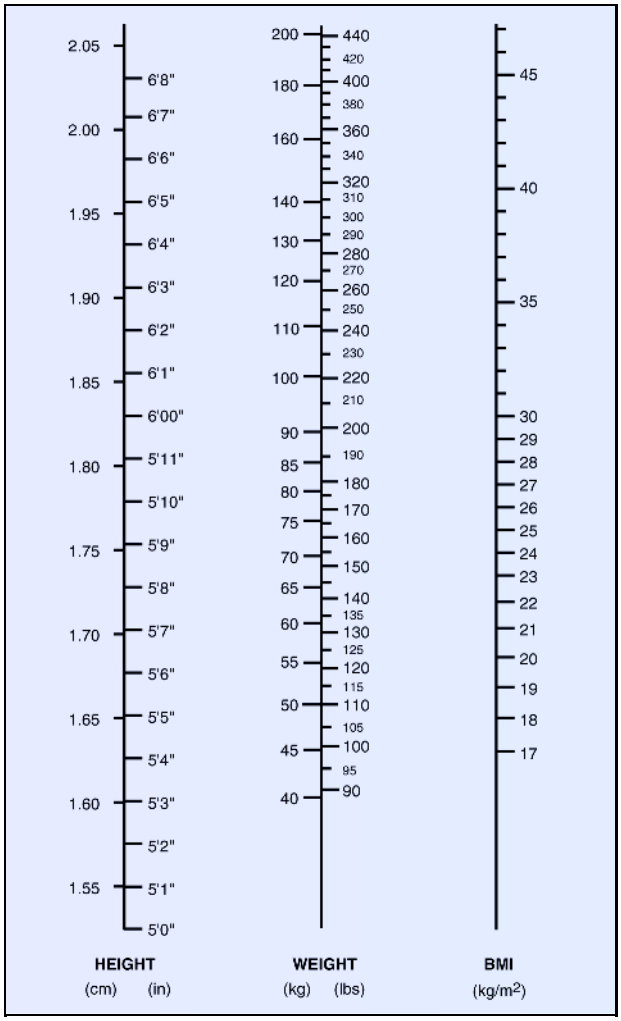
William Arthur Atkins

## Body mass index

### Definition

Body mass index (BMI), also called the Quetelet Index, is a calculation used to determine an individual's amount of body fat.




**Body/mass index can be calculated by locating your height and weight on the chart and drawing a diagonal line between the two. Where the line crosses over the third bar is the approximate BMI.** *(Illustration by Argosi, Inc./Thomson Gale.)*

## Purpose

The BMI gives healthcare professionals a consistent way of assessing their patients' weight and an objective way of discussing it with them. It is also useful in suggesting the degree to which the patient may be at risk for obesity-related diseases.

## Description

BMI is a statistical calculation intended as an assessment tool. It can be applied to groups of people to determine trends or it can be applied to individuals. When applied to individuals, it is only one of several assessments used to determine health risks related to being underweight, overweight, or obese.

### *The history of BMI*

The formula used to calculate BMI was developed more than one hundred years ago by Belgian mathematician and scientist Lambert Adolphe Quetelet (1796-1874). Quetelet, who called his calculation the Quetelet Index of **Obesity**, was one of the first statisticians to apply the concept of a regular bell-shaped statistical distribution to physical and behavioral features of humans. He believed that by careful measurement and statistical analysis, the general characteristics of populations could be mathematically determined. Mathematically describing the traits of a population led him to the concept of the hypothetical "average man" against which other individuals could be measured. In his quest to describe the weight to height relationship in the average man, he developed the formula for calculating the body mass index.

Calculating BMI requires two measurements: weight and height. To calculate BMI using metric units, weight in kilograms (kg) is divided by the height squared measured in meters (m). To calculate BMI in imperial units, weight in pounds (lb) is divided by height squared in inches (in) and then multiplied by 703. This calculation produces a number that is the individual's BMI. This number, when compared to the statistical distribution of BMIs for adults ages 20–29, indicates whether the individual is underweight, average weight, overweight, or obese. The 20–29 age group was chosen as the standard because it represents fully developed adults at the point in their lives when they statistically have the least amount of body fat. The formula for calculating the BMI of children is the same as for adults, but the resulting number is interpreted differently.

Although the formula for calculating BMI was developed in the mid-1800s, it was not commonly used in the United States before the mid-1980s. Until then, fatness or thinness was determined by tables that set an ideal weight or weight range for each height. Heights were measured in one-inch intervals, and the ideal weight range was calculated separately for men and women. The information used to develop these ideal weight-for-height tables came from several decades of data compiled by life insurance companies. These tables determined the probability of death as it related to height and weight and were used by the companies to set life insurance rates. The data excluded anyone with a chronic disease or anyone who, for whatever health reason, could not obtain life insurance.

Interest in using the BMI in the United States increased in the early 1980s when researchers became concerned that Americans were rapidly becoming

## KEY TERMS

**Anorexia nervosa**—A psychiatric disorder signified by obsession with weight loss and voluntary self-starvation accompanied by serious, potentially fatal health problems.

**Morbid obesity**—A term used to describe individuals 100 lb (45 kg) or more than 50% overweight and/or who have a body mass index above 40.

**Triglycerides**—A type of fat found in the blood. High levels of triglycerides can increase the risk of coronary artery disease.

obese. In 1984 the national percentage of overweight individuals was reported in a major assessment of the nation's health. Men having a BMI of 28 or greater were considered overweight. This BMI number was chosen to define overweight because 85% of American men ages 20–29 fell below it. A different calculation, not BMI, was used for women in the report.

In 1985, the term overweight was redefined as a BMI equal to or greater than 27.8 for men and equal to or greater than 27.3 for women. No BMI was selected to define underweight individuals. This definition of overweight was used in reports on obesity until 1998. In 1998, the United States National Institutes of Health revised its weight definitions to bring them in line with the definitions used by the World Health Organization. Overnight 30 million Americans went from being classified as normal weight to being classified as overweight. Overweight is now defined for both men and women as a BMI of 25 or less. At the same time, an underweight classification was added, as was the classification of obese for individuals with a BMI greater than or equal to 30.

### *Interpreting BMI calculations for adults*

All adults age 20 and older are evaluated on the same BMI scale as follows:

- BMI below 18.5: Underweight
- BMI 18.5–24.9: Normal weight
- BMI 25.0–29.9: Overweight
- BMI 30 and above: Obese

Some researchers consider a BMI of 17 or below an indication of serious, health-threatening malnourishment. In developed countries, a BMI this low in the absence of disease is often an indication **anorexia nervosa**. At the other end of the scale, a BMI of 40 or greater indicates morbid obesity that carries a very high risk of developing obesity-related diseases such as stroke, heart attack, and type 2 diabetes.

### *Interpreting BMI calculations for children and teens*

The formula for calculating the BMI of children ages 2–20 is the same as the formula used in calculating adult BMIs, but the results are interpreted differently. Interpretation of BMI for children takes into consideration that the amount of body fat changes as children grow and that the amount of body fat is different in boys and girls of the same age and weight.

Instead of assigning a child to a specific weight category based on their BMI, a child's BMI is compared to other children of the same age and sex. Children are then assigned a percentile based on their BMI. The percentile provides a comparison between their weight and that of other children the same age and gender. For example, if a girl is in the 75th percentile for her age group, 75 of every 100 children who are her age weigh less than she does and 25 of every 100 weigh more than she does. The weight categories for children are:

- Below the 5th percentile: Underweight
- 5th percentile to less than the 85th percentile: Healthy weight
- 85th percentile to less than the 95th percentile: At risk of overweight
- 95th percentile and above: Overweight

### *Application of BMI information*

The BMI was originally designed to observe groups of people. It is still used to spot trends, such as increasing weight in a particular age group over time. It is also a valuable tool for comparing body mass among different ethnic or cultural groups, and can indicate to what degree populations are undernourished or overnourished.

When applied to individuals, the BMI is not a diagnostic tool. Although there is an established link between BMI and the prevalence of certain diseases such as type 2 diabetes, some cancers, and cardiovascular disease, BMI alone is not intended to predict the likelihood of an individual developing these diseases. The National Heart, Lung, and Blood Institute recommends that the following measures be used to assess the impact of weight on health:

- BMI
- Waist circumference (an alternate measure of body fat)

- Risk factors for disease associated with obesity. These include high blood pressure, high LDL or "bad" cholesterol
- Low HDL or "good" cholesterol
- High blood glucose (sugar)
- High triglycerides
- Family history of cardiovascular disease
- Low physical activity level
- Cigarette smoking

### Precautions

BMI is very accurate when defining characteristics of populations, but less accurate when applied to individuals. However, because it is inexpensive and easy to determine BMI is widely used. Calculating BMI requires a scale, a measuring rod, and the ability to do simple arithmetic or use a calculator. Potential limitations of BMI when applied to individuals are:

- BMI does not distinguish between fat and muscle. BMI tends to overestimate the degree of "fatness" among elite athletes in sports such as football, weightlifting, and bodybuilding. Since muscle weighs more than fat, many athletes who develop heavily muscled bodies are classified as overweight, even though they have a low percentage of body fat and are in top physical condition.
- BMI tends to underestimate the degree of fatness in the elderly as muscle and bone mass is lost and replaced by fat for the same reason it overestimates fatness in athletes.
- BMI makes no distinction between body types. People with large frames (big boned) are held to the same standards as people with small frames.
- BMI weight classes have absolute cut-offs, while in many cases health risks change gradually along with changing BMIs. A person with a BMI of 24.9 is classified as normal weight, while one with a BMI of 25.1 is overweight. In reality, their health risks may be quite similar.
- BMI does not take into consideration diseases or drugs that may cause significant water retention.
- BMI makes no distinction between genders, races, or ethnicities. Two people with the same BMI may have different health risks because of their gender or genetic heritage.

BMI is a comparative index and does not measure the amount of body fat directly. Other methods do give a direct measure of body fat, but these methods generally are expensive and require specialized equipment and training to be performed accurately. Among them are measurement of skin fold thickness, underwater (hydrostatic) weighing, bioelectrical impedance, and dual-energy x-ray absorptiometry (DXA). Combining BMI, waist circumference, family health history, and lifestyle analysis gives healthcare providers enough information to analyze health risks related to weight at minimal cost to the patient.

### Parental concerns

**Childhood obesity** is an increasing concern. Research shows that overweight children are more likely to become obese adults than normal weight children. Excess weight in childhood is also linked to early development of type 2 diabetes, cardiovascular disease, and early onset of certain cancers. In addition, overweight or severely underweight children often pay a heavy social and emotional price as objects of scorn or teasing.

Both the American Academy of Pediatrics (AAP) and the United States Centers for Disease Control and Prevention (CDC) recommend that the BMI of children over age two be reviewed at regular intervals during pediatric visits. Parents of children whose BMI falls above the 85th percentile (at risk of being overweight and overweight categories) should seek information from their healthcare provider about health risks related to a high BMI and guidance on how to moderate their child's weight. Strenuous dieting is rarely advised for growing children, but healthcare providers can give guidance on improving the chid's diet, eliminating empty calories (such as those found in soda and candy) and increasing the child's activity level in order to burn more calories and improve fitness.

Tish Davidson, A.M.

## Bodybuilding diet

### Definition

The bodybuilding diet is designed to build muscle and reduce body fat. It emphasizes foods high in **protein** and complex **carbohydrates**, such as whole grain bread, pasta, and cereal. There are many variations of the bodybuilding diet but an essential component remains the same throughout, a regular strength-building exercise building program.

### Origins

Many scholars believe bodybuilding diets began with the ancient Greeks, whose gods, like Hercules

and Apollo, were often portrayed as quite muscular. This influenced ancient Greek society to emulate the concept of a perfect physique. The same desire for physical perfection is found in ancient Rome and Egypt. The modern era of bodybuilding began in the late 1800s in England; German strongman Eugen Sandow is credited with being the first professional bodybuilder of the modern era. He was a featured attraction at the 1893 World Columbian Exposition in Chicago for his feats of strength. He opened a chain of 20 weight training studios in England and published a magazine that included tips on diet. Sandow's own diet was high in calories, protein, carbohydrates, and **fats**.

## Description

A bodybuilding diet generally contains 2,500–5,500 calories per day for men and 1,500–3,000 calories daily for women, depending on the types and levels of exercise. The diet's ratio of protein, carbohydrates, and fat can differ. Some programs recommend 40% carbohydrates, 40% protein, and 20% fats. Others suggest a ratio of 40% protein, 30% carbohydrates, and 30% fat. There are many variations of this diet where the calorie intake and ratios are different. Most bodybuilding diets include nutritional supplements as well as protein powders. The focus of bodybuilding has shifted away from an emphasis on health toward an emphasis on appearance at all costs. To achieve a bigger, better body, many bodybuilders have placed a huge emphasis on nutritional and other types of supplements, including the illegal use of steroids.

All diets require an exercise routine of three to seven days a week, usually with weightlifting and cardiovascular exercises. The body burns up to 50 calories per day for every pound of muscle. So adding 10 pounds of muscle can burn up to 500 extra calories each day. The exact diet and exercise routine can vary greatly and can be confusing, especially to people new to bodybuilding. When it comes to either diet or exercise, no two people follow the same routine.

### *Basic nutrition of bodybuilding*

The three main components of a bodybuilding diet are the three **macronutrients**: carbohydrates, protein, and fat.

**CARBOHYDRATES.** Carbohydrates are the main source of energy for the body. They are especially important in aerobic exercise and high-volume weight training, including aiding in muscle recovery. Eating carbohydrates causes the pancreas to release the hormone insulin, which helps regulate blood glucose (sugar) levels. Insulin takes carbohydrates and stores them as fat, in muscle, or in the liver as glycogen. Insulin also takes amino acids from protein and stores them in muscle cells that aid in recovery and repair following strength-building exercise. All carbohydrates are broken down into glucose by the body and released into the blood; the speed at which this process occurs varies depending on the type of carbohydrate

## KEY TERMS

**Amino acids**—A group of organic acids that are constituents of protein.

**Carbohydrates**—An organic compound that is an important source of food and energy.

**Cardiovascular**—Pertaining to the heart and blood vessels.

**Cholesterol**—A solid compound found in blood and a number of foods, including eggs and fats.

**Epidemiologist**—A scientist or medical specialist who studies the origins and spread of diseases in populations.

**Glycemic index (GI)**—A method of ranking of carbohydrates by the way they affect blood glucose levels.

**Glycemic load (GL)**—A more practical ranking of how an amount of a particular food will affect blood glucose levels. The glycemic index (GI) is part of the equation for determining ranking.

**Glycogen**—A compound stored in the liver and muscles that is easily converted to glucose as an energy source.

**Insulin**—A hormone that regulates the level of glucose (sugar) in the blood.

**Monounsaturated fat**—A type of fat found in vegetable oils such as olive, peanut, and canola.

**Pancreas**—A digestive gland of the endocrine system that regulates several hormones, including insulin.

**Polyunsaturated fat**—A type of fat found in some vegetable oils, such as sunflower, safflower, and corn.

**Saturated fat**—A type of fat generally found in meat products with visible fat and dairy products.

**Trans fat**—A type of fat generally found in butter, whole milk products, fried foods, shortening, and coconut, palm, and other tropical oils.

and the presence of fat and protein in the stomach. This rate of absorption is a critical factor in maintaining energy levels, reducing body fat, and maintaining overall health.

Carbohydrates are often referred to as either simple or complex. A bodybuilding diet contains both simple and complex carbohydrates. Complex carbohydrates have a chemical structure composed of three or more sugars. They provide energy that is sustained over time. Simple carbohydrates have a chemical structure composed of one or two sugars and provide quick but short-lasting energy. A bodybuilding diet contains mostly complex carbohydrates eaten throughout the day. Simple carbohydrates are eaten immediately after working out to aid in faster recuperation and repair of muscles. Complex carbohydrates are found in whole-grain bread, pasta, cereal, beans, and most vegetables. Simple carbohydrates are found in fruit and sugary foods such as candy, juice, and sport drinks.

There are two other ways bodybuilding diets classify carbohydrates besides the simple and complex designations: glycemic index (GI) and glycemic load. The GI measures the quality rather than the quantity of carbohydrates found in food. Quality refers to how quickly blood sugar levels are raised following eating. The standard for GI is white bread, which is assigned an index value of 100. Other foods are compared to the standard to arrive at their ratings. The higher the GI number, the faster blood sugar increases when that particular food is consumed. A high GI is 70 and greater, a medium GI is 56–69, and a low GI value is 55 or less. The GI is not a straightforward formula when it comes to reducing blood sugar levels. Various factors affect the GI value of a specific food, such as how the food is prepared (boiled, baked, sautéed, or fried, for example) and what other foods are consumed with it. Foods that are readily broken down and absorbed by the body are typically high on the GI. Foods that are digested slower, such as hose high in **fiber**, have a lower GI value.

In 1997, epidemiologist and nutritionist Walter Willett of the Harvard School of Public Health developed the glycemic load as a more useful way of rating carbohydrates compared to the glycemic index. The glycemic load factors in the amount of a food eaten whereas the glycemic index does not. The glycemic load of a particular food or meal is determined by multiplying the amount of net carbohydrates in a serving by the glycemic index and dividing that number by 100. Net carbohydrates are determined by taking the amount of total carbohydrates and subtracting the amount of dietary fiber. For example, popcorn has a glycemic index of 72, which is considered high, but a serving of two cups has 10 net carbs for a glycemic load of seven, which is considered low.

**PROTEIN.** Muscle is composed primarily of protein and **water**. Protein builds muscle mass but not all protein consumed in the diet goes directly to muscle. Adequate consumption of protein helps preserve muscle tissue and enhance recovery from strenuous weight-bearing workouts. Since weight-bearing exercises cause significant damage to muscle tissue, the subsequent repair and growth of muscle requires a recovery period of at least 24 hours. If an inadequate amount of protein is consumed, muscle mass will suffer along with a decrease in **metabolism**. Most bodybuilding diets recommend 1–1.5 grams of protein per day for each pound of lean body mass (body weight minus body fat). Daily consumption of more than 3g per kilogram body mass can lead to serious health problems, especially kidney damage. Protein is found in lean meat, poultry, and fish, eggs, tofu, and **soy** products.

**FATS.** Fat in a diet is needed to maintain a healthy metabolism. There are four types of fat: saturated, trans, polyunsaturated, and monounsaturated. Saturated and trans fats are limited because high consumption is a risk factor for heart disease, **obesity**, high cholesterol, diabetes, and some cancers. Sources of saturated and trans fats are butter, whole milk products, fried foods, shortening, and coconut, palm, and other tropical oils. Meat with visible fat is also a source of saturated fat. Monounsaturated and polyunsaturated fats are good fats because they lower the risks of heart disease, diabetes, high cholesterol, and obesity. These fats are derived from avocados, most nuts, fish, flax, and olive, canola, peanut, safflower, corn, sunflower, soybean, and cottonseed oils.

Two other important factors in the bodybuilding diet are water and the number and timing of meals. Bodybuilding diets suggest drinking at least eight eight-ounce glasses of water a day. In addition, bodybuilders drink about a quarter cup of water every fifteen minutes during their workout. Water helps control appetite and drinking cold water increases metabolism.

The number and content of meals is important as is the timing and quality of foods, especially just before and just after workouts. An efficient way to burn fat is to elevate the body's metabolism. The process of digesting meals burns calories in itself, so a concept of this diet is to eat more frequently to make the process more efficient. Most bodybuilding diets recommend consuming six to eight smaller meals a day, starting with breakfast. Carbohydrates are important right after a workout because the body's

supply of glycogen (a compound easily converted to glucose for energy) is depleted. Many bodybuilding nutritionists recommend that the post-workout meal contain twice the calories, protein, and carbohydrates as the other meals of the day. The pre-workout meal contains foods high in carbohydrates since they improve exercise performance and enhance muscle recovery.

### Function

The purpose of the bodybuilding diet is to gain muscle mass and lose fat. It is not a weight loss diet and most people will likely gain weight. Nutrition provides the body, especially muscles, with the raw materials needed for energy, recuperation, growth, and strength.

### Benefits

The benefits of the bodybuilding diet are health and appearance. The bodybuilding diet promotes increased muscle mass, which increases metabolism.

### Precautions

When monitored by a health professional, the bodybuilding diet can be healthy method for increasing strength and body mass. Caution should be used in regard to nutritional supplements, especially protein powders. Excess protein intake is known to cause serious health problems such as kidney damage and **dehydration**. Bodybuilders should discuss any supplements with their doctor, and steroids, such as human growth hormone and testosterone, should only be used for medical reasons and with a doctor's prescription. Since exercise is a main component of the diet, people with arthritis or back, knee, or other joint problems should discuss the fitness regimen with their physicians before starting exercise. Making major changes to a person's diet should be done in small incremental steps so the body can adapt to the changes. A sudden reduction or increase in calories can cause the body to store or hoard fat.

### Risks

The rigorous and regular exercise component of this diet is a risk to people with heart disease or certain other health problems. Individuals with these conditions should consult their physician before starting the diet. A bodybuilding diet is not recommended for women who are pregnant or nursing.

## QUESTIONS TO ASK YOUR DOCTOR

- What health factors should I be concerned about if I were to increase my exercise regimen and begin a bodybuilding diet?
- Which dietary supplements should I consider if I adopt the bodybuilding diet?
- What are the health risks involved with this diet?
- What other diets should I consider following to accomplish my bodybuilding goals?
- Have you treated other patients who are on a bodybuilding diet? If so, what has their response to the diet been?

### Research and general acceptance

The bodybuilding diet is generally accepted by the medical and bodybuilding communities as being safe and effective in helping increase muscle mass and decrease fat. There is no general acceptance on the exact ratio of protein, carbohydrates, and fats.

Protein is considered the basic nutrient in repairing muscle that is broken down during weightlifting and for muscle maintenance and growth. The recommended dietary allowance (RDA) per day for protein is 0.8 g/kg. However, research shows that a greater amount of protein is needed for weightlifters. Depending on a person's level of activity, the amount of protein needed for a bodybuilder is greater than the RDA, but not more than 1.5-2 g/kg. Research indicates that muscles double the rate of protein synthesis following exercise and remains elevated for at least 24 hours.

The amount of carbohydrates in a bodybuilder's diet can range from 40–60 percent, but such levels are not necessarily effective. An inadequate consumption of carbohydrates can have a negative effect of exercise performance and duration. Other studies have shown that the dominant factor in weight loss is a reduction of calorie intake. There has been a great deal of research on bodybuilding nutrition from the 1980s forward.

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**ORGANIZATIONS**

American College of Nutrition. 300 South Duncan Ave., Suite 225, Clearwater, FL 33755. Telephone: (727) 446-6086. Website: <http://www.amcollnutr.org>.
American Council on Exercise. 4851 Paramount Drive, San Diego, CA 92123. Telephone: (858) 279-8227. Website: <http://www.acefitness.org>.
American Dietetic Association. 120 South Riverside Plaza, Suite 2000, Chicago, IL 60606-6995. Telephone: (800) 877-1600. Website: <http://www.eatright.org>.
American Society for Nutrition. 9650 Rockville Pike, Bethesda, MD 20814. Telephone: (301) 634-7050. Website: <http://www.nutrition.org>.
Bodybuilding.com. 305 Steelhead Way, Boise, ID 83704. Telephone: (877) 991-3411. Website: <http://www.bodybuilding.com>.
Center for Nutrition Policy and Promotion. 3101 Park Center Drive, 10th Floor, Alexandria, VA 22302-1594. Telephone: (703) 305-7600. Website: <http://www.cnpp.usda.gov>.
Teen Bodybuilding.com. 305 Steelhead Way, Boise, ID 83704. Telephone: (877) 991-3411. Website: http://www.teenbodybuilding.com.

Ken R. Wells

Brazilian diet *see* **South American diet**

# Breastfeeding

## Definition

Breastfeeding is the practice of feeding an infant milk through the mother's breast. According to La Leche League International (LLLI), human milk is 'a living fluid that protects babies from disease and actively contributes to the development of every system in baby's body'". Breastfeeding stimulates babies' immune systems and protects against diarrhea and infection.

## Description

The mother's body prepares for breastfeeding while she is pregnant. The fatty tissue of the breast is replaced by glandular tissue that is necessary to produce milk. When baby suckles the breast the hormone oxytocin is released. This causes the muscle cells of the breast to squeeze milk from the milk ducts to the nipple.

## History

Throughout time millions of mothers have breastfed their babies. During ancient times mothers breastfed their babies for 12-18 months or until the mother's menstrual cycle returned.

For thousands of years breastfeeding was the only source of nutrition for the first part of a baby's life. Before the invention of formula few alternatives were available. If a mother could not breastfeed a wet nurse was found or the baby was fed animal milk or "pap", a mixture of flour, rice, and **water**. In the early 1900's most babies in America were still breastfed, and over half of them were breastfed for one year or longer. However, as more women entered the workforce and supplemental methods of feeding were introduced, breastfeeding rates in America decreased. According to a survey from Ross Labs, by 1971 only 24.7% of

**Benefits of breastfeeding**

| Benefits for Infant | Benefits for Mother |
|---|---|
| • Perfect food for infant | • Promotes faster shrinking of the uterus |
| • Guarantees safe, fresh milk | • Promotes less postpartum bleeding |
| • Enhances immune system | • Promotes faster return to pre-pregnancy weight |
| • Protects against infectious and noninfectious diseases | • Eliminates the need for preparing and mixing formula |
| • Protects against food allergies and intolerances | • Saves money not spent on formula |
| • Decreases risk of diarrhea and respiratory infections | • Decreases risk of breast and ovarian cancer |
| • Promotes correct development of jaw, teeth, and speech patterns | • Increases bonding with infant |
| • Decreases risk of childhood obesity | • Enhances self-esteem in the maternal role |
| • Increases cognitive function | • Delays the menstrual cycle |
| • Increases bonding with mother | |

*(Illustration by GGS Information Services/Thomson Gale.)*

**Breastfeeding rates around the world**

| Country | At birth | At 4–6 months |
|---|---|---|
| Denmark | 98% | |
| Kenya | 98% | 12% |
| Nigeria | 97% | 1% |
| Sweden | 97% | |
| Haiti | 96% | 2% |
| Indonesia | 96% | 42% |
| Egypt | 95% | 56% |
| India | 95% | 43% |
| Turkey | 95% | 10% |
| Brazil | 93% | 29% |
| China | 93% | 64% |
| Australia | 87% | 48% |
| Canada | 72% | 31% |
| United States | 70.1% | 33.2% |
| United Kingdom | 69% | 21% |
| Scotland | 50–63% | 30% |
| France | 50% | |
| Ireland | 31–54% | 14% |

**Statistics developed by La Leche League International (LLLI) in 2003 revealed the percentage of women breastfeeding their infants at birth and at 2-4 months.** *(Illustration by GGS Information Services/Thomson Gale.)*

American babies were breastfed at birth, and of these babies, only 5.4% of them were still breastfed at 6 months.

## Demographics

In 1982, the United States experienced resurgence in breastfeeding and rates have continued to increase. The National Immunization Survey conducted by the Center for Disease Control and Prevention (CDC) in 2005 revealed that 72% of American babies were breastfed at birth and 39% were still breastfed at 6 months.

The developing world has experienced a decline in breastfeeding rates as well due to urbanization, social change, and the promotion of formula. Mothers who choose to feed their babies formula often encounter unsafe hygienic conditions in which to prepare the bottles, or they cannot afford to purchase the fuel needed to heat the water. Two of the major causes of infant mortality in developing countries are diarrhea and acute respiratory infections. Both are conditions that breastfeeding can protect against.

The World Health Organization (WHO) and the United Nations Children Fund (UNICEF) are working together to bring about a change in the global breastfeeding culture. In 2002, they developed "The Global Strategy for Infant and Young Child Feeding", which recommends that all babies are exclusively breastfed for the first 6 months of life with continued breastfeeding up to 2 years or beyond. Exclusive breastfeeding means that breast milk is the child's only food source of nutrition for the first 6 months of life and that no other solids or liquids such as formula or water are introduced at this time, with the exception of liquid **vitamins** or medicines. Despite this recommendation, only one-third of all babies in the developing world were exclusively breastfed for 6 months in 2004. The highest rates of exclusive breastfeeding were in the East Asia/Pacific region (43%) and the lowest rates were in the Western/Central Africa region (20%).

## Composition of Breast Milk

Breast milk is the perfect food for an infant. It contains all the nutrients a baby needs to grow and stay healthy:

- Fats: Breast milk contains omega-3 fatty acids essential for the growth and development of the brain and nerve tissue. The amount of fat a baby receives depends on the length of the feeding. The milk at the beginning of the feeding is called the foremilk. It is the low fat milk. The hind milk that comes at the end of the feeding contains higher concentrations of

## KEY TERMS

**Exclusive breastfeeding**—Breast milk is the child's only food source of nutrition for the first 6 months of life. No other solids or liquids such as formula or water are introduced at this time, with the exception of liquid vitamins or medicines.

**Oxytocin**—A hormone that produces a calm, relaxed feeling.

**Postpartum**—This refers to the period of time after childbirth.

fat. Therefore, the longer the baby nurses the higher the fat content.

- Proteins: The whey proteins found in breast milk are easier to digest than formula. Taurine, an amino acid that is important in the development of brain tissue, is found in breast milk but not in cow's milk.
- Sugars: Breast milk contains lactose, a milk sugar that provides energy. Breast milk contains 20-30% more lactose than cows milk.
- Vitamins and minerals: Breast milk provides the most balanced source of vitamins and minerals for an infant.
- Immune system boosters: White blood cells and immunoglobulins are responsible for fighting and destroying infection.

The content of breast milk varies from feeding to feeding, at different times of day, and as the baby grows.

### Breastfeeding Benefits

#### *Benefits for Baby*

There are a plethora of benefits for the breastfeeding baby, including:

- Increased immunity: Breast milk contains antibodies that are relayed by the mother and help to protect the baby from bacteria and viruses. These immunoboosters are not found in formula.
- Low incidence of ear infections and respiratory infections
- Higher intelligence: Several studies have found higher levels of brain-boosting DHA in the blood levels of breastfed babies than in formula-fed babies.
- Improved digestion and less constipation.
- Decreased risk of diarrhea, pneumonia, urinary tract infections, and certain types of spinal meningitis.
- Decrease in food allergies and eczema.
- Promotes normal weight gain: Breastfed babies are less likely to be overweight than formula-fed babies.
- Reduced risk of juvenile (Type 1) and adult onset (Type 2) diabetes, celiac disease, cancer, rheumatoid arthritis, multiple sclerosis, liver disease, and acute appendicitis.
- Lower risk of Sudden Infant Death Syndrome (SIDS).
- Reduced risk of breast cancer (in daughters who have been nursed).
- Promotes development of jaw and facial structure.
- Promotes bonding between mother and child.

#### *Benefits for Mother*

Breastfeeding women also enjoy many benefits:

- Reduced risk of breast, ovarian, and uterine cancers.
- Natural contraceptive: Many women who breastfeed exclusively for six months experience a delay of fertility.
- Faster postpartum recovery: Breastfeeding uses up extra calories so it's easier for moms to lose their pregnancy weight. Nursing also helps the uterus shrink back to its normal size faster.
- Relaxation: When a mother is breastfeeding her body produces oxytocin, a hormone that induces a calm, content feeling.
- Protection from osteoporosis.
- Saves time and money: Breast milk is cheaper than formula and the mother doesn't have to spend time preparing bottles.
- Better for the environment as there are no bottles to wash or cans to dispose of.

### Mother nutrition

The ideal diet of a breastfeeding woman is comprised of healthy and nutritious foods from the five basic food groups. The main concentration (50–55%) should be made up of carbohydrate foods such as pastas, grains, and fruits. Healthy **fats** such as fatty fish and avocados should be 30%, and proteins should equal 15–20% . Breastfeeding women should make sure to eat foods that contain lots of **calcium**, such as dairy products, broccoli, and beans, and make sure they eat plenty of iron-rich foods like lean red meat, fish and poultry.

In order to compensate for the energy they expend breastfeeding their babies, breastfeeding women should add 300–500 extra nutritious calories to their diet each day and drink extra fluids. Breastfeeding mothers should also continue to take a prenatal vitamin.

## Complications

### *Breastfeeding concerns*

Every substance that a breastfeeding mother puts into her body has the potential to pass to her baby through her breast milk. This includes food, medicine, alcohol, and cigarettes.

- Foods: Foods such as dairy products, caffeine, grains and nuts, gassy foods, and spicy foods may cause the baby to fuss if the food upsets the baby's stomach. If this occurs, the mother should eliminate the suspect food from her diet for 10-14 days to see if the trouble stops.
- Medications: Any medication taken while breastfeeding should be approved by a doctor.
- Birth control pills: The high estrogen type of birth control pills may decrease a breastfeeding mother's milk supply and are not recommended. A progestin-only pill such as the "mini-pill" is the least likely to cause milk supply issues.
- Alcohol: Infants have a hard time detoxifying from the alcohol that passes through their mother's breast milk to them. It is recommended to limit alcohol consumption while breastfeeding.
- Cigarettes: Cigarettes contain toxins that can pass through to the baby and are not recommended for breastfeeding women.

### *When breastfeeding is not an option*

Although breastfeeding is the optimal way to feed an infant, sometimes it is not possible or feasible. A small percentage of women have conditions that prevent breast milk production, such as insufficient development of milk production glands, and cannot breastfeed. Women with HIV are advised against breastfeeding as the virus may be passed to their babies. Women who are newly diagnosed with infectious tuberculosis should not breastfeed unless they are on medication. Babies with galactosemia, a rare genetic disorder where the infant cannot metabolize the sugar in breast milk, cannot breastfeed.

### Resources

#### BOOKS

La Leche League International *The Womanly Art of Breastfeeding*New York, NY: Penguin Group, 2004

Meek, Joan Younger, MD. *American Academy of Pediatrics New Mother's Guide to Breastfeeding*New York, NY: Bantam Dell, 2005

Sears, William, MD. and Sears, Martha, RN. *The Baby Book: everything you need to know about your baby-from birth to age two*Boston, MA: Little, Brown and Company, 2003

#### ORGANIZATIONS

The American Academy of Pediatrics, 141 Northwest Point Boulevard, Elk Grove Village, IL 60007-1098. (847) 434-4000. <http://www.aap.org>.

Centers for Disease Control and Prevention (CDC), 1600 Clifton Rd, Atlanta, GA 30333. (800) 311-3435. <http://www.cdc.gov/>.

La Leche League International, PO Box 4079, Schaumburg, IL 60168-4079. (800) LALECHE. <http://www.lalecheleague.org>.

United Nations Children Fund (UNICEF), 3 United Nations Plaza, New York, NY 10017 (United States address). (212) 686-5522. <http://www.unicef.org>.

World Health Organization, Department of Child and Adolescent Health and Development (CAH), Avenue Appia 20, CH-1211 Geneva 27, Switzerland. (+00 41 22) 791 21 11. <http://www.who.int/child-adolescent-health/index.htm>.

Jennifer L. Byrnes

British diet *see* **Northern European diet**

# British Heart Foundation diet

## Definition

The British Heart Foundation diet is a three day diet that claims to allow dieters to lose 10 pounds in three days if they follow the diet's specific meal plan. It was not created by nor is it endorsed by the British Heart Foundation.

## Origins

The origins of the British Heart Foundation diet are unclear. It was not created by the British Heart Foundation as its name implies, and the British Heart Foundation does not endorse or recommend this diet in any way. The diet seems to circulate mainly from person to person and on the internet.

It is not clear in which country the diet originated, as some versions call for Ritz Crackers (an American product), some call for Snax crackers (an Australian product), and some call for biscuits (a British term). It is probable that the diet developed in Britain because of the reference to the British Heart Foundation and because most versions call for "beetroot," which is a British term for what Americans call beets.

## Description

The British Heart Foundation diet is a diet that is intended to be done over the course of three days.

## KEY TERMS

**Calorie**—A measurement of the energy content of food, also known as a large calorie, equal to 1000 scientific calories.

**Diabetes mellitus**—A condition in which the body either does not make or cannot respond to the hormone insulin. As a result, the body cannot use glucose (sugar). There are two types, type 1 or juvenile onset and type 2 or adult onset.

**Dietary supplement**—A product, such as a vitamin, mineral, herb, amino acid, or enzyme, that is intended to be consumed in addition to an individual's diet with the expectation that it will improve health.

**Mineral**—An inorganic substance found in the earth that is necessary in small quantities for the body to maintain a health. Examples: zinc, copper, iron.

**Vitamin**—A nutrient that the body needs in small amounts to remain healthy but that the body cannot manufacture for itself and must acquire through diet.

During these three days the diet claims that a dieter can lose ten pounds if the diet is followed exactly. There are many variations of this diet, with the main differences being in which crackers or sausages are called for. These differences may reflect cultural food differences between the different places in the world that this diet has been circulated.

During this diet, the dieter is provided with a meal plan for three meals a day for each of three days. Amounts of food are specified in ounces, so to follow this diet effectively a dieter needs a kitchen scale or other means of accurately weighing food. The diet requires that dieters drink five eight-ounce glasses of **water** each day, and nothing else except the black tea or coffee specified in the meal plan. The diet says that it must be followed exactly to result in the promised weight loss.

### *Day One*

Breakfast: For breakfast the dieter must drink black coffee or tea, and eat 1/2 of a grapefruit, one slice of dry toast, and 2 teaspoons of peanut butter.

Lunch: For lunch the dieter must again drink black coffee or tea. The dieter must eat 4 ounces of tuna and one slice of dry toast.

Dinner: For dinner the dieter must eat 2 slices of any cold meat, 1 cup of string beans, 4 ounces of beets, 1 small apple, and 4 ounces of vanilla ice cream. No specific requirement is made for a drink with this meal, so only water is allowed.

### *Day Two*

Breakfast: For breakfast on day two the dieter may again drink black tea or coffee. Today the dieter must eat 1 egg (boiled or poached), 1 slice of dry toast, and 1/2 of a banana.

Lunch: For lunch the dieter must eat 4 ounces of cottage cheese and 5 crackers. The brand of cracker varies, some versions require Ritz, Tuc, Snax, or Saltine brand crackers.

Dinner: For dinner the dieter must eat 3 ounces of broccoli, 2 ounces of carrots, 1/2 of a banana, and 2 hot dogs. Some versions call for frankfurters instead of hot dogs. Dinner is again finished with 4 ounces of vanilla ice cream.

### *Day Three*

Breakfast: For breakfast the dieter may drink black tea or coffee and eat 5 crackers, 1 slice of cheddar cheese, and 1 small apple.

Lunch: Lunch on the third day is 1 hard boiled egg and 1 slice of dry toast. There is no specified drink so the dieter must drink water.

Dinner: Dinner on the last day of the diet is 4 ounces of tuna, 4 ounces of beets, 4 ounces of cauliflower, 1/2 of a melon, and 4 ounces of vanilla ice cream.

Some versions of the diet specify that the tuna must be the type packed in water, not oil, although some do not. This makes sense as tuna packed in oil can contain many more calories and many more grams of fat than the type that is packed in water. No specifications are made for whole grain toast, but whole grain bread is usually considered to be more healthy and to contain more **vitamins** and **minerals** than white bread.

## Function

This diet claims to help dieters lose 10 pounds in 3 days. It is not intended to be a long term diet, although many versions of the diet tell dieters that they can repeat the diet as often as desired, and even claim that dieters can lose up to 40 pounds in one month. The diet is not intended to be a lifestyle change, but is intended instead to be a brief, quick, weight loss tool. It does not provide any recommendations for exercise

or advice about any other lifestyle changes, such as techniques for stress reduction.

## Benefits

The British Heart Foundation diet claims that it will allow dieters to lose 10 pounds in only 3 days. Many experts suggest that if weight loss does occur this quickly, the weight lost will mainly be water weight that will be gained back when the dieter begins to eat normally again. A possible benefit however, is that losing weight quickly may help give dieters the positive outlook required to help them continue to lose weight using a more balanced approach. This psychological benefit may be undone if the weight is regained quickly after the diet is completed.

There are many benefits to losing weight if it is done at a safe, moderate pace through a combination of healthy eating and exercise. There are many conditions for which **obesity** is considered a significant risk factor, including type II diabetes and cardiovascular disease. The risk of these and other diseases may be reduced through weight loss. This is especially true for very obese people who are generally thought to be at the greatest risk. The **Sacred Heart diet** is not considered appropriate for long term weight loss, and losing 10 pounds in 3 days is not considered a moderate pace.

## Precautions

Dieters should consult a physician or other medical professional before beginning this or any other diet. Daily requirements of vitamins and minerals can differ significantly between people, depending on age, weight, gender, and the presence of certain diseases and conditions. Getting all required nutrients can be difficult when on a diet that severely limits the types or amounts of food allowed. This diet may contain as few as 700 calories a day if followed exactly. This is not considered to be a safe number of calories for weight loss unless the diet is done under a physicians's close supervision. Pregnant or **breastfeeding** women should be especially cautious because what is eaten by the mother can affect unborn or nursing babies.

## Risks

There are some risks with any diet, but following a diet that severely limits the foods the dieter is allowed to eat generally has higher risks. When a dieter consumes very few different foods it is difficult for the dieter to get all of the different vitamins and nutrients required for good health. The British Heart Foundation diet is only intended to be done over three days. Because it is a very low calorie diet, repeating this diet frequently or over an extended period may greatly increase the risk of problems relating from deficiencies of vitamins, minerals, or calories. Pregnant or breastfeeding women should be especially cautious, because even minor deficiencies can carry risks for babies who are still receiving their nutrients from their mother. Anyone beginning this, or any other very limiting diet, should consult a medical practitioner about whether a multivitamin or supplement might be appropriate for to help reduce the risk of deficiency. Multivitamins and s! upplements have their own associated risks.

### QUESTIONS TO ASK THE DOCTOR

- Is this diet safe for me?
- Is this diet the best diet to meet my goals?
- Do I have any dietary requirements this diet might not meet?
- Would a multivitamin or other dietary supplement be appropriate for me if I were to begin this diet?
- Is this diet safe for my entire family?
- Is it safe for me to follow this diet over an extended period of time?
- Are there any sign or symptoms that might indicate a problem while on this diet?

## Research and general acceptance

There have been no significant scientific studies of the safety or effectiveness of this diet. Although it is named the British Heart Foundation diet, it was not created by the British Heart Foundation, and the Foundation does not endorse or recommend it. Instead the British Heart Foundation makes recommendations for slow, healthy weight loss and weight control that involve light to moderate exercise and a well balanced, healthy diet. The recommendations endorsed by the British Heart Foundation for a healthy diet are generally similar to those provided by the United States Department of Agriculture's MyPyramid guide.

MyPyramid recommends that adults eat the equivalent of 2 to 3 cups of vegetables each day for good health. The British Heart Foundation diet may meet this requirement. Each day requires that the dieter eat two different types of vegetables at dinner.

For many people these amounts might be enough to meet the minimum requirements. Vegetables are an especially important part of any weight loss plan, as well as part of any healthy diet, because they are often low in calories but have high volume, which can help a dieter feel full and satisfied while eating fewer calories.

The British Heart Foundation diet may also meet the recommendations for fruit. MyPyramid recommends that healthy adults eat the equivalent of 1 1/2 to 2 cups of fruit per day. 1 cup of fruit is equivalent to 1 small apple, or 1 large orange. This diet includes two different types of fruit each day, one at breakfast and one at dinner. This may meet the recommendations for most people.

Dairy products are generally considered to be part of a healthy diet. MyPyramid recommends the equivalent of 3 cups of low-fat or non-fat dairy each day for healthy adults. The British Heart Foundation Diet would not meet this recommendation. The diet provides dairy, about half of which is in the form of four ounces of ice cream eaten each night. Ice cream is not considered an optimal way to get required dairy, as it is often high in fat. The diet also does not provide enough dairy, and because the dieter is not allowed to drink skim milk while on the diet there is no way for the dieter to increase dairy intake while still strictly following to the diet.

MyPyramid recommends that healthy adults eat the equivalent of 3 to 4 ounces of grains each day, of which at least half should be whole grains. This is equivalent to about one piece of whole grain bread. The British Heart Foundation diet would provide about two servings of grains per day. These are in the form of toast and crackers, which are not specified as whole grain. This would not meet the MyPyramid recommendation.

The MyPyramid recommendation for the meat and beans group is that healthy adults eat between 5 and 6 1/2 ounces of food from this group each day. One egg or one tablespoon of peanut butter are equivalent to about one ounce from this group. The British Heart Foundation diet may provide dieters with enough servings from this food group.

The diet requires dieters to drink five eight-ounce glasses of water each day, and nothing else except for the drinks required by the meal plan. Generally it is recommended that adults drink eight eight-ounce glasses of water each day, so this diet would not meet this recommendation.

The British Heart Foundation diet does not include any recommendations for exercise. In 2007, the Center for Disease Control recommended that healthy adults get at least 30 minutes per day of light to moderate exercise. Regular exercise has been shown to have many health benefits including decreasing the risk of cardiovascular disease. Additionally, studies have shown that regular exercise can help dieters manage their weight. Plans that include diet and exercise together have been shown to help dieters lose more weight than just diet or exercise done alone.

### Resources

#### BOOKS

Shannon, Joyce Brennfleck ed. *Diet and Nutrition Sourcebook*. Detroit, MI: Omnigraphics, 2006.

Willis, Alicia P. ed. *Diet Therapy Research Trends*. New York: Nova Science, 2007.

#### ORGANIZATIONS

American Dietetic Association. 120 South Riverside Plaza, Suite 2000, Chicago, Illinois 60606-6995. Telephone: (800) 877-1600. Website: <http://www.eatright.org>

#### OTHER

*British Heart Foundation* 2007. <http://www.bhf.org.uk> (April 7, 2007).

*Get the Skinny on Diets* 2007. <http://www.skinnyondiets.com> (March 26, 2007).

Helen M. Davidson

# Bulimia nervosa

## Definition

Bulimia nervosa is an eating disorder that involves repeated **binge eating** followed by purging the body of calories to avoid gaining weight. The person who has bulimia has an irrational fear of gaining weight and a distorted **body image**. Bulimia nervosa can have potentially fatal health consequences.

## Description

Bulimia is an eating disorder whose main feature is eating an unreasonably large amount of food in a short time, then following this binge by purging the body of calories. Purging is most often done by self-induced vomiting, but it can also be done by laxative, enema, or diuretic abuse. Alternately, some people with bulimia do not purge but use extreme exercising and post-binge fasting to burn calories. This can lead to serious injury. Nonpurging bulimia is sometimes called exercise bulimia. Bulimia nervosa is officially recognized as a psychiatric disorder in the *Diagnostic*

**Effects of bulimia on the body**

| | |
|---|---|
| Blood | Anemia |
| Body fluids | Dehydration<br>Low potassium, magnesium, and sodium |
| Brain | Anxiety<br>Depression<br>Dizziness<br>Fear of gaining weight<br>Low self-esteem<br>Shame |
| Cheeks | Soreness<br>Swelling |
| Heart | Heart failure<br>Heart muscle weakened<br>Irregular heart beat<br>Low pulse and blood pressure |
| Intestines | Abdominal cramping<br>Bloating<br>Constipation<br>Diarrhea<br>Irregular bowel movements |
| Hormones | Irregular or absent period |
| Mouth | Cavities<br>Gum disease<br>Teeth sensitive to hot and cold food<br>Tooth enamel erosion |
| Muscles | Fatigue |
| Skin | Abrasion of knuckles<br>Dry skin |
| Stomach | Delayed emptying<br>Pain<br>Rupture<br>Ulcers |
| Throat and esophagus | Blood in vomit<br>Soreness and irritation<br>Tears and ruptures |

SOURCE: National Women's Health Information Center, Office on Women's Health, U.S. Department of Health and Human Services

*(Illustration by GGS Information Services/Thomson Gale.)*

*and Statistical Manual for Mental Disorders Fourth Edition-Text Revision (DSM-IV-TR)* published by the American Psychiatric Association.

Bulimia nervosa is diagnosed when most of the following conditions are present:

- Repeated episodes of binge eating followed by behavior to compensate for the binge (i.e. purging, fasting, over-exercising). Binge eating is defined as eating a significantly larger amount of food in a limited time than most people typically would eat.
- Binge/purge episodes occur at least twice a week for a period of three or more months.
- The individual feels unable to control or stop an eating binge once it starts and will continue to eat even if uncomfortably full.
- The individual is overly concerned about body weight and shape and puts unreasonable emphasis on physical appearance when evaluating his or her self-worth.
- Bingebingeinging and purging does not occur exclusively during periods of anorexia nervosa.

Many people with bulimia will consume 3,000–10,000 calories in an hour. For example, they will start out intending to eat one slice of cake and end up eating the entire cake. One distinguishing aspect of bulimia is how out of control people with bulimia feel when they are eating. They will eat and eat, continuing even when they feel full and become uncomfortable.

Most people with bulimia recognize that their behavior is not normal; they simply cannot control it. They usually feel ashamed and guilty over their binge/purge habits. As a result, they frequently become secretive about their eating and purging. They may, for example, eat at night after the family has gone to bed or buy food at the grocery store and eat it in the car before going home. Many bulimics choose high-fat, high-sugar foods that are easy to eat and easy to regurgitate. They become adept at inducing vomiting, usually by sticking a finger down their throat and triggering the gag reflex. After a while, they can vomit at will. Repeated purging has serious physical and emotional consequences.

Many individuals with bulimia are of normal weigh, and a fair number of men who become bulimic were overweight as children. This makes it difficult for family and friends to recognize that someone suffering from this disorder. People with bulimia often lie about induced vomiting and laxative abuse, although they may complain of symptoms related to their binge/purge cycles and seek medical help for those problems. People with bulimia tend to be more impulsive than people with other **eating disorders**. Lack of impulse control often leads to risky sexual behavior, anger management problems, and alcohol and drug abuse.

A subset of people with bulimia also have **anorexia nervosa**. Anorexia nervosa is an eating disorder that involves self-imposed starvation. These people often purge after eating only a small or a normal-sized portion of food. Some studies have shown that up to 60% of people with bulimia have a history of anorexia nervosa.

Dieting is usually the trigger that starts a person down the road to bulimia. The future bulimic is very concerned about weight gain and appearance, and may constantly be on a diet. She (most people with bulimia are female) may begin by going on a rigorous low-calorie diet. Unable to stick with the diet, she then

## KEY TERMS

**Diuretic**—A substance that removes water from the body by increasing urine production.

**Electrolyte**—Ions in the body that participate in metabolic reactions. The major human electrolytes are sodium (Na+), potassium (K+), calcium (Ca 2+), magnesium (Mg2+), chloride (Cl−), phosphate ($HPO_4$ 2−), bicarbonate ($HCO_3$−), and sulfate ($SO_4$ 2−).

**Neurotransmitter**—One of a group of chemicals secreted by a nerve cell (neuron) to carry a chemical message to another nerve cell, often as a way of transmitting a nerve impulse. Examples of neurotransmitters include acetylcholine, dopamine, serotonin, and norepinephrine.

**Obsessive-compulsive disorder**—A psychiatric disorder in which a person is unable to control the desire to repeat the same action over and over.

eats voraciously far more than she needs to satisfy her hunger, feels guilty about eating, and then exercise or purges to get rid of the unwanted calories. At first this may happen only occasionally, but gradually these sessions of bingeing and purging become routine and start to intrude on the person's friendships, daily activities, and health. Eventually these practices have serious physical and emotional consequences that need to be addressed by healthcare professionals.

## Demographics

Bulimia nervosa is primarily a disorder of industrialized countries where food is abundant and the culture values a thin appearance. Internationally, the rate of bulimia has been increasing since the 1950s. Bulimia is the most common eating disorder in the United States. Overall, about 3% of Americans are bulimic. Of these 85–90% are female. The rate is highest among adolescents and college women, averaging 5–6%. In men, the disorder is more often diagnosed in homosexuals than in heterosexuals. Some experts believe that number of diagnosed bulimics represents only the most severe cases and that many more people have bulimic tendencies, but are successful in hiding their symptoms. In one study, 40% of college women reported isolated incidents of bingeing and purging.

Bulimia affects people from all racial, ethnic, and socioeconomic groups. The disorder usually begins later in life than anorexia nervosa. Most people begin bingeing and purging in their late teens through their twenties. Men tend to start at an older age than women. About 5% of people with bulimia begin the behavior after age 25. Bulimia is uncommon in children under age 14.

Competitive athletes have an increased risk of developing bulimia nervosa, especially in sports where weight it tied to performance and where a low percentage of body fat is highly desirable. Jockeys, wrestlers, bodybuilders, figure skaters, cross-country runners, and gymnasts have higher than average rates of bulimia. People such as actors, models, cheerleaders, and dancers who are judged mainly on their appearance are also at high risk of developing the disorder. This same group of people is also at higher risk for developing anorexia nervosa. Some people are primarily anorexic and severely restrict their calorie intake while also purging the small amounts they do eat. Others move back and forth between anorectic and bulimic behaviors.

## Causes and symptoms

Bulimia nervosa is a complex disorder that does not have a single cause. Research suggests that some people have a predisposition toward bulimia and that something then triggers the behavior, which then becomes self-reinforcing. Hereditary, biological, psychological and social factors all appear to play a role.

### *Causes*

- Heredity. Twin studies suggest that there is an inherited component to bulimia nervosa, but that it is small. Having a close relative, usually a mother or a sister, with bulimia slightly increases the likelihood of other (usually female) family members developing the disorder. However, when compared other inherited diseases or even to anorexia nervosa, the genetic contribution to developing this disorder appears less important than many other factors. Family history of depression, alcoholism, and obesity also increase the risk of developing bulimia.
- Biological factors. There is some evidence that bulimia is linked low levels of serotonin in the brain. Serotonin is a neurotransmitter. One of its functions is to help regulate the feeling of fullness or satiety that tells a person to stop eating. Neurotransmitters are also involved in other mental disorders such as depression that often occur with bulimia. Other research suggests that people with bulimia may have abnormal levels of leptin, a protein that helps regulate weight by telling the body to take in less food. Research in this area is relatively new, and the findings are still unclear.

- Psychological factors. Certain personality types appear to be more vulnerable to developing bulimia. People with bulimia tend to have poor impulse control. They are of often involved in risky behavior such as shoplifting, drug and alcohol abuse and risky sexual activities. People with bulimia have low-self worth and depend on the approval of others to feel good about themselves. They are aware that their behavior is abnormal. After a binge/purge session, they are ashamed and vow never to repeat the cycle, but the next time they are unable to control the impulse to eat and purge. They also tend to have a black-or-white, all-or-nothing way of seeing situations. Major depression, obsessive-compulsive disorder, and anxiety disorders are more common among individuals who are bulimic.
- Social factors. The families of people who develop bulimia are more likely to have members who have problems with alcoholism, depression, and obesity. These families also tend to have a high level of open conflict and disordered, unpredictable lives. Often something stressful or upsetting triggers the urge to diet stringently and then begin binge/purge behaviors. This may be as simple as a family member as teasing about the person's weight, nagging about eating junk food, commenting on how clothes fit, or comparing the person unfavorably to someone who is thin. Life events such as moving, starting a new school, and breaking up with a boyfriend can also trigger binge/purge behavior. Overlaying the family situation is the false, but unrelenting, media message that thin is good and fat is bad; thin people are successful, glamorous, and happy, fat people are stupid, lazy, and failures.

### *Signs and symptoms*

Binge/purge cycles have physical consequences. These include:

- teeth damaged from repeated exposure to stomach acid from vomiting; eroded tooth enamel;
- swollen salivary glands; sores in mouth and throat
- dehydration
- sores or calluses on knuckles or hands from using them to induce vomiting
- electrolyte imbalances revealed by laboratory tests
- dry skin
- fatigue
- irregular or absent menstrual cycles in women
- weight, heart rate and blood pressure may be normal

## Diagnosis

Diagnosis is based on several factors including a patient history, physical examination, the results of laboratory tests, and a mental status evaluation. A patient history is less helpful in diagnosing bulimia than in diagnosing many diseases because many people with bulimia lie about their bingeing and purging and their use of laxatives, enemas, and medications. The patient may, however, complain about related symptoms such as fatigue or feeling bloated. Many people with bulimia express extreme concern about their weight during the examination.

A physical examination begins with weight and blood pressure and moves through the body looking for the signs listed above. Based on the physical exam and patient history, the physician will order laboratory tests. In general these tests will include a complete blood count (CBC), urinalysis, and blood chemistries (to determine electrolyte levels). People suspected of being exercise bulimic may need to have x rays to look for damage to bones from over-exercising.

Several different evaluations can be used to examine a person's mental state. A doctor or **mental health** professional will assess the individual's thoughts and feelings about themselves, their body, their relationships with others, and their risk for self-harm.

## Treatment

Treatment choices depend on the degree to which the bulimic behavior has resulted in physical damage and whether the person is a danger to him or herself. Hospital impatient care may be needed to correct severe electrolyte imbalances that result from repeated vomiting and laxative abuse. Electrolyte imbalances can result in heart irregularities and other potentially fatal complications. Most people with bulimia do not require hospitalization. The rate of hospitalization is much lower than that for people with anorexia nervosa because many bulimics maintain a normal weight.

Day treatment or partial hospitalization where the patient goes every day to an extensive treatment program provides structured mealtimes, nutrition education, intensive therapy, medical monitoring, and supervision. If day treatment fails, the patient may need to be hospitalized or enter a full-time residential treatment facility.

Outpatient treatment provides medical supervision, nutrition counseling, self-help strategies, and psychotherapy. Self-help groups receive mixed reviews from healthcare professionals who work with bulimics. Some groups offer constructive support in stopping the

binge/purge cycle, while others tend to reinforce the behavior.

Drug therapy helps many people with bulimia. Selective serotonin reuptake inhibitors (SSRIs) such as fluoxetine (Prozac) and sertraline (Zoloft) have been approved by the United States Food and Drug Administration (FDA) for treatment of bulimia. These medications increase serotonin levels in the brain and are thought to affect the body's sense of fullness. They are used whether or not the patient shows signs of depression. Drug treatment should always be supplemented with psychotherapy. (see Therapies below).

Other drugs are being explored for use in the treatment of bulimia. Individuals with bulimia interested in entering a clinical trial at no cost can find a list and description of clinical trials currently enrolling volunteers at <http://www.clinicaltrials.gov>.

## Nutrition/Dietetic concerns

A nutrition consultant or dietitian is part of the team needed to successfully treat bulimia. These professionals usually do a dietary review along with nutritional counseling so that the recovering bulimic can plan healthy meals and develop a healthy relationship with food.

## Therapy

Medical intervention helps alleviate the immediate physical problems associated with bulimia. Medication can help the person with bulimia break the binge/purge cycle. However drug therapy alone rarely produces recovery. Psychotherapy plays a major role helping the individual with bulimia recover from the disorder. Several different types of psychotherapy are used depending on the individual's situation. Generally, the goal of psychotherapy is help the individual change his or her behavior and develop a healthy attitude toward their body and food.

Some types of psychotherapy that have been successful in treating people with bulimia are listed below.

- Cognitive behavior therapy (CBT) is designed to confront and then change the individual's thoughts and feelings about his or her body and behaviors toward food, but it does not address why those thoughts or feelings exist. Strategies to maintain self-control may be explored. This therapy is relatively short-term. CBT is often the therapy of choice for people with bulimia, and it is often successful at least in the short term.
- Interpersonal therapy is short-term therapy that helps the individual identify specific issues and problems in relationships. The individual may be asked to look back at his or her family history to try to recognize problem areas and work toward resolving them. Interpersonal therapy has about the same rate of success in people with bulimia as CBT.
- Family and/or couples therapy is helpful in dealing with conflict or disorder that may be a factor in triggering binge/purge behavior at home.
- Supportive-expressive therapy or group therapy may be helpful in addition to other types of therapy.

## Prognosis

The long-term outlook for recovery from bulimia is mixed. About half of all bulimics show improvement in controlling their behavior after short-term interpersonal or cognitive behavioral therapy with nutritional counseling and drug therapy. However, after three years, only about one-third are still doing well. Relapses are common, and binge/purge episodes and bulimic behavior often comes and goes for many years. Stress seems to be a major trigger for relapse.

The sooner treatment is sought, the better the chances of recovery. Without professional intervention, recovery is unlikely. Untreated bulimia can lead to death directly from causes such as rupture of the stomach or esophagus. Associated problems such as substance abuse, depression, anxiety disorders, and poor impulse control also contribute to the death rate.

## Prevention

Some ways to prevent bulimia nervosa from developing are as follows:

- If you are a parent, do not obsess about your own weight, appearance, and diet in front of your children.
- Do not tease your children about their body shapes or compare them to others.
- Make it clear that you love and accept your children as they are.
- Try to eat meals together as a family whenever possible.
- Remind children that the models they see on television and in fashion magazines have extreme, not normal or healthy bodies.
- Do not put your child on a diet unless advised to by your pediatrician.
- Block your child from visiting pro-bulimia Websites. These are sites where people with bulimia give advice

on how to purge and support each other's binge/purge behavior.

- If your child is a competitive athlete, get to know the coach and the coach's attitude toward weight.
- be alert to signs of low self-worth, anxiety, depression, and drug or alcohol abuse and seek help as soon as these signs appear.
- If you think your child has an eating disorder, do not wait to intervene and the professional help. The sooner the disorder is treated, the easier it is to cure.

Relapses happen to many people with bulimia. People who are recovering from bulimia can help prevent themselves from relapsing by:

- never dieting; instead plan healthy meals
- eating with other people, not alone.
- staying in treatment; keep therapy appointments
- monitoring negative self-talk; practicing positive self-talk
- spending time doing something enjoyable every day
- staying busy, but not overly busy; getting at least seven hours of sleep each night
- spending time each day with people you care about and who care about you

## Resources

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American Psychological Association. 750 First Street, NE, Washington, DC 20002-4242. Telephone: (800) 374-2721; (202) 336-5500. TDD/TTY: (202)336-6123. Website: <http://www.apa.org>

National Association of Anorexia Nervosa and Associated Disorders (ANAD). P.O. Box 7 Highland Park, IL 60035. Telephone: (847) 831-3438. Website: <http://www.anad.org>

National Eating Disorders Association. 603 Stewart Street, Suite 803, Seattle, WA 98101. Help and Referral Line: (800) 931-2237. Office Telephone: (206) 382-3587. Website: <http://www.edap.org>


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Tish Davidson, A.M.

# C

## Cabbage soup diet

### Definition

The cabbage soup diet is a quick weight loss program intended to be followed for seven days. The centerpiece of the diet is a recipe for cabbage soup, which the dieter may consume in unlimited quantities. In addition to the cabbage soup, there are certain other foods the dieter must eat on specific days during the week. There are several versions of the diet, most of which promise a 10-17 lb weight loss during the week.

The cabbage soup diet has a number of other names:

- TWA Stewardess Diet
- Model's Diet
- Dolly Parton Diet
- Military Cabbage Soup Diet
- Mayo Clinic Diet
- Sacred Heart Hospital Diet
- Miami Heart Institute Diet
- Spokane Diet
- Fat Burning Diet
- T. J.'s Miracle Soup Diet
- The Skinny

### Origins

The cabbage soup diet may be the oldest fad diet still in use; it seems to resurface with a new name every 10 to 15 years. It has been described by some historians of popular culture as a good example of an urban legend—a type of modern folklore passed from person to person via word of mouth, photocopies, or e-mail. Urban legends are often stories or anecdotes, but some can be called "widely accepted misinformation."

No one seems to know when the cabbage soup diet was first formulated or the identity of its originator. According to the American Dietetic Association's timeline of **fad diets**, the cabbage soup diet originated around 1950, but it may date back even earlier. There is a recipe for "Doughboy Cabbage Soup" dating back to World War I (1914–1918), when American soldiers fighting in France had few other vegetables available and eating cabbage offered protection against scurvy, a deficiency disease caused by inadequate **vitamin C** in the diet. The name "Military Cabbage Soup Diet" is likely derived from the World War I soup recipe, although that early recipe lacked the tomatoes, bouillon cubes, and other seasonings included in recent versions of the diet.

After the 1950s, the cabbage soup diet was revived in the early 1980s not only as the Dolly Parton Diet but also as the Trans World Airlines (TWA) Stewardess Diet and the Model's Diet. It acquired these names because of the belief that celebrities, models, and flight attendants had to meet rigorous periodic weight check-ins in order to keep their jobs. The cabbage soup diet was passed around from person to person in the form of photocopies during this period. It often claimed that the dieter would lose 10-17 lb during the first week either because cabbage supposedly has no calories at all or because it contains a "miracle fat-burning" compound.

The cabbage soup diet reappeared in the mid-1990s, when fax machines and the Internet made it easy for people to transmit copies of the diet to friends and workplace colleagues. The diet was also published in magazines such as *Cosmopolitan* and *Gentlemen's Quarterly* (now *GQ*) in 1995. The diet was attributed to health associations as well as the cardiology departments of several hospitals and medical centers in this period. These institutions supposedly gave the diet to overweight patients preparing for heart surgery to help them to lose weight quickly before their operations. Thus, the diet acquired such names as the **Sacred Heart diet** or the Spokane diet (from the names of hospitals in Brussels, Belgium, Montreal, Quebec, and

## KEY TERMS

**Flatulence**—The medical term for intestinal gas expelled through the anus.

**Scurvy**—A deficiency disease caused by a lack of dietary vitamin C, characterized by spongy gums, eventual loss of teeth, and bleeding into the skin and mucous membranes.

**Urban legend**—A story, anecdote, or piece of advice based on hearsay and circulated by person-to-person transmission.

Spokane, Washington), the American Heart Association Diet, the **Mayo Clinic Diet**, and the Miami Heart Institute Diet.

## Description

### *Cabbage soup recipes*

Most versions of the cabbage soup diet begin with a recipe for the soup. One change that has evolved since the diet first appeared in the 1950s is the cooking instructions; the earliest versions of the diet recommended cooking the soup for an hour, which would destroy most of the nutrients in the cabbage and other ingredients. Recent soup recipes recommend simmering the soup no more than 10 to 15 minutes after being brought to a boil.

**STANDARD RECIPE.** Ingredients:

- 6 large green onions
- 2 green peppers
- 1 or 2 cans diced tomatoes
- 1 bunch of celery
- 1 envelope of dry onion soup mix
- 1 or 2 bouillon cubes (some versions specify low-sodium vegetable flavor) if desired
- 1 large head of cabbage
- 1 8-oz can of V-8 juice (optional)

Preparation of the soup is simple. Vegetables are cut into small pieces and covered with **water** (and V-8, if desired) in a large pot. The mixture is brought to a boil and simmered for 10 to 15 minutes or until vegetables are tender. Parsley, Worcestershire sauce, and/or black pepper may be added to taste.

**MILITARY DIET RECIPE.** Ingredients:

- 2 13-ounce cans of chicken broth
- 1 large bunch of celery
- 2 bunches of spring onions
- 1 large head of cabbage
- 1 large can of whole tomatoes
- 3 large bell peppers
- Salt and pepper to taste

Considered the original cabbage soup recipe on some websites, this version is prepared by cutting vegetables into small pieces and covering them with chicken broth and canned tomatoes in a large pot. The mixture is cooked over low heat for 15 minutes.

**GREEN CABBAGE SOUP RECIPE.** Ingredients:

- One-half of a green cabbage, chopped
- 3 large onions, diced
- 1 large green pepper, sliced
- 1 cup fresh mushrooms, washed and sliced
- 1 or 2 cups washed fresh spinach leaves
- 1 can of diced tomatoes
- 1 envelope of dry onion soup mix
- 3 vegetable-flavored bouillon cubes
- 8 to 12 cups of water
- Oregano, cilantro, garlic powder, basil, pepper, and/or parsley to taste

Preparation involves combining vegetables in a large pot with water, soup mix, bouillon cubes, and canned tomatoes. Additional water may be added if needed to fully cover the vegetables. The mixture is cooked over low heat about 15 minutes or until the vegetables are soft.

### *Cabbage soup diet plan*

Dieters are supposed to follow specific menus for each day of the diet, with the understanding that an unlimited amount of cabbage soup can be eaten each day.

- Day One: Eat only the cabbage soup and all the fruit you want (except bananas). Cantaloupe and watermelon are recommended. Permissible drinks are water, black coffee, cranberry juice, or unsweetened tea.
- Day Two: No fruit. Raw or cooked vegetables can be eaten in unlimited quantity along with the soup, except for corn, peas, and beans. A baked potato with butter can be eaten at dinnertime.
- Day Three: Unlimited fruit or vegetables, but no baked potato.
- Day Four: Eat at least three and as many as eight bananas, and drink an unlimited amount of skim milk. Day Four is supposed to curb a desire for sweets.
- Day Five: Eat 10-20 oz of beef and up to six fresh tomatoes (or one can of stewed tomatoes. Cabbage soup must be eaten for at least one meal. Drink 6-8

glasses of water to flush acids from the body. Baked or broiled chicken (without the skin) or fish may be substituted for beef at one meal.

- Day Six: Eat cabbage soup at least once during the day; otherwise, an unlimited amount of beef and vegetables can be consumed, but no baked potato.
- Day Seven: Eat an unlimited amount of brown rice and vegetables and drink an unlimited amount of unsweetened fruit juice. Cabbage soup must be eaten at least once during the day. No bread, alcohol, or carbonated beverages (including diet soda) are allowed.

#### *Additional instructions*

Some Internet versions of the cabbage soup diet include additional instructions for the dieter:

- Follow the diet religiously
- Drink at least four glasses of water each day
- Only follow the diet for seven days
- Eat unlimited amounts of cabbage soup to prevent hunger
- Take a good multivitamin supplement every day
- Try different spices to liven up the soup and add variety

#### *Cabbage soup diet pills*

Diet pills available on the Internet supposedly represent the cabbage soup used in the diet in dehydrated form. Discovery of the pills is credited to a woman who works in a food processing plant that makes meals ready to eat (MREs) for the military. She is said to have tried dehydrating cabbage soup in the ovens for preparing MREs and ended up with a powder that tasted like the original soup when warm water was added. A local manufacturer of homeopathic remedies supposedly began packaging the powder in pill form. The cabbage soup diet pills claim to speed up weight loss, melt fat, curb appetite, cure depression, detoxify the digestive tract, boost the immune system, and protect against **cancer**.

## Function

The cabbage soup diet is intended only for short-term weight loss. It is usually recommended as a quick way to lose weight after holiday-related overeating or to fit into an outfit for a special occasion. A few Internet versions claim the cabbage soup diet can be used for weight maintenance or for long-term nutrition. A book published on the diet in 1997 and revised in 2004 does contain an appropriate maintenance diet intended for use after the seven-day soup diet.

## Benefits

The cabbage soup diet does work for some people as a short-term way to lose weight rapidly. Some people like the fact that the diet offers a break from junk food or fast food, and does not require any unusual or expensive ingredients, complex recipes, or appetite suppressants. Also, the soup can be stored in the refrigerator for convenience or frozen for later use.

## Precautions

The cabbage soup diet is safe for most adults in good health who follow it no longer than seven days. The diet should not be used by individuals with type 2 diabetes, **eating disorders**, or other disorders requiring special diets without consulting a doctor or registered dietitian. Dieters who do use this diet should be aware that most of the weight they lose during the week is water weight, and is easily regained when return to their previous eating habits.

Due to the restrictive and repetitive nature of this diet, it is difficult to sustain for any length of time. Such diets are not useful for long-term weight loss and weight maintenance. Frequent use could lead to yo-yo dieting, which has been shown to be detrimental to health.

The cabbage soup diet does not include an adequate balance of nutrients and may be too low in calories to make it suitable for long-term use. Claims that the diet can be used indefinitely or repeated within three days of completing the first cycle should be ignored as they are not safe.

The diet does not require spending large amounts of time cooking or assembling ingredients, but it may be difficult to follow when cooking for a family.

## Risks

Side effects from the diet may include dizziness, light-headedness, and flatulences (intestinal gas). The latter may be a social risk due to embarrassment related to passing gas in public. Common versions of the soup recipe are high in salt. Dieters who must restrict their **sodium** intake should discuss variations with their physician.

## Research and general acceptance

#### *Basic nutritional information about cabbage*

The cabbage soup diet has not been the subject of any mainstream clinical trials as of 2007, most likely because it is a classic fad diet. Cabbage by itself, however, has been studied by nutritionists and food chemists for some years, and is considered a good food to include in

## QUESTIONS TO ASK YOUR DOCTOR

- Do you have any patients who have tried the cabbage soup diet?
- In your opinion, is this diet safe to use for a week as long as it is not repeated?
- Can someone with high blood pressure use this diet as long as they are taking prescription medications for that condition?

any healthful and well-balanced diet. The cabbage used as food by modern humans, *Brassica oleracea*, was developed from a variety of wild mustard native to southern Italy and France several centuries before the Christian era. It was eaten both raw and cooked by the ancient Greeks and Romans. Ancient physicians used a paste made from raw cabbage to reduce inflammation surrounding a wound. Cabbage is a cool-weather crop that can be harvested in 50 to 80 days, which helps explain why it is a dietary staple in northern and central Europe as well as in Korea and other parts of Asia.

According to the U.S. Department of Agriculture (USDA) database, raw cabbage contains 20 calories per 100g (about 3-1/2 oz), 5.6g of **carbohydrates**, and 32mg of vitamin C—about 53% of an adult's daily requirement. The carbohydrate content includes 3.2g of sugars per 100g, which are released during cooking, and 2.3g of dietary **fiber**. Thus, the cabbage soup diet does make use of some scientific findings about the nutritional value and low calorie content of cabbage: the short period of cooking recommended by the soup recipe helps remove the bitter taste of raw cabbage without destroying its dietary fiber or **vitamins**.

### *Evaluations of the cabbage soup diet*

The American Heart Association (AHA) and the hospitals whose names have been associated with the cabbage soup diet have issued formal disclaimers warning the public that they do not endorse this diet. The Hôpital du Sacré-Coeur de Montréal states in its 2004 press release that the diet is contrary to healthy feeding patterns and even presents potential dangers to good health. The Sacred Heart Medical Center (SHMC) in Spokane requests that people do not affiliate the diet with their hospital as they do not consider it a safe or healthy method of weight loss. A SHMC disclaimer states, "This diet did not originate at SHMC and it is not endorsed by the dietitians or the staff of our cardiac rehabilitation program. One of our major concerns about this diet plan is it emphasizes the consumption of fruits and vegetables while excluding the consumption of meat or fish, cereal grains and milk products on most days. Any diet that focuses on only certain food groups will be low or deficient in essential nutrients and, therefore, lead to poor nutritional status long-term. Our experience with any low calorie diets like this one is that they do not lead to permanent weight loss. Once individuals start eating in a more normal pattern, the weight is regained. A very important factor in obtaining a healthy weight is to evaluate your physical activity and other lifestyle concerns. This is most appropriately done by consulting with a registered dietitian."

Scientific evidence is not yet available to support claims that cabbage has unique detoxifying, fat-burning, immunoprotective, antidepressant, or anticancer properties. Claims regarding the possibility of losing 17 pounds by the end of one week on this diet are exaggerated. In addition, there is no indication that the government of Australia (or any other government) has ever sponsored clinical trials of cabbage soup, whether in pill form or fully constituted.

## Resources

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**ORGANIZATIONS**

American Dietetic Association (ADA). 120 South Riverside Plaza, Suite 2000, Chicago, IL 60606-6995. Telephone: (800): 877-1600. Website: <http://www.eatright.org>.

Cabbage Soup Diet Pills. P.O. Box 1388, Cordova, TN 38088. Telephone: (901) 737-4138. Website: <http://www.cabbagesoupdietpill.com/index.html>.

Dietitians of Canada. 480 University Avenue, Suite 604, Toronto, Ontario, Canada M5G 1V2. Telephone: (416) 596-0857. Website: <http://www.dietitians.ca>.

Partnership for Healthy Weight Management (PHWM), c/o Federal Trade Commission (FTC), Bureau of Consumer Protection. 601 Pennsylvania Avenue, NW, Room 4302, Washington, DC. 20580. Website: <http://www.consumer.gov/weightloss/>.

Rebecca J. Frey, PhD

**Caffeine**

| Product | Amount of caffeine (mg) |
|---|---|
| Cocaine energy drink, 8.5 oz. | 280 |
| Caffeine tablet, 1 | 200 |
| Coffee, brewed 8 oz. | 135 |
| Red Bull energy drink, 8.5 oz. | 80 |
| SoBe No Fear energy drink, 8 oz. | 80 |
| Excedrin headache tablet, 1 | 65 |
| Mountain Dew, 1 can, 12 oz. | 55 |
| Black tea, brewed, 8 oz. | 50 |
| Diet Coke, 1 can, 12 oz. | 45 |
| Sunkist Orange, regular or diet, 1 can, 12 oz. | 41 |
| Coffee, espresso, 1 oz. | 40 |
| Pepsi Cola, 1 can, 12 oz. | 37 |
| Coca-Cola Classic, 1 can, 12 oz. | 34 |
| Hershey's Special Dark chocolate, 1 bar, 1.5 oz. | 31 |
| Barq's Root Beer, 1 can, 12 oz. | 22 |
| Green tea, brewed, 8 oz. | 15 |
| Hershey's Milk Chocolate, 1 bar, 1.5 oz. | 10 |
| Coffee, decaffeinated, 8 oz. | 5 |
| Tea, decaffeinated, 8 oz. | 4 |
| Diet Barq's Root Beer, 1 can, 12 oz. | 0 |
| Sprite, diet or regular, 1 can, 12 oz. | 0 |
| 7-Up, 1 can, 12 oz. | 0 |

*(Illustration by GGS Information Services/Thomson Gale.)*

# Caffeine

## Definition

Caffeine is a mild alkaloid stimulant made by some plants. It is found in coffee beans, tea leaves, and cocao beans, added to soft drinks, energy drinks, energy bars, and sold in capsules and tablets as a dietary supplement. Caffeine has no nutritional value.

## Purpose

Caffeine is a mild stimulant. It is used to temporarily relieve fatigue and increase mental alertness. Caffeine is added to some antihistamine drugs to help counteract the sleepiness they may cause. It is also added to over-the-counter headache remedies (e.g., Excedrin) and migraine headache drugs to enhance their painkilling effects. Under medical supervision, citrated caffeine (a prescription drug) is used to treat breathing problems in premature infants.

## Description

Caffeine, from the Italian word cafée, meaning coffee, is naturally made by about 60 plants. The most familiar of these are coffee leaves and beans, tea leaves, kola nuts, yerba mate, guarana berries, and cacao (the source of chocolate). In plants, caffeine is a pesticide. Insects eating plants that contain caffeine become disabled or die.

Humans have eaten plants containing caffeine for thousands of years; first chewing the seeds and leaves, and later boiling them and drinking the resulting liquid. Coffee, a major source of caffeine, was introduced to Europe from the Middle East in the seventeenth century and rapidly became a popular drink. Coffee houses began appearing in London in the mid-1600s. A German chemist purified caffeine in 1819. Today, besides being found naturally in coffee, tea, and chocolate, it is added to soft drinks, energy drinks and bars, headache remedies, and is sold as a dietary supplement to improve mental and physical functioning. The United States is a highly caffeinated nation. In 2007, it was estimated that 90% of North Americans consumed caffeine daily.

Caffeine is the most widely used psychoactive compound in the world. It has no nutritional value, but has these effects on the body:

- increases heart rate
- temporarily increases blood pressure
- increases urine output (a diuretic)
- relaxes smooth muscle cells in the airways
- releases fatty acids and glycerol in the body for energy use
- easily crosses the blood-brain barrier and changes the level of neurotransmitters in the brain
- passes into breast milk

Caffeine is absorbed in the stomach. Its effects are noticeable in about 15 minutes and usually last several hours. However, there is huge variation among people

both in their sensitivity to caffeine and in how long it stays in their bodies. Although the average time it takes half a dose of caffeine to be eliminated from the body is three to four hours, this time may extend to six hours in women taking oral contraceptives, and be much longer in pregnant women and in people with liver damage.

Many well-designed, well-documented studies show that caffeine makes people more alert, improves short-term memory, enhances the ability to concentrate, increases the individual's capacity for physical work and speeds up reaction time. However, caffeine achieves this by preventing detrimental effects of withdrawal in habitual caffeine drinkers. It does not boost functioning to above normal levels. All these effects are temporary. Caffeine does not replace the need for rest or sleep.

Caffeine is on the United States Food and Drug Administration (FDA) list of foods generally recognized as safe (GRAS list). In moderate amounts, caffeine does not appear to be harmful to humans, although it is poisonous to dogs, horses, and some birds. "Moderate" generally means consumption in the rage of 300–400 mg or 3–4 cups of coffee daily. Caffeine has not been shown to cause birth defects and is considered safe in reasonable amounts during pregnancy. The March of Dimes Birth Defects Foundation recommends that pregnant women limit their caffeine intake to the equivalent of two cups of coffee per day, and that women who are having difficulty becoming pregnant eliminate caffeine from their diet.

By law, caffeine must be listed as an ingredient on food labels, but the amount of caffeine per serving is not required to be disclosed. Since caffeine is added to so many products, it is difficult to the amount of caffeine in an individual's diet. Caffeine content of coffees and teas varies depending on where the plants were grown and how the beverages are prepared. The approximate amounts of caffeine is some common products are:

- coffee, brewed 8 oz: 135 mg
- coffee, decaffeinated, 8 oz: 5 mg
- coffee, espresso, 1 oz: 40 mg
- green tea, brewed, 8 oz: 15 mg
- black tea, brewed, 8 oz: 50 mg
- tea, decaffeinated, 8 oz: 4 mg
- Mountain Dew, 1 can (12 oz): 55 mg
- Coca-Cola Classic, 1 can (12 oz): 34 mg
- Diet Coke: 1 can (12 oz) 45 mg
- Pepsi Cola, 1 can (12 oz): 37 mg
- Sunkist Orange, regular or diet, 1 can (12 oz): 41 mg
- Barq's Root Beer: 1 can (12 oz): 22 mg
- diet Barq's Root Beer: 1 can (12 oz): 0 mg
- Sprite, diet or regular: 1 can (12 oz) 0 mg
- 7-Up, 1 can (12 ounces): 0 mg
- Red Bull energy drink, 8.5 oz: 80 mg
- Cocaine energy drink, 8.5 oz: 280 mg
- SoBe No Fear energy drink, 8 oz: 80 mg
- Hershey's Special Dark chocolate, 1 bar (1.5 oz): 31 mg
- Hershey's Milk Chocolate, 1 bar (1.5 oz): 10 mg
- Excedrin headache tablet, 1: 65 mg
- caffeine tablet, 1: 200 mg

## Precautions

People vary in their sensitivity to caffeine based on their weight, age, medications they may be taking, and personal biology. Individuals should be alert to how much caffeine they consume during a day and how it makes them feel, then moderate their intake accordingly. Caffeine does not replace the need for sleep. All mental and physical benefits are temporary and a "crash" is likely to occur after a dose of caffeine wears off. People who use caffeine to stay awake to drive or operate heavy machinery are at risk of being involved in an accident because of excessive tiredness once the effect of caffeine wears off.

Caffeine stays in the system of pregnant women and people with liver damage longer than normal. These people should closely monitor their caffeine intake.

Caffeine passes into breast milk and although it may have no effect on the **breastfeeding** woman, it may make the infant restless, irritable, and less likely to sleep.

Athletes should be aware that the International Olympic Committee tests for caffeine levels over 12 mg/ml of urine. This level could be reached by drinking four large cups of coffee.

## Interactions

Caffeine appears to enhance the effectiveness of over-the-counter headache remedies. Some of these medications contain a mixture of caffeine and painkiller. People with a high sensitivity to caffeine should read the labels carefully.

People taking diuretic medication (**water** pills) may see increased urine output because caffeine is a weak diuretic.

## Complications

Although caffeine in moderate amounts poses no major health risks, the body quickly develops tolerance

to the effects of caffeine, along with a mild physical and psychological dependency. For example, tolerance to caffeine-related sleep disruption disappears in about a week among people who drink 3–4 cups of coffee daily. The amount of caffeine it takes to reach this state is highly variable.

Discontinuing caffeine among regular users causes withdrawal symptoms. These can include headaches (very common), irritability, nausea, fatigue, sleepiness, inability to concentrate, and mild depression. Caffeine withdrawal symptoms begin 12–24 hours after caffeine is stopped. Withdrawal symptoms peak at around 48 hours, and can last up to five days. Tapering caffeine use, for example cutting down on caffeine by the equivalent of half a cup of coffee (about 50 mg) a day, minimizes or eliminates withdrawal symptoms.

People who use more than about 500 mg (the amount varies greatly among individuals) of caffeine a day may develop a condition called caffeinism. Caffeinism produces unpleasant sensations, some of which are similar to withdrawal symptoms. Symptoms caffeine overuse include restlessness, irritability, nervousness, anxiety, muscle twitching, headaches, inability to fall asleep, and a racing heart. Severe overuse of caffeine can cause four psychiatric disorders recognized by the American Psychiatric Association and described in the *Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition*. Caffeine is considered the cause of these disorders after other causes have been ruled out.

- Caffeine intoxication: Usually the result of taking caffeine pills (e.g., NoDoz), this condition causes mental changes, rambling thoughts and speech, irregular heart beat, and all symptoms associated with overuse. In severe cases death can result from ventricular fibrillation (unsynchronized contractions of the ventricle of the heart).
- Caffeine-induced anxiety disorder: Severe anxiety that interferes with daily social interactions and occurs after caffeine intoxication or heavy long-term use of caffeine.
- Caffeine-induced sleep disorder: An inability to sleep that is so great it requires medical/psychiatric attention and occurs after prolonged caffeine consumption.
- Non-specific caffeine-induced disorder: Disorders not listed that are attributable to either acute or long-term caffeine consumption.

## Parental concerns

Children get most of their caffeine from soft drinks. Parents should choose soft drinks that contain little or no caffeine or replace soft drinks with water, fruit juice, or low-fat milk. Adolescents are increasingly using energy drinks and energy bars containing caffeine. At the same time, many adolescents start drinking coffee. Parents educate their children about the effects of caffeine and encourage them to monitor their caffeine consumption from all sources.

Accidental overdose from caffeine pills can be fatal. Caffeine tablets, like all drugs, should be kept out of reach of children. Children who accidentally eat caffeine pills need immediate medical attention from a physician or emergency room.

### KEY TERMS

**Alkaloid**—An organic, compound found in plants; chemically it is a base and usually contains at least one nitrogen atom.

**Blood-brain barrier**—A specialized, semi-permeable layer of cells around the blood vessels in the brain that controls which substances can leave the circulatory system and enter the brain.

**Neurotransmitter**—One of a group of chemicals secreted by a nerve cell (neuron) to carry a chemical message to another nerve cell, often as a way of transmitting a nerve impulse. Examples of neurotransmitters include acetylcholine, dopamine, serotonin, and norepinephrine.

**Tolerance**—Adjustment of the body to a drug so that it takes more and more to produce the same physiological or psychological effect, or adjustment to a drug so that side effects are diminished.

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Food Standards Agency, Aviation House. 125 Kingsway, London, UK WC2B 6NH. Telephone: 020 7276 8000. Website: <http://www.eatwell.gov.uk>

International Food Information Council. 1100 Connecticut Avenue, NW Suite 430, Washington, DC 20036. Telephone: 202-296-6540. Fax: 202-296-6547. Website: <http://ific.org>.

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Tish Davidson, A.M.

**Calcium**

| Age | Recommended dietary allowance (mg) | Tolerable upper intake level (mg) |
|---|---|---|
| Children 0–6 mos. | 210 (AI) | Not established |
| Children 7–12 mos. | 270 (AI) | Not established |
| Children 1–3 yrs. | 500 | 2,500 |
| Children 4–8 yrs. | 800 | 2,500 |
| Children 9–13 yrs. | 900 | 2,500 |
| Adolescents 14–18 yrs. | 1,300 | 2,500 |
| Adults 19-50 yrs. | 1,000 | 2,500 |
| Adults 50> yrs. | 1,200 | 2,500 |
| Pregnant women 18≤ yrs. | 1,300 | 2,500 |
| Pregnant women 19≥ yrs. | 1,000 | 2,500 |
| Breastfeeding women 18≤ yrs. | 1,300 | 2,500 |
| Breastfeeding women 19≥ yrs. | 1,000 | 2,500 |

| Food | Calcium (mg) |
|---|---|
| Yogurt, plain, 1 cup | 415 |
| Cheese, mozzarella, 1.5 oz. | 372 |
| Sardines with bones, canned in oil, 3 oz. | 324 |
| Cheese, cheddar, 1.5 oz. | 305 |
| Milk, any type, 1 cup | 300 |
| Yogurt with fruit, 1 cup | 245–384 |
| Tofu, firm, with calcium sulfate, ½ cup | 204 |
| Orange juice, fortified, 6 oz. | 200–260 |
| Salmon with bones, canned, 3 oz. | 181 |
| Spinach, cooked, ½ cup | 120 |
| Beans, white, cooked, ½ cup | 113 |
| Instant breakfast drink, powder, prepared with water | 105–250 |
| Cereal, fortified, 1 cup | 100–1,000 |
| Bok choy, cooked, ½ cup | 61 |
| Beans, pinto or red, cooked, ½ cup | 43 |
| Bread, whole wheat, 1 slice | 20 |

AI=Adequate intake
mg=milligram

*(Illustration by GGS Information Services/Thomson Gale.)*

# Calcium

## Definition

Calcium (Ca) is the most abundant mineral in the body. About 99% of calcium in the body is in bones and teeth. The remaining 1% is in blood and soft tissue. Calcium in body fluids is an electrolyte with a charge of +2. Humans must meet their need for calcium through diet.

## Purpose

Calcium is essential for:

- building and maintaining strong bones and teeth
- muscle contraction
- blood vessel contraction and relaxation
- nerve impulse transmission
- regulating fluid balance in the body

## Description

Most calcium in the body is stored in bones and teeth. Here it combines with phosphate to form strong, stable crystals. The remaining 1% is dissolved in body fluids and much of it forms Ca 2+ ions. In the body, these electrically charged particles are called **electrolytes**. Calcium and other electrolytes are not distributed evenly throughout the body. Dissolved calcium is found mainly in the fluid outside cells (extracellular fluid). Metabolic events cause the movement of calcium across cell membranes result in muscle contraction, nerve impulse transmission, and various chemical reactions. The cell then uses energy to restore the balance of calcium between the inside and outside of the cell membrane, so that the event can be repeated.

To remain healthy, the amount of calcium dissolved in body fluids must be stay within a very narrow range. Bone acts like a calcium bank. Bone is constantly being broken down by cells called osteoclasts and built up

again by cells called osteoblasts. This process is called bone remodeling, and it continues throughout an individual's life. When excess calcium is present in the blood, osteoblasts deposit calcium into bones. When too little calcium is in the blood, osteoblasts dissolve calcium from bones and move it into the blood. This process is controlled by parathyroid hormone (PTH) secreted by the parathyroid glands. The parathyroid glands are extremely sensitive to the level of calcium in the blood, and in a healthy individual they are able to maintain the concentration of calcium ions fluctuates very little.

### *Normal calcium requirements*

The United States Institute of Medicine (IOM) of the National Academy of Sciences has developed values called **Dietary Reference Intakes** (DRIs) for many **vitamins** and **minerals**. The DRIs consist of three sets of numbers. The Recommended Dietary Allowance (RDA) defines the average daily amount of the nutrient needed to meet the health needs of 97–98% of the population. The Adequate Intake (AI) is an estimate set when there is not enough information to determine an RDA. The Tolerable Upper Intake Level (UL) is the average maximum amount that can be taken daily without risking negative side effects. The DRIs are calculated for children, adult men, adult women, pregnant women, and **breastfeeding** women.

The IOM has not set RDAs for calcium, but instead it has set AI levels for all age groups based on observed and experimental information. However, many studies show that Americans across almost all age groups are not meeting these AI levels. One large study, the Continuing Survey of Food Intakes of Individuals, found that in children ages 6–11 44% of boys and 58% of girls were getting lower than recommended amounts of calcium. In adolescents ages 12–19, the rate of deficiency was higher—64% for boys and a huge 87% for girls. Adults over age 20 did not do much better with 55% of men and 78% of women taking in less calcium than recommended. IAs and ULs for calcium are measured in milligrams (mg). The following list gives the recommended AL and UL levels of calcium for each age group.

- children birth–6 months: AI 210 mg; UL not established;.
- children 7–12 months: AI 270 mg; UL not established.
- children 1–3 years: AI 500 mg; UL 2,500 mg
- children 4–8 years: AI 800 mg; UL 2,500 mg
- children 9–13 years: RDA 9 mg; UL 2,500 mg
- adolescents 14–18 years: IA 1,300 mg; UL 2,500 mg
- adults age 19–50: RDA 1,000 mg; UL 2,500 mg
- adults over age 50: RDA 1,200 mg; UL 2,500 mg
- pregnant women 18 years and younger: RDA 1,300 mg; UL 2,500 mg
- pregnant women over age 18: RDA 1,000 mg; UL 2,500 mg
- breastfeeding women 18 years and younger: RDA 1,300 mg; UL 2,500 mg
- breastfeeding women over age 18: RDA 1,000 mg; 2,500 mg

## KEY TERMS

**Dietary supplement**—A product, such as a vitamin, mineral, herb, amino acid, or enzyme, that is intended to be consumed in addition to an individual's diet with the expectation that it will improve health.

**Diuretic**—A substance that removes water from the body by increasing urine production.

**Electrolyte**—Electrically charged particles (ions) that form when salts dissolve in water or fluids. Electrolytes regulate water balance in the body and play a critical role in almost every metabolic reaction.

**Enzyme**—Proteins that change the rate of a chemical reaction within the body without themselves being used up in the reaction.

**Mineral**—An inorganic substance found in the earth that is necessary in small quantities for the body to maintain a health. Examples: zinc, copper, iron.

### *Sources of calcium*

In the United States, dairy products—milk, yogurt, and cheese—are the main sources of dietary calcium. Low-fat dairy products, such as skim milk or reduced-fat cheese, contain about the same amount of calcium as whole milk products. Other sources of calcium include canned fish with bones, dark green leafy vegetables, and tofu made with calcium sulfate. Other types of tofu do not contain significant amounts of calcium. Processed foods such as orange juice, breakfast cereal, instant breakfast drinks, and bread are often fortified with calcium. This will be indicated on the label.

The following list gives the approximate **manganese** content for some common foods:

- milk, any type, 1 cup (8 ounces): 300 mg
- yogurt, plain, 8 ounces: 415 mg
- yogurt with fruit, 8 ounces: 245–384 mg

- cheddar cheese, 1.5 ounces: 305 mg
- mozzarella cheese, 1.5 ounces: 372 mg
- sardines with bones, canned in oil, 3 ounces: 324
- salmon with bones, canned, 3 ounces: 181 mg
- tofu, firm, made with calcium sulfate, 1/2 cup: 204 mg
- pinto or red beans, cooked, 1/2 cup: 43 mg
- white beans, cooked, 1/2 cup: 113 mg
- bok choy, 1/2 cup cooked: 61 mg
- spinach, cooked, 1/2 cup: 120 mg
- bread, whole wheat, 1 slice 20 mg
- orange juice, fortified, 6 ounces: 200–260 mg
- instant breakfast drink, powder prepared with water, 105–250 mg
- breakfast cereal, fortified, 1 cup: 100–1,000 mg

Although experts recommend that people meet as many of their vitamins and minerals needs through diet as possible, it is difficult for many people to get enough calcium from food alone. This is especially true for vegans, who eat no dairy products, adolescent girls who are very calorie conscious and tend to avoid milk and replace it with diet sodas, and people with lactose intolerance who cannot easily digest dairy products. Pregnant women and older individuals may also have a hard time eating enough to meet their calcium needs. People who do not get enough calcium through diet can benefit from taking a dietary supplement containing calcium.

Calcium supplements are available over-the-counter. The most common supplements supply calcium in the form of calcium carbonate or calcium citrate. Calcium carbonate is usually the most economical calcium supplement. People who are taking medications to reduce stomach acid may more easily absorb calcium citrate. Some supplements combine calcium and **vitamin D** because vitamin D helps the body absorb calcium. No calcium supplement contains enough calcium meet the entire daily adequate intake, because the pill would be too large to swallow. In addition, the body absorbs calcium best in doses of 500 mg or less. People who need more than 500 mg of supplemental calcium should divide the dose in half to be taken morning and evening.

### *Calcium deficiency*

Calcium deficiency, called hypocalcemia, can occur because of inadequate calcium intake, excess calcium excretion by the kidney (usually caused by kidney damage), the inability to adequately absorb calcium, or because of interactions between calcium and some prescription drugs. People at highest risk of calcium deficiency are teenagers, women past the age of menopause, individuals who are lactose intolerant, vegans, and people with kidney (renal) damage.

Calcium deficiency rarely shows up in blood tests because calcium is withdrawn from the bones to maintain blood levels of calcium. The bones then become less dense, weaker, and more likely to break. This condition is called **osteoporosis** and it is most noticeable in the elderly who have a high rate of broken bones resulting from falls. Osteoporosis is a part of aging, but eating a healthy diet high in calcium, getting adequate vitamin D, and doing weight-bearing exercises regularly can delay its onset. Severe calcium deficiency, is usually caused by a medical condition rather than inadequate calcium intake. It causes symptoms such as muscle cramps, tingling in the fingers, lethargy, convulsions, heart rhythm abnormalities, and death. These symptoms can also be caused by many other diseases.

### *Calcium excess*

Calcium excess is called hypercalcemia. It usually results from poor kidney function (renal failure) or from a malignant **cancer** tumor. It can also be caused by very large supplemental doses of vitamin D. Very rarely is hypercalcemia caused by too much calcium from food or **dietary supplements**. High levels of calcium interfere with the absorption of other minerals such as **iron**, **zinc**, **magnesium**, and phosphorous. People with hypercalcemia usually have multiple medical problems and are under the supervision of a physician.

## Precautions

People of all ages, races, and gender need to be alert to getting enough calcium in their diet. Building strong, dense bones begins in childhood and adolescence, even though the results cannot be seen until old age. People mentioned above as being at especially high risk of low dietary calcium intake should investigate taking a calcium supplement.

## Interactions

Absorption of calcium is affected by several conditions.

- Age. Infants absorb as much as 60% of the calcium in their digestive system. This decreases to 15–20% in adulthood, and even less in old age.
- Pregnancy. Pregnancy increases the efficiency of calcium absorption in the intestine to meet the demands of fetal development.
- Amount of calcium consumed. The more calcium consumed at one time, the less efficient absorption

becomes. Calcium from supplements should be spaced out during the day for maximum absorption.

- Vitamin D. The presence of vitamin D improves calcium absorption. Vitamin D deficiency can worsen calcium deficiency.
- Plant products. Phytic found in beans and oxalic acid found in spinach and leafy greens decrease the amount of calcium absorbed from those foods, but does not affect the absorption of calcium from other foods present at the same time in the intestine. Fiber such as wheat bran also reduced calcium absorption.

Prescription medications can also affect or be affected by the absorption of calcium. These include:

- digoxin
- fluroquinolones
- levothyroxine
- tetracycline antibiotics
- anticonvulsants
- thiazide-type diuretics
- glucacorticoids
- mineral oil
- stimulant laxatives
- antacids

People taking these drugs should check with their healthcare provider or pharmacist about potential adjustments in their medications or calcium intake.

## Complications

No complications are expected when healthy people take calcium in amounts equal to the AI level and less than the UL level. Some people experience gas, nausea, and abdominal discomfort from calcium supplements. Taking the supplement with meals, taking smaller doses spread out over the day, or changing the type of supplement usually solves this problem. Complications of excess calcium and calcium deficiency are discussed above.

## Parental concerns

Building strong bones starts in childhood, and parents should be aware of how much calcium their child needs compared to how much he or she is getting. As children get older they tend to replace milk in their diet with juice, bottled **water**, and especially carbonated soft drinks. This leads to large calcium deficiencies during adolescence. Parents should monitor their child's diet and encourage calcium supplements if they cannot induce their adolescents to eat more dairy products and other calcium-rich food.

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American Dietetic Association. 120 South Riverside Plaza, Suite 2000, Chicago, Illinois 60606-6995. Telephone: (800) 877-1600. Website: <http://www.eatright.org>

International Food Information Council. 1100 Connecticut Avenue, NW Suite 430, Washington, DC 20036. Telephone: 202-296-6540. Fax: 202-296-6547. Website: <http://ific.org>

Linus Pauling Institute. Oregon State University, 571 Weniger Hall, Corvallis, OR 97331-6512. Telephone: (541) 717-5075. Fax: (541) 737-5077. Website: <http://lpi.oregonstate.edu>

National Institutes of Health Osteoporosis and Related Bone Diseases National Resource Center. 2 AMS Circle, Bethesda, MD 20892-3676 Telephone: (800) 624-BONE or (202)223-0344. TTY: (202) 293-2356. Fax: (202)466-4325. Website: <http://www.niams.nih.gov/bone/>

Office of Dietary Supplements, National Institutes of Health. 6100 Executive Blvd., Room 3B01, MSC 7517, Bethesda, MD 20892-7517 Telephone: (301)435-2920. Fax: (301)480-1845. Website: <http://dietary-supplements.info.nih.gov>


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# Calorie restriction

## Definition

The definition of calorie restriction is when the body does not receive an adequate intake of energy. This can result as a consequence of lack of availability of adequate volumes of food. However, sometimes the failure to consume an adequate calorie intake may be a conscious and deliberate decision, for example, in individuals seeking to lose weight or people who suffer with the eating disorder, **anorexia nervosa**. Calorie restriction can result in malnutrition or a deficiency of one or more nutrients.

## Purpose

The human body requires an adequate amount of energy or calories to enable us to grow, perform daily activities, produce hormones and to minimize the risk of nutrition-related complications. Calorie requirements for individuals vary from one individual to the next and are dependent on variables including gender, age, activity levels, climate and environment and the presence or absence of medical or nutritional complications. Consequently, it is possible that individuals of similar weight and age may have different energy requirements owing to unique individual needs. In addition to the body requiring energy to perform the aforementioned tasks, energy is also required to support activity of the internal organs and to maintain body temperature. This energy is called the basal or resting **metabolism**. The basal metabolic rate (BMR) is determined experimentally when an individual is lying down at complete physical and mental rest under standardized environmental conditions. Research over many years has provided researchers with guidelines on how to assess and determine an individuals BMR using specific calculations.

**Estimated daily calorie needs**

| | Calorie range | |
|---|---|---|
| | Sedentary | Active |
| **Children** | | |
| 2–3 years | 1,000 | 1,400 |
| **Females** | | |
| 4–8 years | 1,200 | 1,800 |
| 9–13 | 1,600 | 2,200 |
| 14–18 | 1,800 | 2,400 |
| 19–30 | 2,000 | 2,400 |
| 31–50 | 1,800 | 2,200 |
| 51+ | 1,600 | 2,200 |
| **Males** | | |
| 4–8 years | 1,400 | 2,000 |
| 9–13 | 1,800 | 2,600 |
| 14–18 | 2,200 | 3,200 |
| 19–30 | 2,400 | 3,000 |
| 31–50 | 2,200 | 3,000 |
| 51+ | 2,000 | 2,800 |

**Sedentary** means a lifestyle that includes only the light physical activity associated with typical day-to-day life.
**Active** means a lifestyle that includes physical activity equivalent to walking more than 3 miles per day at 3 to 4 miles per hour, in addition to the light physical activity associated with typical day-to-day life.

SOURCE: Center for Nutrition Policy and Promotion, U.S. Department of Agriculture

*(Illustration by GGS Information Services/Thomson Gale.)*

## Description

Individuals require a certain number of calories on a daily basis, which incidentally may vary subject to activity levels and physical status but overall is within a relatively stable range. When dietary intake remains stable weight too remains unchanged. Conversely, increases or decreases in intake can result in weight changes. To clarify,

- When energy intake equals energy expenditure, weight remains unchanged.
- When energy intake exceeds expenditure, weight increases.
- When energy intake is less than expenditure, weight will decrease.

It is when expenditure exceeds calorie intake that the body experiences a negative energy balance and weight loss ensues.

There is little research available to help us understand the impact of starvation on humans. Understandably, ethically it would not be appropriate to impose such situations on individuals, however, two major studies did impose such situations in 1919 and

1950. This first of these studies involved the recruitment of 34 volunteers who were underfed for three months to facilitate a weight loss of 10%. This study highlighted that resting metabolic rate (RMR) decreased rapidly at first and then more slowly with continuing weight loss. The second study, carried out by Keys and colleagues, again exposed a group of male volunteers to a reduced calorie intake over a period of 24 weeks to achieve a weight loss of 25%. They confirmed a decrease in metabolic rate and estimated that 65% of the decrease in metabolic rate could be attributed to the loss of the metabolic activity of the tissue. This study also provided useful information in respect of the symptoms associated with starvation when individuals adopt restrictive eating patterns. The study highlighted that many of the signs and symptoms that people typically associate with people who suffer with an eating disorder are very likely to develop in non-eating disordered individuals if they were to be exposed to a similar extreme reduction in their dietary intake. These symptoms include an increased preoccupation with food, adoption of unusual eating patterns including concoctions of food, spending a long time consuming food, social withdrawal and a lowering of mood and an associated decrease in libido.

## KEY TERMS

**BMI**—This relates weight to height and is used as part of the nutritional assessment of individuals. BMI is the weight (in kg) divided by the height (in meters) squared. The acceptable healthy range is 20–25.

**Calorie**—The amount of heat needed to raise 1g of water by 10C. For nutritional purposes the Calorie (or kilocalorie) is the amount of heat needed to raise 1,000g of water by 10. The modern unit is the joule. One calorie is a little over 4 joules.

**Malnutrition**—A disorder resulting from an inadequate diet or failure to absorb or assimilate nutrients.

**Minerals**—Elements that are essential for the body to function correctly including calcium, iron, phosphorous, magnesium, sodium, chloride, iodine, manganese, copper, and zinc.

**Starvation**—A long-term consequence of food deprivation.

**Vitamins**—Compounds required by the body in small amounts to assist in energy production and in cell growth and maintenance. They are essential for life and with the exception of vitamin D, cannot be made in the body. They should ideally be consumed from food. However, individuals who struggle to eat can obtain their vitamin requirements from dietary supplements.

## Complications

### *Physical effects of starvation*

Malnutrition occurs when is there is a deficiency of one or more nutrients. It may be mild or severe. Severe Malnutrition is rare in developed countries but sadly remains prevalent in many developing countries. Weight loss is an obvious sign of a diet too low in calories or energy. Protein-energy malnutrition occurs when the diet provides too little energy and **protein**. Malnutrition is assessed in terms of degrees of weight loss in adults, whilst in children height and weight are used and compared with growth charts. Weight loss in adults and failure to thrive in children are the most obvious signs of insufficient energy intake. In adults, this is usually noticed by a drop in the **body mass index** (BMI), which is a method used to relate weight to height and is used as part of the process in determining an individuals' nutritional status. In children, insufficient energy intakes are noticed when children fail to meet expected growth milestones. In the long-term, stunted growth may result as a consequence of insufficient energy requirements and children may not reached an expected height for weight ratio.

It is important to remember that individuals of a healthy body weight could still be classified as malnourished if they are lacking in essential nutrients. Therefore, overall nutritional status of individuals cannot be assessed solely on body weight. Consequently, nutritional assessment screening tools are useful to help identify individuals who may be at risk of malnutrition in hospitals, care homes and primary care settings. In summary, malnutrition may develop owing to a number of factors including a decreased dietary intake, increased nutritional requirements or increased losses or an inability to absorb or utilize nutrients.

Severe cases of low energy intake result in starvation and life threatening conditions called Kwashiorkor (characterized by protein deficiency) and Marasmus (primarily a deficiency of energy-providing foods). Marasmus is a chronic condition of semi-starvation, characterized in later stages by muscle wasting and an absence of subcutaneous fat and to which children adjust, to some extent, by reduced growth. In Kwashiorkor, subcutaneous fat is usually preserved; muscle wasting occurs but is often masked by edema (swelling). Overall the physical effects of malnutrition are dependent on what nutrients are missing from the diet, for example,

calories, protein, fat, **vitamins** or **minerals**. Usually, when individuals dietary intake is inadequate there is likely to be an overall deficiency of many nutrients.

Below is a list of some of the general effects of starvation.

- tiredness
- lethargy
- poor concentration
- weakness
- hair loss and sometimes the growth of additional hair on the arms and back. (The growth of additional hair called lanugo hair and is frequently evident on people who suffer with anorexia nervosa.)
- decreased muscle mass and tone
- weight loss
- menstruation may stop if weight loss is serious
- delayed puberty in adolescents
- iron-deficiency anemia
- poor immunity
- decrease in bone mineral density and an increased risk of osteoporosis if weight loss is not reversed
- constipation
- deficiencies of various vitamins and minerals
- delayed gastric emptying

#### *Cognitive changes associated with starvation*

As the body starts to lose weight as a as a result of insufficient energy intake, the ability of the brain to function correctly is impaired. The symptoms associated with changes in the way the brain functions are referred to as cognitive changes.

The cognitive changes associated with starvation include

- increased risk of depression-related symptoms
- poor decision making skills
- irritable
- anxiety
- very reactive
- poor concentration

#### *Social and sexual changes associated with starvation*

- withdrawal from social activities
- decreased libido
- decreased enjoyment in previously enjoyed activities

### Parental concerns

As mentioned above, children who have an insufficient energy intakes over prolonged periods of time may not reach expected growth rates. Furthermore, they may lose weight and ultimately experience stunted growth and develop nutrition-related complications. Parents should ensure that a registered doctor monitors growth rates regularly or a suitably qualified professional.

### Resources

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## Cambridge diet

### Definition

The Cambridge diet is a commercial very-low-calorie diet (VLCD). The diet was first used only in weight-loss clinics in the United Kingdom. In the early 1980s, the products associated with the diet (powder mix, meal bars, and liquid meals) started selling commercially in the United States and the United Kingdom. Formulations of the Cambridge diet in the United Kingdom differ from that sold in the United States. In both the United Kingdom and North America, the Cambridge products are available only from distributors; they cannot be purchased over the counter at pharmacies or supermarkets.

**Cambridge diet**

**British version—4 stages**

**Preparation**
Reduce food intake gradually over a week or 10 days before beginning the diet

**Losing weight (Sole Source program)**
Women shorter than 5' 8": three servings of Cambridge diet products daily and no other food
Women taller than 5' 8" and men: four servings of Cambridge diet products daily and no other food
Coffee, tea, and tap and bottled water allowed
Drink at least 2 quarts of fluid per day
415 to 554 calories per day

**Stabilization**
After 4 weeks on the Sole Source program, add a meal of 3 oz. of lean white fish or poultry, cottage cheese, and a portion of green or white vegetables to the basic Cambridge meals
Total of 790 calories per day
Return, if necessary, to the Sole Source regimen for further rapid weight loss
Other options allow 1,000 or 1,200 calories per day for more gradual weight loss or to accommodate lifestyles

**Weight maintenance**
Begins at an intake of 1,500 calories per day

**American version—5 programs**

**Regular**
Designed for a weight loss of 2–5 pounds per week
820 calories per day: 3 servings of Cambridge Food for Life formula plus one 400-calorie conventional meal
A minimum of 8–10 glasses (8oz.) of water daily
Tea and coffee allowed, but not as substitutes for the water
Continue on the program until weight loss goal achieved

**Fast start**
For rapid and safe weight loss
Regimen is similar to the British Sole Source program
Do not remain on the program longer than 2 weeks at a time
Return to the Regular Program and contact a physician if experiencing headaches, nausea, or vomiting

**Physician-monitored**
Recommended for weight loss of 30 pounds or more, or for persons under doctor's care for other medical conditions
Essentially the British Sole Source program, with the added provision that the dieter switch to the Regular Program when 10 to 15 pounds from weight goal

**Maintenance**
Essentially the use of the Cambridge's Food for Life nutrition formula as a foundation, adding conventional foods while determining caloric level to maintain body weight

**Lifetime nutrition**
Use Cambridge diet products as meal substitutes for one or two meals a day, or as healthy snacks

*(Illustration by GGS Information Services/Thomson Gale.)*

## Origins

### *United Kingdom and Western Europe*

A scientist at Cambridge University in England, Alan Howard, initiated the research that eventually lead to the development of the Cambridge diet in the 1960s. Howard became interested in **obesity** as an increasingly common nutritional problem. He worked together with Ian McLean-Baird, a physician at the West Middlesex Hospital, to create a formula diet food that would allow people to lose weight rapidly without losing lean muscle tissue, create a mild ketosis (a condition in which the body begins to use fat rather than **carbohydrates** as a source of energy), and contain enough **vitamins**, **minerals**, and micronutrients to maintain health. Howard and Mc-Lean Baird also organized the first national symposium on obesity in the United Kingdom, which was held in 1968.

The formula that satisfied the researchers' goals was successful in helping people in hospital obesity clinics lose weight, but was not particularly appetizing. The researchers collaborated with food technologists to improve the flavor of the formula. After further testing with clinic patients, the Cambridge diet was marketed commercially in the United Kingdom in 1984, four years after it was available in the United States. In 1985 the Cambridge diet became available in Germany, France, and the Scandinavian countries, and in 1990 in Poland and Eastern Europe. The British company, Cambridge Manufacturing Company Limited (CMC), which manufactures the diet products as well as the Cambridge Health and Weight Plan, were owned by the Howard Foundation between 1982 and 2005, a charitable trust established by Alan Howard to offer scholarships to international students and to fund research in obesity and nutrition. In 2005 the Cambridge Manufacturing Company was sold to its three senior managers and became Cambridge Nutritional Foods Limited.

The present Cambridge diet products available in the United Kingdom are sachets (packets) of powder, Mix-a-Mousse granules, liquid meals, and meal bars. The sachets are intended to be mixed with a half-pint of **water** (hot or cold) to produce a shake or soup. The sachets, which provide about 138 calories, are sold in boxes of 21 servings, a week's supply. There are 12 different flavors including banana, mixed fruit, and chicken mushroom. The dieter may also purchase Mix-a-Mousse granules that add 20 calories to the powdered formula but give it a thicker texture. The liquid formula is available in a ready-to-drink version packaged as Tetra Briks—sealed cartons with straws. Tetra Briks come in banana or chocolate flavor. There are four flavors of chocolate-covered meal bars (caramel, chocolate, orange, and toffee), one of which can be consumed each day.

Each sachet or liquid formula contains enough nutrients to be used as a complete meal. The meal bars can replace a meal as well but have extra carbohydrates and should only be eaten once a day. The Cambridge diet products can be consumed exclusively

## KEY TERMS

**Body mass index (BMI)**—The ratio between a person's weight and the square of their height. A BMI over 25 is considered overweight; below 20 is considered underweight.

**Cholelithiasis**—The medical term for gallstones. People on a VLCD have an increased risk of developing gallstones from an increase of cholesterol content in the bile produced by the liver.

**Cognitive behavioral therapy (CBT)**—An approach to psychotherapy based on modifying the patient's day-to-day thoughts and behaviors, with the aim of changing long-standing emotional patterns. Some people consider CBT a useful or even necessary tool in maintaining long-term weight reduction.

**Ketosis**—An abnormal increase in the number of ketone bodies in the body, produced when the liver breaks down fat into fatty acids and ketone bodies. Ketosis is a common side effect of low-carbohydrate diets or VLCDs. If continued for a long period of time, ketosis can cause serious damage to the kidneys and liver.

**Very low-calorie diet (VLCD)**—A term used by nutritionists to classify weight-reduction diets that allow around 800 calories or fewer a day.

as meal replacements or used in conjunction with regular food (e.g., sachet for breakfast, Tetra Brik for lunch, and normal dinner).

### *United States*

Rights to the original Cambridge diet formula—a powder to be mixed in a blender with water or diet soft drinks—in the United States were obtained by Cambridge Direct Sales in 1979. After working to improve the formula's flavor, the diet was placed on the market in 1980. It was initially quite popular. The original version of the Cambridge diet is sometimes known as the "Original 330 Formula" in the company's promotional literature because Dr. Howard's first rapid weight-loss program called for a total daily consumption of only 330 calories, provided by three servings of the original powder formula (110 calories per serving). The nutrient ratio of the original formula is 10–11 g of **protein** per serving, 15 g of carbohydrates (derived primarily from fructose or fruit sugar), and 1 g of fat.

In 1984 Cambridge Direct Sales hired Dr. Robert Nesheim to develop Cambridge Food for Life products. Like the Original 330 Formula, Food for Life is a powder that comes in a can to be reconstituted with conventional foods. Food for Life is available in a super oats cereal version as well as flavor choices including tomato, potato, mushroom, chicken soup, vanilla, chocolate, strawberry, and eggnog. Nesheim was specifically asked to meet guidelines for nutrition supplements established by the U.S. Food and Drug Administration (FDA). The company states that Nesheim "increased the protein and carbohydrate content for an extra margin of safety when used as the sole source of nutrition." Food for Life contains 140 calories per serving, 13–15 g of protein, 18 g of carbohydrates, and 1 g of fat.

The American company introduced a Cambridge nutrition bar in 1983, but was unsuccessful as the product had a short shelf life, and lacked flavor appeal. Dr. Nesheim tripled the shelf life of the nutrition bars and improved their taste. Each bar contains 170 calories, with 10 g of protein, 19–22 g of carbohydrates, and a low fat content.

## Description

### *British version*

The British version of the Cambridge diet cannot be used without the supervision of an official counselor, who "provide[s] a personal screening, advisory, monitoring and support service." The counselors are trained and accredited by the company, and must follow a code of conduct in their dealings with customers. According to the company, most counselors are people who have successfully used the Cambridge diet themselves.

The British version of the Cambridge diet is for adults over the age of 16 and has four stages:

- Preparation: The dieter is asked to reduce food intake gradually over a week to 10 days before beginning the diet.
- Losing weight: This initial step is called the "Sole Source" program and gives the dieter between 415 and 554 calories per day. Dieters are advised not to remain on the Sole Source program for longer than four weeks at a time. They are required to obtain a signed certificate from their doctor before they can begin the Sole Source program. Female dieters shorter than 5 ft 8 in take three servings of Cambridge diet

products per day and eliminate other food; women taller than 5 ft 8 in and men are allowed four servings. Allowable beverages include coffee, tea, and tap or bottled water; forbidden beverages include alcoholic drinks, coffee or tea with milk added, fruit juices, and any drink containing sugar. The dieter is advised to drink at least 2 qt of fluid per day.

- Stabilization: After four weeks on the Sole Source program, the dieter can add a meal of 3 oz lean white fish or poultry, cottage cheese, and a portion of green or white vegetables to the basic Cambridge meals for a total of 790 calories per day. The dieter can then return to the Sole Source regimen for further rapid weight loss. There are other options allowing the dieter 1,000-1,200 calories per day that are better suited for gradual weight loss.
- Weight maintenance: Begins at an intake of 1,500 calories per day.

### *American version*

The American version of the Cambridge diet is divided into five separate programs:

- Regular: Designed for a weight loss of 2–5 lb per week, the Regular Program provides 820 calories per day: three servings of Cambridge Food for Life formula plus one 400 calorie conventional meal. The dieter is advised to drink a minimum of 8–10 8-oz glasses of water each day. Tea and coffee are allowed, but not as substitutes for the water. There is no stipulation that the Regular program is limited to four weeks.
- Fast Start: Similar to the British Sole Source program, the Fast Start program is to be followed no longer than two weeks at a time. The dieter is advised to return to the Regular Program and contact a physician if they experience headaches, nausea, or vomiting.
- Physician-Monitored: Recommended for persons who need to lose 30 lb or more, or who are under a doctor's care for other medical conditions. It is essentially the British Sole Source program with the added provision that the dieter should switch to the Regular Program when he or she is 10–15 lb from their goal weight.
- Maintenance: Uses the Food for Life nutrition formula as a foundation, while adding conventional foods until a caloric intake is determined to maintain an ideal weight.
- Lifetime Nutrition: The Food for Life company recommends using the Cambridge diet products as meal substitutes for one or two meals a day, or as snacks indefinitely. This maintenance program is not endorsed by any government agency.

## Function

The Cambridge diet claims to be a flexible plan that can be used as a VLCD for rapid initial weight loss and then modified to serve as a maintenance diet.

## Benefits

The Cambridge diet offers a rapid initial weight loss that compensates (for some dieters) the low calorie intake and other food restrictions. The American version also offers a peer support network and a self-instruction program based on cognitive behavioral therapy (CBT) called Control for Life.

## Precautions

People under a physician's care for high blood pressure, kidney or liver disease, diabetes, or who need to lose more than 30 lb should consult their physician before starting the Cambridge diet or any VLCD. The Cambridge diet should not be used by adolescents under the age of 16, and should be used by elderly persons, pregnant women, or nursing women only with caution.

## Risks

VLCDs in general should not be attempted without consulting a physician, and the Cambridge diet is no exception. The diet is not suitable for people whose work or athletic training requires high levels of physical activity. One physical risk from this diet, as from other VLCDs, is an increased likelihood of developing cholelithiasis, or **gallstones**.

There is also some financial risk to using the Cambridge diet. Although the American website states that the Physician-Monitored version is less expensive than VLCD hospital programs, all forms of the Cambridge diet cost $95–100 for a 15-day supply of the Original 330 Formula or $85–89 for a 15-day supply of the Food for Life formula. A case of six cans of the Original 330 Formula, supplying a total of 126 servings, is about $160. Although the cost per meal is between $1.25 and $1.45, the fact that the dieter must purchase at least a two-week quantity at a time is a risk for people who may not like the products well enough to remain on the diet.

A common criticism of the Cambridge diet, as of all VLCDs, is that it does not teach the dieter how to make wise food choices or the other lifestyle changes necessary to maintain weight loss. The British website states rather defensively, "To these armchair critics [the Cambridge diet] is just another fad diet. Nothing could be further from the truth as anyone can vouch

## QUESTIONS TO ASK YOUR DOCTOR

- Have any of your patients ever tried the Cambridge diet? If so, how much weight did they lose? How long did they maintain the weight loss?
- Have you ever supervised anyone on the "Physician-Monitored" form of this diet?
- Do you know of anyone who has ever had health problems or adverse effects from following the "Regular" or "Fast Start" versions of the Cambridge diet?
- Have you read any of the research studies published about this diet? If so, what is your opinion of their findings?
- In your opinion, is cognitive behavioral therapy a helpful addition to a VLCD?

who has used the diet as a sole source of nutrition for several weeks. For the first time one realises that vast quantities of food are not indispensable to life. It trains you to live without having food continually on your mind and the experience has a beneficial effect on most people."

### Research and general acceptance

Proponents of the Cambridge diet claim that it is scientific and has been subjected to clinical research, however, there are no recent studies in mainstream medical journals specific to this diet. The British Cambridge diet website cites research papers from the late 1990s on VLCDs as a group, most of them concerning studies conducted in England, Sweden, and Finland. In addition, neither the two British researchers who originally developed the diet nor the American scientist who reformulated the British products for the American market in 1984 began their careers as weight reduction experts. John Marks was trained as a psychiatrist and published a number of books in psychological medicine, dependence as a clinical phenomenon, and the misuse of benzodiazepine tranquilizers as well as editing an encyclopedia of psychiatry. He wrote a book on the use of vitamins in medical practice in 1985, one year before the book he co-authored with Alan Howard on the Cambridge diet.

Robert Nesheim, the American physician credited with reformulating the original Cambridge diet products for the American market, began as a researcher in agricultural medicine. Dr. Nesheim acted as chief of research and development at the Quaker Oats Company until he retired in 1983. He believed in promoting products on the basis of taste, convenience, and cost.

Opinion is somewhat divided among medical and health care professionals on the subject of VLCDs as a group of weight reduction regimens, with European researchers tending to be more favorable to these plans than physicians in North America. The first report of the National Task Force on the Prevention and Treatment of Obesity on these diets noted that ":Current VLCDs are generally safe when used under proper medical supervision in moderately and severely obese patients (**body mass index** 30) and are usually effective in promoting significant short-term weight loss. . . . [but] long-term maintenance of weight loss with VLCDs is not very satisfactory and is no better than with other forms of obesity treatment."

In general, researchers in the United States and Canada maintain that VLCDs are not superior in any way to conventional low-calorie diets (LCDs). One Canadian study reported in 2005 that a history of **weight cycling** tended to lower the health benefits that obese patients could receive from VLCDs, while a 2006 study carried out at the University of Pennsylvania in Philadelphia found that the use of liquid meal replacement diets (LMRs) with a daily calorie level of 1000–1500 calories "provide[d] an effective and less expensive alternative to VLCDs." The American Academy of Family Practice (AAFP), a professional association of primary care physicians, discourages the use of VLCDs in general, and categorizes the Cambridge diet in particular as a liquid "fad diet." The only study that reported that VLCDs are "one of the better treatment modalities related to long-term weight-maintenance success" was completed in the Netherlands in 2001. The Dutch researchers added, however, that an active follow-up program, including behavior modification therapy or cognitive behavioral therapy and exercise, is essential to the long-term success that they reported.

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American Academy of Family Physicians (AAFP). P.O. Box 11210, Shawnee Mission, KS 66207-1210. Telephone: (800) 274-2237 or (913) 906-6000. Website: http://www.aafp.org.

Cambridge Direct Sales, 2801 Salinas Highway, Suite F, Monterey, CA 93940-6240. Telephone: (800) 4-HEALTH. Website: http://www.cambridgedietusa.com.

Cambridge Health and Weight Plan, Clare House, Hunter's Road, Corby, Northants, NN17 5JE. Telephone: (44) 1536-403344. Website: http://www.cambridge-diet.co.uk.

Partnership for Healthy Weight Management (PHWM), c/o Federal Trade Commission (FTC), Bureau of Consumer Protection. 601 Pennsylvania Avenue, NW, Room 4302, Washington, DC. 20580. Website: http://www.consumer.gov/weightloss/.

U.S. Food and Drug Administration (FDA). 5600 Fishers Lane, Rockville, MD 20857. Telephone: (888) INFO-FDA [(888) 463-6332]. Website: http://www.fda.gov.

Rebecca J. Frey, PhD



# Cancer

## Definition

Cancer is a group of diseases characterized by uncontrolled growth of cells in the human body and the ability of these cells to travel from the original site and spread to distant sites. Another name for cancer cells is malignant cells. Diet and nutrition play an important role in cancer prevention and cancer treatment.

## Description

By definition, cancer is a disease of the genes. A gene is a small part of DNA, which is the master molecule of the cell. Genes make proteins, which serve as the workhorses of the body's cells. These proteins allow the body to carry out all of the many processes that permit breathing, thinking, moving, and others often taken for granted.

Throughout people's lives, the cells in their bodies are growing, dividing, and replacing themselves. Many genes produce proteins that are involved in controlling the processes of cell growth and division. Any alteration, or mutation, to the DNA molecule can disrupt the genes and produce faulty proteins. This causes the cell to become abnormal and lose the restraints on its growth. The abnormal cell will begin to divide uncontrollably. The new growth it forms will be called a tumor or neoplasm. Not all tumors are cancerous. Those that are cancerous spread to other parts of the body near the original cancer site or to distant sites. Cancerous tumors are called malignancies. A tumor that is not cancerous is called benign.

Cancer can occur in anyone and is the second leading cause of death in the United States. Although cancer may be inherited, it also may occur due to certain environmental risk factors or behaviors. For example, it is well known that smoking can lead to lung cancer or that unprotected sun exposure is a risk factor for skin cancer. Diet and physical activity also play a role in cancer risk.

## Demographics

The American Cancer Society (ACS) estimated that almost one and one-half million new cases of cancer would be diagnosed in 2007 in the United States. And more than 1,500 people a day were projected to die of cancer in 2007. Lung cancer remains the leading cause of cancer deaths among U.S. men and women. **Prostate** cancer is the second-leading cause of cancer deaths among men and breast cancer is the second-leading cause of death among U.S. women. Colon and rectal cancer is the third-leading

**Most prevalent cancer-related deaths, 2002**

| Male cancers | Deaths (000) | Female cancers | Deaths (000) |
|---|---|---|---|
| Trachea/ bronchus/lung | 886 | Breast | 474 |
| Stomach | 523 | Trachea/ bronchus/lung | 353 |
| Liver | 428 | Stomach | 326 |
| Colon/rectum | 321 | Colon/rectum | 299 |
| Oesophagus | 284 | Cervix Uteri | 239 |
| Prostate | 268 | Liver | 191 |

SOURCE: The World Health Report 2003

*(Illustration by GGS Information Services/Thomson Gale.)*

## KEY TERMS

**Benign**—Mild, does not threaten health or life. When referring to a tumor, it generally means noncancerous.

**Malignant**—Unfavorable, tending to produce deterioration or death. For a tumor, it generally means cancerous.

**Radiopharmaceutical**—A drug that is radioactive. It is used for diagnosing or treating diseases.

cause of cancer death among U.S. men and women. There are various racial and ethnic differences in incidence of cancer and deaths from cancer in the United States. Some of these differences may be due to cultural factors such as behaviors or access to care. Others may be related to genetics. Survival rates for all races and types of cancer combined continue to increase substantially. From 1996-2002, 66% of cancer survivors lived five years or longer, combined with only 50% between 1975 and 1977.

### Causes and symptoms

There are numerous risk factors and causes of cancer. Among them are age, sex, and family medical history. Some risk factors depend on the type of cancer. In some cases, a person may have more than one risk factor for the disease. Another person may be diagnosed with cancer and have no apparent risk factor. Genetic causes can't be controlled by an individual, but people who know they are at risk because a close relative had a particular cancer should follow all recommendations for screening and prevention.

Often, physicians cannot explain what causes cancer. In addition to a family history of cancer, overall risk factors for cancer include aging, tobacco or alcohol use, exposure to sunlight or ionizing radiation, exposure to certain chemicals or substances, and exposure to some viruses and bacteria. Poor diet, lack of physical activity, or being overweight also are risk factors for cancers. Not all of these risk factors pertain to all cancers. For example, exposure to sunlight is a risk factor for skin cancer, while certain hormones increase the risk of breast cancer.

Cancer may not produce pain. And many symptoms may be due to a condition that is not cancer. But any signs similar to those for a particular cancer or that show a change in health should be checked by a physician. Symptoms vary depending on the type of cancer, but some common symptoms of cancer include:

- feeling weak or very tired
- a lump in the breast or any other part of the body
- a new mole or changes in an existing mole
- changes to bowel or bladder habits
- hoarseness or a cough that won't go away
- a sore that doesn't heal
- difficulty swallowing
- unexplained weight loss or weight gain
- unusual discharge or bleeding

### Diagnosis

Generally, the earlier cancer is found, the better. Many cancer types have screening methods to help find them early. For example, screening mammography helps detect breast cancer before symptoms occur. A Pap test screens for cervical cancer. Several tests, such as colonoscopy, are recommended for people of certain ages or with certain risk factors, to screen for colon and rectal cancer. It is important to follow the guidelines of organizations such as the American Cancer Society concerning recommended screening for cancers.

Physicians use a combination of family and medical history, screening examination results, laboratory examinations, imaging examinations, and other procedures to diagnose cancer. Family and medical history are important to look for hereditary links to many cancers. Medical history helps to determine if a person may have behaviors, such as smoking, that increase risk for many cancers.

Laboratory examinations may test a person's blood, urine, or other fluids. These tests often are conducted to search for levels of substances called tumor markers. Laboratory tests alone cannot diagnose cancer, but can help lead a physician toward or away from a suspected diagnosis.

X rays are traditional imaging and may be the first type of imaging performed. Mammography is a form of x ray; it is the screening and diagnostic examination used to detect breast cancer. Chest x rays may be used to detect lung cancer. Other types of x rays may be used in cancer diagnosis.

Computed tomography (CT) scanning. Because the use of the computer can generate finer, cross-sectional detail in combination with x rays, CT scans often are used to image a particular area. And CT scans have been used to screen for lung cancer, though the practice still is in debate. CT colonography can screen for polyps and other lesions in the large intestine, much like a colonoscopy. But CT is noninvasive, meaning it does not penetrate the skin or enter the body. CT may involve use of contrast that is injected to help make certain fluids or tissues more visible on the image for the radiologist.

Nuclear medicine or radionuclide scans involve injection of a small amount of a radiopharmaceutical into a vein. The agent flows through the bloodstream and collects in certain areas or organs. When a special camera is used to take images, the agent will show in "hot spots," which the radiologist will use to interpret the results. Often, nuclear medicine scans will be used to check for spread of cancer to bone, but they also have other uses. Most of the radiopharmaceutical passes out of the body in urine or stool and the rest disappears through natural loss of radioactivity over time. Reaction to the agent is rare.

Ultrasound is an imaging examination that does not use radiation. Instead, high-frequency sound waves are used to produce images. Ultraound often is used to follow up in suspicious mammogram findings. Ultrasound images show fluids and soft tissues very well and often help radiologists determine if a mass is most likely a benign cyst or a malignant (cancerous) solid mass. Other common areas that ultrasound is used to image when diagnosing cancer are the thyroid, the abdomen, the pelvic area (ovaries, uterus), and the prostate.

Magnetic resonance imaging (MRI) also does not require use of radiation. Instead, a strong magnetic field and radio waves provide clear and detailed pictures through a computer display. MRI has proven to be the most sensitive examination for brain tumors. MRI also has become increasingly useful in breast cancer imaging in recent years, as well as for many other suspected cancers.

Positron emission tomography, or PET, scanning is a nuclear medicine procedure that acquires images based on detection of radiation, as in a radionuclide scan, but through emission of positrons. Positrons are tiny particles emitted from a radioactive substance administered to the patient. Cancer cells sometimes show up as areas of high activity. In recent years, physicians have been able to combine these images with CT images, fusing them with one another to show superb detail of the anatomy from CT scans along with the functional details gained from PET. These images improve diagnosis, staging, and tracking of treatment progress for cancer patients.

In most cases, at least for cancers that are solid tumors, a biopsy is the only definite method for confirming cancer diagnosis. Before many of the imaging methods discussed above were developed, a biopsy only could be performed through surgery, where a small sample of the tissue was cut out and sent to a laboratory for evaluation by a pathologist. Today, these samples can be extracted using small needles. The physician can be guided to the site of the suspected cancer by use of ultrasound, CT, MRI, or other imaging methods. The biopsy method often is called fine needle aspiration biopsy or core needle biopsy. Biopsies also may be performed during surgery, particularly to verify and stage cancer when a mass is removed as part of treatment. Removal and biopsy of the entire tumor is called excisional biopsy, while removal of only a portion of the tumor is called incisional biopsy.

## Treatment

Planning treatment for cancer first involves staging of the cancer. Once the physician has gathered the information needed to determine the cancer's stage, the physician will communicate with the patient about treatment options. The most common treatments for cancer are chemotherapy, radiation, and surgery. A cancer patient may receive one or all of these treatments or a combination of them in any order. The particular use and details of each treatment depend on the type of cancer, the stage, and many other factors individual to each patient.

### *Staging*

Cancer staging determines the extent of the cancer in the body. It usually is based on the size of the original tumor, whether the cancer has spread to the lymph nodes, and whether the cancer has spread to organs of the body that are distant from the original site. Each cancer has its own staging system using letters and numbers. The T in cancer staging describes the original tumor and the N stands for whether the cancer has spread to nearby lymph nodes. The M stands for metastases, or distant spread of the cancer. Numbers area assigned along with the letters. Stage I cancers are the least advanced and have the best outlook for survival. Stage IV is the most advanced level. A cancer's stage

does not change, even if cancer recurs or distant spread develops.

### *Chemotherapy*

Cancer can spread, even early in the cancer cells' development. Chemotherapy uses cancer-killing drugs that are given to the patient by mouth or by intravenous injection. The drugs travel through the bloodstream to try to kill cancer cells throughout the body, not just at the original tumor site. Usually, the drugs are given in cycles and treatment can last up to six months. Chemotherapy may cause side effects, including fatigue, nausea, and increased susceptibility to colds and infections.

### *Radiation therapy*

Also called radiotherapy or radiation treatment, radiation therapy usually is used to shrink or control growth of a tumor. The radiation destroys the cancer cells' ability to reproduce and the body naturally gets rid of the cells. In the past, radiation only came from external beam radiation therapy, where x-ray beams were directed toward the tumor from a machine outside the patient's body. But patients also may receive brachytherapy, a procedure in which radioactive sources, sometimes called seeds, are placed inside the body at the tumor site. Radiation therapy techniques have improved dramatically in recent years. Using computers and 3-D imaging, radiation oncologists and radiation therapists can precisely target the tumor area, sparing healthy tissues. Newer techniques even take into account natural movements such as breathing to better target the cancer cells. Radiation can produce some side effects, such as skin changes. Most of the effects are short term.

### *Surgery*

When a surgeon removes cancerous tissue, he or she often removes a little bit of the tissue around it. This is to ensure that all of the cancer cells were removed, to help minimize chance of recurrence. Surgery may require a hospital stay and recovery time, depending on the type and extent of the surgery. The belief that surgery for cancer leads to spreading of the disease is untrue.

## Nutrition/Dietetic concerns

Diet also is an important part of cancer treatment. It is important to eat the right kinds of foods before treatment, during treatment, and after treatment.

The American Cancer Society says that according to scientific evidence, about one-third of the cancer deaths that occur in the United States each year are due to nutrition and physical activity factors. These factors include excess weight. In 2006, the ACS recommended that Americans maintain a healthy weight throughout life, adopt a physically active lifestyle as adults and children, and consume a healthy diet with an emphasis on plant sources. The physical activity suggestions include at least 30 minutes of moderate to vigorous physical activity for adults five or more days a week, with 45 to 60 minutes of activity preferred. Children and adolescents should engage in at least 60 minutes of activity at least five days a week.

The ACS recommends choosing food and beverages that help to achieve and maintain a healthy weight. The society also recommends eating nine or more servings of a variety of fruits and vegetables per day. Whole grains should replace processed grains and the recommendations say to limit consumption of processed and red meats. Scientific evidence shows that populations with diets rich in vegetables and fruits but low in animal fat, meat, and calories have reduced risk of some common cancers.

Diet also is important during cancer treatment. Cancer and its treatment can cause nutritional deficiencies. Many cancer treatments can cause loss of appetite, and chemotherapy can additionally cause nausea. Radiation also can affect appetite, depending on the location of the tumor and treatment. Other nutritional needs for cancer patients arise because of a tendency to lose weight and muscle mass. When cancer is diagnosed, many patients will be placed on high-protein and high-calorie diets for a period of time to help maintain muscle and weight.

During treatment, the physician may recommend diet strategies to help soothe side effects. If patients are having trouble chewing or difficulty swallowing, thick liquids such as milkshakes may be suggested. Other semi-solid foods such as mashed potatoes may be helpful until swallowing or chewing ability improves. Other patients may have pain, nausea, vomiting, or diarrhea. Eating a meal before treatment may ease nausea. Eating small meals several times a day and choosing bland foods are some suggestions caregivers will offer patients to deal with nausea caused by cancer treatment. Diarrhea can be treated by eating broth, soups, sports drinks, or bananas and avoiding greasy foods. Loss of appetite can be overcome by eating small snacks that contain plenty of calories and **protein** and eating foods with odors that are appealing, as well as by trying new foods. Sometimes, cancer treatment alters the taste of foods. Rinsing the mouth before eating, using plastic utensils if foods taste metallic and adding spices to foods may help ease the symptoms.

After cancer treatment, it is important to resume healthy eating habits, following the recommendations of the American Cancer Society to maintain a healthy weight, be as physically active as possible, and to eat a balanced diet that leans toward whole grains and plant-based foods instead of red meats and processed foods.

### Therapy

Some cancer patients will need nutrition therapy to restore nutrients and remain nourished, particularly if they experience malnutrition because of their cancer or cancer treatment. Nutrition therapy may consist of enteral nutrition, also known as tube feeding. Enteral nutrition is food given in liquid form directly through a tube that is inserted into the stomach or small intestine. Parenteral nutrition is delivered into the blood stream through a thin tube, or catheter, inserted into a vein. Eating by mouth always is preferred to these methods, and patients are encouraged to eat as soon as they can following these nutrition therapies.

Some patients may receive palliative care for cancer. Palliative care is not treatment of the cancer, but steps taken to improve the patient's quality of life and symptom side effects. Hospice is a program of special care for patients who are at the end of their life. It may be provided in a hospital, special hospice facility, or in cooperation with the patient's family and other caregivers in the patient's home.

### Prognosis

Cancer prognosis depends on the type and stage of cancer at diagnosis, the person's overall health at diagnosis, and treatment success. Studies show that physicians sometimes are reluctant to provide information about prognosis, so it is important for cancer patients to ask specific questions about their likelihood of survival if they want detailed information.

### Prevention

In addition to following the American Cancer Society guidelines concerning diet, nutrition, and activity, it is important to follow recommendations from the ACS, family physicians, and other credible health sources regarding behaviors that might lead to cancer. Examples of these behaviors include tobacco use and exposure to ultraviolet rays (sunshine) without protection. Anyone who has a first-degree relative with cancer should speak with their physician about their risk for the same type of cancer and participate in recommended screening as recommended. In cancer, early detection is essential to treatment and good prognosis.

### Resources

#### BOOKS

*American Cancer Society's Health Eating Cookbook. 3rd Edition.* American Cancer Society, 2005.

*Good for You! Reducing Your Risk of Developing Cancer.* American Cancer Society, 2002.

#### ORGANIZATIONS

American Cancer Society. P.O. Box 22718, Oklahoma City, OK 73213-1718 or contact the office in closest city. 800-227-2345. <http://www.cancer.org>

National Cancer Institute. 6116 Executive Blvd, Room 3036A, Bethesda, MD 20892. 800-422-6237. <http://www.cancer.gov>

Teresa G. Odle

## Cancer-fighting foods

### Definition

It appears more than ever, that there is a great deal of truth to the philosophy of eating fruits and vegetables to maintain optimum health. It is not only because of the nutrients they contain in the form of **vitamins** and **minerals**, also because of the chemicals found in these foods. Scientists continue to extensively study the nutrient quality and quantity of foods we consume. Although scientists are still not certain about the specifics, they're beginning to close in on the healthful constituents of plant-based foods. In particular, they're looking closely at two components: phytochemicals and **antioxidants**. The goal is to determine precisely how and why these substances in fruits and vegetables can prevent or stop the development of tumors and **cancer**. When animals are given vegetables and fruits before being exposed to carcinogen (cancer-causing agents), they are less likely to develop cancer. Although additional experimental data needs to be collected in humans, there is evidence to suggest that consuming generous amounts of fruits and vegetables plays an important role in preventing cancer.

### Purpose

Phytochemicals, are plant chemicals that are naturally occurring substances in plants. Several hundred types of phytochemicals have been identified, but many more likely remain to be identified. Some examples include indoles in cabbage or cauliflower, saponins in

**Cancer-fighting foods**

| Foods | Effects on cancer |
|---|---|
| Avocados | May attack free radicals in the body by blocking intestinal absorption of certain fats; may be useful in treating viral hepatitis (a cause of liver cancer) |
| Beans | May prevent or slow genetic damage to cells, prevent prostate cancer, and lower the risk of digestive cancers |
| Berries | May help prevent skin, bladder, lung, and breast cancers and slow the reproduction of cancer cells |
| Cabbage and cauliflower | May slow cancer growth and development and help to reduce the risk of lung, prostate, and bladder cancers |
| Broccoli | May prevent some types of cancer, including stomach, colon and rectal |
| Carrots | May reduce a wide range of cancers including lung, mouth, throat, stomach, intestine, bladder, prostate and breast |
| Chili peppers and jalapeños | May prevent cancers such as stomach cancer |
| Cruciferous vegetables (broccoli, cauliflower, kale, Brussels sprouts, and cabbage) | May help decrease prostate and other cancers |
| Dark green leafy vegetables | May reduce the risk of lung and breast cancer |
| Figs | May shrink tumors |
| Flax | May reduce the risk of breast, skin, and lung cancer |
| Garlic | May increase the activity of immune cells that fight cancer and indirectly help break down cancer causing substances. May help block carcinogens from entering cells and slow tumor development. May render carcinogens in the liver inactive May lower risk of a variety of cancers including stomach, colon, lung and skin |
| Grapefruits | May prevent cancer by sweeping carcinogens out of the body and inhibit the proliferation of breast-cancer cells in vitro |
| Grapes | May inhibit the enzymes that can stimulate cancer-cell growth and suppress immune response |
| Kale | May help stop the conversion of certain lesions to cancerous cells in estrogen-sensitive tissues, suppress tumor growth, and block cancer-causing substances from reaching their targets |
| Licorice root | May prevent the growth of prostate cancer |
| Mushrooms | May help the body fight cancer and build the immune system |
| Nuts | May suppress the growth of cancers |
| Oranges and lemons | May stimulate cancer-killing immune cells like lymphocytes that may function in breaking down cancer-causing substances |
| Papayas | May reduce absorption of cancer-causing nitrosamines from the soil or processed foods. May minimize cervical dysplasia and certain cancers |
| Red wine | May inhibit cell proliferation and help prevent cancer |
| Rosemary | May inhibit the development of breast and skin tumors |
| Seaweed and other sea vegetables | May help in the fight against breast cancer |
| Soy products like tofu | May help to prevent breast and prostate cancer by blocking and suppressing cancerous changes |
| Sweet potatoes | May prevent cancer cells from dividing, reduce the risk of cancer of the stomach, lung, colon, rectum, liver and pancreas, and protect against various types of cancer |
| Tomatoes | May combat prostate cancer and protect against breast, lung, mouth, stomach, and pancreatic cancer. May reduce risk of breast, prostate, pancreas and colorectal cancer. May prevent cellular damage that leads to cancer. |
| Tumeric | May inhibit the production of the inflammation-related enzyme cyclo-oxygenase 2 (COX-2), which reaches abnormally high levels in certain inflammatory diseases and cancers, especially bowel and colon cancer |
| Whole grains | May help decrease the risk of developing most types of cancer |

*(Illustration by GGS Information Services/Thomson Gale.)*

peas and beans, genstain in soybeans and isoflavones in **soy** milk and tofu. Over the past 20 years, nutrition scientists have consistently found that individuals that eat greater amounts of vegetables and fruits have lower rates of cancer. It has been only recently that the mechanism(s) by which phytochemicals assist the body in resisting cancer have begun to be understood. The phytochemicals present in fruits and vegetables protect the body by stunting the growth of malignant cells. Investigators have only an inkling of how many phytochemicals exist and how they work. They are confident, however, that an individual can get a basketful of anticancer nutrients by mixing and matching at least five servings a day of fruits and vegetables with seven or more starchy or protein-rich plant foods such as grains, peas and beans, and potatoes.

Supplements containing vitamins and minerals can help an individual gain some of the benefits of these substances. However, vitamin and mineral supplements are not a total replacement for real food.

This is because vitamin and mineral supplements, though very beneficial, do not supply the thousands of phytochemicals that might be present in fruits and vegetables, according to the Cleveland Clinic Foundation in Ohio. For example, eating a sweet potato with its skin, which is a great source of both beta carotene and **fiber**, provide at least 5,000 phytochemicals that are not present in a beta carotene supplement. That's an extremely important difference. Isolating a few compounds in a pill will not provide you with the hundred of protective benefits that plant food provide. The best advice is to obtain phytochemicals by eating a good variety of plant foods every day. Whether fruits and vegetables are consumed in raw or cooked form does not really matter with regard to phytochemical content. Even canned, frozen and juiced fruits and vegetables pack a phytochemical punch. However, raw or steamed vegetables would provide the best nutrient value.

The antioxidants found in fruits, vegetables, and other plant-based foods fight free radicals, which are compounds in the body that attack and destroy cell membranes. The uncontrolled activity of free radicals is believed to cause many cancers. Examples of antioxidants include **carotenoids**, such as beta carotene, lycopene, and vitamins C and E.

The carotenoids, in particular, which give fruits and vegetables their bright yellow, orange, and red colors, are now gaining recognition for their nutritional worth. Numerous studies have extolled the virtues of lycopene (the carotenoid that makes tomatoes red) in preventing **prostate** cancer. One such study at Harvard University found that men who include tomato products in their meals twice a week could reduce their risk of developing prostate cancer by one-third compared with men who do not consume tomatoes.

Other lycopene-rich foods, such as watermelon, red grapefruit, and guava, are now piquing the interest of researchers. Watermelon not only yields more lycopene per serving (15 mg in 11/2 cups) than raw tomatoes (11 mg per 11/2 cups), but it's also a rich source of vitamins A and C.

Whether antioxidants can reduce the incidence of cancer is still uncertain at this point because of the lack of sufficient studies. However, research data obtained thus far indicates that antioxidants do appear to provide health benefits.

The National Cancer Institute estimates that roughly one-third of all cancer deaths may be diet related. Scientists have recently estimated that approximately 30 to 40% of all cancers could be averted if people ate more fruits, vegetables, and plant-based foods and minimized high-fat, high-calorie edibles that have scant nutritional value. What you eat can hurt you, but it can also help you. In the past, researchers had linked fat consumption with the development of cancers, but they currently believe that eating fruits, vegetables, and grains may be more important in preventing the disease than not eating fat. Many of the common foods found in grocery stores or organic markets contain cancer-fighting properties, from the antioxidants that neutralize the damage caused by free radicals to the powerful phytochemicals that scientists are just beginning to explore. There isn't a single element in a particular food that does all the work. The best thing to do is eat a variety of foods.

## KEY TERMS

**antioxidants**—A substance, such as vitamin E, vitamin C, or beta carotene, thought to protect body cells from the damaging effects of oxidation.

**phytochemicals**—A nonnutritive bioactive plant substance, such as a flavonoid or carotenoid, considered to have a beneficial effect on human health.

## Description

There are a number of foods that have been demonstrated to have the ability to help stave off cancer and some can even help inhibit cancer cell growth or reduce tumor size. The following is a list of foods that because of the nutrients they contain, have been determined to be the best cancer fighters:

Avocados: They are rich in glutathione, a powerful antioxidant that attacks free radicals in the body by blocking intestinal absorption of certain **fats**. They also supply even more potassium than bananas and are a strong source of **vitamin E**. Scientists also believe that avocados may also be useful in treating viral hepatitis (a cause of liver cancer), as well as other sources of liver damage.

Beans: Beans contain a number of phytochemicals, which have been shown to prevent or slow genetic damage to cells. While this makes beans beneficial for helping to reduce your risk of many types of cancer, specific research has suggested they are especially potent in preventing prostate cancer. As an added bonus, the high fiber content of beans has been connected with a lower risk of digestive cancers.

Berries: The two most widely studied cancer-fighting compounds in berries are ellagic acid (richest in strawberries and raspberries) and anthocyanosides (richest in

blueberries). Ellagic acid is believed to help prevent skin, bladder, lung, and breast cancers, both by acting as an antioxidant and by slowing the reproduction of cancer cells. The anthocyanosides in blueberries are currently the most powerful antioxidants known to scientists and are beneficial in the prevention of all types of cancer. Raspberries contain many vitamins, minerals, plant compounds and antioxidants known as anthocyanins that may protect against cancer. According to a recent research study reported by Cancer Research, rats fed diets of 5% to 10% black raspberries saw the number of esophageal tumors decrease by 43% to 62%. A diet containing 5% black raspberries was more effective than a diet containing 10% black raspberries. Research reported in the journal Nutrition and Cancer in May 2002 shows black raspberries may also thwart colon cancer. Black raspberries are rich in antioxidants, thought to have even more cancer-preventing properties than blueberries and strawberries.

Cabbage, and cauliflower: All cruciferous vegetables including cabbage and cauliflower, are rich in a variety of compounds that have been shown to slow cancer growth and development in a number of laboratory studies. These vegetables contain a chemical component called indole-3-carbinol that can combat breast cancer by converting a cancer-promoting estrogen into a more protective variety. Other larger human studies have shown that cruciferous vegetables can help to reduce the risk of lung, prostate, and bladder cancers.

Broccoli: Broccoli, which is also a cruciferous vegetable, contains the phytochemical sulforaphane, a product of glucoraphanin, that is believed to aid in preventing some types of cancer, like stomach, colon and rectal cancer. Sulforaphane induces the production of certain enzymes that can deactivate free radicals and carcinogens. The enzymes have been shown to inhibit the growth of tumors in laboratory animals. However, be aware that the Agriculture Department studied 71 types of broccoli plants and found a 30-fold difference in the amounts of glucoraphanin. It appears that the more bitter the broccoli is, the more glucoraphanin it has. Broccoli sprouts have been developed under the trade name BroccoSprouts that have a consistent level of sulforaphane that is as much as 20 times higher than the levels found in mature heads of broccoli.

Carrots: They contain a plentiful amount of beta carotene, which may help reduce a wide range of cancers including lung, mouth, throat, stomach, intestine, bladder, prostate and breast. Some research indicated beta carotene may actually cause cancer, but this has not proven that eating carrots, unless in very large quantities i.e. 2 to 3 kilos a day, can cause cancer. In fact, a substance called falcarinol that is found in carrots has been found to reduce the risk of cancer, according to researchers at Danish Institute of Agricultural Sciences (DIAS). It has been demonstrated that isolated cancer cells grow more slowly when exposed to falcarinol. This substance is a polyacethylen.

Chili peppers and jalapenos: They contain a chemical, capsaicin, which may neutralize certain cancer-causing substances called nitrosamines and may help prevent cancers such as stomach cancer.

Cruciferous vegetables - broccoli, cauliflower, kale, Brussels sprouts, and cabbage contain two antioxidants, lutein and zeaxanthin that may help decrease prostate and other cancers.

Dark Green Leafy Vegetables: Leafy-green vegetables-like romaine lettuce, mustard greens, chicory, and Swiss chard-are rich sources of antioxidants called carotenoids. These compounds scavenge dangerous free radicals from the body before they can promote cancer growth. The vegetables are also rich in **folate**, a vitamin shown to reduce the risk of lung and breast cancer.

Figs: Apparently figs contain a derivative of benzaldehyde. It has been reported by investigators at the Institute of Physical and Chemical Research in Tokyo that benzaldehyde is highly effective at shrinking tumors, though further experiments need to be conducted. In addition, the U.S. Department of Agriculture says figs, which contain vitamins A and C, and **calcium**, **magnesium** and potassium, may curtail appetite and improve weight-loss efforts. Fig juice is also a potent bacteria killer in test-tube studies.

Flax: Flax contains lignans, which may have an antioxidant effect and block or suppress cancerous changes. Flax is also high in **omega-3 fatty acids**, which are thought to protect against colon cancer and heart disease. **Flaxseed** in the form of oil and meal contains phytoestrogens believed to reduce the risk of breast, skin, and lung cancer. Research on the potency of flaxseed as an anti-cancer food is still ongoing. A specialized diet called the Budwig diet, which has been used by some cancer patients, uses the combination of flax seed oil and cottage cheese. When these two foods are consumed simultaneously, it is said that they increase the levels of substances called phosphatides and lipoproteins in the blood. Dr. Johanna Budwig, the creator of the diet claims that the diet is both preventative and curative in regard to cancer.

Garlic: This herb has immune-enhancing allium compounds (dialyl sultides) that appear to increase the activity of immune cells that fight cancer and indirectly help break down cancer causing substances.

These substances also help block carcinogens from entering cells and slow tumor development. Diallyl sulfide, a component of garlic oil, has also been shown to render carcinogens in the liver inactive. Studies have linked garlic as well as onions, leeks, and chives to lower risk of a variety of cancers including stomach, colon, lung and skin cancer. Dr. Lenore Arab, professor of epidemiology and nutrition at the UNC-CH (University of North Carolina at Chapel Hill) schools of public health and medicine and colleagues analyzed a number of studies and reported their findings in the October 2000 issue of the American Journal of Clinical Nutrition. According to the report, individuals who consume raw or cooked garlic regularly face about half the risk of stomach cancer and two-thirds the risk of colorectal cancer as individuals who eat little or none. Their studies did not show garlic supplements had the same effect. It is believed garlic may help prevent stomach cancer because it has anti-bacterial effects against a bacterium, Helicobacter pylori, found in the stomach and known to promote cancer there.

Grapefruits: Like oranges and other citrus fruits, grapefruits contain monoterpenes, that are believed to help prevent cancer by sweeping carcinogens out of the body. Some studies show that grapefruit may inhibit the proliferation of breast-cancer cells in vitro. Grapefruits also contain **vitamin C**, beta-carotene, and folic acid.

Grapes: Particularly red and purple grapes, are a rich source of resveratrol, a potent antioxidant and anti-inflammatory agent, which inhibits the enzymes that can stimulate cancer-cell growth and suppress immune response. Resveratrol is thought to work by preventing cell damage before it begins. Grapes also contain ellagic acid, a compound that blocks enzymes that are necessary for cancer cells. Ellagic acid also appears to help slow the growth of tumors. Red grapes also contain bioflavonoids, which are powerful antioxidants that work as cancer preventives.

Kale: This cruciferous vegetable contains indoles, which are a nitrogen compound that may help stop the conversion of certain lesions to cancerous cells in estrogen-sensitive tissues. In addition, isothiocyanates, phytochemicals found in kale, are thought to suppress tumor growth and block cancer-causing substances from reaching their targets.

Licorice root: It has a chemical, glycyrrhizin, that blocks a component of testosterone and therefore may help prevent the growth of prostate cancer. However, excessive amounts can lead to elevated blood pressure.

Mushrooms: There are a number of mushrooms that appear to help the body fight cancer and build the immune system. They include Shiitake, maitake, reishi, Agaricus blazei Murill, and Coriolus Versicolor. The active ingredient in medicinal mushrooms are polysaccharides called beta-glucans. These beta-glucans are powerful compounds that help in building immunity. Examples of beta-glucans include Lentinan and a unique beta-glucan called D-fraction, that is found in the Maitake mushroom. This D-fraction is believed to be responsible for the many health benefits of Maitake. These mushrooms also have a **protein** called lectin, which attacks cancerous cells and prevents them from multiplying. They also contain Thioproline. These mushrooms can stimulate the production of interferon in the body. Extracts from mushrooms have been successfully tested in recent years in Japan as an adjunct to chemotherapy.

Nuts: Many nuts contain the antioxidants quercetin and campferol that may suppress the growth of cancers. Brazil nuts contain 80 micrograms of **selenium**, which is important for those with prostate cancer.

Oranges and lemons: They both contain Iimonene which stimulates cancer-killing immune cells like lymphocytes that may also function in breaking down cancer-causing substances.

Papayas: They have vitamin C that works as an antioxidant and may also reduce absorption of cancer-causing nitrosamines from the soil or processed foods. Papaya contains folacin (also known as folic acid), which has been shown to minimize cervical dysplasia and certain cancers.

Red wine: Even without alcohol, red wine has polyphenols that may protect against various types of cancer. Polyphenols are potent antioxidants, compounds that help neutralize disease-causing free radicals. Also, researchers at the University of North Carolina's medical school in Chapel Hill found the compound resveratrol, which is found in grape skins. It appears that resveratrol inhibits cell proliferation and can help prevent cancer. However, the findings didn't extend to heavy imbibers, so it should be used in moderation. In addition, alcohol can be toxic to the liver and to the nervous system, and many wines have sulfites, which may be harmful to your health. Since some research indicates that alcohol is considered a class "A" carcinogen that can actually cause cancer, it is probably best to consume non-alcoholic wines.

Rosemary: This herb may help increase the activity of detoxification enzymes. An extract of rosemary, termed carnosol, has inhibited the development of both breast and skin tumors in animals. We haven't found any studies done on humans. Rosemary can be used as a seasoning and it can also be consumed as a tea.

Seaweed and other sea vegetables: They contain beta-carotene, protein, vitamin $B_{12}$, fiber, and chlorophyll, as well as chlorophylones, which are important fatty acids that may help in the fight against breast cancer. Many sea vegetables also have high concentrations of the minerals potassium, calcium, magnesium, **iron**, and **iodine**.

Soy products like tofu: These contain several types of phytoestrogens which are weak, nonsteroidal estrogens that resemble some of the body's natural hormones. These compounds could help prevent both breast and prostate cancer by blocking and suppressing cancerous changes. There are a number of isoflavones in soy products, but research has shown that genistein is the most potent inhibitor of the growth and spread of cancerous cells. It appears to lower breast-cancer risk by inhibiting the growth of epithelial cells and new blood vessels that tumors require to flourish and is being scrutinized as a potential anti-cancer drug. However, there are some precautions to consider when adding soy to the diet. Eating up to 4 or 5 ounces of tofu or other soy a day is probably fine, but research is being done to see if loading up on soy could cause hormone imbalances that stimulate cancer growth. As a precaution, women who have breast cancer or are at high risk should talk to their doctors before taking pure isoflavone powder and pills, extracted from soy.

Sweet potatoes: They contain many anticancer properties, including beta-carotene, which may protect DNA in the cell nucleus from cancer-causing chemicals outside the nuclear membrane.

Teas: **Green tea** and Black tea contain certain antioxidants known as polyphenols (catechins) which appear to prevent cancer cells from dividing. Green tea is best, followed by our more common black tea (herbal teas do not show this benefit). According to a report in the July 2001 issue of the *Journal of Cellular Biochemistry*, these polyphenols that are abundant in green tea, red wine and olive oil, may protect against various types of cancer. Dry green tea leaves, which are about 40% polyphenols by weight, may also reduce the risk of cancer of the stomach, lung, colon, rectum, liver and pancreas, study findings have suggested.

Tomatoes: Tomatoes contain lycopene, an antioxidant that attacks roaming oxygen molecules, known as free radicals, which are suspected of triggering cancer. Lycopene appears to be more easily absorbed if the tomatoes are eaten in processed form—either as tomato sauce, paste, or juice. It appears that the hotter the weather, the more lycopene tomatoes produce. Lycopene, has been shown to be especially potent in combating prostate cancer and may also protect against breast, lung, stomach, and pancreatic cancer. Scientists in Israel have shown that lycopene can kill mouth cancer cells. An increased intake of lycopene has already been linked to a reduced risk of breast, prostate, pancreas and colorectal cancer. Recent studies indicate that for proper absorption, the body also needs some oil along with lycopene. Tomatoes also have vitamin C, an antioxidant that can prevent cellular damage that leads to cancer. Watermelons, carrots, and red peppers also contain these substances, but in lesser quantities. It is concentrated by cooking tomatoes.

Tumeric: A member of the ginger family, that is claimed to have medicinal properties. Tumeric appears to inhibit the production of the inflammation-related enzyme cyclo-oxygenase 2 (COX-2), which reaches abnormally high levels in certain inflammatory diseases and cancers, especially bowel and colon cancer. A pharmaceutical company Phytopharm in the UK hopes to introduce a natural product, P54, that contains certain volatile oils, which greatly increase the potency of the turmeric spice.

Whole Grains: Whole grains contain a variety of anti-cancer compounds, including fiber, antioxidants, and phytoestrogens. When eaten as part of a balanced diet, whole grains can help decrease the risk of developing most types of cancer.

A considerable amount of information and knowledge has been accumulated regarding the cancer fighting foods. No single food or food substance alone can protect an individual against cancer, but the right combination of plant-based foods in the diet can greatly increase the chances of avoiding cancer. Evidence is mounting that the minerals, vitamins, antioxidants and phytochemicals in many plant foods interact to provide extra cancer protection by working synergistically in the body. For this reason, many nutrition scientists recommend that at least 2/3 of the diet should consist of vegetables, fruit, whole grains and beans.

## Precautions

In some cases, high intakes of individual vitamins can be harmful. An example of this is the risk of high levels of beta-carotene increasing the risk of lung cancer in smokers.

## Parental concerns

Children can greatly benefit from a diet rich in cancer-fighting foods. The healthy diet will promote a lifetime of good health as well as encourage proper growth. However, vitamin supplementation is not recommended outside of a physician's or registered dietetian's care as children have different vitamin

requirements and the level of doses appropriate for an adult may not be the same for a child.

### Resources

#### BOOKS

Greenwood-Robinson, Maggie. *Foods That Combat Cancer: The Nutritional Way to Wellness* . New York: Avon Books, HarperCollins, 2003.

Varona, Verne. *Nature's Cancer-Fighting Foods* . New York: Penguin Putnam Inc., 2001.

#### OTHER

American Institute for Cancer Research. 1759 R Street NW, Washington, DC 20009. Telephone: 1-800-843-8114 Website: http://www.aicr.org/site/PageServer?pagename=dc_foods_home.

American Institute for Cancer Research. 1759 R Street NW, Washington, DC 20009. Telephone: 1-800-843-8114. Website: http://www.aicr.org/site/PageServer?pagename=dc_foods_home.

The Cancer Cure Foundation. P.O. Box 3782, Westlake Village, California 91359. Telephone: 1-800-282-2873. Website: http://www.cancure.org/cancer_fighting_foods.htm.

Thomas Prychitko

# Carbohydrate addict's diet

## Definition

The carbohydrate addict's diet is an eating plan that emphasizes foods low in **carbohydrates** (carbs). It is based on the theory that some people develop unmanageable **cravings** for high-carb foods due to the pancreas producing too much insulin, leading to weight gain.

## Origins

American research scientists Rachel Heller and Richard Heller developed the carbohydrate addict's diet in the early 1990s after the husband and wife lost a combined 200 lb (75 kg) on the diet. Both Hellers are professors and researchers specializing in biomedical sciences. They outlined their method in their first book, *The Carbohydrate Addict's Diet*, published in 1991. They have since expanded upon the diet in subsequent books and several updates of the original book. The term "carbohydrate addiction" was coined in 1963 by Robert Kemp, a biochemist at Yale University.

## Description

The carbohydrate addict's diet is a program based on the theory that balancing insulin levels in the body will lead to reduced insulin resistance and less cravings for foods high in carbohydrates. The diet has two steps: reduce the high-carbohydrate foods that are consumed, and regulate insulin levels by using **dietary supplements**. Although the Hellers recommend an exercise program with the diet, there is not a major emphasis on exercise. The Hellers define carbohydrate addiction as a compelling hunger, craving, or desire for foods high in carbohydrates, or an escalating and recurring need for starchy foods, snack foods, junk foods, and sweets. These foods include breads, bagels, cakes, cereals, chocolate, cookies, crackers, pastry, fruit and fruit juices, ice cream, potato chips, pasta, potatoes, pretzels, rice, pies, popcorn, and sugar-sweetened beverages. The Hellers also advocate avoiding sugar substitutes (Equal, NutraSweet, Splenda), which they theorize causes the body to release insulin and the body to store fat.

Up to 75% of people who are overweight are addicted to carbohydrates, according to the Hellers. Carbohydrate addiction is caused by an over-production of the hormone insulin when foods high in carbohydrates are eaten. The insulin tells the body to take in more food and once the food is eaten, the insulin signals the body to store the extra food energy as fat, the Hellers hypothesize. When too much insulin is released after eating, it is called *post-prandial reactive hyperinsulinemia*. Over time, some people with this condition develop insulin resistance, where cells in tissue stop responding to insulin. The body continues to produce insulin but because the tissues do not respond to it, the body is unable to use the glucose (sugar) properly. Insulin resistance is often found with other health problems, including diabetes, high cholesterol, high **triglycerides**, high blood pressure and cardiovascular disease. When more than one of these diseases are found together, it may be termed "insulin resistance syndrome".

There is no medical test to indicate carbohydrate addiction so the Hellers developed a self-administered quiz to determine if a person is a carbohydrate addict. The quiz, which is available in their books and on their Website, asks ten "yes" or "no" questions. They are:

- Are you hungry before lunch even if you've had a full breakfast?
- Is it hard to stop eating starches, snack foods, junk food, or sweets?
- Do you feel unsatisfied despite having just finished a meal?

- Does seeing, smelling, or thinking of food make you want to eat?
- Do you eat when you are not hungry?
- Do you snack at night?
- Are you lethargic after a big meal?
- Are you tired and/or hungry in the afternoon without a reason to be?
- Do you continue to eat even when you are full?
- Do you yo-yo diet?

Scoring of the quiz is based on the number of "yes" answers. A score of 0–2 indicates no carbohydrate addiction. A score of 3–4 suggests a mild carbohydrate addiction. A score of 5–7 suggests a moderate addiction. A score of 8–10 indicates a severe addiction to carbohydrates.

The carbohydrate addict's diet begins with the entry plan, which allows two complementary meals and one reward meal each day for the first week. In subsequent weeks, the diet is adjusted depending on a person's weight loss goal and amount of weight lost in the previous week. The diet also allows for a snack and salads. The complementary meal is composed of one serving of meat and two cups of low-carb vegetables or two cups of salad. There is an extensive list of meats and vegetables to choose from. The reward meal can be as large as the person wants but it must be composed of equal portions of **protein**, low-carb vegetables, and high-carb foods (including dessert). The reward meal must be eaten in an hour. A snack is the same as a complementary meal but half the size. The diet allows for an unlimited amount of **water**, diet drinks, and unsweetened coffee and tea.

Very few people need a morning breakfast to provide energy through the day, according to the Hellers. Since food takes several hours to clear the stomach and a few more hours to be processed in the small intestine, it is the food that is eaten the night before that gives a person energy for the first part of the next day, the Hellers say. For people who are not hungry in the morning, the Hellers recommend skipping breakfast and having just coffee or tea. Skipping breakfast is not a practice widely recommended among dieticians and nutritionists.

### *Children and teens*

There are two different carbohydrate addict's diets for children and teenagers. Both are outlined in the Hellers' book, *Carbohydrate-Addicted Kids*. Carbohydrate addiction affects up to 74% of children and teens, according to the Hellers. It is also a problem in adolescents with behavior, motivation, concentration, and learning problems, and mood swings. On the step-by-step carbohydrate addict's diet, children go at a slower pace, and are offered additional food incentives besides the rewards meal. The jump-start carbohydrate addict's diet is designed for older children and teens. It offers foods high in **fiber** and protein for meals and snacks. Like the adult diet, it provides a reward meal in which dieters can eat anything they want, provided it is equal portions of protein, low-carb vegetables, and high-carb foods. The book also provides information on meals for special occasions, such as birthdays, holidays, vacations, and other celebrations. The diets for adolescents also have a vegetarian component.

## KEY TERMS

**Carbohydrate addiction**—A compelling hunger, craving, or desire for foods high in carbohydrates, or an escalating and recurring need for starchy foods, snack foods, junk foods, and sweets.

**Carbohydrates**—An organic compound that is an important source of food and energy.

**Cardiovascular**—Pertaining to the heart and blood vessels.

**Cholesterol**—A compound found in blood and a number of foods, including eggs and animal fats.

**Endocrinologist**—A medical specialist who treats diseases of the endocrine (glands) system, including diabetes.

**Insulin**—A hormone that regulates the level of glucose (sugar) in the blood.

**Pancreas**—A digestive gland of the endocrine system that regulates and produces several hormones, including insulin.

**Post-prandial reactive hyperinsulinemia**—A condition resulting from excess insulin production after eating.

## Function

The premise of the carbohydrate addict's diet is to correct the body's excess release of insulin, which occurs following consumption of foods high in carbohydrates. The excess release of insulin triggers an intense and recurring craving for more carbohydrate-rich foods. The diet, combined with exercise, is designed to correct the underlying cause of the cravings, the excess release of insulin.

## Benefits

The primary benefit of the carbohydrate addict's diet is that carb-addicts can control their cravings and

lose weight by eating high-carb foods only once a day. The diet is less strict than the Atkins **low-carb diet** since it allows for one meal a day with three equal portions of foods high in carbohydrates, high in protein, and low in carbohydrates. The carbohydrate addict's diet is suitable for vegetarians (though not vegans) since it allows for low-fat cheeses, egg whites, egg substitutes, and tofu.

### Precautions

Like any strict diet, the carbohydrate addict's diet should be undertaken with the supervision of a doctor. People with diabetes should consult an endocrinologist, who may recommend discussing the diet with a dietitian. Persons considering the carbohydrate addict's diet should ask their doctors if they need to take any vitamin, mineral, or nutritional supplements, based on their overall health and any specific medical conditions they may have.

### Risks

There are no general health risks associated with the carbohydrate addict's diet. Critics of the diet claim it contains too much fat, is not nutritionally balanced, and is not a long-term solution for losing weight and keeping it off. It may be difficult for people to maintain a low-carb diet over the long-term. The diet is not recommended for women who are pregnant or nursing. Individuals who have a history of stroke, diabetes, heart disease, high cholesterol, or kidney stones should talk to their doctor before starting any low-carb diet.

### Research and general acceptance

There is mixed acceptance of the carbohydrate addict's diet and low-carb diets in general by the medical community and dietitians. Some studies have shown low-carb diets can be effective in controlling blood sugar levels in diabetics and in helping people lose weight. Other studies have contradicted these findings. No major studies or research has shown that low-carb diets are harmful to a person's health; however most professional organizations do not support low-carb diets.

A 2003 study by researchers at the University of Pennsylvania School of Medicine found that a low-carb diet produced a greater weight loss than a conventional low-calorie, **low-fat diet** after six months. However, after one year, the two diets produced similar weight loss results. A 2004 study by the same medical center found that both a low-carb and conventional diet produced similar weight loss results after one year but that a low-carb diet improved the health of people with atherogenic dyslipidemia, a cholesterol disorder characterized by the elevation of triglycerides and a decrease in "good cholesterol" high-density lipoprotein (HDL) levels in the blood. This lipid disorder is associated with an increased risk of developing cardiovascular disease. Also, individuals participating in the study had better control of blood sugar levels.

## QUESTIONS TO ASK YOUR DOCTOR

- Which dietary supplements do you recommend for the carbohydrate addict's diet?
- What are the health risks involved with this diet?
- What other diets you would recommend to help me accomplish my weight loss goals?
- Have you treated other patients on the carbohydrate addict's diet? If so, what has been their response to the diet?

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**ORGANIZATIONS**

American Academy of Family Physicians. 11400 Tomahawk Creek Parkway, Leawood, KS 66207. Telephone: (800) 274-2237. Website: <http://www.aafp.org>.
American College of Nutrition. 300 South Duncan Ave., Suite 225, Clearwater, FL 33755. Telephone: (727) 446-6086. Website: <http://www.amcollnutr.org>.
American Diabetes Association. 1701 N. Beauregard St., Alexandria, VA 22311. Telephone: (800) 342-2383. Website: <http://www.diabetes.org>.
American Dietetic Association. 120 South Riverside Plaza, Suite 2000, Chicago, IL 60606-6995. Telephone: (800) 877-1600. Website: <http://www.eatright.org>.
American Society for Nutrition. 9650 Rockville Pike, Bethesda, MD 20814. Telephone: (301) 634-7050. Website: <http://www.nutrition.org>.
Center for Nutrition Policy and Promotion. 3101 Park Center Drive, 10th Floor, Alexandria, VA 22302-1594. Telephone: (703) 305-7600. Website: <http://www.cnpp.usda.gov>.

Ken R. Wells

# Carbohydrates

## Definition

Carbohydrates are compounds that consist of carbon, hydrogen, and oxygen, linked together by energy-containing bonds. There are two types of carbohydrates: complex and simple. The complex carbohydrates, such as starch and **fiber**, are classified as polysaccharides. Simple carbohydrates are known as sugars and they are classified as either monosaccharides (one sugar molecule) or disaccharides (two sugar molecules).

**Carbohydrates**

| Refined and processed carbohydrates | Whole grain and high-fiber carbohydrates |
|---|---|
| White bread | 100% whole wheat bread |
| White rice | Oatmeal |
| White potatoes | Brown rice |
| Pasta | Whole wheat pasta |
| Sugary cereals | Whole grain crackers |
| Cinnamon toast | Popcorn |
| Sweets | Cornmeal |
| Jellies | Hulled barley |
| Candy | Whole wheat bulgur |
| Soft drinks | Bran cereals |
| Sugars | Rye wafer crackers |
| Fruit drinks (fruitades and fruit punch) | English muffins |
| | Dry beans and peas |
| Cakes, cookies and pies | Navy beans |
| Dairy desserts | Kidney beans |
| Ice cream | Split peas |
| Sweetened yogurt | Lentils |
| Sweetened milk | White beans |
| | Pinto beans |
| | Green peas |
| | Soybeans |
| | Whole fruits, fresh, frozen or canned |
| | Vegetables |
| | Low-fat milk |

*(Illustration by GGS Information Services/Thomson Gale.)*

## Purpose

In the digestive tract, carbohydrates are broken down into glucose, which provides energy for the body's cells and tissues. Glucose is the body's primary source of fuel.

## Description

Carbohydrates are one of the three major food groups, along with proteins and **fats**. They are essential to human life and health. Carbohydrates are either simple or complex. Both have four calories per gram, and both are further reduced by the body to glucose, but complex carbohydrates, which undergo most of their digestion in the large intestine, take longer to digest. Carbohydrates come almost exclusively from plants, vegetables, and grains. Milk is the only animal-based product that contains a significant amount of carbohydrate. Simple carbohydrates include the single sugars, or monosaccharides, and the double sugars, or disaccharides. The monosaccharides include glucose, fructose, and galactose. Disaccharides include lactose,

which is made of glucose and galactose; maltose, made of two glucose units; and sucrose, made of glucose and fructose. Monosaccharides can be absorbed directly into the bloodstream, but disaccharides need to be broken down into their monosaccharide components before they can be absorbed.

When food is eaten, the digestion of carbohydrates begins in the mouth, where an enzyme in saliva breaks down starch molecules into the disaccharide maltose. The food then moves into the stomach where it mixes with the stomach's acid and other juices. In the small intestine, starch is further broken down into disaccharides and small polysaccharides by an enzyme released from the pancreas. Cells lining the small intestine then secrete an enzyme that further splits these disaccharides and polysaccharides into monosaccharides. The cells lining the small intestine can absorb these monosaccharides, which are then taken to the liver. The liver converts fructose and galactose to glucose. If there is an excess of fructose or galactose, it may also be converted to fat. Lastly, the glucose is transported to the body's cells by the circulatory system, where it can be used for energy.

When there is an excess of glucose, the muscle and liver cells often convert it to glycogen, which is the storage form of glucose. The muscles store two thirds of the body's glycogen solely for themselves, and the liver stores the other one third, which can be used by the brain or other organs. When blood glucose levels decline, the body breaks down some of its glycogen stores, and uses the glucose for energy. If blood glucose (sugar) levels are too high, the excess glucose is taken to the liver where it is converted to glycogen and stored for future use.

### *Fiber*

One of the complex carbohydrates, fiber, is a polysaccharide in which the bonds holding it together cannot be digested by humans. Fiber can be either water-soluble or water-insoluble. Even though these compounds cannot be digested by humans, they serve several important functions. The main function of insoluble fiber is to bind bile acids, which reduces fat and cholesterol absorption. Sources of insoluble fiber include wheat bran, whole grains, and brown rice. Soluble fiber, which helps decrease low-density lipoprotein (LDL) cholesterol, also called the "bad" cholesterol, can be found in barley, fruit, legumes, and oats.

Fiber is an extremely important part of the diet. It aids in weight control by displacing calorie-dense fats in the diet. Fiber also absorbs **water** and slows the movement of food through the digestive tract, promoting a feeling of fullness. Recommended intakes of fiber should be about 27 to 40 grams per day. The United States Department of Agriculture (USDA) Dietary Guidelines were designed by health professionals to help consumers make nutritious food choices. The guidelines, released in 2005, replace the food pyramid that the USDA used for many years. Instead of recommending a certain number of servings per food group, as the food pyramid did, the new guidelines advise consumers to eat a diet that emphasizes fruits, vegetables, whole grains, and fat-free or low-fat milk and milk products; includes lean meats, poultry, fish, beans, eggs, and nuts; and is low in saturated fats, trans fats, cholesterol, salt, and added sugars. The guidelines recommend that 45–65% of total calories come from carbohydrates and that foods containing complex carbohydrates (such as whole-grains) are preferred over simple carbohydrates (such as table sugar and white flour.) As an example, one cup of whole-grain brown rice has more nutritional value and fiber that processed white rice.

## KEY TERMS

**Diabetes**—A condition characterized by inadequate use of insulin preventing a person from controlling blood sugar levels.

**Fructose**—A monosaccharide known as fruit sugar.

**Galactose**—A monosaccharide known as milk sugar.

**Glucose**—A monosaccharide used for energy; also known as blood sugar.

**Lactose**—A disaccharide known as milk sugar.

**Low-density lipoprotein (LDL)**—The so-called bad cholesterol that contains a large amount of cholesterol and transports lipids (fats) to other tissues in the body.

**Maltose**—A disaccharide known as malt sugar.

**Sucrose**—A disaccharide known as table sugar.

**Polysaccharides**—Long chains of glucose units linked together.

## Precautions

A common concern among consumers is that a high intake of carbohydrate-rich foods will cause weight gain. Consuming too much of any particular food can cause an increase in weight, but eating a balanced diet with plenty of fruits, vegetables, and grains will help promote weight management. General

guidelines recommend that about 45–65% of daily calories come from carbohydrates. This percentage varies depending on age, general health, health problems (including being overweight or obese), and activity level.

## Interactions

There are no known adverse dietary interactions associated with carbohydrates.

## Aftercare

Registered dietitians and nutritionists are the professionals most qualified to educate individuals on the role of carbohydrates in a healthy diet, as well as the complications associated with low-carbohydrate intakes. Medical doctors, including endocrinologists (specialists that tread diseases of the endocrine (glands) system, including diabetes) and nursing professionals also play an important role in treating carbohydrate-related conditions such as diabetes, while dietitians serve to make recommendations concerning the nutritional needs of these individuals.

## Complications

When carbohydrate intake is low, there is insufficient glucose production, which then causes the body to use its **protein** for energy. This ultimately prevents the body's protein from performing its more important functions, such as maintaining the body's immune system. Without carbohydrate, the body also goes into a state of ketosis, in which by-products of fat breakdown, called ketones, accumulate in the blood. This causes a shift in the acid-base balance of the blood, which can be fatal.

### *Diabetes*

Diabetes is a disease in which the body cannot metabolize carbohydrates, and either doesn't make or doesn't respond to insulin, a hormone secreted by the pancreas that is used to transport glucose to the body's cells. In individuals with type 1 diabetes, the pancreas fails to produce insulin, thus causing blood glucose levels to remain the same after meals. This condition is known as hyperglycemia. These individuals must receive daily injections of insulin to control their blood glucose levels. In type 2 diabetes, there may be sufficient insulin, but the body's cells may be resistant to it. Once again, this causes blood glucose levels to rise. Type 2 diabetes can be treated through oral medication and proper diet, although the need for insulin injections may develop later on. There is some disagreement in the medical community about the type of diet diabetics, especially type 1 diabetics, should be on. The conventional diet is one of low-fat, high-carbohydrate food, which is recommended by the American Diabetes Association. Some doctors, particularly endocrinologists, recommend the **Bernstein diet**, which is low in carbohydrates and high in fat, to maintain constant, normal blood sugar levels throughout the day.

### *Carbohydrate intolerance*

Carbohydrate intolerance is the inability of the small intestine to completely process the nutrient carbohydrate (a classification that includes sugars and starches) into a source of energy for the body. This is usually due to deficiency of an enzyme needed for digestion. Lactose intolerance is the inability to digest the sugar found in milk.

## Parental concerns

Parents should consult their child's pediatrician, physician, or endocrinologist if they are unsure the child's diet has a nutritional balance of carbohydrates. A doctor also should be consulted before a child or adolescent goes on a low-carbohydrate diet (such as the Atkins, Zone, and Sugar Busters diets) for weight loss.

## Resources

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United States Department of Agriculture; Food, Nutrition, and Consumer Services. 3101 Park Center Drive, Alexandria, VA 22302. Telephone: (703) 305-2281. Website: http://www.fns.usda.gov.

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# Caribbean Islander diet

## Origins

Travel advertisements for the Caribbean Islands portray long stretches of sun-drenched beaches and swaying palm trees, with people dancing to jazz, calypso, reggae, or meringue music. Indeed, the beauty, warmth, and lush landscapes had Christopher Columbus in awe in 1492 when he came upon these tropical islands, stretching approximately 2,600 miles between Florida and Venezuela.

### *European Settlement*

The Arawaks and Caribs, the first natives of the islands, were not treated kindly, however, as the Spanish, French, Dutch, and British conquered the islands at different periods, all but wiping out the native populations. Today, only a few aboriginals remain in the Caribbean.

The European settlers soon realized that sugarcane was a profitable crop that could be exported to the European market. However, there was a shortage of European farmers, and slaves were brought from Africa to work on the sugar plantations. The slave trade started in 1698. European settlers fought to keep their territories and hoped for great wealth, while actively pursuing the sugar and slave trades.

Two things changed the situation on the islands. In 1756, missionaries from Germany (Moravian Protestants), came to the islands, though the landowners were opposed to their presence, fearing that any education of the slaves could lead to a revolution. At about the same time a German scientist by the name of Margraf discovered that sugar could be produced from beets, and many European countries began to produce their own sugar.

In 1772, after many revolts and uprisings, the Europeans began to free their slaves. The sugar plantations

**Popular dishes of selected Caribbean islands**

| Island | Special dishes |
|---|---|
| Antigua, Montserrat, Nevis | Fish soup, pepper pot soup (any available fish, meat, chicken, and vegetables cooked in fermented cassava juice); saltfish with avocado and eggplant |
| Barbados | Flying fish; jug-jug (mashed stew of pigeon peas, usually served at Christmas)<br>Black pudding (a type of sausage made by combining cooked rice mixed with fresh pig's blood, seasoned with salt, pepper, and other condiments, and placed in thoroughly cleaned pieces of pig's intestine, and then tied on both ends and boiled in seasoned water) |
| Belize | Rice and chicken, tamales, conch fritters, refried beans and iswa (fresh corn tortillas) |
| Dominica | Tannia (coco, a starch tuber soup); mountain chicken (frog's legs) |
| Grenada | Callaloo (soup with green vegetables)<br>Lambi souse (conch marinated in lime juice, hot pepper, onion); oil-down (a highly seasoned dish of coconut milk and salted fish) |
| Guyana | Mellagee (one-pot stew of pickled meat/fish and coconut milk with tubers and vegetables); rice treat (rice with shrimp, vegetables, and pineapple) |
| Jamaica | Saltfish and ackee (a fruit commonly used as a vegetable, boiled and then sautéed in oil); escoveitched fish (fried fish marinated in vinegar spices, seasoning); roasted breadfruit; asham or brown George (parched dried corn that is finely beaten in a mortar, sifted, and mixed with sugar) |
| St. Vincent and the Grenadines | Stewed shark |
| British Virgin Islands | Fish chowder, conch salad, saltfish and rice |
| Trinidad and Tobago | Pelau (rice with meat, fish, peas, vegetables); pakoras; kachouri; palouri (fried vegetable fritters) |
| Guadeloupe and Martinique | Mechoui (spit-roasted sheep); pate en pot (finely chopped sheep and lamb parts cooked into a thick, highly seasoned stew) |

*(Illustration by GGS Information Services/Thomson Gale.)*

## KEY TERMS

**Absorption**—Uptake by the digestive tract.

**Asthma**—A respiratory disorder marked by wheezing, shortness of breath, and mucus production.

**Malnutrition**—Chronic lack of sufficient nutrients to maintain health.

**Tuber**—swollen plant stem below the ground.

still needed laborers, however, and indentured workers were brought from China and India to work in the fields. Sugar cane, and its by-products, molasses and rum, brought great prosperity to the settlers. However, not wanting to depend solely on sugar, they began to grow yams, maize, cloves, nutmeg, cinnamon, coconuts, and pineapples on a very large scale. Coffee also began to flourish. Many of the islands had wild pigs and cattle on them, and spiced, smoked meat became part of the diet. Today, jerk meat is a specialty.

## Description

### *Foods of the Islands*

The foods of the Caribbean are marked by a wide variety of fruits, vegetables, meats, grains, and spices, all of which contribute to the area's unique cuisine. Foods of Creole, Chinese, African, Indian, Hispanic, and European origin blend harmoniously to produce mouth-watering dishes.

Fruits and Vegetables. There are many fruits and vegetables found in the various Caribbean Islands, and because many of them have been exported to North America and Europe, people have become familiar with them. This exotic array of fruits and vegetables in vibrant colors forms the heart of island cooking.

Chayote, also called Christophene or Cho-cho, is a firm pear-shaped squash used in soups and stews. The Chinese vegetable bokchoy (or pakchoy) has become widely used on the islands. Plantains, which resemble bananas, are roasted, sautéed, fried, and added to stews and soups. The breadfruit grows profusely, and is either boiled or baked, sliced, and eaten hot, or ground into flour. The breadfruit blossoms make a very good preserve.

Yucca, also known as cassava or manioc, is a slender tuber with bark-like skin and a very starchy flesh that must be cooked and served like a potato, or it can be made into cassava bread. Mangoes can be picked from the tree and eaten by peeling the skin and slicing the flesh off the large pit. They are used in salads, desserts, frozen drinks, and salsa. Papaya, which has a cantaloupe-like flavor, contains the enzyme papain, which aids in digestion. To be eaten, the black seeds must be removed and the flesh scooped out.

The soursop is a large, oval, dark-green fruit with a thick skin that is soft to the touch when it ripens. The fruit has a creamy flesh with a sweet, tart flavor. Its rich custard-like flavor can be made into a sherbet, ice cream, or refreshing drink.

Spices and Condiments. The food of the Caribbean can be highly spiced. The Scotch bonnet, a colorful pepper with a hot aroma, is widely used in soups, salads, sauces, and marinades. Some other important spices are annatto, curry, pimento, cinnamon, and ginger. Annatto seeds are often steeped in oil and used to flavor soups, stews, and fish dishes. Curry powder is made from a variety of freshly grounded spices. Curry dishes and hot sauces, which are used regularly in cooking, were brought to the islands by Indian settlers.

Pimento, also known as allspice, is used in pickles, marinades, soups, and stews and is an important ingredient in jerking, a method of cooking meat and poultry over an open fire. To bring out the flavor of meat and chicken, they are marinated in a mixture of scallions, garlic, thyme, onion, lemon juice, and salt. The spices and the method of slow cooking over a fire give jerk meat its distinctive flavor.

**Protein** sources. Although fish, conch (a pink shellfish), goat meat, pork, and beef are used throughout the Caribbean, legumes make up a fair percentage of the region's protein intake. Kidney and lima beans, chickpeas, lentils, black-eyed peas, and other legumes are used in soups, stews, and rice dishes. Accra fritters, made from soaked black-eyed peas that are mashed, seasoned with pepper, and then fried, is a dish of West African origin similar to the Middle Eastern falafel. Sancocho is a hearty Caribbean stew made with vegetables, tubers, and meats.

Cooking Methods. A "cook-up" dish is one made with whatever ingredients an individual has on hand, and is an opportunity to be creative. Such a dish will often include rice, vegetables, and possibly meat. By adding coconut milk, this could turn into an enticing coconut-scented pilaf. Burning sugar to color stews is another technique used in island cooking. This process begins by heating oil, then adding sugar, and stirring until the sugar becomes an amber color.

The roti is a griddle-baked flour wrapping that is filled with curried meat, chicken, or potatoes. Coucou, or fungi, is a cornmeal mush that is served with meat, poultry, fish, or vegetable dishes.

Beverages and desserts. A variety of fruit beverages are often served in the Caribbean. Beverages include **green tea** and "bush tea," served sweetened with sugar or honey, with or without milk. Bush tea is an infusion of tropical shrubs, grasses, and leaves that has a number of medicinal uses. People drink it as a remedy for gas, the common cold, asthma, high blood pressure, fever, and other ailments. Sweetened commercial drinks made from carrot, beet, guava, tamarind, and other fruits and vegetables are also popular.

A number of fermented drinks are also popular. *Garapina* is made from pineapple peelings, while *mauby* is made from the bark of the mauby tree. Grated ginger is used to produce ginger beer. *Horlicks* is a malted milk made with barley.

Fruit is eaten anytime of the day, but is not considered a dessert unless prepared in a fruit salad or some other form. Coconut and banana form the basis for many desserts. A sweet pudding that goes by many names (e.g., duckunoo, blue drawers, pain me, paimee, and konkee) is made from grated banana, plantain, or sweet potato, which is then sugared, spiced, and mixed with coconut milk or grated coconut, and then wrapped in banana leaves and boiled in spiced **water**. A prepared sweet pone (pudding) cake or pie is a popular dessert. Black fruitcake, made from dried fruits soaked in wine, is popular at Christmas time, and is also used for weddings and other celebrations.

## Benefits

### *Innovative Programs*

Due to insufficient resources and less than adequate planning, the school feeding programs on most of the islands exhibit many shortcomings. However, on the island of Dominica, where a self-help initiative involving the parents was introduced, the eating habits of school-aged children improved and the parents and communities adopted many of the program's menus and preparation methods. As a result, school attendance increased and the attention span of the children in class improved.

School nutrition programs need constant monitoring to improve the nutritional status of the children involved. Furthermore, a good nutrition promotion campaign must be designed to educate and promote a healthy lifestyle for the population at large.

The Caribbean region has the tremendous task of putting in place appropriate policies, plans, and programs to address the changing health and disease patterns of the region's people. This effort is made more difficult because of the socioeconomic, political, and cultural differences among the Caribbean countries. The various countries must not only examine the food availability and how it is consumed, but they must also assess and evaluate the quality of the food and the nutrition intake of those most at risk.

The Caribbean Food and Nutrition Institute (CFNI), established in 1967, aims to improve the food and nutrition status in member countries, which include Anguilla, Antigua, Bahamas, Barbados, Belize, the British Virgin Islands, Cayman Islands, Dominica, Grenada, Guyana, Jamaica, Montserrat, St. Christopher-Nevis, St. Lucia, St. Vincent, Suriname, Trinidad and Tobago, and Turks and Caicos Islands.

The governments of the Caribbean have come together under an initiative called Caribbean Cooperation in Health. They hope to work closely together through five types of activities: service, education training, providing information, coordination, and research. The food goals of each country must be analyzed, with care and attention paid to the agricultural policies and economic opportunities in each specific country.

### *Forming Healthy Communities*

Desiring a longer and richer quality of life, many governments of the Caribbean Islands have introduced programs to combat chronic diseases and promote a more physically active lifestyle. For example, in Grenada, a campaign to "grow what you eat and eat what you grow" demonstrates a move to increase consumption of local foods.

Adequate nutrition cannot be achieved without the consumption of sufficient foods containing a wide array of nutrients. Poor health status, whether as a result of insufficient food intake, overconsumption, or nutrition imbalance, threatens longevity and increases health care costs. The challenge is to improve the availability of nutritious foods and the eating habits of the varied population.

## Risks

### *Health Issues*

In the Caribbean region, nutrition-related chronic diseases are common, threatening the well-being of the people of the islands. In the 1950s, the governments of the Caribbean were concerned about the malnutrition that permeated the region. They were able to increase the protein and calorie needs by making meat, **fats**, oils, and refined sugar more available. The health and nutrition initiatives introduced helped curbed the malnutrition, but new and related health and nutrition problems began to emerge.

The health administrators of the Caribbean region are concerned with the rise of iron-deficiency anemia in pregnant women and school-aged children due to inadequate **iron** intake and poor absorption. The increased incidence of diabetes, **hypertension**, **coronary heart disease**, **cancer**, and **obesity**, especially in the thirty-five-and-over age group, is thought to be directly linked to the existing lifestyle and dietary practices of the islanders.

The Caribbean Islands have seen a proliferation of fast-food restaurants, and the increased consumption of meals high in fat, sugar, and salt has contributed to the increase in chronic diseases. In addition, there has been a reduction in the amount of cereals, grains, fruits, vegetables, tubers, and legumes that are eaten. The popularity of fast foods among the young has led the government to focus on improving nutrition in the schools. Also contributing to the health problems is the dependency on costly imported processed foods that do the body harm. Overconsumption of imported foods high in fat and **sodium** has led to a deterioration of the health status of people throughout the region, with an increase in health problems such as obesity, diabetes, hypertension, cardiovascular disease, and cancer.

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Paulette Sinclair-Weir

# Carotenoids

## Definition

Carotenoids are fat-soluble plant pigments, some of which are important to human health. The most common carotenoids in the diet of North Americans are alpha-carotene, beta-carotene, beta-cryptoxanthin, lutein, zeaxanthin, and lycopene.

## Purpose

The role carotenoids play in human health is not well understood. Carotenoids are **antioxidants** that react with free radicals. Molecules called free radicals form during normal cell **metabolism** and with exposure to ultraviolet light or toxins such as cigarette smoke. Free radicals cause damage by reacting with **fats** and proteins in cell membranes and genetic material. This process is called oxidation. Antioxidants are compounds that attach themselves to free radicals so that it is impossible for the free radical to react with, or oxidize, other molecules. In this way, antioxidants may protect cells from damage. Although carotenoids have antioxidant activity in the laboratory, it is not clear how much they function as antioxidants in the body. Claims that carotenoids can protect against **cancer** and cardiovascular disease are primarily based on their antioxidant properties.

One subgroup of carotenoids that includes alpha-carotene, beta-carotene, and beta-cryptoxanthine is converted into **vitamin A** (retinol) by the body. Vitamin A affects is important for maintaining good vision, a healthy immune system, and strong bones. Vitamin A also helps turn on and off certain genes (gene expression) during cell division and differentiation. The degree to which this group of provitamin A carotenoids is converted into vitamin A appears to depend on whether or not the body is getting enough vitamin A in other forms. Only 10% of all carotenoids can be converted into vitamin A.

## Description

Carotenoids are highly colored red, orange, and yellow pigments found in many vegetables. A German scientist isolated the first carotenoid in 1826 from carrots and named it beta-carotene. Since then, more than 600 carotenoids have been identified in plants, algae, fungi, and bacteria. Carotenoids must be dissolved in a small amount of fat to be absorbed from the intestine. **Dietary supplements** of carotenoids contain oil, which makes them more readily available to the body than carotenoids in food. Carotenoids in

**Carotenoids**

| Carotenoid | Food sources |
|---|---|
| Alpha-carotene | Carrots<br>Collard greens<br>Peas<br>Plantains<br>Pumpkin<br>Tangerines<br>Tomatoes, raw<br>Winter squash |
| Beta-carotene | Broccoli<br>Cantaloupe<br>Carrot juice<br>Carrots<br>Dandelion greens<br>Kale<br>Pumpkin<br>Spinach<br>Turnip greens<br>Sweet potatoes<br>Winter squash |
| Beta-cryptoxanthin | Carrots<br>Corn, yellow<br>Nectarines<br>Orange juice<br>Oranges<br>Papaya<br>Pumpkin<br>Red bell peppers<br>Tangerines<br>Watermelon |
| Lutein and zeaxanthin | Broccoli<br>Brussels sprouts<br>Collard greens<br>Corn, yellow<br>Dandelion greens<br>Kale<br>Mustard greens<br>Peas<br>Pumpkin<br>Spinach<br>Summer squash<br>Turnip greens<br>Winter squash |
| Lycopene | Baked beans, canned<br>Catsup<br>Grapefruit, pink<br>Marinara sauce<br>Sweet red peppers<br>Tomato juice<br>Tomato paste and puree<br>Tomato soup<br>Tomatoes, raw<br>Vegetable juice cocktail<br>Watermelon |

*(Illustration by GGS Information Services/Thomson Gale.)*

vegetables are best absorbed if they are cooked in oil or eaten in a meal that contains at least some fat. (A very tiny amount of fat is adequate).

The United States Institute of Medicine (IOM) of the National Academy of Sciences develops values called **Dietary Reference Intakes** (DRIs) for **vitamins** and **minerals**. The DRIs define the amount of a nutrient a person needs to consume daily and the largest daily amount from food or dietary supplements that can be taken without harm. The IOM has not developed any DRIs for carotenoids because not enough scientific information is available and because no diseases have been identified as being caused by inadequate intake of carotenoids. The IOM, the American Cancer Society, and the American Heart Association all recommend that people get all their antioxidants, including carotenoids, from a diet high in fruits, vegetables, and whole grains rather than from dietary supplements.

### *Health claims for carotenoids*

Many health claims for carotenoids are based on laboratory and animal studies. Results from human studies are often inconsistent and confusing. One difficulty in evaluating these studies comes from the variety of ways in which they are conducted. When increased carotenoid intake comes from eating foods high in carotenoids, it is hard to separate the effects of the carotenoids from the effects of other vitamins and minerals in the food. When a dietary supplement is given to increase the level of a specific carotenoid, the outcomes often differ from those that occur in a diet of carotenoid-rich vegetables. In addition, the fact that some carotenoids are converted into vitamin A blurs the line between their effects and that of vitamin A from other sources. More controlled research needs to be done on these compounds. Many clinical trials are underway to determine safety and effectiveness of different carotenoids, both alone and in combination with other drugs and supplements.

**BETA-CAROTENE.** Beta-carotene is a yellow-orange provitamin A carotenoid. Good sources of beta-carotene include carrots, sweet potatoes, winter squash, pumpkin, spinach, kale, and broccoli. When vitamin A stores are low, the body can convert beta-carotene into vitamin A to prevent symptoms of vitamin A deficiency. It takes 12 mcg of beta-carotene to make 1 mcg of retinol, the active form of vitamin A. Therefore, vitamin A deficiency is usually more effectively treated by eating more foods high in vitamin A and/or taking a vitamin A supplement than by increasing beta-carotene intake.

The only use for beta-carotene dietary supplements proven in well-controlled clinical trials is to treat a rare genetic disorder called erythropoietic protoporphyria. This disorder causes the skin to be painfully sensitive to sunlight and causes the development of **gallstones** and problems with liver function. Symptoms are relieved by giving beta-carotene supplements under the supervision of a physician.

A diet high in vegetables rich in beta-carotene appears to reduce the risk of developing certain cancers. However, in a large study of 29,000 men, when a beta-carotene dietary supplement was taken by men who smoked, they developed lung cancer at a rate 18% higher and died at a rate 8% higher than men who did not take the supplement. Another study that gave men dietary supplements of beta-carotene and vitamin A was stopped when researchers found the men receiving the beta-carotene had a 46% greater chance of dying from lung cancer than those who did not take it. The official position of the IOM is that "beta-carotene supplements are not advisable for the general population."

**ALPHA-CAROTENE.** Alpha-carotene is the lesser-known cousin of beta-carotene. It also is a provitamin A carotenoid, but it takes 24 mcg of alpha-carotene to make 1 mcg of retinol. Good sources of alpha-carotene include pumpkin, carrots, winter squash, collard greens, raw tomatoes, tangerines, and peas. Less research has been done on alpha-carotene than beta-carotene, but it is not recommended as a dietary supplement.

**BETA-CRYPTOXANTHIN.** Beta-cryptoxanthin is also a provitamin A carotenoid. It takes 24 mcg of beta-cryptoxanthin to make 1 mcg of retinol. Good sources of beta-cryptoxanthin include pumpkin, red bell peppers, papaya, tangerines, nectarines, oranges and orange juice, carrots, yellow corn, and watermelon.

**LUTEIN AND ZEAXANTHIN.** Lutein and zeaxanthin do not have vitamin A activity. They are the only carotenoids found in the human eye. It has been proposed, but not proven, that they may help slow the development of cataracts. Cataracts are changes in the lens of the eye that result in clouding and vision loss. These carotenoids are also found in the retina. They absorb light in the blue wavelength range. It is theorized that they can help slow or prevent age-related breakdown of the retina (age-related macular degeneration), a common cause of vision loss in the elderly. Good sources of lutein and zeaxanthin include spinach, kale, turnip, collard, and mustard greens, summer squash, peas, broccoli, Brussels sprouts, and yellow corn.

**LYCOPENE.** Lycopene is the carotenoid that gives tomatoes, watermelons, and guavas their reddish color. In the American diet, almost all dietary lycopene comes from tomato products.

The relationship between dietary intake of lycopene and the risk of men developing **prostate** cancer is of great interest to researchers. One large study of 58,000 Dutch men found no relationship between the two. However, an analysis of 21 studies examining the relationship between lycopene intake and prostate cancer found that men with the highest dietary intake of lycopene were less likely to develop prostate cancer. The reduction appeared real, but modest—11–19%.

## KEY TERMS

**Antioxidant**—A molecule that prevents oxidation. In the body antioxidants attach to other molecules called free radicals and prevent the free radicals from causing damage to cell walls, DNA, and other parts of the cell.

**Cell differentiation**—The process by which stem cells develop into different types of specialized cells such as skin, heart, muscle, and blood cells.

**Dietary supplement**—A product, such as a vitamin, mineral, herb, amino acid, or enzyme, intended to be consumed in addition to an individual's diet with the expectation that it will improve health.

**Provitamin**—A substance the body can convert into a vitamin.

**Retina**—The layer of light-sensitive cells on the back of the eyeball that function in converting light into nerve impulses.

### Precautions

The relationship between lung cancer and beta-carotene strongly suggests that all carotenoids should be obtained through diet and not through dietary supplements. There is also no information on the safety of carotenoid dietary supplements in children or women who are either pregnant or **breastfeeding**.

### Interactions

Interactions of specific carotenoids with drugs, herbs, and dietary supplements have not been well studied. In general, cholesterol-lowering drugs, **orlistat** (Xenical or Alli), and mineral oil reduce the absorption of carotenoids from the intestine, but it is not known whether this has an effect on health.

### Complications

There are no identified complications from carotenoid deficiency.

Beta-carotene supplements of 30 mg per day or more or excessive consumption of carrots and other beta-carotene rich food can cause the skin to become yellow, a condition called carotenodermia. Carotenodermia is not associated with any health problems and disappears when beta-carotene intake is reduced.

Lycopene supplements or excessive intake of tomatoes and tomato products can cause the skin to turn orange, a condition called lycopenodermia. This condition disappears when lycopene intake is reduced.

No recommendations have been set about the maximum daily intake of carotenoids from diet, but dietary supplements of carotenoids are not recommended by the IOM, the American Heart Association or the American Cancer Society.

### Parental concerns

Parents should encourage their children to eat a healthy and varied diet high in fruits, vegetables, and whole grains. There is no need to give children dietary supplements of carotenoids. The safety of these supplements in children has not been studied.

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American Cancer Society. 1599 Clifton Road NE, Atlanta GA 30329-4251. Telephone: 800 ACS-2345. Website: <http://www.cancer.org>

American Heart Association. 7272 Greenville Avenue, Dallas, TX 75231. Telephone: (800) 242-8721. Website: <http://www.americanheart.org>

American Dietetic Association. 120 South Riverside Plaza, Suite 2000, Chicago, Illinois 60606-6995. Telephone: (800) 877-1600. Website: <http://www.eatright.org>

Linus Pauling Institute. Oregon State University, 571 Weniger Hall, Corvallis, OR 97331-6512. Telephone: (541) 717-5075. Fax: (541) 737-5077. Website: <http://lpi.oregonstate.edu>

Office of Dietary Supplements, National Institutes of Health. 6100 Executive Blvd., Room 3B01, MSC 7517, Bethesda, MD 20892-7517 Telephone: (301)435-2920. Fax: (301)480-1845. Website: <http://dietary-supplements.info.nih.gov>


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Tish Davidson, A.M.

## Caveman diet

### Definition

The caveman diet is a diet that is intended to mimic, as closely as possible, the way that the ancestors of humans ate more than 10,000 years ago.

### Origins

The caveman diet is also sometimes referred to as the Paleolithic diet. The Paleolithic period is the period occurring before 10,000 years ago. During the Paleolithic period the ancestors of humans were hunters and gatherers. They ate the foods that they could find in the wild, including game that could be killed and fruits and vegetables that grew locally. Everything during this time was consumed raw. Milk and other dairy products were not available because animals had not yet been domesticated.

10,000 years ago the Neolithic period began. During the Neolithic period fire was mastered, allowing

the cooking of foods, and agriculture was adopted. Agriculture led to an increased consumption of grains as they were farmed for the first time and so became available abundantly. Anything that became available during the Neolithic period is not allowed on the Caveman diet.

It is not clear when the interest in going back to the diet of Paleolithic humans began. There are many different people who recommend different versions of the diet. There are many commonalities between the various versions of the caveman diet, but in general there is one main difference. Some proponents of the diet suggest eating a variety of very lean meats raised as most like animals in the wild as possible, and some proponents who encourage eating a large quantity of red meats with high fat contents.

The two most popular versions of the diet come from Ray Audette and Loren Cordain. Audette wrote the book "Neaderthin" and Cordain is the author of the book "The Paleo Diet". These diets have many similarities and differ mainly on what types of meats and how much fat should be eaten. They also differ in the way that they suggest beginning the diet and on the strictness with which they require the diet to be followed.

## KEY TERMS

**Diabetes mellitus**—A condition in which the body either does not make or cannot respond to the hormone insulin. As a result, the body cannot use glucose (sugar). There are two types, type 1 or juvenile onset and type 2 or adult onset.

**Dietary supplement**—A product, such as a vitamin, mineral, herb, amino acid, or enzyme, that is intended to be consumed in addition to an individual's diet with the expectation that it will improve health.

**Mineral**—An inorganic substance found in the earth that is necessary in small quantities for the body to maintain a health. Examples: zinc, copper, iron.

**Vitamin**—A nutrient that the body needs in small amounts to remain healthy but that the body cannot manufacture for itself and must acquire through diet.

## Description

The caveman diet is intended to include only foods that were available to humans that existed more than 10,000 years ago. The most basic meaning of this is that only foods that can be eaten raw can be included, as fire was not discovered until after this time period. On the diet however, the food does not actually have to be eaten plain and raw, it can be moderately prepared. Food can be cooked but should be eaten very close to its raw state, without complex preparation methods being used. Because the food has to be able to be eaten raw this excludes some foods like many members of the legume family (such as beans, peas, and peanuts) because they have to be cooked.

The other basic premise is that nothing that requires technology can be eaten. Technology in this case encompasses things as diverse as agricultural methods to complex processing and canning. This means that any kind of food that has been processed in any way is forbidden. This excludes all forms of refined sugars, and large amounts of the foods normally eaten by average consumers today.

No dairy products are allowed while on this diet. This means no milk, cheese, butter, or anything else that comes from milking animals. This is because milking did not occur until animals were domesticated, sometime after the Paleolithic age. Eggs are allowed however, because Paleolithic man would probably have found eggs in bird's nests during foraging and hunting.

Because agriculture did not exist during the Paleolithic era this means that no grains of any kind can be eaten while on the caveman diet. Although wild grains did exist during the Paleolithic period, many of them were very different than the grains that exist today. They were unlikely to have been as robust and would have provided little nutrition. Additionally grains could not be collected in any significant way until pottery (another invention of the Neolithic age) was invented so that there was an available method to collect and store it. So on the caveman diet grains in all forms are forbidden. This includes rice, wheat, and even corn.

Root vegetables that are starchy are also forbidden on the diet. These include potatoes and sweet potatoes. Yams and Cassava are also not allowed, and some people believe beets are acceptable on the diet and some do not. These foods are not allowed because they generally have to be cooked and are not believed to have been eaten during Paleolithic times.

Meat and fat recommendations for while on this diet are where the two main proponents of the diet show their biggest dietary difference. Audette believes that eating fat can help a dieter feel fuller on less, and even reports that he eats a pound of bacon for breakfast each morning. Cordain believes the dieter should take an approach that limits the intake of such fatty meats and includes a variety of lean meats. He believes

that Paleolithic humans ate meat that was leaner because animals raised in the wild, instead of captivity, tend to have less fat and leaner muscle. To mimic this he suggests eating a variety of animals such as elk and buffalo that are raised on grass and are more free to roam than regular farm animals.

Different versions of the caveman diet differ in their recommendations about exercise. Some versions do not make recommendations, while others suggest significant amounts of exercise, especially outdoor exercise. The premise is that Paleolithic humans spent most of their time hunting and gathering food, which would have required a significant amount more physical activity than average humans engage in today.

Cordain believes that when beginning the caveman diet it is often advisable to begin slowly, and slowly include more meals that follow the diet's guidelines as time goes on. He also believes that having what he calls "open meals," during which the guidelines are relaxed, can be a good way to help the dieter stick to the diet in the long run. Cordain also believes that even just following some of the recommendations of the caveman diet can be beneficial, and encourages people to do as much as they are comfortable with. Audette generally takes a more hard line approach and does not allow for any bending of the rules with certain meals. He reports that not only do he and his wife follow this diet strictly, but that their son has been on the diet since birth, as well.

## Function

The caveman diet is intended to promote weight loss and overall better health by mimicking a diet similar to the diet of the humans who lived during the Paleolithic age. It is believed that the human body is not designed to be able to process foods that were not consumed during the Paleolithic age. It is also thought that eliminating these foods will allow the body to function more in the manner for which it was designed, leading to better health and a decreased risk of many of the diseases that are prevalent in the industrialized world such as **obesity**, diabetes, and heart disease.

## Benefits

There are many benefits to losing weight if it is done at a moderate pace through healthy eating and increased exercise. Obesity causes an increased risk of diabetes, cardiovascular disease, and many other diseases and conditions. The greater the obesity the greater the risk of these diseases, and the greater the severity of the symptoms associated with them. Losing weight can reduce the risks of these and other obesity-related diseases as well as reduce the severity of the symptoms if the diseases have already occurred.

In addition to the general benefits of weight loss, the caveman diet may provide a variety of other health benefits. Fresh fruits and vegetables are high in many **vitamins** and **minerals**, which are important for overall good health. Some versions of the caveman diets that recommend free range, grass-fed lean meats may have additional benefits as these meats may be higher than regular meats in **omega-3 fatty acids**, which are believed have positive health benefits for the heart and cardiovascular system.

Varieties of the caveman diet that recommend large amounts of exercise may have additional health benefits. Regular exercise can help weight loss to occur more quickly by helping the body use more calories and creating muscle mass. Regular exercise also may reduce the risk of cardiovascular disease.

## Precautions

Anyone thinking of beginning a new diet should consult a medical practitioner. Requirements of calories, fat, and nutrients can differ significantly from person to person, depending on gender, age, weight, and many other factors such as the presence of any diseases or conditions. Pregnant or **breastfeeding** women should be especially cautious because deficiencies of vitamins or minerals can have a significant negative impact on a baby.

## Risks

There are some risks with any diet. It is often difficult to get enough of some vitamins and minerals when eating a limited variety of foods. All varieties of the caveman diet exclude all milk and dairy products. Because these foods are excellent sources of **calcium** it is possible that people on the caveman diet may not get enough calcium in their diet. Lack of calcium can lead to many different disease and conditions such as **osteoporosis** and rickets. Anyone beginning this diet may want to consult their physician about whether taking a vitamin or supplement might help them reduce this risk. Also such a low starchy carbohydrate intake could cause health problems such as lethargy and fatigue due to low energy.

Versions of the caveman diet that allow and encourage large quantities of high fat red meat being eaten have their own risks. High-fat diets, especially diets high in animal **fats**, have been shown to increase the risk of cardiovascular disease. Versions of the diet

## QUESTIONS TO ASK THE DOCTOR

- Would a multivitamin or other dietary supplement be appropriate for me if I were to begin this diet?
- Is this diet appropriate for my entire family?
- Is it safe for me to follow this diet over a long period of time?
- Is this diet the best diet to meet my goals?
- Are there any sign or symptoms that might indicate a problem while on this diet?

that encourage the consumption mainly of lean meats probably do not have this increased risk.

### Research and general acceptance

There have been various scholarly studies aimed at determining what the likely diet of Paleolithic humans ate. However, there is not a significant body of research examining how this kind of diet would affect modern humans. There is however research indicating that a healthy, varied diet including many different fruits and vegetables is important for good overall health.

Some experts find concern in the fact that the diet completely eliminates dairy products, which are generally considered to be part of a healthy diet. The United States Department of Agriculture's MyPyramid, the updated version of the Food Guide Pyramid, recommends the equivalent of 3 cups of low-fat or non-fat dairy products per day for healthy adults. The caveman diet also does not allow grains, although whole grains are also generally considered an important part of a healthy diet. MyPyramid recommends the equivalent of 3 to 4 ounces of grains each day, of which at least half should be whole grains, for healthy adults.

The Center for Disease Control recommended in 2007 that healthy adults get at least 30 minutes of light to moderate exercise everyday. The versions of the caveman diet that recommend large amounts of regular exercise would exceed this minimum recommendation. Regular exercise is generally accepted as an excellent way of improving health, reducing the risk of disease, and managing weight.

The caveman diets that recommend large amounts of red meat and eggs, and encourage the consumption of fattier meats, are extremely controversial. Although many diets that are low in **carbohydrates** and high in meat, such as the very popular **Atkins diet**, have gained many followers, especially in the mid 2000s, physicians, nutritionists, and other health and science professionals continue to debate their various health benefits and risks. It is generally accepted, however, that regularly eating a diet high in saturated fats, which are often found in high quantities in red meat, has a detrimental effect on the health in the long run and studies have shown that it can lead to increased incidence of cardiovascular disease.

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#### ORGANIZATIONS

American Dietetic Association. 120 South Riverside Plaza, Suite 2000, Chicago, Illinois 60606-6995. Telephone: (800) 877-1600. Website: <http://www.eatright.org>

#### OTHER

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Helen M. Davidson

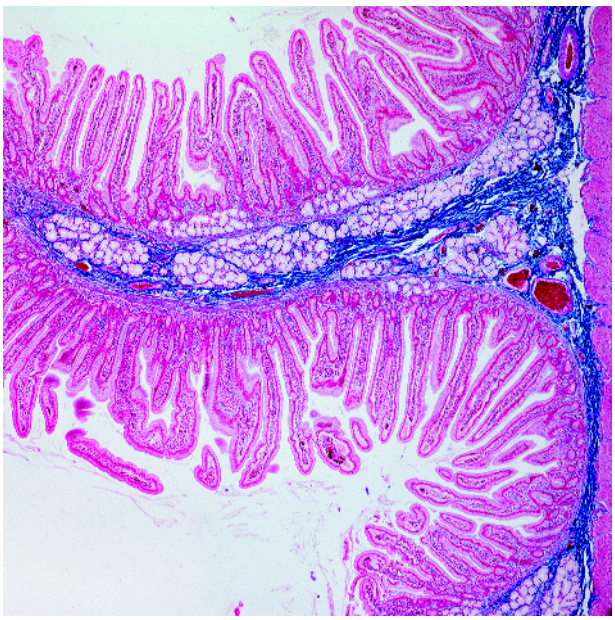
# Celiac disease

### Definition

Celiac disease, also known as sprue, celiac sprue, nontropical sprue, and gluten-sensitive enteropathy, is a life-long autoimmune disease in which the body's reaction to gluten causes damage to the intestines that results in poor absorption of nutrients.

### Description

Absorption of most nutrients occurs in the small intestine. The intestine is lined with microscopic, hair-like projections called villi, and it is through these villi that nutrients are absorbed. Villi project into the



**Light micrograph of healthy villi (tiny finger-like projections) on the lining of the small intestine. When people with celiac disease eat foods or use products containing gluten, their immune system responds by damaging or destroying the villi. Villi allows nutrients from food to be absorbed into the bloodstream; without healthy villi, a person becomes malnourished, regardless of the quantity of food eaten.** *(Eye of Science/Photo Researchers, Inc. Reproduced by permission.)*

intestine and provide an increased the surface area for absorption. Damage to the villi results in inadequate absorption, especially of **vitamins**, **minerals**, and **fats**.

Celiac disease is an autoimmune disease. Whenever immune system cells in the body sense the presence of foreign material, they produce proteins called antibodies that act to disable the foreign material. In an autoimmune disease, the body treats some of its own cells as foreign and attacks them. Celiac disease is also classified as a malabsorption disease because the cells that are damaged by the body's immune system are cells of the villi lining the small intestine. When these cells are damaged, the villi flatten out, decreasing the surface area available for absorption. Nutrients are not properly absorbed, and vitamin and mineral deficiencies often develop.

The symptoms of celiac disease were describe as early as 1888, but it was not until the 1950s that physicians began to understand what caused the disease. A Dutch pediatrician, W. K. Dicke, was the first person to make the connection between the consumption of foods containing wheat and symptoms of celiac disease. Today researchers know that the problem substance is gluten found in wheat, rye, and barley, and products such as four, bread, and pasta made from these grains. The role of oats and oat products in celiac disease remains controversial.

## Demographics

Celiac disease is most common among people of Northern European ancestry and is uncommon to rare among people of African or Asian ancestry. Initially celiac disease was thought to be uncommon in the United States, but recent improvements in genetic testing and disease awareness have changed that picture. Experts now believe that in the United States and other areas of the world settled primarily by Europeans (e.g. Australia), about 1 of every 133 people has celiac disease. The disease has an inherited component, and the rate increases to 1 of every 22 people who are blood relatives of a parent, sibling, or child with the disease. In about 70% of identical twins, if one has celiac disease, the other also has it. Celiac disease is also more common among people with other genetically-related autoimmune diseases such as systemic lupus erythematosus, type 1 diabetes (juvenile diabetes), rheumatoid arthritis, and autoimmune thyroid disease.

People of any age can be diagnosed with celiac disease. However, there are two common peaks for diagnosis, one between 8–15 months, which is shortly after infants usually begin eating wheat products, and another between 30–40 years in adults.

## Causes and symptoms

Researchers have traced the genetic component of celiac disease to a cluster of genes on chromosome six. Multiple genes are involved, which may account for the variation in symptoms and inheritability of the disease. Often, symptoms of the disease develop after a serious infection, physical trauma, pregnancy, or surgery. Researchers do not know why stress on the body appears to trigger symptoms.

Symptoms of celiac disease are varied. Some people have the disease (as diagnosed by samples that show damage to the small intestine), but they show no symptoms. Others go along for years with annoying or intermittent symptoms, and some, especially children, show severe symptoms of malnutrition that stunt growth despite eating a healthy diet. Symptoms are similar to those of other, more common, **digestive diseases**. Often celiac disease is initially misdiagnosed.

Common symptoms of celiac fall into two categories, those primarily related to the immediate problems of digesting food and those that result mainly from long-term deficiencies in vitamins and minerals.

## KEY TERMS

**Antibody**—a protein produced by the immune system to fight infection or rid the body of foreign material. The foreign material that stimulates the production of antibodies is called an antigen. Specific antibodies are produced in response to each different antigen and can only inactivate that particular antigen.

**Mineral**—an inorganic substance found in the earth that is necessary in small quantities for the body to maintain a health. Examples: zinc, copper, iron.

**Osteoporosis**—a condition found in older individuals in which bones decrease in density and become fragile and more likely to break. It can be caused by lack of vitamin D and/or calcium in the diet.

**Quinoa**—a high-protein grain native to South America (pronounced keen-wah)

**Systemic lupus erythematosus (SLE)**—a serious autoimmune disease of connective tissue that affects mainly women. It can cause joint pain, rash, and inflammation of organs such as the kidney.

**Triticale**—man-made hybrid plant that combines wheat and rye and that produces a higher protein flour

**Type 1 diabetes**—also known as insulin-dependent diabetes mellitus (IDDM), or juvenile diabetes, an autoimmune disease in which the body appears to disable cells in the pancreas that produce insulin. Without insulin, the body cannot use glucose (sugar).

**Vitamin**—a nutrient that the body needs in small amounts to remain healthy but that the body cannot manufacture for itself and must acquire through diet

Symptoms primarily related to immediate difficulties in digestion include:

- chronic diarrhea
- foul-smelling grayish stools. These result from inability to properly digest fats.
- gas, abdominal bloating
- abdominal cramps
- weight loss

Other symptoms that develop because of vitamin and mineral deficiencies can include:

- iron deficiency anemia, low red blood cell count
- joint pain, muscle pain, muscle cramps
- osteoporosis (inadequate calcium absorption)
- tingling in the legs from nerve damage
- seizures
- bleeding disorders (inadequate vitamin K)
- missed menstrual periods
- infertility (women), frequent miscarriages
- failure to thrive in infants
- delayed mental and physical growth in children

Other symptoms include:

- fatigue
- irritability and behavioral changes especially in children
- pale sores inside the mouth
- dermatitis herpetiformis, an itchy skin rash that usually appears on the trunk, buttocks, neck, and scalp.

### Diagnosis

Celiac disease can be difficult to diagnose because its symptoms are similar to those of so many other diseases. Often it is initially misdiagnosed as **irritable bowel syndrome** or **Crohn's disease**. Stool examination, blood tests, and lactose (milk sugar) tolerance tests are often done when the patient first complains of symptoms, but there are two definitive tests for celiac disease.

The immune system of people with celiac disease produces higher than normal levels of certain antibodies. Blood tests can detect abnormal levels of these antibodies. If blood tests are positive, a small bowel endoscopy with biopsies is done. Endoscopies are usually performed in a doctor's office or an outpatient clinic while the patient is under light sedation. In this procedure, the physician inserts a tube called an endoscope down the patient's throat, through the patient's stomach and into the upper part of the small intestine. A tiny camera at the end of the endoscope allows the doctor to see if there is damage to villi. During this procedure, the doctor also removes small tissue samples (biopsies) from the intestinal lining in order to look for cell damage under the microscope. Presence of a specific type of damage is a positive diagnosis for celiac disease.

### Treatment

There is no cure for celiac disease. The only treatment is life-long avoidance of any foods that contain gluten. This means not eating foods that contain wheat, rye, and barley, such as bread or baked goods, pizza,

spaghetti, and many processed foods that use flour as a thickening agent.

When individuals fail to improve on a **gluten-free diet**, it is sometimes because they are unintentionally consuming sources of hidden gluten. A few people on truly gluten-free diets do not improve. They can be treated with corticosteroid drugs to reduce inflammation, but this does not heal the intestine. Clinical trials concerning treatment of celiac disease are underway. Patients interested in participating in a clinical trial at no cost can find a list of trials currently enrolling volunteers at <http://www.clinicaltrials.gov>

## Nutrition/Dietetic concerns

Individuals newly diagnosed with celiac disease need counseling from a nutritionist and help in meal planning from a dietitian. Two issues need to be addressed. First, what is safe to eat, and second, how to get the right balance of nutrients in a gluten-free diet. Complicating matters, damage to the intestines may make some people lactose intolerant, so that they either cannot eat or must limit dairy products in their diet.

Many cookbooks are available to help people on a gluten-free diet. Home cooks must learn to substitute ingredients such as cornstarch and rice flour for wheat flour in their foods. An increasing number of gluten-free foods are available commercially. However, these often cost more than their gluten-containing counterparts. Below are listed just a few foods people with celiac disease can safely eat.

- plain fruits and vegetables
- plain meat that has not been breaded, coated, or mixed with fillers
- potatoes
- rice (all types)
- cornmeal, cornstarch, and products made of corn, such as corn tortillas
- tapioca
- buckwheat
- dried beans and peas
- nuts
- quinoa
- amaranth
- arrowroot

Other foods must be avoided. Individuals with celiac disease must also avoid cross-contamination with these foods. For example, they should not cut gluten-free bread using a knife that has cut regular wheat bread unless the knife has been thoroughly washed. Even small amounts of gluten can cause damage to the intestine. Some of the foods people with celiac disease must avoid are listed below.

- wheat flours including durum flour, enriched flour, graham flour, semolina flour, and white flour
- wheat germ, wheat starch, wheat bran, cracked wheat
- products made with the above mentioned wheat products such as pasta, bread, cakes, cookies
- barley, barley flour, and products made with barley
- rye, rye flour, and products made with rye
- triticale and other wheat hybrids

Learning how to read food labels is very important to people who must avoid gluten. However, this may become easier in the future. In January 2007, the United States Food and Drug Administration (FDA) published preliminary regulations s for foods that could be labeled "gluten free." Labeling will be voluntary. The FDA hopes to have these rules take effect by August 2008. This will make it easier for shoppers who must avoid gluten to find products they can safely eat. Meanwhile, people with celiac disease must be alert to "hidden" sources of gluten that often serve as binders or thickeners in commercially prepared foods. Some of these non-obvious sources of gluten that may appear on food labels are listed below.

- starch (type unspecified)
- modified food starch
- hydrolyzed vegetable protein (HVP)
- hydrolyzed plant protein (HPP)
- texturized vegetable protein (TVP)
- binders
- fillers
- extenders
- excipients (ingredients used in medications that do not have medicinal value, such as coatings of tablets. Consult a pharmacist or physician about whether before taking drugs, vitamins, etc.)
- malt

Some brands of commercially prepared french fries, potato chips, hot dogs, meatballs, gravy mixes, soups, **soy** sauce, and candy contain these hidden sources of gluten. Others are gluten-free. A nutritionist and dietitian can help people with celiac disease learn to read labels accurately to distinguish that foods are safe for them.

## Therapy

Switching to a gluten-free diet requires major lifestyle changes. It can be especially hard on children and teens who want to be able to go out with their friends

and eat pizza and fast food. Many people find Internet support groups are helpful in making the transition to a gluten-free diet.

### Prognosis

The intestines of people with celiac disease who go on a gluten-free diet heal. In children the healing usually takes 3–6 months. In adults healing can take 2 years. The intestinal villi remain intact and function properly so long as the diet remains free of gluten, but the disease is never cured.

People who are not diagnosed or who do not stay on a gluten-free diet face increased chances of developing **cancer** of the intestine. They may also develop **osteoporosis** because of poor **calcium** absorption. Other vitamin and mineral deficiencies may contribute to a multitude of health problems. Untreated pregnant women have higher than normal rates of miscarriage and babies born with birth defects, especially neural tube defects, which arise from inadequate amounts of folic acid. Untreated children may have stunted mental and physical growth.

### Prevention

Celiac disease is a genetic autoimmune disorder that cannot be prevented. Once diagnosed, the only way to prevent symptoms and complications is to follow a strictly gluten-free diet.

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#### ORGANIZATIONS

American College of Gastroenterology. P.O. Box 342260 Bethesda, MD 20827-2260. Telephone: (301) 263-9000. Website: <http://www.acg.gi.org>

Celiac Sprue Association. P. O. Box 31700, Omaha, NE, Telephone: (877)CSA-4CSA. Fax: (402) 558-1347. Website: <http://www.csaceliacs.org>

National Digestive Diseases Information Clearinghouse (NDDIC). 2 Information Way. Bethesda, MD 20892-3570. Telephone: (800) 891-5389. Fax: (703) 738-4929. Website: <http://digestive.niddk.nih.gov>

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Tish Davidson, A.M.

## Central American and Mexican diet

### Definition

The diets of peoples in Mexico and Central America (Guatemala, Nicaragua, Honduras, El Salvador, Belize, and Costa Rica) have several commonalities, though within the region great differences in methods of preparation and in local recipes exist. The basis of the traditional diet in this part of the world is corn (maize) and beans, with the addition of meat, animal products, local fruits, and vegetables. As in other parts of the world, the diet of people in this area has expanded to include more processed foods. In many parts of Mexico and Central America, access to a variety of foods remains limited, and undernutrition, particularly among children, is a major problem. Although access to an increased variety of foods can improve the adequacy of both macronutrient and micronutrient status, there is evidence that the use of processed foods is contributing to the rapidly increasing prevalence of **obesity** and diet-related chronic diseases such as diabetes.

**Common foods of Central America and Mexico**

Avocado
Bananas
Beans
Beef
Cacti
Calabaza (pumpkin)
Carrots
Chicken
Chile peppers
Con leche (coffee, milk, cinnamon, and sugar)
Corn
Eggs
Fish
Greens, locally grown
Guavas
Limes
Mangoes
Melons
Nances (fruit)
Onions
Oranges
Papayas
Pineapple
Plantains
Pork
Queso del pais, a mild, soft white cheese
Tomatillos
Tomatoes
Tortillas, corn and flour
Tunas (prickly pears from cacti)

*(Illustration by GGS Information Services/Thomson Gale.)*

## Origins

### *Traditional Dietary Habits*

The traditional diet of Mexico and Central America is based on corn and beans, but offers a wide diversity of preparations. Coupled with locally available fruits, vegetables, meat and dairy products, the diet can be highly nutritious. However, poverty frequently limits access to an adequate variety of quality foods, resulting in malnutrition. At the same time, the increasing use of processed foods is contributing to obesity, diabetes, and other chronic conditions in this region. The balance between improving access to variety and maintaining dietary quality poses a challenge for public health.

The central staple in the region is maize, which is generally ground and treated with lime and then pressed into flat cakes called *tortillas*. In Mexico and Guatemala, these are flat and thin, while in other Central American countries tortillas are thicker. In El Salvador, for example, small, thick cakes of maize, filled with meat, cheese, or beans, are called *pupusas*. Maize is also used in a variety of other preparations, including tacos, tamales, and a thin gruel called atole. The complementary staple in the region is beans (*frijoles*), most commonly black or pinto beans. Rice is also widely used, particularly in the southernmost countries, such as El Salvador, Honduras, Nicaragua, and Costa Rica. Historically, major changes in the traditional diet occurred during colonial times, when the Spaniards and others introduced the region to wheat bread, dairy products, and sugar. Wheat is commonly consumed in the form of white rolls or sweet rolls, or, in the northern part of Mexico, as a flour-based tortilla. Noodles (*fideos*), served in soups or mixed with vegetables, have also become popular.

The consumption of meat and animal products, although popular, is often limited due to their cost. Beef, pork, chicken, fish, and eggs are all used. Traditional cheeses are prepared locally throughout the region as *queso del pais*, a mild, soft, white cheese, and milk is regularly used in *café con leche* and with cereal gruels.

The region is a rich source of a variety of fruits and vegetables. Best known among these are the chile peppers, tomatoes, and tomatillos that are used in the salsas of Mexico. Avocado is also very popular in Mexican and Central American cuisines. Other commonly used vegetables include *calabaza* (pumpkin), carrots, plantains, onions, locally grown greens, and cacti. Fruits are seasonal but abundant in the rural areas and include guavas, papayas, mangoes, melons, pineapples, bananas, oranges, and limes, as well as less-known local fruits such as *nances, mamey*, and *tunas* (prickly pears from cacti). Traditional drinks (*frescos, chichas*, or *liquados*) are made with fruit, **water**, and sugar.

## Description

### *Methods of Cooking*

The traditional preparation of maize involves boiling and soaking dried maize in a lime-water solution and then grinding it to form a soft dough called *masa*. Soaking in lime softens the maize and is an important source of **calcium** in the diet. The masa is shaped and cooked on a flat metal or clay surface over an open fire. In some areas, lard or margarine, milk, cheese, and/or baking powder may be added to the tortilla during preparation. Beans are generally boiled with seasonings such as onion, garlic, and sometimes tomato or chile peppers. They are served either in a soupy liquid or are "refried" with lard or oil into a drier, and higher fat, preparation.

Meat, poultry, and fish are commonly prepared in local variations of thin soup (*caldo* or *sopa*), or thicker soups or stews (*cocido*) with vegetables. In Mexico and

## KEY TERMS

**Macronutrient**—Nutrient needed in large quantities.

**Malnutrition**—Chronic lack of sufficient nutrients to maintain health.

**Micronutrient**—Nutrient needed in very small quantities.

**Undernutrition**—Food intake too low to maintain adequate energy expenditure without weight loss.

Guatemala, grilled meats are cut into pieces and eaten directly on corn tortillas as tacos.

These are often served with a variety of salsas based on tomato or tomatillo with onion, chile, coriander leaves (cilantro), and other local seasonings. Tamales are made with corn (or corn and rice) dough that is stuffed with chicken and vegetables. The tamales are steamed after being wrapped in banana leaves. Salvadorian *pupusas* are toasted tortillas filled with cheese, beans, or pork rind eaten with coleslaw and a special hot sauce.

### *Central American and Mexican Dishes*

Beyond the basic staples, the cuisine of Mexico and Central America is rich with many regional variations. The tortilla-based Mexican preparations familiar in the United States are generally simpler in form in Mexico. *Tacos* are generally made with meat, chicken, or fish grilled or fried with seasoning and served on tortillas; *enchiladas* are filled tortillas dipped in a chile-based sauce and fried; and *tostadas* are fried tortillas topped with refried beans or meat, and sometimes with vegetables and cream. *Chiles rellenos* are made with the large and sweet chile *poblano* and filled with ground meat. Examples of specialty dishes include *mole*, a sauce made with chocolate, chile, and spices and served over chicken, beef, or enchiladas; and *ceviche*, raw marinated fish or seafood made along the coast throughout Central America and Mexico.

### *Influence of Central American and Mexican Culture*

As two cultures intermingle, foods and preparations from each tend to infiltrate the other. This is clearly the case near the U.S.-Mexican border, where Mexican immigrants and return immigrants have incorporated foods from U.S. diets into their traditional diets. The result has been a modified form of Mexican cuisine popularly known as "Tex-Mex." Beyond the border, this Americanized version of popular Mexican foods has spread throughout the United States through the popularity of Mexican restaurants. In the United States, tacos and tostadas tend to have less Mexican seasoning, but include lettuce and shredded processed cheese. Flour, rather than corn, tortillas are more widely used along the border. Many foods, such as soups and chiles, prepared along the border have become known for their spicy hotness, due to the Mexican-influenced use of chiles and chile powder.

## Benefits

The staple diet of the region—corn and beans, supplemented with meat, dairy products, and local fruit and vegetables—is nutritionally complete and well suited to a healthful lifestyle. The proper combination of tortilla and beans provides an excellent complement of amino acids, thus supplying the necessary amount of complex **protein**. The process of liming the maize makes the calcium and the **niacin** in the tortilla more bioavailable, and this food is a major source of these nutrients. In addition, the traditional preparation of tortillas with a hand mill and grinding stones appears to add **iron** and **zinc** to the tortilla. Beans are excellent sources of B **vitamins**, **magnesium**, **folate**, and **fiber**. The tomato and chile-based salsas, along with several of the tropical fruits such as limes and oranges are important sources of **vitamin C**, and the variety of vegetables and yellow fruits such as papaya, melon, and mango provide excellent sources of **carotenoids**, which are precursors of **vitamin A**.

## Risks

Unfortunately, limited financial access to this variety of foods for many people in Central America and Mexico means that the diet often does not include sufficient levels of vitamins and **minerals**. For low-income groups, lack of access to animal products contributes to deficiencies in iron, zinc, vitamin A, and other nutrients. When animal products are included, there has been a tendency to choose high-fat products such as sausage and fried pork rinds (*chicharron*). The use of lard and a preference for fried foods also contributes to high intakes of saturated fatand cholesterol among subsets of the population.

### *Changes in Dietary Practices*

Throughout the world, the diets of traditional cultures have experienced what has been called the "nutrition transition," particularly during the last few decades of the twentieth century. In Mexico and

Central America, as elsewhere, this transition has been fueled by globalization and urbanization. Major dietary changes include an increased use of animal products and processed foods that include large amounts of sugar, refined flour, and hydrogenated **fats**. At the same time, a decline in the intake of whole grains, fruit, and vegetables has been documented. While the increased variety has improved micronutrient status for many low-income groups, the inclusion of more animal fat and refined foods has contributed to a rapid increase in obesity and chronic disease throughout the region.

These changes are more evident among immigrants to the United States, where adoption of U.S. products has been shown to have both positive and negative impacts on nutritional status. Studies that compared diets of Mexican residents to newly arrived Mexican-American immigrants and to second-generation Mexican Americans have documented both nutritionally positive and negative changes with acculturation. On the positive side, acculturated Mexican Americans consume less lard and somewhat more fruit, vegetables, and milk than either newly arrived immigrants or Mexican residents. On the negative side, they also consume less tortilla, beans, soups, stews, gruels, and fruit-based drinks, with greater use of meat, sweetened ready-to-eat breakfast cereals, soft drinks, candy, cakes, ice cream, snack chips, and salad dressings.

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Katherine L. Tucker

## Central European and Russian diet

### Description

A health gap separates Central and Eastern Europe from the United States, Canada, Japan, and the Western part of Europe. This East-West gap in health started during the 1960s. Almost half of this gap was due to cardiovascular disease (CVD) mortality differentials. There has been a marked increase of CVD in Central and Eastern Europe, which is only partially explainable by the high prevalence of the three traditional CVD risk factors (hypercholesterolemia, **hypertension**, and smoking) in these countries. There is an extreme nonhomogeneity of the former Soviet bloc, and the data from each country must be analyzed individually. The aim here is to present the latest available data, which show the health status of various regions of postcommunist Europe. All data used are taken from the World Health Organization (WHO) Health for All Database (as updated in June 2003). The last available data from most countries are from the year 2002.

As premature mortality was considered the most important information, the standardized death rate (SDR) for the age interval 0–64 years was used (SDR is the age-standardized death rate calculated using the direct method; it represents what the crude death rate would have been been if the population had the same age distribution as the standard European population).

#### *Central Europe (Poland, Hungary, Czech Republic, Slovakia)*

Total, CVD and **cancer** mortality in Central Europe was relatively low at the beginning of the 1960s, but then an increase occurred. While the differences in 1970 between the nations of the European Union (EU) and the Central European communist countries were not great, from the mid-1970s on, the relative trends in CVD mortality in EU countries and Central Europe showed a marked change: mortality in Central Europe increased, whereas in EU countries it decreased steadily. Between 1985 and 1990, the male CVD mortality in Central Europe was more than two times higher than in EU countries. A substantial proportion of this divergence was attributable to ischemic heart disease. After the collapse of Communism, however, a decrease in CVD mortality in Central Europe was observed.

#### *The Former Soviet Union (Russian Federation)*

The most significant changes in CVD mortality have been observed in the region of the former Soviet

**Male and female life expectancy at birth in Europe, 2004**

| Country | Males | Females |
|---|---|---|
| Russian Federation | 59 | 72 |
| Ukraine | 62 | 73 |
| Hungary | 79 | 83 |
| Romania | 68 | 76 |
| Bulgaria | 69 | 76 |
| Poland | 71 | 79 |
| Slovakia | 70 | 78 |
| Czech Republic | 73 | 79 |
| Portugal | 74 | 81 |
| Spain | 77 | 83 |
| United Kingdom | 76 | 81 |
| Germany | 76 | 82 |
| Italy | 78 | 84 |
| Sweden | 78 | 83 |
| Switzerland | 78 | 83 |
| France | 76 | 83 |

SOURCE: World Health Organization

*(Illustration by GGS Information Services/Thomson Gale.)*

Union (USSR). Between the years 1980 and 1990, male premature mortality was relatively stable in all regions of the USSR, and two to three times higher than in EU nations, or average. After the collapse of the USSR, CVD mortality began to rise dramatically in all the new independent states within the territory of the former USSR. In 1994 the male CVD mortality in Russia and Latvia was more than five times higher than the EU average. Women in these countries have been affected to almost the same degree as men, and the CVD mortality trends were strongest among young adults and middle-aged individuals. Cancer mortality was stable during this period, however. In 1994 the life expectancy of Russian men was almost twenty years less than that of men in Japan and some European countries. After 1994, however, there was a sudden drop in mortality both in males and females, followed by a further increase.

## Origins

### *Lifestyle and Nutrition*

Communist period (1970–1989). The socioeconomic situation in the democratic part of Europe and in the United States after World War II was substantially different than that in the Soviet bloc. The United States and the European democratic states were prosperous countries with effective economies and a rich variety of all kinds of foods. The communist states, however, had ineffective centralized economies and lower standards of living. The amount of various foods, especially foods of animal origin, was almost always insufficient in the USSR and the majority of its satellite countries. Data on food consumption compiled by the Food and Agricultural Organization (FAO) confirm that meat consumption was, between 1961 and 1990, substantially lower in the USSR, Poland, Romania, and Bulgaria than in Western Europe or the United States. Similarly, the consumption of milk and butter in Bulgaria, Hungary, and Romania was significantly lower in comparison with Western and Northern Europe.

The increase of CVD mortality within the Soviet bloc seems to be only partially associated with a high prevalence of traditional risk factors. Efforts to apply the experience gained from successful preventive projects in Finland or the United States without analyzing the specificity of risk factors in this region, could lead to an incorrect formulation of priorities when determining preventive measures. The contribution of physical activity remains an open issue, but due to technical backwardness (lower number of cars, lower mechanization, etc.), the physical activity of people working in industry, agriculture, and services was generally higher in Eastern Europe than in the West.

Some authors believe that economic conditions were the principal determinant of the gap in health status between the East and West. The close relationship between the gross national product per capita and life expectancy is well known, but the inhabitants of Central Europe were less healthy than their wealth predicted. The dramatic changes that occurred after the onset of communism created a toxic psychosocial environment. A loss of personal perspectives, chronic stress, tension, anger, hostility, social isolation, frustration, hopelessness, and apathy led to a lowered interest in health and to a very high incidence of alcoholism and suicide. People living for many decades in the informationally polluted environment rejected even useful health education.

## KEY TERMS

**Antioxidant**—Substance that prevents oxidation, a damaging reaction with oxygen.

**Free radical**—Highly reactive molecular fragment, which can damage cells.

**Hypercholesterolemia**—High levels of cholesterol in the blood.

**Hypertension**—High blood pressure.

**Plasma**—The fluid portion of the blood, distinct from the cellular portion.

It is widely believed that chronic stress can aggravate the development of chronic diseases. However, the reasons for the high cancer and CVD mortality in Eastern Europe are (with the significant exception of male smoking) not yet known. It is possible that in communist countries the effect of traditional risk factors has been intensified unidentified factors. Hypothetically, such factors can comprise psychosocial disorders, alcoholism, environmental pollution and specific nutritional deficiencies (e.g., very low intake of antioxidant **vitamins**, folic acid, and bioflavonoids). Very low blood levels of **antioxidants**, especially of **vitamin C** and **selenium**, were found in various regions of Central and Eastern Europe between 1970 and 1990.

Postcommunist period (after 1989). Thanks to its geographical location, Central Europe was best prepared for the democratic changes that occurred after 1989. After the collapse of communism, the decrease in CVD mortality in politically and economically more consolidated countries occured. The positive changes in Central European countries can be explained by higher consumption of healthful food, including a substantial increase in the consumption of fruit and vegetables, a decrease in butter and fatty milk consumption, and an increase in the consumption of vegetable oils and high-quality margarines. There was also a rapid improvement in the availability and quality of modern CVD health care.

Finnish and Russian epidemiologists compared the plasma ascorbic-acid concentrations among men in North Karelia (Finland) and in the neighboring Russian district. Almost all Russian men had levels suggesting a severe vitamin C deficiency, while more than 95% Finns had normal vitamin C levels. Comparison of fifty-year-old men in Sweden and Lithuania found significantly lower plasma concentrations of some antioxidant vitamins (beta-carotene, lycopene, gamma-tocopherol) in Lithuanian men. They also had substantially lowered resistance of low-density lipoprotein to oxidation than Swedish men. It is probable that in Russia an imbalance arose in which factors enhancing the production of free radicals (alcoholism, smoking, and pollution) dominated protective antioxidant factors.

High prevalence of smoking and alcoholism has also been an important factor in high CVD mortality rates in Russia. A substantial proportion of CVD deaths in Russia, particularly in the younger age groups, have been sudden deaths due to cardiomyopathies related to alcoholism. Alcoholism has evidently played a key role in the extremely high incidence of CVD mortality, as well as in the numbers of accidents, injuries, suicides, and murders. There is no way to determine a reliable estimation of the actual consumption of alcohol in Russia, since alcohol is being smuggled into the country on a large scale.

### Risks

Normalization in the Russian Federation will likely be more difficult than in Central Europe. Trends in lifestyle, smoking, food selection, **alcohol consumption**, and other areas will be determined by both economic and political factors. The successfulness of the economic transformation, which provides hope for a sensible life, will be a key factor in improving health status in postcommunist countries. A significant decrease in cardiovascular and cancer mortality in Central Europe provides hope for the Russian Federation. Unfortunately, differences in life expectancy between these countries and Western Europe are still very great.

### Resources

#### OTHER

World Health Organization. "Health for All Database: Mortality Indicators by Cause, Age, and Sex." Available from < http://www.euro.who.int/hfadb>.

Emil Ginther

## ChangeOne diet

### Definition

The aim of "ChangeOne: Lose Weight Simply, Safely, and Forever" is to provide a simple, straightforward plan for gradual, permanent weight loss. The book features a twelve-week eating plan that outlines portion sizes, recipes and meal suggestions designed to achieve weight loss. A major distinguishing feature of the ChangeOne plan is its emphasis on making lifestyle changes gradually over a three month interval, rather than advocating a complete, abrupt transformation of existing eating patterns. The diet is based on everyday foods, both home-prepared and available in restaurants and does not require purchase of special foods or supplements.

### Origins

ChangeOne is published by the Reader's Digest Association, a New York-based company which also owns and operates *Reader's Digest*, the best-selling consumer magazine in the United States. ChangeOne has been dubbed "The Official Reader's Digest Diet".

The lead author is John Hastings, a senior staff editor for health at *Reader's Digest*. Co-authors are Peter Jaret, a health journalist, and Mindy Hermann, a Registered Dietitian.

The principles underlying this diet reflect the influence of the Dietary Guidelines for Americans and the Food Guide Pyramid set by the United States Department of Agriculture. These guidelines emphasize moderation, portion control and the use of plant foods—grains, fruits and vegetables—as the basis for meals.

## Description

The cornerstone of this diet is the progressive, gradual nature in which it promotes behavior change. Readers are advised to approach weight loss one meal at a time, one day at a time, beginning with a week-long focus on breakfast. The reader starts out by completing a quiz assessing readiness for permanent lifestyle changes.

Meal plans are designed to meet the following daily intakes:

- Calories: 1,300-1,600
- Calories from fat: 30 to 35% of total calories
- Saturated and hydrogenated ("trans") fats: no more than 10% of calories
- Fiber: at least 25 grams
- Calcium: approximately 1,000 milligrams
- Fruits and vegetables: at least five servings

The ChangeOne diet is flexible in letting readers set their own calorie target within the recommended range and adjust it throughout the program to suit their needs. Those who are physically inactive and weigh less then 190 pounds are advised to aim for the lower end of the calorie range. Readers who weigh more than 190 pounds or get more than thirty minutes of daily vigorous exercise are advised to aim for the higher calorie intake.

A key idea underlying the ChangeOne plan is that all foods can fit within a balanced plan for long term weight management. The authors recognize that food restrictions tend to intensify **cravings**; for this reason, no foods are forbidden on this plan. The crux of the diet lies in portion control. Household items such as tennis balls, golf balls and checkbooks are suggested for gauging portions. The reader is not required to count calories, but must adhere to the recommended food types and portion sizes. Presumably, if the portion sizes are followed correctly, the day's total calories will fall within the targeted range.

The ChangeOne program advocates eating at a slow pace, both to enhance enjoyment of meals and to help the body properly assess hunger and satisfaction levels while eating. The authors recommend a high consumption of **water** and other non-calorie beverages for their satisfying effect. For the same reason, an unlimited intake of non-starchy vegetables such as those used in salads and stir-fries is allowed. Alcohol intake is allowed, but limited to one standard serving of beer or wine per day. Each chapter features recipes to complement the meal plan, as well as "Fast Track" suggestions for accelerating progress, such as increasing minutes spent on physical activity, or using a journal to keep track of foods eaten. Readers learn to use rewards to reinforce positive behavior changes until the weight loss provides the necessary reinforcement.

### KEY TERMS

**Acceptable Macronutrient Distribution Range (AMDR)**—A range of intakes for a particular energy source that is associated with reduced risk of chronic disease while providing adequate intakes of essential nutrients. An AMDR is expressed as a percentage of total energy intake.

**Dietitian/Registered Dietitian**—A health professional who has a Bachelor's degree specializing in foods and nutrition, as well as a period of practical training in a hospital or community setting. The title "Registered Dietitian" and "Dietitian" are protected by law so that only qualified practitioners who have met education qualifications can use that title.

**Emotional Eating**—Eating as a way to suppress or soothe negative emotions, such as stress, anger, anxiety, boredom, sadness and loneliness. Emotional eating is a cause of weight gain and can sabotage weight loss efforts.

**Hydrogenated (Trans) Fats**—Hydrogenation is a process of turning liquid oil into solid fat. During this process, a type of trans fat may be formed that raises cholesterol levels in the blood. This increases the risk of coronary heart disease.

**National Academy of Sciences**—A private, nonprofit society of scholars with a mandate to advise the United States government on scientific and technical matters.

**National Weight Control Registry (NWCR)**—The largest prospective study of long-term successful weight loss. The NWCR is tracking over 5,000 individuals who have lost at least 30 pounds and kept it off for at least one year.

### *The Program at a Glance*

**WEEK ONE: BREAKFAST.** Eating a morning meal is cited as being crucial to weight management. The authors refer to data from the National Weight Control Registry that suggest that eating breakfast every day is associated with losing weight and keeping it off. The ChangeOne breakfast plan encourages a balance of starchy foods, fruit and a calcium-rich food. High-fiber foods are promoted for their satisfying quality and nutrient-density. Sample recipes include vegetable frittata and dried cranberry scones with orange glaze.

**WEEK TWO: LUNCH.** The second week of the program has dieters planning ahead for both home-prepared and purchased lunches that are satisfying and portion-controlled. The mid-day meal is comprised of a small portion of lean meat, fish or a vegetarian alternative, along with a starchy food, one fruit and unlimited vegetables. Restaurant meals can fit the plan as long as recommended portion sizes are honored. Readers are encouraged to anticipate the difficulty of making healthy restaurant choices by creating a list of ChangeOne meals that can be ordered in restaurants. This chapter provides an overview of best options in fast food restaurants. Sample recipes include grilled turkey Caesar salad and roasted vegetable wraps with chive sauce.

**WEEK THREE: SNACKS.** On the ChangeOne regime, dieters plan for two snacks each day. The authors point to scientific evidence that eating frequently throughout the day can assist with weight management by regulating blood sugar levels and warding off cravings and intense hunger. This chapter teaches readers to properly interpret hunger cues and encourages an awareness of emotional eating. It offers strategies to manage hunger and appetite. Sample recipes include chocolate snacking cake and multigrain soft pretzels.

**WEEK FOUR: DINNER.** The fourth week of the program places as much emphasis on how to eat as it does on what and how much to eat. The author provides an overview of the principles of effective goal setting, advising that goals be time-bound, realistic, inspiring and measurable). This chapter provides plenty of practical suggestions for meal preparation, including tips for low-fat cooking, such as the use of marinades to tenderize lean cuts of meat and the use of seasonings and herbs to add flavor without calories. The dinner meal plan features a small serving of lean meat or another protein-rich food, paired with a starchy side dish and unlimited vegetables. Sample recipes include Thai noodle salad and red snapper with Spanish rice. By the end of the fourth week, dieters should have all three meals and two snacks under good control.

**WEEK FIVE: DINING OUT.** The authors recommend eating in restaurants at least twice in the fifth week of the program in order to gain practice navigating menus and making healthy choices. This chapter opens with an eye-opening discussion of how restaurant meals distort our understanding of sensible portions. The keys to sticking with the ChangeOne plan when eating out, the authors contend, is being both prepared and discerning. When possible, reviewing the menu prior to arriving at the restaurant is recommended. Readers are advised to keep a list of restaurants on hand that are known to offer good tasting options that are lower in calories. Dieters are encouraged to be assertive when ordering by requesting ingredient substitutions and smaller portions. Discipline is required to stick to the portion sizes recommended in the meal plans, leaving excess food uneaten. The chapter outlines best menu options for such favorites as Italian, Mexican and Chinese restaurants, surf and turf, diners and coffee shops.

**WEEK SIX: WEEKENDS AND HOLIDAYS.** ChangeOne is realistic in acknowledging that routines tend to change over the weekend. The authors advise against viewing weekends as vacations from the healthy eating patterns implemented during the workweek; to do so implies that the diet is merely a temporary effort to improve eating habits. This chapter encourages enlisting friends and family for support but warns against saboteurs and others who will apply pressure to abandon new healthy eating habits. Strategies are offered for staying on track during the holidays (for example, having low-calorie snacks on hand and directing activities that don't involve food). The recipe section features calorie-wise alternatives to traditional holiday fare, including a revamped turkey dinner and Sunday brunch.

**WEEK SEVEN: FIXING YOUR KITCHEN.** The challenge this chapter proposes is that of taking stock of the food supplies in the kitchen so that they support the reader's new healthy eating habits. The first step advised to get the kitchen diet-ready is purging the shelves of anything that might sabotage healthy eating efforts. The authors offer strategies for smart grocery shopping such as not shopping on an empty stomach, sticking to planned purchases, and spending the most time shopping around the store's perimeter, avoiding aisles laden with processed foods. The reader is advised to inspect foodstuffs and "read the small print", but specifics on how to read and interpret nutrition labels are not offered. The chapter closes with a few recipes that feature basic ingredients found in most pantries.

**WEEK EIGHT: HOW AM I DOING?.** This week serves as a checkpoint for assessing progress and provides an opportunity to reshape goals and renew commitment.

The authors guide in trouble-shooting common stumbling blocks like portion distortion and lack of meal planning. Practical suggestions are offered for dealing with emotional stress and the temptation to quit. The authors advise their readers to revisit their expectations for what constitutes weight loss success. Dieters are taught to pace their long term goals by setting more tangible milestones and rewarding small successes along the way.

**WEEK NINE: STRESS RELIEF.** In week nine, dieters are encouraged to consider the relationship between weight management and stress management. The authors explain how high levels of stress affect the body's hormonal balance, triggering food cravings and promoting fat deposition. Readers are advised to analyze the stressors in their lives and begin brainstorming solutions. The authors emphasize participation in physical activity and the support of friends as effective stress management tools. Readers are encouraged to try a step-by-step 20-minute daily relaxation routine to relieve tension and enhance coping. This week's featured recipes are calorie-reduced versions of traditional comfort foods such as meatloaf, chicken pot pie and beef stew.

**WEEK TEN: STAYING ACTIVE FOR SUCCESS.** In the program's tenth week, healthy eating and active living are shown to be synergistic. The author presents research showing that dieters who exercise regularly enjoy greater success in their weight loss programs than those who are physically inactive. Rather than advocating intense gym workouts, the authors highlight the calories expended in activities of daily living and encourage being active in ways that are enjoyable. For optimal fat burning, however, readers are advised to check their pulse and aim for an intensity equivalent to 60% to 80% of maximum heart rate. The chapter is consistent with the book's message of making changes gradually; it encourages starting out with 10 to 15 minute walks each day and slowly working up to 30 minutes of daily physical activity.

**WEEK ELEVEN: KEEPING ON TRACK.** This week's goal is developing strategies for monitoring progress and trouble-shooting areas of difficulty in order to avoid set-backs. Readers are advised to anticipate small weight fluctuations but to take action before a few pounds of weight gain become a full relapse. The authors provide a diagnostic checklist for identifying areas of difficulty. They advise weekly weigh-ins to gauge long term progress. Dieters are encouraged to monitor and make a written record of mood states in order to uncover their relationship to emotional eating.

**WEEK TWELVE: AVOIDING BOREDOM AND MAINTAINING CHANGES IN THE LONG TERM.** ChangeOne acknowledges that boredom with a set routine is a big obstacle in maintaining changes over the long term. The authors encourage their readers to break their routine slightly every week to foster continued enjoyment of eating. Suggestions include trying a new food every week, creating a salad bar at home for dinner and concocting signature flavor combinations for standbys like homemade pasta and pizza. Again, dieters are reminded to keep the process from becoming tedious by setting rewards for small steps taken towards the achievement of the ultimate goal.

Part Two of the ChangeOne book is a collection of resources, including meal plans, recipes and an eight-week fitness program complete with color photographs of aerobic, strengthening and stretching exercises.

Readers are encouraged to visit http://www.changeone.com for online support. For a fee, dieters have access to online journaling tools, recipe archives, meal plans and activity plans.

## Function

The ChangeOne diet promotes a gradual calorie deficit by remodeling eating habits one meal at a time. Ultimately, three low-calorie meals plus two small snacks provide a total of 1300 to 1600 calories per day, which represents a significant reduction in calorie consumption for the average North American adult.

Meal plans are presented in a style that allows the reader to mix and match set amounts of preferred foods. This flexibility allows the reader to create enjoyable meals that are calorie-controlled, thus promoting weight loss.

Part Two of the ChangeOne book includes recipes and daily menus to support readers who desire the structure of a set meal plan.

## Benefits

The ChangeOne diet promises "no fads, no risks, no craziness". It is based on nutrition principles that are scientifically sound, and it echoes the nutrient balance endorsed by the USDA Food Pyramid. Meals consist of lean **protein**, high-fiber starchy foods, fruits, vegetables and low-fat dairy. No foods are disallowed, and no special foods or supplements are necessary. Meals can be prepared at home or purchased in restaurants. Varied meal plans and tasty menus, combined with numerous recipes and cooking tips make the book practical and informative.

ChangeOne is written in a straightforward, engaging manner. Changes are promoted in a step-wise fashion, in contrast to the all-or-nothing approach

espoused by most diets. Rather than simply providing guidance on what to eat, ChangeOne encourages exploration of the reasons for eating.

### Precautions

The ChangeOne program is a suitable weight loss plan for most adults. A health care provider, however, should be consulted before beginning any weight loss program. The upper limit of 1,600 calories per day may be insufficient for those with high physical activity demands. The use of **artificial sweeteners** is not appropriate for everyone. Readers should get clearance with their doctors regarding ideal exercise type, intensity and duration before beginning any exercise program.

### Risks

Because this diet emphasizes sound patterns of healthy eating, there are no significant risks in following its principles. Dieters should note that the program is not designed for rapid weight loss.

### Research and General Acceptance

The ChangeOne program echoes the principles of healthy eating promoted in the USDA Food Guidelines for Americans. In particular, the diet mirrors the National Academy of Sciences' Acceptable Macronutrient Distribution Ranges (AMDR) for fat, **carbohydrates**, and protein, which are 20 to 35% of total calories, 45 to 65% of total calories, and 10 to 35% of total calories, respectively. The recommended intake of fat, as well as calories from unhealthy (saturated and hydrogenated) **fats**, **fiber** and **calcium** also complies with the recommendations set by the National Academy of Sciences.

Much of the advice and strategies recommended in ChangeOne have a strong scientific basis. The authors substantiate their recommendations by quoting research from reputable sources such as Harvard University, Penn State University, the Journal of the American Medical Association and the Center for Science in the Public Interest. The authors also draw data from the National Weight Control Registry, the largest study of its kind investigating factors associated with successful weight loss and maintenance.

Lead author John Hastings notes that physicians served as advisors in the development of the eating plan. The diet was pilot-tested by volunteers, mostly from the Reader's Digest workforce. Participants lost an average of 17 pounds over the 12 week program. There is no mention of the number of participants involved in testing the diet, and whether these results bear any statistical significance.

### QUESTIONS TO ASK YOUR DOCTOR

- What would be a healthy weight for me?
- What is a realistic time frame for losing this weight?
- Is it safe for me to start doing physical activity?
- What are the best types of physical activity for me?
- The ChangeOne diet advises the use of artificial sweeteners instead of sugar in coffee and tea. Is this safe for me? Are there any artificial sweeteners that I should avoid?
- How can I find a Registered Dietitian who can support me in my weight loss efforts?
- What groups and prgrams are available in the community to help me with my nutrition goals?

### Resources

#### BOOKS

Hastings, John. *ChangeOne: Lose Weight Simply, Safely and Forever*. Pleasantville, NY: Reader's Digest Association, 2003.

Katz, David, and Gonzalez, Maura. *The Way to Eat: A Six Step Path to Lifelong Weight Control*.Naperville, IL: Sourcebooks, 2004.

Larson Duyff, Roberta, and the American Dietetic Association. *American Dietetic Association Complete Food and Nutrition Guide*. Hoboken, NJ: John Wiley & Sons, 2006.

Napier, Kristine, and the American Dietetic Association. *American Dietetic Association Cooking Healthy Across America*. Hoboken, NJ: John Wiley & Sons, 2005.

Tribole, Evelyn, and Resch, Elyse. *Intuitive Eating: A Revolutionary Program That Works*. New York, NY: St. Martin's Press, 2003.

#### PERIODICALS

Avenell, Alison, Sattar, Naveed, and Lean, Mike. "Management: Part I-Behavior Change, Diet, and Activity. " *British Medical Journal* 333.7571. (Oct 7, 2006): p740-743.

Kaplan, Lee. "Keeping the Weight Off." *Weigh Less, Live Longer (Harvard Special Health Report)*. (Sept 2006): p40.

Melanson, Kathleen. "Food Intake Regulation in Body Weight Management: A Primer." *Nutrition Today*. 39.5 (Sep-Oct 2004): p203-215.

Solo, Sally. "Ditch Your Diet" *Real Simple* 8.2 (Feb 2007): p162.

**ORGANIZATIONS**

American Dietetic Association. 120 South Riverside Plaza, Suite 2000, Chicago, IL 60606-6995. (800) 877-1600. <http://www.eatright.org>
American Medical Association. 515 N. State Street, Chicago, IL 60610. (800) 621-8335. <http://www.ama-assn.org/>
Center for Science in the Public Interest. 1875 Connecticut Ave. N.W., Suite 300, Washington, DC 20009. (202) 332-9110.<http://www.cspinet.org/>
Dietitians of Canada. 480 University Avenue, Suite 604, Toronto, ON, Canada M5G 1V2. (416) 596.0857.<http://www.dietitians.ca>

**OTHER**

ChangeOne Diet Online. <http://www.changeone.com>
Mayo Clinic. Weight-Loss Help: How to Stop Emotional Eating. <www.mayoclinic.com/health/weight-loss/MH00025>
National Weight Control Registry <http://www.nwcr.ws>
United States Department of Agriculture. Dietary Guidelines for Americans 2005. <www.health.gov/dietaryguidelines/dga2005/document/>
United States Department of Agriculture. Food Pyramid. <http://www.mypyramid.gov>

Marie Fortin, M.Ed., RD

# Chicken soup diet

## Definition

The chicken soup diet is a seven day diet that allows the dieter to eat one of five approved breakfasts each day and as much chicken soup as desired.

## Origins

The origins of the chicken soup diet are not clear. It seems to circulate mostly from person to person and on the Internet. For many years, people have believed that chicken soup has various health properties. Many different cultures give versions of chicken soup to people who are sick. This belief in the health benefits of chicken soup may have something to do with its popularity as a diet food.

## Description

The chicken soup diet is a diet that is designed to be followed for seven days, although many versions of the diet say that it can be followed for as long as desired, or repeated at any time. It consists of a soup recipe and five breakfast choices. After breakfast, the only thing that the dieter is allowed to eat until the next morning is the soup. This diet also tells dieters what they may or may not drink while on the diet.

### *The Soup*

- 2 tablespoons of oil (olive oil is recommended)
- 4 parsnips (about 1 pound) cut into 1/2 inch pieces
- 4 ribs of celery
- 1 turnip (about 3/4 of a pound) cut into 1/2 inch pieces
- 1 jalapeno pepper, seeded and chopped
- 1 tablespoon of chopped garlic
- 2 teaspoons of salt
- 1/2 teaspoon of cayenne pepper
- 16 cups of reduced fat, low sodium chicken broth
- 7 (5 oz.) cans of chicken or 1 1/2 pound (5 cups) cooked fresh chicken
- 1 bag (16 oz.) frozen carrots
- 1 box (10 oz.) frozen broccoli florets
- 1 box (10 oz.) frozen chopped collard greens
- 1 1/2 cups frozen chopped onions
- 1/4 cup of lemon juice
- 1/4 cup chopped fresh dill or 1 tablespoon dried dill

Directions: Heat the oil over medium heat in a large soup pot. Add the garlic, salt, cayenne pepper, jalapeno, parsnips, celery, and turnip to the pot. Cook these until the vegetables are tender but still crisp, which will take approximately 15 minutes. Next, add the carrots, collard greens, broccoli, onions, chicken broth, and lemon juice to the pot. Bring to a boil, then reduce the heat and allow the soup to simmer for 5 minutes. This recipe is said to make approximately 26 one cup servings. There may be slightly different versions of this recipe, but this one is the most common.

### *Breakfasts*

The chicken soup diet allows the dieter to chose one breakfast each day from five possible breakfasts. Most versions of the diet encourage dieters to eat each breakfast once for the first 5 days, and then choose the breakfasts they liked best and repeat them for days 6 and 7. The breakfasts are:

Breakfast 1: The dieter may eat 1 cup of nonfat vanilla yogurt and 1/2 cup of fruit salad sprinkled with wheat germ.

Breakfast 2: Breakfast 2 allows the dieter to eat 1 cup of ricotta cheese combined with 1/2 teaspoon of sugar and a dash of cinnamon. The dieter may also eat 2 pieces of toasted whole-grain bread and 3 dried figs.

## KEY TERMS

**Dietary supplement**—A product, such as a vitamin, mineral, herb, amino acid, or enzyme, that is intended to be consumed in addition to an individual's diet with the expectation that it will improve health.

**Mineral**—An inorganic substance found in the earth that is necessary in small quantities for the body to maintain a health. Examples: zinc, copper, iron.

**Obese**—More than 20% over the individual's ideal weight for their height and age or having a body mass index (BMI) of 30 or greater.

**Vitamin**—A nutrient that the body needs in small amounts to remain healthy but that the body cannot manufacture for itself and must acquire through diet.

Breakfast 3: The dieter may eat 1 1/2 cups of Total brand cereal, along with 1/2 cup of nonfat milk and 1/2 cup of **calcium** enriched orange juice.

Breakfast 4: This breakfast allows the dieter to eat 1 small whole-wheat bagel that is topped with 1 ounce of melted fat-free cheddar cheese, along with 1/2 cup of prune juice.

Breakfast 5: Breakfast 5 allows the dieter to eat 1 1/2 cups of cooked Wheatena brand cereal along with 1/2 cup of nonfat milk.

After the dieter eats one of these breakfasts, only the chicken soup may be consumed for the rest of the day.

### Function

The chicken soup diet does not make any claims about how much weight a dieter can lose during the seven days of the diet, although it is usually implied that the dieter will be able to lose a substantial amount of weight. It does not have any exercise or healthy living recommendations. Some versions of the diet suggest that it would be a good diet to use if a dieter wanted to "jump start" a more comprehensive dieting plan, or if a dieter needed to lose a large amount of weight quickly for an upcoming special event.

### Benefits

There are many benefits to losing weight if it is done at a safe, moderate pace through a combination of healthy eating and exercise. There are many conditions for which **obesity** is considered a risk factor, including type II diabetes and heart disease. The risk of these diseases may be reduced through weight loss. This is especially true for very obese people who are generally thought to be at the greatest risk. This diet, however, is not considered appropriate for long term moderate weight loss.

The chicken soup diet may have some other benefits in addition to the claim that it can allow a dieter to lose a large amount of weight in a short amount of time. The soup is usually low in calories and contains many different vegetables, which are an important part of a healthy diet. Eating a soup like the one in this diet may be able to help dieters feel more full without eating very many calories, which may make it easier for some dieters stick to a healthy reduced calorie diet.

### Precautions

Anyone thinking of beginning a new diet should consult a doctor or other medical practitioner. Requirements of calories, fat, and nutrients can differ from person to person, depending on gender, age, weight, and other factors such as the presence of diseases or conditions. The chicken soup diet does not allow very many different foods, and although the soup may be healthy, it is unlikely to be able to provide all the **vitamins** and **minerals** needed for healthy adults each day. Pregnant or **breastfeeding** women should be especially cautious if beginning a very restricted diet like this one because deficiencies of vitamins and other nutrients can negatively impact a baby that is receiving its nutrients from its mother.

### Risks

There are some risks associated with any diet. The chicken soup diet does not allow the dieter to eat very many different foods each day. This means that it is unlikely that the dieter will get enough of all vitamins and minerals required each day for good health. Any dieter thinking of beginning this diet may want to consult a healthcare provider about a multi-vitamin or supplement that would be appropriate to take while on this diet to help reduce the risk of deficiencies. This is especially true for any dieter considering following a very limited diet for an extended period of time. Supplements have their own associated risks.

### Research and general acceptance

The chicken soup diet has not been the subject of any significant scientific studies. In 2000 researchers at the University of Nebraska Medical Center did laboratory research that showed that chicken soup may

## QUESTIONS TO ASK THE DOCTOR

- Is this diet safe for me?
- Is this diet the best diet to meet my goals?
- Do I have any dietary requirements this diet might not meet?
- Would a multivitamin or other dietary supplement be appropriate for me if I were to begin this diet?
- Is this diet safe for my entire family?
- Is it safe for me to follow this diet over an extended period of time?
- Are there any sign or symptoms that might indicate a problem while on this diet?

have anti-inflammatory properties that could help reduce the symptoms of the flu and colds. This research lends credibility to what many people already believed, that chicken soup was good for people who were ill. The research done was very preliminary and was done in a laboratory, not using human subjects, so it is not clear what the effect on the immune system of a human would actually be. The soup used in the research was not made using the recipe given in this diet, although it did contain some of the same ingredients.

The United States Department of Agriculture makes recommendations for how many servings of each type of food most adults need to eat each day for good health. These recommendations are given in MyPyramid, the updated version of the food guide pyramid. The chicken soup diet is extremely limited in what foods it allows dieters to eat. This makes it unlikely that dieters following this diet would get enough of all the necessary food groups. It also makes the diet likely to be especially unhealthy if followed for a long time or repeated frequently.

The chicken soup diet would probably allow most dieters to get the recommended daily allowance of vegetables. MyPyramid, recommends that healthy adults eat the equivalent of 2 to 3 cups of vegetables each day. The soup contains many different vegetables, and because it is the only food allowed after the prescribed breakfasts, it is likely that most dieters would eat enough of the soup during the day to get the recommended amount of vegetables. These vegetables would be the same ones each day, however, and because different vegetables contain different vitamins and nutrients it is generally recommended that a variety be consumed for optimum health.

MyPyramid also recommends that healthy adults eat the equivalent of 1 1/2 to 2 cups of fruit per day. Dieters following the diet strictly would not be able to get this recommended amount of fruit each day. The soup itself does not contain any fruit, and although 4 of the 5 breakfasts do contain some fruit, 1/2 cup of fruit salad or 1/2 cup of orange juice is not enough to meet the recommendations. Because the diet does not make recommendations for what can be drank while on the diet, a dieter may decide to drink fruit juice while on the diet. This would help the dieter get enough servings of fruit each day.

Dairy products are generally considered to be part of a healthy diet. The soup in the chicken soup diet does not contain any dairy, although each breakfast option does contain dairy of some kind. MyPyramid recommends the equivalent of 3 cups of low-fat or non-fat dairy per day for healthy adults. The breakfasts prescribed by the diet do not include enough dairy to meet this requirement. The diet does not tell a dieter what to drink while on the diet. If a dieter were to choose to drink skim milk while on the diet, this requirement might be met.

The chicken soup diet does not provide many sources of starches or grains. MyPyramid recommends the equivalent of 3 to 4 ounces of grains each day for healthy adults, of which at least half should be whole grains. Although 4 of the 5 breakfasts provide a serving or more of grains, it would not be enough to meet the requirements for a full day. There are no significant sources of grains or starches in the soup.

MyPyramid recommends that healthy adults eat between 5 and 6 1/2 ounces of meat or beans each day, and specifies that lean meat is preferable. The breakfasts allowed do not provide any servings of meat or beans, but the soup does contain chicken that is a healthy lean meat. Because the amount of soup allowed to be eaten is unlimited, it is likely that a person following this diet would consume enough chicken to meet this requirement. The dieter would however only be consuming one type of meat. Variety is generally considered important for a healthy diet because different meats and beans contain different vitamins and minerals.

In 2007, the Centers for Disease Control recommended that healthy adults get 30 minutes or more of light to moderate exercise each day. The chicken soup diet does not include any recommendation for exercise. Exercise is generally accepted to be an important part of any weight loss program. Studies have shown that weight loss programs are more effective when they combine diet and exercise instead of focusing on just one aspect alone.

### Resources

#### BOOKS

Shannon, Joyce Brennfleck ed. *Diet and Nutrition Sourcebook*. Detroit, MI: Omnigraphics, 2006.

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Helen M. Davidson

**Minimum nutrient and calorie levels for school lunches**

(school week averages)

| | Preshcool | Grades K–6 | Grades 7–12 |
|---|---|---|---|
| Calories | 517 | 664 | 825 |
| Total fat (percentage of total food energy) | *1 | *1, 2 | *2 |
| Saturated fat (percentage of actual total food energy) | *1 | *1, 3 | *3 |
| RDA for protein (g) | 7 | 10 | 16 |
| RDA for calcium (mg) | 267 | 286 | 400 |
| RDA for iron (mg) | 3.3 | 3.5 | 4.5 |
| RDA for vitamin A (RE) | 150 | 224 | 300 |
| RDA for vitamin C (mg) | 14 | 15 | 18 |

*1 The Dietary Guidelines for Americans recommends that after 2 years of age, children should gradually adopt a diet, that by about 5 years of age, contains no more than 30 percent of calories from fat.

2 Not to exceed 30 percent over a school week

3 Less than 10 percent over a school week.

"RE" refers to "retinol equivalent," a measure of the vitamin A activity in foods.

*(Illustration by GGS Information Services/Thomson Gale.)*

# Childhood nutrition

## Definition

Childhood nutrition refers to the dietary needs of healthy children aged 2 years through 11 years of age. Since children younger than 2 years of age and children over the age of 11 years of age have unique nutritional requirements and concerns, the focus of this summary is primarily on healthy children aged 2 to 11 years. (Children with special health care needs and who have special dietary needs require additional guidance beyond what will be discussed and should seek the skills of a Pediatrician or a Registered Dietitian).

Proper nutrition for a healthy child aged 2-11 years of age should provide adequate essential nutrients, **fiber** and energy, sufficient enough to maintain proper growth, maximize cognitive development and promote health. It should introduce balance among the foods consumed such that foods rich in some nutrients do not displace foods that are rich in other nutrients. Balance within the diet helps to ensure adequate nutrient intake within the diet. A child's diet should provide sufficient energy intake for proper growth and development while preventing excess weight gain. To do so, foods selected should be high in nutrient density, meaning the food should have a high nutrient to calorie ratio. The diet should be moderate enough so not to deliver too much of a dietary constituent. It should also ensure variety using different foods on different occasions to ensure adequacy, balance and moderation among all nutrients needed to support the child's growth and developmental needs.

## Origins

Prior to World War II, the main nutritional problems in the United States stemmed from both a limited supply of food and lack of nutrient variety. During this time, scientists began to discover essential nutrients for basic growth and development and began the process of defining the minimum nutrients essential for growth and survival. In the United States the health status of children improved over the decades. An improvement in child nutrition was seen in lower rates of infant mortality and declines in infant, and child nutrient deficiencies.

As the food supply in the United States became more accessible and varied, nutritional concerns began to focus on an overabundance of food and specific nutrients. Around this time, research began to demonstrate links between dietary excesses and chronic diseases such as heart disease and cancers. While the number of children who were overweight increased.

These findings led to the development of dietary recommendations intended to reduce Americans' risk of chronic disease. By the late 1970s, the U.S. Senate Select Committee on Nutrition and Human Needs issued the Dietary Goals for the United States. Since then, dietary guidance for children has broadened from an earlier focus on issues of under consumption

## KEY TERMS

**Dietary deficiency**—Lack or shortage of certain vitamins or minerals within the diet that can result in illnesses.

**Healthy Eating Index (HEI)**—A measure of diet quality that assesses conformance to federal dietary guidance.

and nutrient deficiencies to over consumption and decreased energy expended in physical activity. As more research in childhood nutrition began to emerge, it placed more of a focus on optimal growth and cognitive development of children.

## Description

Public health **dietary guidelines** for childhood nutrition resonate a diet that relies on fruits, vegetables, whole grains, low-fat and nonfat dairy products, legumes, fish, and lean meats. They also emphasize low intakes of saturated **fats** cholesterol, added sugar and salt while recommending little to no trans fat intake.

## Function

Healthful eating habits in childhood have been shown to prevent chronic under-nutrition and growth retardation as well as acute child nutrition problems such as iron-deficiency anemia and dental caries. A healthful childhood diet should also help prevent **obesity** and weight-related diseases, such as diabetes.

Adequate intake of **calcium** are the first preventative measure against **osteoporosis** later in life. Calcium intake is crucial during childhood, adolescence and early adulthood to help reach peak bone mass. Failure of children to meet calcium requirements in combination with a sedentary lifestyle makes achievement of maximal skeletal growth and bone mineralization challenging. Thus, most recommendations include two to three servings a day of milk or dairy products within a children's diet.

**Iron** deficiency has negative effects on a child's motor and mental development and thus on their capacity to do school work. Foods high in iron, such as meats and fortified breakfast cereals are important to a child's diet to ensure that iron requirements are met.

Research supports that children who are overweight experience psychological stress, decreased **body image** scores, and lower self-esteem when compared to normal weight children of the same age. They are also more likely than normal-weight children to become obese adults, which can increase their risk of **coronary heart disease**, **hypertension**, type 2 diabetes, gallbladder disease, osteoarthritis, and some cancers. For this reason, many guidelines will support enough calories for growth and activity while limiting foods of low nutritional value and high in refined sugar.

High intakes of saturated fat have been associated with increased plasma total and low-density lipoprotein (LDL) cholesterol in childhood and can ultimately increase the risk of cardiovascular disease. Most recommendations will suggest fat reduced foods such as lean meats, low- or non-fat dairy products and limited high fat snacks, pastries and candies.

## Guidelines

Many children's health organizations support the guidelines of the United States Department of Agriculture, Food Guide Pyramid for children.

### *Grains*

At least half of the grains a child consumes each day should be from whole grains, such as oatmeal, or 100% whole-wheat products. The amount should increase gradually from age 2 to 5 years, at age 2 this would be too much, about one quarter to a third should be whole grains. Consuming whole grains adds dietary fiber to the diet that can help protect against diseases like heart disease and diabetes, and also help control a child's weight. Refined grains, such as those in white bread and white rice, which have been processed, and many of the nutrients have been taken out are to be used in reduced amounts.

### *Dairy*

Low-fat or non-fat dairy products are recommended In the United Kingdom, low-fat milk is not recommended for children until they reach age 2 and skim milk is not recommended until age 5. Children 2 to 8 years old are suggested to have the equivalent to 2, 8-ounces of milk per day. For children 9 to 11 years old should have the equivalent to 3, 8-ounces of milk per day.

### *Fruits*

Aim for 1–2 cups of fruits per day. Limit fruit juice consumption to meal times. Consumption of whole fruits, fresh, frozen, canned, dried, rather than fruit juice for the majority of the total daily amount is suggested to ensure adequate fiber intake.

## QUESTIONS TO ASK YOUR DOCTOR

- How can I teach my child healthy eating behaviors?
- How much should I feed my child?
- How should I handle food struggles?
- How can I get my child to try new foods?
- Is my child growing at a proper height-for-weight ratio?
- What can I do if my child does not drink milk?
- Should I give my child vitamin/mineral supplements?

#### *Vegetables*

Children should have 2–3 cups of vegetables per day. Select from dark green, orange, starchy vegetables, and other vegetables several times per week. Offer them for snacks and with meals daily.

#### *Lean protein, legumes, nuts/seeds, meat alternatives*

Recommend 2 grams of **protein** for each pound the child weighs. This can be in the form of cooked lean protein or fish, nuts, seeds, eggs or legumes and **soy** products. Children should also eat from lean protein sources and include non-fried fish into their diets on a regular basis.

### Precautions

The Healthy Eating Index (HEI) is used to assess a populations diet quality. The HEI score for children ages 2 to 9 years determined that most **children's diets** "needed improvement" or were "poor". The percentage of children's diets that were reported to "need improvement" among children 2 to 3, 4 to 6, and 7 to 9 years was 60%, 76%, and 80%, respectively; diets reported as "poor" were 4%, 7%, and 8%, respectively.

Average intakes of most **vitamins** and **minerals** for children 2 to 11 years of age exceed 100% of the 1989 RDA. Average dietary fiber intake among children ages 3 to 5 years and 6 to 11 years is 11.4 g/day and 13.1 g/day, respectively; and has remained virtually unchanged since 1976. The food choices of most US children do not meet the recommended food group servings from the Food Guide Pyramid. Children do not eat the recommended amount of fruits and vegetables. For children 2 to 9 years of age, 63% are not consuming the recommended number of servings of fruits, and 78% are not consuming the recommended number of servings for vegetables. Average daily servings are 2.0 for fruits and 2.2 for vegetables. For children 6 to 11 years of age, average daily total grain intake was 6.5 servings, whereas daily whole grain intake was 0.9 servings per day. The proportion consuming an average of two or more servings of whole grains daily was 12.7%. There is also an increase in restau! rant food consumption and other eating outside the home, larger portion sizes, shifts in beverage consumption, meal patterns and meal frequency, and school meal participation among children 2 to 11 years of age. This data shows that many children can improve their diets using the above recommendations from the USDA.

### Research and general acceptance

Numerous research articles support that healthy eating is associated with reduced risk for many diseases, including the three leading causes of death: heart disease, **cancer**, and stroke. It is common knowledge among child nutrition experts that healthy eating in childhood and adolescence is important for proper growth and development and can prevent health problems such as obesity, dental caries, and iron deficiency anemia.

### Resources

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Shield, Jodie, MEd, RD and Mary Catherine Mullen, MS, RD. *ADA Guide to Healthy Eating for Kids: How Your Children Can Eat Smart from 5 to 12*

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American Academy of Pediatrics. <http://www.aap.org>.

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# Childhood obesity

### Definition

Childhood **obesity** is the condition of being overweight or severely overweight which causes risks to health between the ages of 2 and 19.

**Risks associated with childhood obesity**

- ✓ Cardiovascular disease
- ✓ Degenerative joint disease
- ✓ Depression
- ✓ Early puberty and early start of menstruation in girls
- ✓ Eating disorders
- ✓ Exposure to social prejudice and discrimination
- ✓ Fat accumulation in the liver (fatty liver/liver disease)
- ✓ Gallbladder disease
- ✓ High cholesterol
- ✓ Hypertension
- ✓ Increased anxiety and stress
- ✓ Joint pain
- ✓ Low self-esteem
- ✓ Sleep apnea
- ✓ Type 2 diabetes mellitus

*(Illustration by GGS Information Services/Thomson Gale.)*

## KEY TERMS

**Hypothyroidism**—disorder in which the thyroid gland in the neck produces too little thyroid hormone. One of the functions of thyroid hormone is to regulate metabolic rate.

**Type 2 diabetes**—sometime called adult-onset diabetes, this disease prevents the body from properly using glucose (sugar).

## Description

Childhood obesity is of increasing concern as a public health problem in the United States. Overweight and obesity are defined by most healthcare professionals using the **Body Mass Index** (BMI). BMI is a calculation that compares a person's weight and height to arrive at a specific number. For details of how to calculate BMI see the body mass index entry.

Children between the ages of 2 and 19 are assigned a percentile based on their BMI number. The percentile tells them how their weight compares to that of other children who are their same age and gender. For example, if a boy is in the 65th percentile for his age group, 65 of every 100 children who are his age weigh less than he does and 35 of every 100 weigh more than he does. Adult BMI is interpreted differently.

The BMI weight categories for children are:

- Below the 5th percentile: Underweight
- 5th percentile to less than the 85th percentile: Healthy weight
- 85th percentile to less than the 95th percentile: At risk of overweight
- 95th percentile and above: Overweight

There is some debate about what to call children who are in the at risk for overweight and overweight categories. Some healthcare organizations such as the American Obesity Association use the term overweight for those at or above the 85th percentile and obese for those at or above the 95th percentile. The National Institutes of Health prefers to avoid applying the term obese to children, in part because of the social stigma the word carries. Whatever term is used to describe children in the top 15th percentile, these children are at risk of developing health problems because of their weight.

## Demographics

There is no doubt that American children are getting heavier, and although the problem of overweight is growing fastest in the United States, the trend toward heavier children is occurring in most in most developed countries. In the United States, the National Center for Health Statistics has tracked children's weight for several decades and recorded the following changes in the percent of children who are overweight (above the 85th percentile):

- Children ages 2–5: 1971–74 5% 1988–94 7.2% 2003–04 13.9%
- Children ages 6–11: 1971–74 4% 1988–94 11.3% 2003–04 18.8%
- Children ages 12–19: 1971–74 6.1% 1988–94 10.5% 2003–04 17.4%

In terms of numbers, this means that 12.5 million children were overweight in 2003–04. During the same time, 32.2% of adults, or 66 million people, were obese. Other surveys have found the total obesity rate among children and adolescents to be between 21% and 24%.

Significant differences exist in the number of children who are overweight in different races and ethnic groups, and these mirror the differences in the adult population. Significantly more Mexican American boys are overweight than non-Hispanic black or white boys. Significantly more Mexican American girls and non-Hispanic black girls are overweight than white girls. Native Americans and Hawaiians also have higher rates of overweight than whites.

## Causes and symptoms

At its simplest, overweight is caused by taking in more calories than the body uses. This difference is

called the "energy gap." A 2006 study done by the Harvard School of Public Health and published in the journal *Pediatrics* found that, on average, American children consumed between 110 and 165 extra calories than they use up every day. Over a 10-year period, these extra calories would add 10 lbs to their weight. However, already overweight teens took in an average of 700–1,000 extra calories every day, resulting in an average of 58 extra pounds.

### *Causes*

There are many reasons why the energy gap exists, these reasons are related to both increased food intake and decreased energy use. Food intake reasons include:

- increased consumption of sugary beverages, and along with this, a decreased consumption of milk
- tendency to super-size portions. In some fast food restaurants portions have almost tripled since the 1970s.
- more meals eaten away from home
- more use of prepared foods in the home
- increased snacking between meals along with fewer meals eaten together as a family
- heavy advertising of high-sugar, high-fat foods to children
- decrease in children carrying their lunch to school from home
- poor eating habits such as skipping breakfast and later snacking on high fat, sugary foods

Inadequate energy use reasons include:

- more time spent watching television or using the computer.
- fewer physical education requirements at school. According to the Centers for Disease Control, in 2000, only 8% of elementary schools, 6.4% of middle schools, and 5.8% of high school required daily physical education classes.
- fewer children walking to school. In 1969 half of all school children walked or biked to school. The rate was 87% for children living within 1 mile of their school. In 2003, only 15% of children walked or biked to school.
- decreased recess in grades 1–5. More than 28% of schools do not provide a regularly scheduled recess in these grades.
- fear of crime, which limits outdoor activities of children
- more affluence. Teen access to cars has increased over the past 30 years.

Other factors that affect childhood obesity include an inherited tendency toward weight gain, mental illness, **binge eating** disorder, and eating in response to stress, boredom, and loneliness, poor sleeping habits, and having at least one obese parent.

In rare cases, medical or genetic disorders can cause obesity. For example, Prader-Willi syndrome is a genetic disorder that causes an uncontrollable urge to eat. The only way to prevent a person with Prader-Willi disorder from constant eating is to keep them in an environment where they have no free access to food. Other genetic and hormonal disorders (e.g. hypothyroidism) can cause obesity. Certain medications also can cause weight gain (e.g. cortisone, tri-cyclic antidepressants), but these situations are the exception. Most children are too heavy because they eat to much and/or exercise too little.

### *Symptoms*

The most obvious symptom of obesity is an accumulation of body fat. Other symptoms involve changes in body chemistry. Some of these changes cause disease in children, while others put the child at risk for developing health problems later in life. Children who are overweight are at increased risk of:

- type 2 diabetes. This disease is appearing in children and young adults at an alarmingly high rate. In the past, it was usually seen in older adults.
- high blood pressure (hypertension)
- fat accumulation in the liver (fatty liver/liver disease)
- sleep apnea
- early puberty; early start of menstruation in girls
- eating disorders
- joint pain
- depression
- increased anxiety and stress
- low self-worth
- exposure to social prejudice and discrimination

## Diagnosis

Diagnosis is usually made on the basis of the child's BMI. To better assess the problem, the physician will take a family history and a medical history and do a complete physical examination, including standard blood and urine tests. A thyroid hormone test may be done to rule out hypothyroidism as the cause of obesity. Based on the physician's findings, other tests may be performed to rule medical causes of obesity.

## Treatment

Overweight children and their parents may be referred to a registered dietician or nutritionist who can help them develop a plan for eliminating empty calories and increasing the amount of nutrient-rich, low-calorie foods in their diets. Nutrition education usually involves the entire family. Children may be asked to keep a food diary to record everything that they eat in order to determine what changes in behavior and diet need to be made. Typically, children are encouraged to increase their level of exercise rather than to drastically reduce calories.

Drug therapy and weight-loss surgery are very rarely used in children, except in the most extreme cases of health-threatening obesity when other methods of weight control have failed. Some teenagers benefit from joining a structured weight-loss program such as **Weight Watchers** or Jenny Craig. They should check with their physician before joining.

## Nutrition/Dietetic concerns

Teaching children how to eat a healthy diet sets a framework for their lifetime eating habits. A nutritionist or dietitian can help families to understand how much and what kinds of food are appropriate for their child's age, weight, and activity level.

The American Heart Association has adapted the following dietary suggestions from the federal Dietary Guidelines for Americans 2005. These guidelines apply to people over age 2. Separate guidelines exist for **infant nutrition**.

- For children ages 2–3, no more than 35% of their calories should come from fats.
- Children over age 3 should limit their fat intake to about 30% of their total calories. These fats should be monounsaturated or polyunsaturated. Saturated fats and *trans* fats should be avoided.
- Fruit and vegetable intake should be increased, but fruit juice should be limited.
- At least half of all grains eaten should be whole grains.
- Sugary drinks, such as carbonated soft drinks, should be extremely restricted.
- Dairy products should be fat-free or low fat after age 2. Before age 2 children need milk fats for proper growth and development of the nervous system.
- A variety of foods should be offered children, including fish and shellfish.
- Overfeeding children or making them "clean their plates." should be avoided.

It is often difficult for parents to understand how much food their child should eat at a particular age. Parents tend to overestimate the amount of food small children need. The daily amounts of some common foods that meet the American Heart Association guidelines for different ages are listed below. These amounts are based on children who are sedentary or physically inactive. Active children will need more calories and slightly larger amounts of food.

- children age 2– 3 years: Total daily calories 1,000; milk 2 cups; lean meat or beans 2 ounces, fruits 1 cup; vegetables 1 cup; grains 3 ounces.
- girls ages 4–8 years: Total daily calories 1,200; milk 2 cups; lean meat or beans 3 ounces; fruits 1.5 cups; vegetables 1 cups; grains 4 ounces.
- boys ages 4–8 years: Total daily calories 1,400; milk 2 cups; lean meat or beans 4 ounces, fruits 1.5 cup; vegetables 1.5 cups; grains 5 ounces.
- girls ages 9–13 years: Total daily calories 1,600; milk 3 cups; lean meat or beans 5 ounces, fruits 1.5 cups; vegetables 2 cups; grains 5 ounces.
- boys ages 9–13 years: Total daily calories 1,800; milk 3 cups; lean meat or beans 5 ounces, fruits 1.5 cups; vegetables 2.5 cups; grains 6 ounces.
- girls ages 14–18 years: Total daily calories 1,800; milk 3 cups; lean meat or beans 5 ounces, fruits 1.5 cups; vegetables 2.5 cups; grains 6 ounces.
- boys ages 14–18 years Total daily calories 2,200; milk 3 cups; lean meat or beans 6 ounces, fruits 2 cups; vegetables 3 cups; grains 7 ounces.

## Therapy

Children who are overweight often have psychological and social problems that can be helped with psychotherapy in addition to nutritional counseling.

- Cognitive behavior therapy (CBT) is designed to confront and then change the individual's thoughts and feelings about his or her body and behaviors toward food, but it does not address why those thoughts or feelings exist. Strategies to maintain self-control may be explored. This therapy is relatively short-term.
- Family therapy may help children who eat for emotional reasons related to conflict within the family. Family therapy teaches strategies to reduce conflict, disorder, and stress that may be factors in triggering emotional eating.
- Although drugs are rarely prescribed for weight control in children, many overweigh children have depression and anxiety. Drug therapy to treat these conditions may help the child to better deal with his

or her weight and become more involved in physical activities and weight loss strategies.

## Prognosis

The younger the child is when weight control strategies begin, the better the chance that the child will be able to maintain a normal weight. When it comes to weight control, one advantage children over adults is that they grow. If a child can maintain his weight without gaining, he may grow into a normal weight as he becomes taller. Parents need to be careful about how they approach weight loss in children. Critical comments about weight from parents or excess zeal in putting their child on a rigorous diet can trigger **eating disorders** such as **anorexia nervosa** or **bulimia nervosa** in some children, especially adolescent girls.

Children who remain overweight have a much greater likelihood of being overweight adults with all the health problems that obesity brings. Studies have found that 26–41% of preschoolers who are obese become obese adults. In school-aged children, 42–63% of children with obesity become obese adults. The greater the degree of overweight, the higher the likelihood that overweight will continue into adulthood.

## Prevention

Parents must take the lead in preventing obesity in children. Some of the ways they can do this are:

- Serve a healthy variety of foods; keep healthy snacks on hand.
- Choose low-fat cooking methods such as broiling or baking
- Eliminate junk snack food and sugary beverages from the house. This removes temptation and eliminates the need to nag.
- Eat meals together as a family rather than grabbing something quick on the run.
- Limit visits to fast-food restaurants.
- Limit television and computer time.
- Plan family activities that involve physical activity, such as hiking, biking, or swimming.
- Encourage children to become more active in small ways such as walking to school, biking to friends' houses, or doing chores such as waking the dog or mowing the lawn.
- Avoid using food as a reward.
- Pack healthy homemade lunches on school days.
- Encourage school officials to eliminate soda machines on campus, bake sales, and fundraising with candy and cookies.
- Set realistic goals for weight control and reward children's efforts.
- Model the eating behaviors and active lifestyle you would like your child adopt.

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American Academy of Pediatrics. 14 Northwest Point Blvd. Elk Grove, IL 60007. Telephone: (874)434-4000. Website: <http://www.aap.org>

American Heart Association. 7272 Greenville Avenue, Dallas, TX 75231. Telephone: (800) 242-8721. Website: <http://www.americanheart.org>

American Obesity Association. 1250 24th Street, NW, Suite 300, Washington, DC 20037. Telephone: (202) 776-7711. Fax: (202) 776-7712. Website: <http://www.obesity.org>

Centers for Disease Control and Prevention, 1600 Clifton Rd, Atlanta, GA 30333. Telephone CDC Contact Center: (800) CDC-INFO TTY: (888) 232-6348. Website: <http://www.cdc.gov>

Weight-control Information Network (WIN). 1 WIN Way, Bethesda, MD 20892-3665. Telephone: (877)946-4627 or (202) 828-1025. Fax: (202) 828-1028. Website: <http://win.niddk.nih.gov>

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# Children's diets

## Definition

Because children grow at different rates and at different times, it becomes harder to distinguish if a child is overweight compared to establishing overweight in adults. To determine if a child is within an un-healthy weight range, a doctor will use certain criteria to measure a child's height and weight. The **body mass index** (BMI), expressed as body weight in kilograms divided by the square of height in meters (kg/m2), is a weight-for-height index. The BMI is the standard **obesity** assessment in adults, and its use within the pediatric population has limited research to support its effectiveness is still considered the standard measure of overweight in children. The International Task Force on Obesity approved that BMI provides a reasonable index of adiposity and provides a reliable measure across pediatric age groups.

**Healthy snack foods for children**

- Applesauce cups (unsweetened)
- Apples or pears and low-fat cheese
- Baby carrots and celery
- Bagels pizzas with tomato sauce and melted low-fat cheese
- Baked potato chips or tortilla chips with salsa
- Cereal, dry or with low-fat milk
- Cucumber or zucchini slices
- Dried fruits such as raisins, apple rings, or apricots
- Fresh fruit
- Fruit canned in juice or light syrup
- Fruit juice
- Fruit salad
- Frozen fruit bars
- Frozen grapes
- Low-fat chocolate milk
- Low-fat frozen yogurt with fresh berries
- Low-fat yogurt with fruit
- Nonfat cottage cheese with fruit
- Popcorn, air popped or low-fat microwave
- Pretzels (lightly salted or unsalted) and a glass of low-fat milk
- Raw vegetable sticks with low-fat yogurt dip, cottage cheese or hummus
- Rice cakes with peanut butter
- Smoothies with low-fat milk or yogurt and sliced bananas or strawberries
- String cheese and fruit (canned or fresh)
- Vanilla wafers, gingersnaps, graham crackers, animal crackers or fig bars and a glass of milk
- Whole-grain crackers or English muffin with peanut butter
- Whole-wheat crackers with cheese or peanut butter

*(Illustrated by GGS Information Services/Thomson Gale.)*

A children's BMI score is the criteria used by medical professionals to determine an un-healthy weight. Any child who's BMI falls between the 85th and 95th percentile for age and sex should be evaluated for secondary complications of obesity, including **hypertension** and dyslipidemias. An extensive change in BMI would also call for evaluation and possible treatment of the child. Although the degree of change that indicates risk has not been defined, an annual increase of three to four BMI units is thought to reflect concern due to possible increases in a child's body fat.

## Origins for childhood diets

In the United States and elsewhere in developed countries, the prevalence of **childhood obesity** has drastically risen in the past several decades.

Since the 1960s, the prevalence of obesity in children has been assessed by several nationally representative surveys. These include the National Health Examination Survey Cycles I to III and the National Health and Nutrition Examination Surveys I to III. Based on these surveys, the obesity among children is

## KEY TERMS

**Obesity**—Having a body mass index (BMI) at or above the sex- and age-specific 95th percentile of the 2000 Centers for Disease Control and Prevention BMI cutoff points. Obesity having too much body fat.

**Overweight**—When a person's weight is greater than what is considered healthy for his or her height.

**Body mass index (BMI)**—Expressed as body weight in kilograms divided by the square of height in meters (kg/m2), is a weight-for-height index.

**Idiopathic**—Used to describe a disease or disorder that has no known cause.

**Endogenous**—With no apparent external cause, originating within the organism or tissue.

**Behavior therapy**—A non-biological form of therapy that developed largely out of learning theory research and is normally applied to the treatment of specific maladaptive behavior patterns.

estimated to be 25–30%. Furthermore, they estimated the proliferation of obesity has increased by 54% in children six to 11 years of age and by 39% in adolescents 12 to 17 years of age. Morbid obesity jumped 98% and 64% within these groups, respectively. Hispanic, Native American and black children tend to have higher rates in relation to other populations.

Because of these statistics, weight loss diets for children have surfaced. Although weight loss in children is a hot debate in the medical field, there are times when a child's weight should be evaluated and possibly treated by medical professionals who specialize in weight loss for children.

### Complications

Childhood obesity can cause complications in many organ systems. These obesity-related medical conditions include cardiovascular disease; type 2 **diabetes mellitus**, and degenerative joint disease.

Orthopedic complications include slipped capital femoral epiphysis that occurs during the adolescent growth spurt and is most frequent in obese children. The slippage causes a limp and/or hip, thigh and knee pain in children and can result in considerable disability.

Blount's disease (tibia vara) is a growth disorder of the tibia (shin bone) that causes the lower leg to angle inward, resembling a bowleg. The cause is unknown but is associated with obesity. It is thought to be related to weight-related effects on the growth plate. The inner part of the tibia, just below the knee, fails to develop normally, causing angulation of the bone.

Overweight children with hypertension may experience blurred margins of the optic disks that may indicate pseudotumor cerebri, this creates severe headaches and may lead to loss of visual fields or visual acuity.

Research shows that 25 out of 100 overweight, inactive children tested positive for sleep-disordered breathing. The long-term consequences of sleep-disordered breathing on children are unknown. As in adults, obstructive sleep apnea can cause a lot of complications, including poor growth, headaches, high blood pressure and other heart and lung problems and they are also potentially fatal disorders.

Abdominal pain or tenderness may reflect gall bladder disease, for which obesity is a risk factor in adults, although the risk in obese children may be much lower. Children who are overweight have a higher risk for developing gallbladder disease and **gallstones** because they may produce more cholesterol, a risk factor for gallstones. Or due to being overweight, they may have an enlarged gallbladder, which may not work properly.

Endocrinologic disorders related to obesity include noninsulin-dependent diabetes mellitus (NIDDM), an increasingly common condition in children that once used to be extremely rare. The link between obesity and insulin resistance is well documented and which is a major contributor to cardiovascular disease.

Hypertension (high blood pressure), and dyslipidemias (high blood lipids), conditions that add to the long-term cardiovascular risks conferred by obesity are common in obese children.

Childhood obesity also threatens the psychosocial development of children. In a society that places such a high premium on thinness, obese children often become targets of early and systematic discrimination that can seriously hinder healthy development of **body image** and self-esteem, thus leading to depression and possibly suicide.

In all of these examples, it is recommended that the primary clinician should consult a pediatric obesity specialist about an appropriate weight-loss or weight maintenance program.

## Causes of Obesity

Only a small percentage of childhood obesity is associated with a hormonal or genetic defect, with the remainder being environmental in nature due to lifestyle and dietary factors. Although rarely encountered, hypothyroidism is the most common endogenous abnormality in obese children and seldom causes massive weight gain.

Of the diagnosed cases of childhood obesity, roughly 90% of the cases are considered environmental in nature and about 10% are endogenous in nature.

## Goals of therapy

The Division of Pediatric Gastroenterology and Nutrition, New England Medical Center, Boston, Massachusetts as well as many child organizations agree that the primary goal of a weight loss program for children to manage uncomplicated obesity is healthy eating and activity, not achievement of ideal body weight. Any program designed for the overweight or obese child should emphasize behavior modification skills necessary to change behavior and to maintain those changes.

For children with a secondary complication of obesity, improvement or resolution of the complication is an important medical goal. Abnormal blood pressure or lipid profile may improve with weight control, and will reinforce to the child and their parents/caregivers that weight control leads to improvement in health even if the child does not approach ideal body weight.

## Weight goals

In review of much research, expert advice is that most children who are overweight should not be placed on a weight loss diet solely intended to lose weight. Instead they should be encouraged to maintain current weight, and gradually "grow into" their weight, as they get taller. Furthermore, children should never be put on a weight-loss diet without medical advice as this can affect their growth as well as mental and physical health. In view of current research, prolonged weight maintenance, done through a gradual growth in height results in a decline in BMI and is a satisfactory goal for many overweight and obese children. The experience of clinical trials suggests that a child can achieve this goal through modest changes in diet and activity level.

For most children, prolonged weight maintenance is an appropriate goal in the absence of any secondary complication of obesity, such as mild hypertension or dyslipidemia. However, children with secondary complications of obesity may benefit from weight loss if their BMI is at the 95th percentile or higher. For children older than 7 years, prolonged weight maintenance is an appropriate goal if their BMI is between the 85th and 95th percentile and if they have no secondary complications of obesity. However, weight loss for children in this age group with a BMI between the 85th and 95th percentile who have a nonacute secondary complication of obesity and for children in this age group with a BMI at the 95th percentile or above is recommended by some organizations.

When weight loss goals are set by a medical professional, they should be obtainable and should allow for normal growth. Goals should initially be small; one-quarter of a pound to two pounds per week. An appropriate weight goal for all obese children is a BMI below the 85th percentile, although such a goal should be secondary to the primary goal of weight maintenance via healthy eating and increases in activity.

Components of a Successful Weight Loss Plan Many studies have demonstrated a familial correlation of risk factors for obesity. For this reason, it is important to involve the entire family when treating obesity in children. It has been demonstrated that the long-term effectiveness of a weight control program is significantly improved when the intervention is directed at the parents as well as the child. Below describes beneficial components that should be incorporated into a weight maintenance or weight loss effort for overweight or obese children.

- Attainable and safe weight-loss; a rate of 1 to 4 lb per month.
- Dietary management goals should be provided; specify total number of calories allotted per day, broken down into percentage of calories from fat, protein and carbohydrates.
- Physical activity recommended should match the child's fitness and mobility level, with an ultimate goal of 20 to 30 minutes per day of structured movement.
- Behavior modification techniques should be incorporated; self-monitoring tools, nutritional education, identification and modification of stimulus controls, family role modeling, positive reinforcements and non-food rewards.
- Encourages and supports family involvement; family involved in individual or class session, encouraged to attain healthier eating patterns and lead an active lifestyle.

## QUESTIONS TO ASK YOUR DOCTOR

- Will my child just grow out of his/her weight?
- How do you know if my child's weight may be negatively affecting his or her health?

### Complications of Weight-Management Programs

Adverse effects of childhood weight loss may include gall bladder disease, which can occur in adolescents who lose weight rapidly. Another concern is inadequate nutrient intake of essential or non-essential nutrients. Linear growth may slow during weight loss. However, impact on adult stature appears to be minimal. Loss of lean body mass may occur during weight loss. The effects of rapid weight loss (more than 1 pound per month) in children younger than 7 years are unknown and are thus not recommended.

There is a clear association between obesity and low self-esteem in adolescents. This relation brings other concerns that include the psychological or emotional harm a weight loss program may infer on a child. **Eating disorders** may arise, although a supportive, nonjudgmental approach to therapy and attention to the child's emotional state minimize this risk. A child or parent's preoccupation with the child's weight may damage the child's self-esteem. If weight, diet, and activity become areas of conflict, the relationship between the parent and child may deteriorate.

### Preventing Obesity: Tips for Parents/caregivers

- Respect a child's appetite: children know when they are full and do not need to finish every bottle or meal.
- Prepare and supply fresh, non-processed foods often. Avoid sugared foods when possible.
- Limit the amount of high-calorie foods kept in the home. Do not supply sodas; sugar flavored drinks, candy, cakes, cookies in the home.
- Provide low fat foods such as, lean proteins, and low- or non-fat dairy products and choose lower fat options for foods when available. Skim milk may safely replace whole milk at 2 years of age.
- Choose high fiber foods by selecting whole grains, legumes and fresh fruit and vegetables.
- Do not provide food for comfort or as a reward, instead use positive reinforcement.
- Do not "force" a child to eat their meal in order to get dessert.
- Limit amount of sedentary activities such as television viewing, computer time, and video games to two hours or less per day.
- Encourage active play by offering the support needed for the child to be active.
- Establish regular family activities such as daily walks, and other outdoor or indoor activities.

### Treatments

Once the need for obesity treatment has been identified, a medical professional may suggest one or more options. Consultation with a dietitian / nutritionist that specializes in children's needs is often a valuable part of obesity treatment.

#### *Behavior Therapy*

Behavior therapy involves changes in diet and physical activity habits that promote weight maintenance or loss. Some behavioral therapy strategies for children and adolescents should include parent and family involvement. And should be supervised by a medical professional.

**DRUG TREATMENT.** The U.S. Food and Drug Administration has not yet approved the use of any drugs to treat obesity in children. However, clinical trials are under way.

**SURGERY.** Surgical procedures such as gastric bypass have been performed successfully on adolescents. However surgery for adolescents is usually considered only when severe medical conditions are present that can improve with the surgery and other treatment options have failed.

### Resources

#### OTHER

BMI age-for-growth charts for the United States are available at http://www.cdc.gov/nccdphp/dnpa/bmi/bmi-for-age.htm.

Encourages kids to get physically active. http://www.verbnow.com/.

Healthy eating and physical activity tips for kids and parents. http://www.kidnetic.com/.

Information about nutrition and fitness for kids. http://www.kidshealth.org/.

MyPyramid Plan. MyPyramid replaces the Food Guide Pyramid. Available from the U.S. Department of Agriculture (USDA) at www.mypyramid.gov.

The Shapedown Pediatric Obesity Program. http://www.shapedown.com.

Tips for Using the Food Guide Pyramid for Young Children 2 to 6 Years Old. Available from the U.S. Government

Printing Office, 202-512-1800 and at www.usda.gov/cnpp/KidsPyra/PyrBook.pdf.
The Weight-control Information Network (WIN)www.niddk.nih.gov/health/nutrit/pubs/parentips/tipsforparents.htm

Megan C.M. Porter, RD, LD

Chinese diet *see* **Asian diet**

# Chocolate diet

## Definition

The Chocolate diet is a weight-loss plan that includes the daily consumption of limited amounts of chocolate. The phrase "chocolate diet" also signifies the consumption of chocolate because of claims of health benefits such as lowering cholesterol.

## Origins

Chocolate originated during the Classic Period Maya (250–900) in Mesoamerica, an area that encompassed the Tropic Cancer in Mexico, Guatemala, Belize, El Salvador, and parts of Honduras, Nicaragua, and Costa Rica. The Maya and their ancestors developed a method of converting the beans from the *Theobroma cacao* tree into a chocolate beverage. This process started with the harvesting, fermenting, and roasting of the beans. The beans were then ground a paste and mixed with ingredients including **water**, chile peppers, and corn meal.

The Maya and the Aztecs in the15th century used the bitter-tasting beverage in religious and royal ceremonies. Those were just some uses for the products of the cacao tree. Christopher Columbus saw that the Aztecs used cacao beans as currency. He took some cacao beans back to Queen Isabella and King Ferdinand. Later explorers brought back the knowledge about how to convert the beans into a beverage. The Spanish added spices like cinnamon and sugar to the beverage to make it sweeter. The new beverage remained Spain's secret for a century.

Then other Europeans found out about the chocolate drink. It was an expensive indulgence, only affordable to the upper classes. That changed with the Industrial Revolution of the 1800s. Mass production brought down the cost of manufacturing treats including solid chocolate. Another milestone occurred in 1875 when Daniel Peter and Henri Nestle; created milk chocolate by adding condensed milk to chocolate.

### *Composition of chocolate*

Cocoa beans contain approximately 50% fat, and one ounce (28.3 grams) of chocolate contains approximately 150 calories and 8.5 grams of fat. While the calorie and fat gram count could produce a weight gain, the **fats** in chocolate won't raise cholesterol levels. The cocoa butter in chocolate contains oleic acid, which is a monounsaturated fat. That means that it is low in saturated fat, which is connected to cholesterol levels. Chocolate also contains forms of saturated fat known as stearic and palmitic acids. Saturated fats are connected to increases in LDL (Low-Density Lipoprotein). Also known as bad cholesterol, increased LDL cholesterol can clog arteries, raising the risk for heart disease. Palmitic acid, which affects cholesterol levels, forms one-third of the fat calories in chocolate. The stearic acid appeared to have no effect on cholesterol levels.

Chocolate also contains **caffeine** and theobromine, a chemical similar to caffeine. There's also some phenylethylamine, a chemical that creates the sensation people feel when they're in love.

Cacao beans also contain flavanoids, a broad category of plant products that act as **antioxidants**. Flavanoids relax blood vessels, allowing blood to circulate. Antioxidants are thought to be effective in helping to prevent cancer, heart disease, and strokes. Sources of flavonoids include citrus fruits, onions, **green tea**, red wine, and dark chocolate with a cocoa content of 70% or higher. Chocolate belongs to a subgroup of flavonoids called flavonols.

The presence of plant chemicals like flavonoids is related the color of the chocolate. There are more flavonoids in darker chocolate than there are in milk chocolate. Dark chocolate is also known as semisweet or bittersweet chocolate because it contains little or no sugar. It is frequently identified by the percentage of cocoa. The cocoa content in dark chocolate ranges from 30% for sweet dark chocolate to 70% or sometimes above 80%. A higher percentage indicates there is more of a bitter after-taste.

Milk chocolate contains fewer flavonoids than dark chocolate and tastes sweeter. American chocolate contains milk; European varieties often contain condensed milk.

White chocolate lacks flavanoids because there are no cocoa solids in it. It is considered a chocolate because cocoa butter is usually an ingredient. Some white chocolate is made with vegetable fats.

## KEY TERMS

**Body Mass Index**—2Also known as BMI, the index determines whether a person is at a healthy weight, underweight, overweight, or obese. The BMI can be calculated by converting the person's height into inches. That amount is multiplied by itself and then divided by the person's weight. That number is then multiplied by 703. The metric formula for the BMI is the weight in kilograms divided by the square of height in meters.

**Calorie**—The nutritional term for a kilocalorie, the unit of energy needed to raise the temperature of one liter of water by one degree centigrade at sea level. A nutritional calorie equals 1,000 calories.

**Carbohydrate**—A nutrient that the body uses as an energy source. A carbohydrate provide 4 calories of energy per gram.

**Cholesterol**—A fatty substance found each cell of the human body and in animal foods.

**Fat**—A nutrient that the body uses as an energy source. Fats produce 9 calories per gram.

**Fiber**—A complex carbohydrate not digested by the human body. Plants are the source of fiber.

**Low-Density Lipoprotein**—Also known as LDL, the type of cholesterol that may cause clog arteries. A high LDL level increases the risk for heart disease.

**Obese**—A person with a high amount of body fat; someone with a Body Mass Index of 30 or higher.

**Overweight**—A person is too heavy for his or her height; someone with a Body Mass Index of from 25 to 30.

**Protein**—A nutrient that the body uses as an energy source. Proteins produce 4 calories per gram.

### *Food of the gods*

The cacao tree's name, *Theobroma cacao*, translates to " Food of the gods." Humans found numerous medical uses for that food throughout the years. The Maya and Aztecs used it to treat conditions including seizures, fevers, and skin infections. During the 17th century, people used chocolate as a sleep aid, blood purifier, and a pain reliever during childbirth. Some people believed that chocolate helped them live longer.

People realized that chocolate gave them energy. They knew it could be fattening, but excess weight was a sign of prosperity in the 19th century. A thin figure meant that a person wasn't well-off financially, and chocolate was sold as a weight-gain powder. Standards changed during the early decades of the 20th century, when the ideal image was a thin figure. Chocolate became known as a forbidden food for dieters. The role of chocolate in diets started to change during the 1990s.

### *Chocolate health plans*

During the 1990s and in subsequent years, researchers began investigating the health benefits of chocolate. In unrelated actions, several books promoted weight-loss plans that involved chocolate.

**THE PASTA-POPCORN-CHOCOLATE DIET.** A diet detailed on some websites in the spring of 2007 was attributed to Lenny Neimark, a film maker and screenwriter. Neimark wrote *The Pasta-Popcorn-Chocolate Diet*, a 32-page book published in 1999 by Soul Proprietor. It was out-of-print in April of 2007 when Amazon.com carried a link to a bookseller offering one copy of it for $.192.01. According to online information, Neimark based his book on "his unique and humorous perspective of human nature, drama, and people's desire to look, feel, and be thin, scientific facts," and the case histories of overweight patients. The histories were provided by his brother, a doctor with a family medicine practice in California.

The book's title described three foods allowed on a diet, according to descriptions on websites including idiet4u.com. Also on the weight-loss plan were fruits, vegetables, and 1 ounce (28.3 grams)of chocolate each day. Chapter titles included "Thinking Thin" "The Science and Mathematics of Losing Weight," and & "How to Maintain Results."

**THE CHOCOLATE DIET.** Sally Ann Voak's *The Chocolate Diet* is a 235-page book published in 2001. Voak, a British journalist, was then the *The Sun* newspaper's slimming editor. Her writing credits include *The Fatfield Diet,* a book about a weight-loss plan that she created for the British village of Fatfield. Residents were challenged to follow the healthy weight-loss plan. Their progress was tracked on "Bazaar " a popular BBC daytime program.

Voak targeted *The Chocolate Diet* at chocoholics, people who have trouble resisting chocolate. Her book included six diets and the promise that people could eat chocolate and lose weight. Although the paperback book is out of print, copies were available through Amazon.com in the spring of 2007.

## Description

The once forbidden food for dieters was incorporated into some weight-loss plans by the end of the 20th Century. Furthermore, people concerned about health issues like high cholesterol could turn to chocolate as a potential preventive measure.

### *The Pasta-Popcorn-Chocolate Diet*

Details about Neimark's diet on the Internet were limited to what foods were allowed and what were excluded. There was no information about how long the diet lasted or how much weight a dieter could expect to lose. There were limited recommendations for serving sizes. The specified portions included 1 ounce (28.3 grams) of chocolate. This is the equivalent of one baking chocolate square.

The online versions of the diet showed a menu plan for one day, with several meal selections for the dieter to choose from. Other variety in the diet came from choosing different fruits, vegetables, and low-fat pasta sauces. Popcorn could be topped with nonfat butter substitutes or a bit of parmesan cheese. Salt was not permitted.

The diet of three meals and three snacks consists of:

- Breakfast of fresh fruit, fruit salad, or shredded wheat with non-fat milk and strawberries.
- A morning snack of air-popped popcorn or fruit.
- Lunch of salad, pasta salad, or spaghetti. Pasta sauces should be meatless, low fat, and low sodium. Low-calorie salad dressing is allowed
- An afternoon snack of popcorn or a fruit smoothie made with 1 cup (236.6 milliliters) non-fat skim milk.
- Dinner of fettuccini with garlic tomato sauce, whole-wheat pasta primavera salad, or steamed vegetables.
- Evening snack of popcorn or 1 ounce (28.3 grams) of chocolate.

The dieter should drink 2 quarts (2 liters) of water but could not consume

- Coffee or other caffeinated beverages or carbonated soft drinks.
- Sugars, raisins and dates because of the high sugar content, and snack foods like cakes and pie.
- Oils, fried foods, and oily foods like avocados, olives, and coconut.
- Oils, fried foods, and oily foods like avocados, olives, and coconut.
- Red meats and dairy products.
- Nuts, seeds, and snack foods like chips.

### *Sally Ann Voak's chocolate diets*

The front cover of *The Chocolate Diet* promised that the reader could eat chocolate and lose seven pounds in two weeks. Voak's book contains quizzes to determine whether a person is a chocoholic and which of the six diets a person should follow. Each weight loss plan includes selections that fit within the calorie count for meals, strategies for a person to follow, and recommendations for exercises and other activities. The book also includes recipes and a calorie guide for chocolate candies that fit within the diet plan. British and American brands of chocolate are listed.

Each of the diets starts with a week of withdrawal from chocolate. During this time, Voak wrote, people start to control their **cravings** for chocolate. All weight-loss plans include unlimited amounts of vegetables from a list of 28 low-calorie selections. The free vegetables include asparagus, broccoli, mushrooms, red and green peppers, spinach, tomatoes, and watercress. The six diets include items from all of the food groups. The diets were designed for women; men consume 300 more calories each day.

Voak's diet plans are for:

- Secret Bingers, people who hide chocolate and don't want others to know they eat it. The plan consists of a 250-calorie breakfast, two light meals of 350 calories each, a 400-calore main meal, and a 100-calorie treat. In the second week and in following weeks, there is a daily chocolate allowance of 150 calories. Dieters may also have a 200-calorie dessert or beverage, with choices selected from recipes in the book.
- Romantics are often single and use chocolate as a substitute for love. Their menu plan is a 250-calorie breakfast, 350-calorie light meal, 400-calore main meal, and a 100-calorie treat. After the second week, they may spend 300 calories on a chocolate treat three times a week.
- Comfort eaters consume chocolate when tired or faced with a problem. Their plan consists of a 250-calorie breakfast, 350-calorie light meal, 400-calore main meal, and two 50-calorie treats. In the second week, there is a daily chocolate allowance of 200 calories. In following weeks, the allowance is 50 calories.
- Weekend Indulgers associate chocolate with celebrations. Their daily calorie allowance is 1,350 during the week and 1,600 on the weekend. The menu plan is a 250-calorie breakfast, 350-calorie light meal, 400-calore main meal, and two 100-calorie treats. After the second week, 300 calories in chocolate is allowed on each weekend day.

- Sugar addicts often get most of their calories from carbohydrates and may use chocolate as a fix when tired. Their plan consists of a 250-calorie breakfast, two light meals of 250 calories each, a 400-calore main meal, and a 100-calorie treat. In the second week and in following weeks, there is a daily chocolate allowance of 200 calories.
- Premenstrual cravers overindulge in chocolate during some days of the month. Their plan is followed as needed one to two weeks before or during a menstrual period. The diet consists of a five 250-calorie meals and a 100-calorie treat. In the second week, and in following weeks, the daily chocolate allowance is 100 calories.

### *CocoaVia plan*

Consumers are advised to eat two CocoaVia Heart Healthy Chocolate Snacks bars each day to achieve health benefits. The chocolate should be consumed as part of a lifestyle that includes a healthy diet and exercise. Mars' line of CocoaVia products included dark chocolate bars, milk chocolate candy, and the Rich Chocolate Indulgence beverage, as of the spring of 2007. Calorie amounts and fat content varied by product.

According to the nutritional label, the 22-gram (0.78-ounce) Original Chocolate bar contained 100 milligram of cocoa flavanols and 1.1 gram of natural plant extract (sterol). Each bar had 100 calories with 60 calories from fat. There were 6 grams of total fat, 3.5 grams of saturated fat, 2 grams of **fiber**, 9 grams of sugars, 12 grams of **carbohydrates**, and 1 gram of **protein**.

A 5.65-ounce (.167-liter) bottle of the chocolate beverage contained 100 milligram of flavanols, 150 calories, 25 fat calories, 3 fat grams, 1 gram of saturated fat, 3 grams of fibers, and 6 grams of protein.

## Function

Neiman and Voak's diets are used to satisfy dieters' cravings by allowing limited amounts of chocolate. The dark chocolate plan also permits limited amounts of chocolate because consuming it may provide health benefits.

For people trying to lose weight, the Pasta-Popcorn-Chocolate Diet's chocolate restriction and the emphasis on complex carbohydrates should produce a weight loss. Complex carbohydrates come from plants. They are low in calories and provide fiber in the diet. The carbohydrates take longer to digest, so a person experiences a sense of fullness for a longer time. As a result, the person eats less.

Voaks' Chocolate Diet plans are designed for dieters to break their addictions to chocolate and then learn to eat it in moderation. People undergo this behavior change while following one of six nutritionally balanced low-calorie diets. The unlimited allowance of vegetables permits dieters to fill up on complex carbohydrates. The plans call for physical exercise and feature strategies to help dieters cope with issues that could lead to eating too much chocolate.

People eat CocoaVia snacks because of research indicating that regular consumption of the products could benefit cardiovascular health and cholesterol levels. Flavanols in the snacks may improve the flexibility of blood vessels, resulting in healthy blood circulation. According to Mars, clinical research shows that the regular consumption of plant sterols can reduce LDL and total cholesterol levels in the normal range for most people.

## Benefits

People who enjoy pasta, popcorn, and chocolate will be able to eat those foods on Neimark's diet. They should lose weight on the pasta-popcorn-chocolate diet because it is a low-calorie, **high-fiber diet**. Popcorn is a whole-grain food, a food type recommended by organizations including the American Heart Association and the United States Department of Agriculture. Three cups (680.3 grams) of popcorn is equal to 1 ounce (28.3 grams) of whole grains. One cup (226.8 grams) of air-popped popcorn is 30 calories and contains 1.2 grams of fiber. Whole-grain pastas would also be beneficial in a healthy diet, according to organizations including the USDA.

Voak's book could be used for a self-directed weight loss program. It features recommendations for meals and recipes to help dieter lose weight while learning healthy eating habits. Dieters also incorporate exercise into their schedules as well as moderate amounts of chocolate. There are instructions for a yoga-type exercise program and tips for using massage and mediation to handle emotions that dieters formerly may have soothed with chocolate.

Furthermore, regular consumption of flavonol-rich dark chocolate may lower blood pressure and lessen the risk of heart disease.

## Precautions

People who are allergic to chocolate should not prescribe to regimens that involve eating it. People with other conditions such as elevated LDL or total cholesterol levels should consult their physicians before beginning a diet or health regimen involving

## QUESTIONS TO ASK YOUR DOCTOR

- How much weight should I lose?
- Should I have my cholesterol tested?
- Would any health condition prevent me from starting a diet or exercise program?
- Would any health condition prevent me from starting a diet or exercise program?
- Would you recommend the pasta-popcorn-chocolate diet?
- Are any of Sally Ann Voak's diets consistent with a healthy weight-loss plan??
- Will I still lose weight if I eat chocolate?
- Is there a health benefit to eating dark chocolate every day?
- Will eating chocolate affect medication including drugs for managing cholesterol?
- What is the best type of exercise for me?
- How long should I do this exercise?
- How many times a week should I exercise?
- Are there any instructions I need to prevent injuries?

the daily consumption of chocolate. It may be necessary to have their cholesterol tested. Overweight or obese people should ask their health professionals whether it is wise to include chocolate in their diets.

In addition, the Pasta-Popcorn-Chocolate Diet is not nutritionally balanced because it limits dairy products and proteins. All food groups are included in Voak's plans. However, some diets are less than 1,200 calories per day. That's the medically recognized minimum calorie allowance for people not following a medically supervised diet.

### Resources

#### BOOKS

Voak, Sally Ann. *The Chocolate Diet*. Blake Publishing, Ltd., 2001.

#### ORGANIZATIONS

American Dietetic Association, 120 South Riverside Plaza, Suite 2000, Chicago, IL 60606. (800) 877-1600. <http://eatright.org>.

American Heart Association National Center, 7272 Greenville Ave., Dallas, TX 75231. (800) 242-8721. <http://www.americanheart.org.>.

Center for Science in the Public Interest 1875 Connecticut Ave. N.W., Ste. 300, Washington, D.C. 20009. (202) 332-9110. <http://www.cspinet.org>.

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CocoaVia. 1-(866) 290-6849. <http://cocoavia.com/> April 13,2007).>

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Liz Swain

Cholesterol-lowering diet *see* **TLC diet**

# Choline

## Definition

Choline is a nutrient required by the body. It does not meet the classic definition of a vitamin because the body makes some choline, but not enough to support health. The remainder must be acquired through diet. For practical purposes, choline is grouped with the B-complex **vitamins** because it is a water-soluble compound that performs some functions similar to these vitamins.

## Purpose

Choline has several functions in the body. It is incorporated into the fat (lipid)-containing structures in cell membranes, and is necessary for the formation of certain signaling chemicals made by cells to activate other molecules. Choline is also necessary for the formation of acetylcholine. Acetylcholine is a neurotransmitter that transfers information from nerves to muscles. Acetylcholine is also thought to be important to memory and learning in the brain. Finally, choline, like several other B vitamins, is active in the metabolic pathway that breaks down homocysteine and removes it from the body. Homocysteine is an amino acid that circulates in the blood. When too much homocysteine

**Choline**

| Age | Adequate Intake (mg) | Tolerable upper intake level (mg) |
|---|---|---|
| Children 0–6 mos. | 125 | Not established |
| Children 7–12 mos. | 150 | Not established |
| Children 1–3 yrs. | 200 | 1,000 |
| Children 4–8 yrs. | 250 | 1,000 |
| Children 9–13 yrs. | 375 | 2,000 |
| Boys 14–18 yrs. | 550 | 3,000 |
| Girls 14–18 yrs. | 400 | 3,000 |
| Men 19≥ yrs. | 550 | 3,500 |
| Women 19≥ yrs. | 425 | 3,500 |
| Pregnant women | 450 | 3,500 |
| Breastfeeding women | 550 | 3,500 |

| Food | Choline (mg) |
|---|---|
| Beef liver, fried, 3 oz. | 355 |
| Wheat germ, toasted, 1 cup | 172 |
| Egg, 1 large | 126 |
| Cod, cooked, 3 oz. | 71 |
| Brussels sprouts, cooked, 2 cups | 63 |
| Broccoli, cooked, 1 cup | 62 |
| Peanut butter, 2 tbsp. | 20 |
| Milk chocolate, 1.5 oz. | 20 |

mg = milligram

*(Illustration by GGS Information Services/Thomson Gale.)*

builds up, it appears to damage blood vessel walls and promote clot formation in blood vessels.

Well-designed, reproducible research has shown that people who have high levels of homocysteine in the blood are more likely to develop cardiovascular diseases such as coronary artery disease and stroke. Clinical trials are underway to investigate the effects of choline oh Alzeheimer's disease, heart disease, and fetal exposure to alcohol.

## KEY TERMS

**Amino acid**—Molecules that are the basic building blocks of proteins.

**B-complex vitamins**—A group of water-soluble vitamins that often work together in the body. These include thiamine ($B_1$), riboflavin ($B_2$), niacin ($B_3$), pantothenic acid ($B_5$), pyridoxine ($B_6$), biotin ($B_7$ or vitamin H), folate/folic acid ($B_9$), and cobalamin ($B_{12}$).

**Dietary fiber**—Also known as roughage or bulk. Insoluble fiber moves through the digestive system almost undigested and gives bulk to stools. Soluble fiber dissolves in water and helps keep stools soft.

**Fatty liver**—A condition in which liver cells accumulate fat. The condition is associated with alcohol abuse, obesity, and pregnancy and can result in serious damage to the liver.

**Neurotransmitter**—One of a group of chemicals secreted by a nerve cell (neuron) to carry a chemical message to another nerve cell, often as a way of transmitting a nerve impulse. Examples of neurotransmitters include acetylcholine, dopamine, serotonin, and norepinephrine.

**Triglycerides**—A type of fat found in the blood. High levels of triglycerides can increase the risk of coronary artery disease.

**Water-soluble vitamin**—A vitamin that dissolves in water and can be removed from the body in urine.

## Description

Choline has not been the subject of as much research as many of the other micronutrients. Not until 1998 did the Food and Nutrition Board of the United States Institute of Medicine (IOM), a part of the National Academy of Sciences, declare choline to be an essential nutrient and establish **dietary guidelines** for it.

### *Normal choline requirements*

The IOM has developed values called **Dietary Reference Intakes** (DRIs) for many vitamins, **minerals**, and essential micronutrients. The DRIs consist of three sets of numbers. The Recommended Dietary Allowance (RDA) defines the average daily amount of the nutrient needed to meet the health needs of 97–98% of the population. The Adequate Intake (AI) is an estimate set when there is not enough information to determine an RDA. The Tolerable Upper Intake Level (UL) is the average maximum amount that can be taken daily without risking negative side effects. The DRIs are calculated for children, adult men, adult women, pregnant women, and **breastfeeding** women.

The IOM has not set RDAs for choline because of the scarcity of large, long-term dietary studies on this micronutrient. Instead it has set AI levels for all age groups based on the best observed and experimental information available. For choline, the AI level was established as the average daily amount needed to prevent the development of a condition called fatty liver. It may not be the amount needed for optimal health. IAs and ULs for choline are measured in

milligrams (mg). The following list gives the recommended AL and UL levels of choline for each age group.

- children birth–6 months: AI 125 mg; UL not established. All choline should come from breast milk and infant formula or infant food.
- children 7–12 months: AI 150 mg; UL not established. All choline should come from food, not dietary supplements.
- children 1–3 years: AI 200 mg; UL 1,000 mg
- children 4–8 years: AI 250 mg; UL 1,000 mg
- children 9–13 years: RDA 375 mg; UL 2,000 mg
- boys 14–18 years: IA 550 mg; UL 3,000 mg
- girls 14–18 years: IA 400 mg; UL 3,000 mg
- adult men age 19 and older: RDA 550 mg; UL 3,500 mg
- adult women age 19 and older: RDA 425 mg; UL 3,500 mg
- pregnant women all ages: RDA 450 mg; UL 3,500 mg
- breastfeeding women all ages: RDA 550 mg; UL 3,500 mg

### *Sources of choline*

Research suggests that the body makes only between 10% and 20% of the choline it needs to maintain health. The rest comes from diet. Foods rich in choline include beef liver, egg yolks, peanuts, and soybeans. Most choline in foods is in the form of phosphatidylcholine, which is also known as lecithin. Much less information is available about the choline content of specific foods than is available for other nutrients. Most people can meet the AI levels of choline through their normal diet. Some foods that have been analyzed for choline are listed below.

- beef liver, 3 ounces fried: 355 mg
- wheat germ, 1 cup toasted: 172 mg
- egg, 1 large: 126 mg (choline is concentrated in the yolk)
- cod, 3 ounces cooked: 71 mg
- Brussels sprouts, 2 cup cooked: 63 mg
- broccoli, 1 cup cooked: 62 mg
- peanut butter, 2 Tablespoons: 20 mg
- milk chocolate, 1.5 ounces: 20 mg

Choline chloride and choline bitartrate are also sold as a **dietary supplements**. Choline is also found in dietary supplements marketed as lecithin. Soybeans are the most common source for lethicin in dietary supplements. These supplements contain a much smaller and more variable amount of choline than choline chloride or choline bitartrate supplements. Consumers should read the lethicin labels carefully. Some children's multivitamins also contain choline.

## Precautions

Moderate choline deficiency is associated with an increase in the blood levels of homocysteine. High levels of this molecule are known to increase the risk of cardiovascular disease. Extreme choline deficiency can result in a condition called fatty liver. Fat accumulates in liver cells where, in the absence of choline, it cannot be packaged and transported through the body. As a result, **fats** in the blood called **triglycerides** increase, creating an increased risk of heart disease and other health problems. Choline deficiency in pregnant women appears to have a negative effect on the development of the fetal brain and may cause learning, memory, and attention problems for affected children later in life.

Large excesses (10 g or more) of choline can cause nausea and extreme sweating. However, the most noticeable symptom of excess is the development of a highly unpleasant fishy body odor that results from the excretion of a choline breakdown product from the skin, urine, and breath. Large doses of choline dietary supplements do not appear to improve either physical or mental performance, nor do they appear to confer any specific health benefits.

## Interactions

Methotrexate, a drug used to treat **cancer**, psoriasis, and rheumatoid arthritis causes choline deficiency in laboratory animals. Individuals taking this drug should discuss possible side effects with their physician. Choline also is involved in many of the same metabolic pathways as other B-complex vitamins. Deficiencies or excesses of any of these B vitamins may potentially alter choline **metabolism**.

## Complications

No complications are expected when choline is taken in amounts equal to or exceeding the AI level. Doses much higher than the UL level have been tolerated without any obvious serious negative side effects (but also without any observed benefits).

## Parental concerns

Animal studies suggest that choline has a positive effect in stimulating the developing brain of the fetus and that choline supplements given after birth may offset some of the effects of fetal alcohol exposure. Some

Dietary supplement sellers have hyped these results, calling choline a miracle brain supplement or a genius supplement. Pregnant and breastfeeding women do need to eat a diet that provides adequate intake of choline, but should not be taken in by claims that choline supplements will increase the intelligence of their baby. As of 2007, these choline studies had only been done on rats where "learning" and "genius" were related to negotiating a laboratory maze. It remains to be seen if or how these findings relate to brain development in children.

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Linus Pauling Institute. Oregon State University, 571 Weniger Hall, Corvallis, OR 97331-6512. Telephone: (541) 717-5075. Fax: (541) 737-5077. Website: <http://lpi.oregonstate.edu>

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Helen M. Davidson

# Chromium

## Definition

Chromium is a mineral that is essential to humans. It is found naturally in a variety of foods, and supplements are available in capsules or tablets. Supplements are prepared using a number of formulas, including chromium (III), chromium aspartate, chromium chloride, chromium citrate, chromium nicotinate, chromium picolinate, GTF chromium, and trivalent chromium.

**Chromium**

| Age | Adequate Intake (mcg/day) |
|---|---|
| Children 0–6 mos. | 0.2 |
| Children 7–12 mos. | 5.5 |
| Children 1–3 yrs. | 11 |
| Children 4–8 yrs. | 15 |
| Boys 9–13 yrs. | 25 |
| Girls 9–13 yrs. | 21 |
| Boys 14–18 yrs. | 35 |
| Girls 14–18 yrs. | 24 |
| Men 19–50 yrs. | 35 |
| Women 19–50 yrs. | 25 |
| Men 50> yrs. | 30 |
| Women 50> yrs. | 20 |
| Pregnant women 18≤ yrs. | 29 |
| Pregnant women 19≥ yrs. | 30 |
| Breastfeeding women 18≤ yrs. | 44 |
| Breastfeeding women 19≥ yrs. | 45 |

| Food | Chromium (mcg) |
|---|---|
| Broccoli, ½ cup | 11 |
| Grape juice, 1 cup | 8 |
| English muffin, whole wheat, 1 | 4 |
| Garlic, dried, 1 tsp. | 3 |
| Potatoes, mashed, 1 cup | 3 |
| Basil, dried, 1 tbsp. | 2 |
| Beef cubes, 3 oz. | 2 |
| Orange juice, 1 cup | 2 |
| Turkey breast, 3 oz. | 2 |
| Whole wheat bread, 2 slices | 2 |
| Red wine, 5 oz. | 1–13 |
| Apple, unpeeled, 1 med. | 1 |
| Banana, 1 med. | 1 |
| Green beans, ½ cup | 1 |

mcg = microgram

*(Illustration by GGS Information Services/Thomson Gale.)*

## Purpose

Chromium supports the normal function of insulin, which is a hormone secreted by the pancreas. Insulin helps transport glucose from the bloodstream into liver, muscle, and fat cells. Once it is inside these cells, the sugar is metabolized into a source of energy. Insulin is also involved in regulating protein, fat, and catalytic enzyme processes. People with diabetes do not produce insulin (or produce very little) or their bodies cannot properly use the insulin that is produced. As a result, sugar builds up in the bloodstream, causing serious health effects. Numerous scientific studies have shown that chromium is useful in treating insulin resistance (metabolic syndrome) and diabetes. Diabetic peripheral neuropathy, a form of nerve damage that is a direct result of diabetes, is indirectly related to a lack of sufficient chromium.

## Description

Several studies have shown that chromium supplements may improve insulin sensitivity, and lower blood glucose and elevated body fat. In February 2004, the University of Pennsylvania School of Medicine began a comprehensive study of chromium as a therapy for insulin resistance. This condition occurs when the body fails to respond properly to the insulin it already produces. People who are insulin resistant may have the ability to overcome this problem by producing more insulin. However, if the body cannot produce sufficient amounts of insulin, glucose levels in the bloodstream rise, and type 2 diabetes ultimately occurs. It is estimated that up to 80 million Americans have insulin resistance.

A study conducted by Isala Clinics and University Hospital Groningen in the Netherlands, and released in 2003, showed that a daily dose of 1,000 micrograms of chromium significantly reduced blood sugar levels in people with poorly controlled type 2 diabetes who use insulin.

Chromium has also been used as an effective treatment for polycystic ovarian syndrome (PCOS), a hormonal condition affecting about two million American women. The condition can lead to infertility if untreated, and is associated with insulin resistance and type 2 diabetes. A study released in 2003 by the State University of New York at Stony Brook showed that insulin sensitivity increased an average of 35% after two months of daily treatment with 1,000 micrograms (mcg) of chromium.

Through its involvement with insulin function, chromium plays an indirect role in lowering blood lipids. Studies suggest, but have not proven, that chromium supplementation can reduce the risk of cardiovascular (heart) disease in men, and may decrease total cholesterol and triglyceride levels. However, several studies contradict these claims. Studies in animals suggest chromium supplementation may reduce hypertension (high blood pressure). Lipid reduction is secondary to insulin regulation and control; therefore, persons whose insulin is well regulated and controlled may not achieve reduced heart disease risk by taking chromium supplements.

Chromium supplements in high doses—1,000 mcg or more a day—are sometimes used in weight loss and muscle development. However, a number of scientific studies have found that chromium supplements are not effective in these areas. In fact, precautions warn against chromium doses exceeding 1,000 mcg per day. Weight loss and muscle development are secondary to insulin regulation and control. Therefore, when insulin is well regulated and controlled, chromium may not impact weight loss or muscle development.

### KEY TERMS

**Calcium carbonate**—A salt that is used in many antacids.

**Diabetes**—Several metabolic disorders in which the body produces insufficient insulin.

**Glucose**—Sugar.

**Hypertension**—High blood pressure, which, if untreated, can lead to heart disease and stroke.

**Insomnia**—The inability to sleep.

**Insulin**—A hormone that helps liver, muscle and fat cells take up sugars, starches, and other foods for conversion into energy the body needs.

**Insulin resistance**—Also called metabolic syndrome, a condition in which the body fails to properly respond to the insulin it produces.

**Polycystic ovarian syndrome**—PCOS, a hormonal condition in women that if untreated can lead to the inability to have children.

A complete lack of chromium is rare, and the United States Food and Drug Administration (FDA) has not established recommended dietary allowances (RDA) for the mineral. However, national statistics on the prevalence of diabetes, heart disease, and obesity suggest that chromium deficiencies may be common. Chromium occurs naturally in meat, seafood, dairy products, eggs, whole grains, black pepper, and almonds. According to *The PDR Family Guide to Natural Medicines and Healing Therapies*, the usual chromium supplement dose for children ages seven and older and adults is 50–200 mcg a day in tablets or capsules. For persons with type 2 diabetes who are not taking insulin, doses from 200–1,000 mcg daily may be taken. However, persons should only take doses at these levels after consulting with a physician. Chromium should not be taken in doses exceeding 1,000 mcg a day. The cost of a bottle of 100 tablets or capsules (200 mcg) of chromium picolinate ranges from $5 to $10.

## Precautions

Doses of 200–1,000 mcg of chromium should be taken only after consultation with a physician. Pregnant or breastfeeding women are advised to consult a physician before taking chromium supplements. Chromium should not be taken in doses exceeding

1,000 mcg a day. Increased dietary sugar may be associated with higher urinary excretion of chromium.

### Interactions

Persons who are taking antacids are advised to talk with a physician before taking chromium supplements. Studies in animals suggest that antacids, especially those containing calcium carbonate, may reduce the body's ability to absorb chromium. Studies have shown that chromium may enhance the effectiveness of drugs taken by people who have type 2 diabetes or insulin resistance. These drugs include glimepiride, glipizide, glyburide, insulin, and metformin. Individuals taking these drugs should discuss chromium supplementation with a physician because improved insulin function may necessitate medication dosage changes.

### Complications

Several studies have noted occasional reports of irregular heartbeats with chromium use. Infrequently, chromium has been reported to cause such sleep pattern changes as insomnia and increased dream activity. Irritability has also been reported. In rare instances, persons may be allergic to a chromium formula. The symptoms of an allergic reaction include difficulty breathing, chest pain, hives, rash, and itchy or swollen skin. If this happens, the patient is advised to seek medical care immediately. High doses may also cause liver and kidney damage, or gastric irritation, although these side effects are rare.

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Ken R. Wells

## Cleveland Clinic 3-day diet

### Definition

The Cleveland Clinic three-day diet is a very low-calorie diet (VLCD) or quick weight loss program intended to be followed, as the name indicates, for three days. There are certain foods (e.g., specific vegetables, hot dogs, vanilla ice cream, and saltine crackers) that the dieter must eat on specific days during the three-day period, although some versions of the diet allow substitutions. Most Internet versions of this diet promise a 10 lb (4.5 kg) weight loss over the first three days, or 40 lb (18 kg) if the diet is followed for a month. The Cleveland Clinic diet plan is primarily available on the Internet.

A number of other three-day diets share similar concepts as the Cleveland Clinic version, some of which are derived from other healthcare institutions or the military:

- Cardiac diet
- Birmingham Hospital cardiac unit diet
- American Heart Association (AHA) diet
- Three-day Army diet
- Three-day Navy diet
- Hot dog diet (or hot dog and ice cream diet)
- Kaiser three-day diet

## KEY TERMS

**Urban legend**—A story, anecdote, or piece of advice based on hearsay and circulated by person-to-person transmission, often by e-mail.

**Very low-calorie diet (VLCD)**—A term used by nutritionists to classify weight-reduction diets that allow around 800 or fewer calories a day.

- Dr. Perricone's three-day diet
- Dr. Christopher's three-day cleansing program
- Bubba's three-day diet
- Oregon Health and Science University (OHSU) diet

## Origins

The Cleveland Clinic diet development is attributed to the Cleveland Clinic located in Cleveland, Ohio. However, there is no official record of the diet's use in the facility. In fact, the origins of the diet have become somewhat of an urban legend. Many variations of the diet and stories of its development can be found posted by anonymous sources on Web sites and blogs. It is possible that the diet became associated with the Cleveland Clinic because the clinic does publish specialized cookbooks and nutrition guides for persons with kidney disorders or diabetes.

There are no books or privately published versions of the Cleveland Clinic diet in print, which makes it difficult to date this diet let alone trace it back to its original source. Although some accounts maintain that the Cleveland Clinic diet first began to circulate around 1985, the Oregon Health and Science University's disclaimer about this diet states that an early form of it called the University of Oregon Medical School diet has been passed around the Pacific Northwest since 1975. The Cleveland Clinic diet has been attributed to the cardiology departments of various hospitals and medical centers. Supposedly these facilities have overweight patients scheduled for heart surgery use the diet to help them lose weight before the operation.

## Description

Most versions of the Cleveland Clinic diet begin with the claim that the dieter will lose weight by means of a chemical breakdown. In fact, weight loss on this diet results from simple **calorie restriction**; the diet allows between 600 and 1,100 calories per day.

### *Basic three-day diet plan*

Day One:

- Breakfast: Black coffee, water, or tea; half of a grapefruit or pink grapefruit juice; and one slice of toast with 1 or 2 tbl of peanut butter
- Lunch: Black coffee, water, or tea; 1/2 cup of water-packed tuna; and one slice of dry toast
- Dinner: Black coffee, water, or tea; 3 oz lean meat; 1 cup green beans; 1 cup beets; 1 cup vanilla ice cream; and one small apple

Day Two:

- Breakfast: Black coffee, water, or tea; one egg, any style; one banana (some versions say 1/2 banana); and one slice of dry toast
- Lunch: Black coffee, water, or tea; 1 cup of cottage cheese; and five saltine crackers
- Dinner: Black coffee, water, or tea; two hot dogs; 1/2 cup carrots; 1 cup broccoli (or cabbage); one banana (some versions say 1/2 banana); and 1/2 cup vanilla ice cream

Day Three:

- Breakfast: Black coffee, water, or tea; five saltine crackers; one egg (or one slice cheddar cheese); and one 4-oz glass of apple juice
- Lunch: Black coffee, water, or tea; one hard-boiled egg; one small apple; and one slice of dry toast
- Dinner: Black coffee, water, or tea; 1 cup tuna, chicken, or turkey; 1 cup cauliflower or green beans; 1 cup beets; 1 cup cantaloupe or one small apple; and 1/2 cup vanilla ice cream

### *Instructions*

Some Internet versions of the Cleveland Clinic diet include tips and instructions for the dieter:

- Do not alter amounts or make substitutions on the diet menu.
- Drink at least four glasses of water or diet soda each day.
- Salt and pepper may be used but no other seasonings.
- No snacks allowed.
- Use this diet for three consecutive days each week.
- After three days of dieting, resume eating as usual but avoid binging.
- After four days of normal eating, repeat the three-day diet.
- Cheating on the diet will make it ineffective.
- Strictly follow the rules of the diet.

### *Variations of the three-day diet*

Some versions of the Cleveland Clinic diet allow herbs, lemon juice, vinegar, **soy** sauce, mustard, catsup, and Worcestershire sauce to add spice or flavor foods.

Versions of this diet that allow food substitutions do so on the basis that it is a calorie based diet. As long as food substitutions have equivalent calorie amounts, the diet will remain effective. Other versions provide specific lists of permitted substitutions:

- An orange instead of grapefruit
- Tuna instead of cottage cheese and vice versa
- Frozen yogurt instead of ice cream
- Cauliflower instead of broccoli and vice versa
- Green beans instead of broccoli or cauliflower
- Beets instead of carrots
- A slice of toast instead of five crackers or vice versa

## Function

The primary function of the Cleveland Clinic three-day diet is rapid short-term weight loss. Most variations of the diet imply that the diet can be used indefinitely, following a three-days on and four-days off pattern. Some online versions of this diet claim that it is a detoxification and weight regulation diet. The Cleveland Clinic three-day diet is also claimed to reduce the dieter's risk of heart disease by lowering blood pressure and cholesterol levels.

## Benefits

There are no benefits to health from the Cleveland Clinic diet other than a few pounds of temporary weight loss. Some dieters like the simple menu and no requirements for over-the-counter appetite suppressants.

## Precautions

The so-called Cleveland Clinic three-day diet or any of its three-day variations cannot be recommended for anyone who needs to lose weight; in particular, it poses risks to health for anyone with a history of heart disease or an eating disorder. In addition to avoiding **fad diets** such as this one, a general precaution for anyone seeking to lose weight is to consult a physician before trying any specific diet. This precaution is particularly important for adolescents, women who are pregnant or nursing, people with kidney or liver disorders, people with **eating disorders**, anyone who has had recent surgery, and anyone who needs to lose more than 30 lb (13.5 kg).

## QUESTIONS TO ASK YOUR DOCTOR

- Have any of your other patients actually tried the Cleveland Clinic Diet or any other three-day diet? If so, did they experience any side effects?
- Why or why wouldn't you recommend this diet to anyone even for a three-day trial period?
- What types of food substitutions would be acceptable?
- What is your opinion on cycling the program each week (three days on, four days off)?

## Risks

The Cleveland Clinic three-day diet is touted on some websites as a regimen that will lower blood cholesterol levels and the risk of heart disease. On the contrary, the diet requires foods that are high in fat, saturated fat, and cholesterol; all of which have been linked to heart disease.

The rigid rules associated with this diet as well as its calorie restriction place individuals diagnosed with eating disorders at risk of a relapse. A study at the University of Minnesota reported in 2007 that adolescent girls are at particularly high risk of developing or retaining disordered eating patterns with frequent exposure to magazine or online articles recommending diets, including such fad diets as the Cleveland Clinic diet.

Very restrictive diets such as the Cleveland Clinic diet may have an effect on dieter's morale. Some nutritionists have expressed concern that when dieters fail to lose weight on these diets, the dieters see themselves as weak or lacking willpower rather than recognizing that the diet is unsustainable.

## Research and general acceptance

The Cleveland Clinic diet is rejected by mainstream physicians and dietitians. The American Heart Association (AHA) and the hospitals whose names have been associated with the **cabbage soup diet** have issued formal disclaimers warning the public that they do not endorse this diet. The Oregon Health and Science University stated in 2003 that the "hot dog and ice cream diet . . . has been a thorn in our side for years. . . . We will not publish the entire meal plan for fear that someone might take it seriously."

The UAB Health System not only disowns the three-day diet, but notes its specific nutritional inadequacies,

including not providing adequate **iron** and **calcium** needed for a healthy diet.

Other critics of the Cleveland Clinic diet note its association with yo-yo dieting or **weight cycling**. Yo-yo dieting is a phrase coined in the early 1980s by Kelly Brownell, an **obesity** specialist at Yale University, to describe a repetitive pattern of weight loss and regaining in which the dieter's weight goes up and down like a yo-yo. The weight cycle may be as small as 5–10 lb (2–5 kg) or as large as 50 lb (22 kg). Weight cycling is no longer thought to affect **metabolism** but it does appear to increase a dieter's risk of **gallstones**, high cholesterol levels, and high blood pressure. Therefore, it is healthier to lose weight slowly through lifestyle changes (including more exercise) and keep it off than to use fad diets like the Cleveland Clinic diet as part of a weight cycling pattern.

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#### ORGANIZATIONS


American Dietetic Association (ADA). 120 South Riverside Plaza, Suite 2000, Chicago, IL 60606-6995. Telephone: (800): 877-1600. Website: <http://www.eatright.org>.

Cleveland Clinic. 9500 Euclid Avenue, Cleveland, OH 44195. Telephone: (216) 444-2200. Website: <http://www.clevelandclinic.org/>.

Dietitians of Canada/Les diététistes du Canada (DC). 480 University Avenue, Suite 604, Toronto, Ontario, Canada M5G 1V2. Telephone: (416) 596-0857. Website: <http://www.dietitians.ca>.

Partnership for Healthy Weight Management (PHWM), c/o Federal Trade Commission (FTC), Bureau of Consumer Protection. 601 Pennsylvania Avenue, NW, Room 4302, Washington, DC. 20580. Website: <http://www.consumer.gov/weightloss/>.

Rudd Center for Food Policy and Obesity. 309 Edwards Street, Yale University, New Haven, CT 06520-8369. Telephone: (203) 432-6700. Website: <http://www.yaleruddcenter.org/home.aspx>.


Rebecca J. Frey, PhD

Cobalamin *see* **Vitamin $B_{12}$**

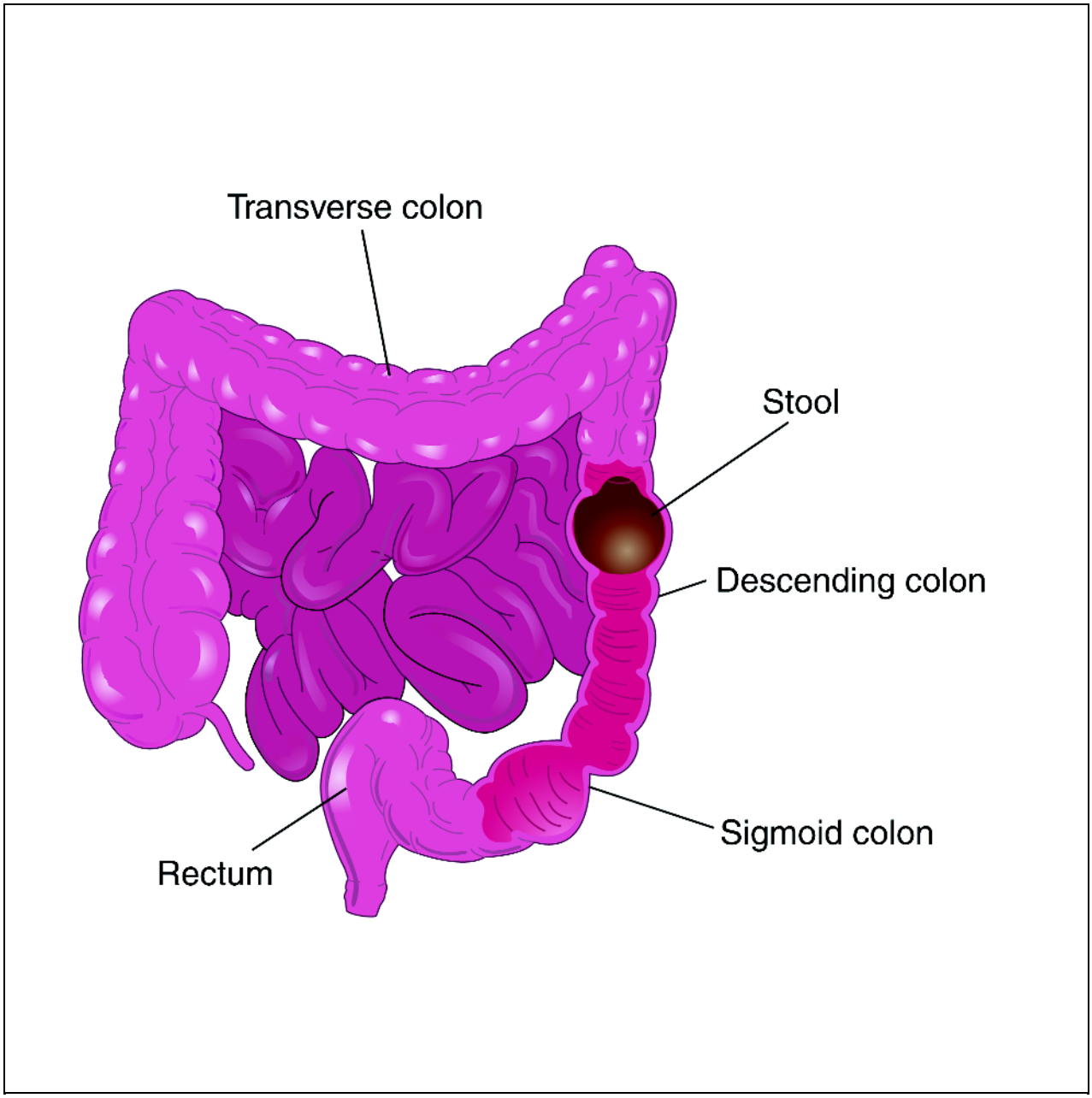
# Constipation

## Definition

Constipation is a symptom characterized by either having fewer than three bowel movements a week or having difficulty passing stools that are often hard, small, and dry.

## Description

Food in the process of being digested moves through the intestines in as a slurry or watery mush. In the small intestine, nutrients are absorbed from this material. After most of the nutrients have been absorbed, the material passes into the colon, or large intestine. Here much of the **water** in the slurry is absorbed back into the




**Constipation is an acute or chronic condition in which bowel movements occur less often than usual or consist of hard, dry stools that are painful or difficult to pass.** *(Illustration by Electronic Illustrators Group/Thomson Gale.)*

bloodstream, and the remaining solid material is eliminated as waste or stool. Constipation occurs when too much water is removed from the slurry, and it becomes difficult or painful to eliminate the stool. The most common reason why too much water is removed is that the material stays too long in the colon.

The frequency of bowel movements varies greatly from person to person and is influenced by age, health, diet, and lifestyle. It is a common misperception that a daily bowel movement is necessary for health. This is not true. For some healthy people, it is normal to have three bowel movements a day, while other healthy people have only three a week. Determining whether an individual is constipated must start with knowing what frequency of bowel movements is normal for that person.

## Demographics

Constipation is a very common complaint. About 2% of Americans complain of frequent or constant constipation. In 2005, constipation accounted for about 2.5 million visits to the doctor. In the United States more black Americans report being constipated than white Americans. In Africa, the reverse is true, suggesting that diet plays a more important role than race in determining who develops constipation. This is also supported by the fact that very few Asians who eat an **Asian diet** report being constipated, while those who adopt a Western diet report constipation much more frequently. Complaints about constipation are more likely to come from women than from men and from people over age 65. Pregnant women are at higher risk to become constipated, as are people who have had surgery and who are taking narcotic painkillers.

## Causes and symptoms

Constipation is not a disorder but a symptom of a health problem, like a fever or a cough. There are two general categories of constipation, idiopathic constipation, and functional constipation. Idiopathic means "of unknown origin." Idiopathic constipation is constipation that arises from an unknown cause. It may be related to hormonal abnormalities, nerve, or muscle damage, or something physicians do not yet understand. Functional constipation occurs when the bowel is healthy, but constipation develops because of diet, lifestyle habits, psychological disorders, or abnormalities in the rectum or anus.

Symptoms of constipation may include:

- bowel movements that occur less frequently than normal
- straining to eliminate stools
- small, hard, dry, painful, stools
- a feeling of pressure in the rectum
- a feeling of abdominal fullness or bloating
- leakage of small amounts of liquid stool. This occurs when there is a blockage or impaction and the colon is abnormally stretched.

Constipation has many causes. The most common cause in the United States is poor diet. A diet that increases the chances of developing constipation is one that is high in meat, dairy products, and refined sugar and low in dietary **fiber**. Other causes include:

- little physical exercise. This is a particular problem in the elderly.
- medications, especially narcotic drugs used to treat pain, but also antidepressants, antacids containing aluminum, iron supplements, tranquilizers, antispasmodics and anticonvulsants
- pregnancy
- change in routine, for example traveling
- irritable bowel syndrome
- not drinking enough fluids; dehydration
- laxative abuse (People become dependant on laxatives and need higher and higher doses to avoid constipation.)
- poor bowel habits, such as ignoring the urge to have a bowel movement or refusal to use public toilets
- tumor or other mechanical blockage
- eating disorders such as anorexia nervosa or bulimia nervosa where there is low calorie intake and (for bulimia) vomiting
- stroke or other conditions causing nerve damage such as multiple sclerosis, Parkinson's disease, and spinal cord injuries
- disorders that affect the muscles that cause material to move through the colon
- hormonal disorders such as diabetes, hypercalcemia (too much calcium), and hypothyroidism (too little thyroid hormone)
- abnormalities of the rectum or anus
- iron supplements

### KEY TERMS

**Anus**—The opening from the rectum to the outside of the body through which stools pass. The opening and closing of the anus is controlled by a strong ring of muscles under somewhat voluntary control.

**Dietary fiber**—Also known as roughage or bulk. Insoluble fiber moves through the digestive system almost undigested and gives bulk to stools. Soluble fiber dissolves in water and helps keep stools soft.

**Idiopathic**—Occurring from unknown causes.

**Laxative**—A substance that stimulates movement of food through the bowels. Laxatives are used to treat constipation.

**Rectum**—The last few inches of the large intestine.

## Diagnosis

Diagnosis begins with a medical history so that the physician can determine the normal frequency of

bowel movements and the length of time the individual has been constipated. The clinical definition of constipation requires that it be present for at least 12 weeks out of the past 12 months. The 12 weeks do not have to be consecutive.

A physical examination including a rectal exam and blood tests. Other tests, such as a thyroid hormone test, may be necessary to rule out other disorders. When symptoms are severe or do not improve with treatment, the physician may order specialized tests to determine how long material stays in the colon, evaluate the condition of the muscles of the rectum and anus, and look for evidence of **cancer** or other disease. These tests may include a sigmoidoscopy, barium enema x ray, colorectal transit study, and anorectal function tests.

## Treatment

The first choice in treating constipation is a change of diet. People with constipation are advised to eat more foods high in dietary fiber, decrease dairy, egg, and meat products to a healthy balance, and increase the amount of water and non-caffeinated beverages they drink. They are also encouraged to increase their level of physical activity and respond promptly to the urge to have a bowel movement.

When changes in diet and exercise do not work, laxatives can be used to stimulate movement of the bowels. Many types of laxatives can be purchased without a prescription. Americans spend about $725 million annually on laxatives. However, laxative dependency can become a problem with all laxatives. People who have been using laxatives regularly and wish to stop should reduce their use gradually. Each type of laxative has benefits and drawbacks. Individuals should discuss which one is best for them with their healthcare provider or pharmacist. Laxatives usually take 6–12 hours to stimulate a bowel movement.

Bulk-forming or fiber supplement laxatives are generally the safest type of laxative. Some common brand names of fiber-supplement laxatives are Metamucil, Citrocel, Fiberall, Konsyl, and Serutan. These must be taken with water. They provide extra fiber that absorbs water and helps keep the stool soft. The extra bulk also helps move materials through the colon.

Stool softeners help prevent the stool from drying out. They are recommended for people who should not strain to have a bowel movement, for example, people recovering from abdominal surgeries or childbirth. Brand names include Colace and Surfak.

Stimulant laxatives such as Ducolax, Senokot, Correctol, and Purge increase the rhythmic contractions of the colon and move the material along faster.

Lubricants add grease to the stool so that it moves more easily through the colon. Mineral oil is the most common lubricant.

Saline laxatives such as Milk of Magnesia draw water from the body into the colon to help soften and move the stool.

In the case of serious constipation, prescription drugs such as tegaserod (Zelnorm) may be used under the supervision of a doctor. Other medical treatment involves treating the underlying cause of the constipation such as changing a medication, removing tumors, or correcting a hormonal imbalance.

## Nutrition/dietetic concerns

The major cause of constipation is poor diet. Studies find that the average American eats only 5–14 grams of fiber daily. The United States Institute of Medicine (IOM) of the National Academy of Sciences has issued the following guidelines for daily consumption of fiber.

- men age 50 and younger: 38 grams
- women age 50 and younger: 25 grams
- men age 51 and older: 30 grams
- women age 51 and older: 21 grams

There are two types of dietary fiber, and both play a role in controlling constipation. Insoluble fiber passes through the intestines undigested, adds bulk to stool, and increases the speed with which it moves through the colon. Good sources of insoluble fiber include many whole grains such as wholemeal bread, brown rice, and high bran cereals. Soluble fiber dissolves in water and forms a gel that keeps the stool soft. It also has health benefits such as lowering cholesterol (see entry for **high fiber diet**). Good sources of soluble fiber include oats, apples, beans, peas, citrus fruits, barley, and carrots.

The American Dietetic Association and several other health organizations encourage people to increase the amount of fiber in their diet for many health reasons, not just to control or prevent constipation. The following list gives the fiber content of some common foods.

- split peas, cooked, 1 cup: 16.3 g
- lentils, cooked, 1 cup: 14.6 g
- kidney beans, cooked, 1 cup: 13.1 g
- brown rice, cooked, 1 cup: 3.5 g
- 100% bran cereal, 1/2 cup: 8.4 g

- oatmeal, 1 cup: 4.0 g
- peas, cooked, 1/2 cup: 3.6 g
- carrots, cooked, 1/2 cup: 2.3 g
- potato, baked with skin: 2.5 g
- potato, baked without skin: 1.4 g
- apple with skin: 3.5 g
- apple without skin: 2.7 g
- pear with skin, 1/2: 3.1 g
- pear without skin, 1/2: 2.5 g
- prunes, 3: 3.0 g
- whole-wheat bread, 1 slice: 1.9 g
- popcorn, air popped, 2 cups: 2.4 g
- peanuts, 10: 1.4 g

## Therapy

Biofeedback training may help individuals whose constipation is caused by dysfunctional control of the muscles that control the anus.

## Prognosis

Many people have short bouts of constipation, especially when traveling, after childbirth or surgery, or with a change in lifestyle. These usually can be resolved through attention to diet and exercise. People who have chronic idiopathic constipation, **irritable bowel syndrome**, and the elderly (especially those who are bed or wheelchair bound), often continue to have long-term problems with constipation despite attention to diet and become dependent on laxatives. Since many people self-treat constipation with over-the-counter laxatives, rates of improvement are difficult to determine.

Some people develop **hemorrhoids** and cracks in their skin at the anus (anal fissures) as the result of constipation. These are painful, but not usually medically serious. Some people also develop rectal prolapse from straining to produce a bowel movement. In this case, the lining of the rectum bulges out through the anus. The most serious complication from constipation is an impaction, which is a hard mass of stool that blocks the colon. Removing an impaction often requires professional medical intervention.

## Prevention

A diet high in fiber, whole grains, fruits, and vegetables and low in sugar, **fats**, and refined grains helps promote good bowel health in most people. Adequate amounts of fluid and regular exercise also help prevent constipation from becoming a problem.

## Resources

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American Gastroenterological Association. 4930 Del Ray Avenue, Bethesda, MD 20814. Telephone: (301) 654-2055. Fax: (301) 654-5920. Website: <http://www.gastro.org>

National Digestive Diseases Information Clearinghouse (NDDIC). 2 Information Way, Bethesda, MD 20892-3570. Telephone: (800) 891-5389. Fax: (703) 738-4939. Website: <http://digestive.niddk.nih.gov>

International Foundation for Functional Gastrointestinal Disorders. P. O. Box 170864, Milwaukee, WI 53217, Telephone: (888) 964-2001 or (414) 964-1799. Fax: (414) 964-7176. Website: <http://www.iffgd.org>

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# Copper

## Definition

Copper is an essential mineral that plays an important role in iron absorption and transport. It is considered a trace mineral because it is needed in very small amounts. Only 70–80 mg of copper are found in the body of a normal healthy person. Even though the body needs very little, copper is an important nutrient that holds many vital functions in the body.

## Purpose

Copper is essential for normal development of the body because it:

- Participates in a wide variety of important enzymatic reactions in the body.
- Is a component of or a cofactor for approximately 50 different enzymes. These enzymes need copper to function properly.
- Is essential for iron absorption and transport. Iron is needed to make hemoglobin, a main component of red blood cells. Therefore, copper deficiency is often linked to iron-deficiency anemia.
- Is required to build elastin and collagen, which are an important components of bones and connective tissues. Therefore, copper is believed to protect the bones and joints against degeneration and osteoporosis.
- Is required for melanin production. People with copper deficiency may have pale skin and hair.
- Is a key mineral for the immune system. Copper promotes wound healing. Studies show that premature infants or children with genetic copper defects are at high risk of getting infections and would significantly improve with copper supplementation.
- Attacks free radicals. Copper is a strong antioxidant. It works by attaching itself to the enzyme Superoxide dismutase (SOD). Copper also binds to a protein to form ceruloplasmin, which is an antioxidant.
- Helps the body produce energy. Copper participates in many oxidative reactions that break down fats in fat tissue to produce much needed energy. Copper deficiency has been associated with high cholesterol levels.
- Is necessary for normal functioning of insulin. Copper deficiency is also associated with poor blood glucose control.
- Is needed for normal functioning of the cardiovascular system.
- Protects the structure and function of the nervous system, including the brain. Copper protects nerve fiber by maintaining myelin, the insulating sheath that surrounds nerve cells. It also aids the transmission of nerve signals in the brains.

**Copper**

| Age | Recommended Dietary Allowance (mcg/day) |
|---|---|
| Children 0–6 mos. | 200 (AI) |
| Children 7–12 mos. | 220 (AI) |
| Children 1–3 yrs. | 340 |
| Children 4–8 yrs. | 440 |
| Children 9–13 yrs. | 700 |
| Adolescents 14–18 yrs. | 890 |
| Adults 19≥ yrs. | 900 |
| Pregnant women | 1,000 |
| Breastfeeding women | 1,300 |
| **Food** | **Copper (mcg)** |
| Beef, liver, 3 oz. | 1,240 |
| Oysters, cooked, 6 med. | 374 |
| Chocolate, semisweet, 1 cup | 176 |
| Mushrooms, shitake, cooked, 1 cup | 130 |
| Cashews, dry roasted, 1 oz. | 70 |
| Peas, black-eyed, cooked, ½ cup | 70 |
| Soybeans, boiled, 1 cup | 70 |
| Beans, white, canned, 1 cup | 60 |
| Sunflower seeds, ¼ cup | 59 |
| Chickpeas, cooked, 1 cup | 57 |
| Baked beans, with pork, 1 cup | 54 |
| Lentils, cooked, 1 cup | 50 |
| V-8 juice, canned, 1 cup | 48 |
| Potato skin, baked, 1 | 47 |
| Raisins, seedless, 1 cup | 46 |
| Salmon, baked, 3 oz. | 30 |

AI = Adequate Intake
mcg = microgram

*(Illustration by GGS Information Services/Thomson Gale.)*

Copper supplements may be beneficial in treating or preventing copper deficiency. Copper deficiency used to be relatively rare because the body requires so little of it, only about 2 mg per day. In addition, it is available naturally in a variety of foods such as whole grains, shellfish, nuts, beans, and leafy vegetables. Additional sources of copper are the copper water pipes that run through homes or the copper cookware in the kitchen. These sources leach copper into the water we drink and the food we eat. The level of copper in drinking water is sometimes so high that it becomes a public concern. However, scientists now realize that copper deficiency, especially borderline cases, is more common than once thought. Copper deficiency is currently on the rise due to a decrease of whole foods in the diet and high consumption of fatty and processed foods.

## Description

It was discovered in 2001 that vegetarian diets generally contain more copper, but that the absorption

## KEY TERMS

**Antioxidants**—Antioxidants are nutrients that deactivate reactive molecules (free radicals) and prevent harmful chain reactions.

**Lacto-ovo vegetarian**—People who do not eat meat, but do include dairy products and eggs in their diets.

**Minerals**—Inorganic chemical elements that are found in plants and animals and are essential for life. There are two types of minerals: major minerals, which the body requires in large amounts, and trace elements, which the body needs only in minute amounts.

efficiency was lower for lacto-ovo vegetarians than for nonvegetarians. The study also showed that the increased amounts of copper in the vegetarian diets allow for greater copper content.

Besides dietary causes, certain diseases or conditions may reduce copper absorption, transport or increase its requirements, resulting in abnormally low copper blood levels. Increased copper intake through diet or supplementation may be necessary in the following conditions:

- premature infants fed only cow's milk
- pregnant women
- malnutrition
- celiac disease, sprue, cystic fibrosis, or short-bowel syndrome (these diseases cause poor absorption of dietary copper)
- kidney disease
- high consumption of zinc or iron (these minerals interfere with copper absorption)
- highly processed foods (copper is stripped away during food processing)
- Menkes syndrome (copper deficiency is caused by genetic defects of copper transport; Menkes syndrome patients cannot use copper supplied by the diet efficiently)

Symptoms of copper deficiency include:

- anemia
- malnourished infants
- prominently dilated veins
- pale hair or skin
- poorly formed bones
- nervous system disorders
- high cholesterol levels
- heart disease
- loss of taste
- increased susceptibility to infections
- infertility
- birth defects

Exceeding the daily requirement is dangerous, however, because copper toxicity commonly occurs. Copper toxicity is a very serious medical problem. Acute toxicity due to ingestion of too much supplement, for example, may cause nausea, vomiting, abdominal pain, diarrhea, dizziness, headache, and a metallic taste in the mouth. Chronic toxicity is often caused by genetic defects of copper metabolism, such as Wilson's disease. In this disease, copper is not eliminated properly and is allowed to accumulate to toxic levels. Copper is therefore present at high concentration where it should not be, such as in the liver, the lens of the eye, kidneys, or brain.

### *Disease prevention*

Copper is a good antioxidant. It works together with an antioxidant enzyme, superoxide dismutase (SOD), to protect cell membranes from being destroyed by free radicals. Free radicals are any molecules that are missing one electron. Because this is an unbalanced and unstable state, a radical is desperately finding ways to complete its pair. Therefore, it reacts to any nearby molecules to either steal an electron or give away the unpaired one. In the process, free radicals initiate chain reactions that destroy cell structures. Like other antioxidants, copper scavenges or cleans up these highly reactive radicals and changes them into inactive, less harmful compounds. Therefore, it can help prevent cancer. In 2001, a study reported that concentrations of copper sulfate and ascorbate may inhibit breast cancer growth. With further study, the combination may even prove useful as a chemotherapy agent for certain breast cancer patients.

Copper may also help prevent degenerative diseases or conditions such as premature aging, heart disease, autoimmune diseases, arthritis, cataracts, Alzheimer's disease, or diabetes.

### *Osteoporosis*

Copper may play a role in preventing osteoporosis. Calcium and vitamin D have long been considered the mainstay of osteoporosis treatment and prevention. However, a recent study has shown that they can be even more effective in increasing bone density and preventing osteoporosis if they are used in combination with copper and two other trace minerals, zinc and manganese.

### *Rheumatoid arthritis*

Copper has been a folklore remedy for rheumatoid arthritis since 1500 B.C. in ancient Egypt. Some people believe that wearing jewelry made of copper may relieve arthritic symptoms. To evaluate the effect of copper for the treatment of rheumatoid arthritis, Dr. Walker and his colleagues conducted a study of 77 arthritic patients. Patients were divided into two groups: treatment group wearing copper jewelry and placebo group wearing nothing or aluminum jewelry. In this study, patients who wore copper bracelets felt significantly better than those in the placebo group. In addition, patients in the treatment group reported recurrences of symptoms after the bracelets were removed. To explain the effects of the copper bracelets, these researchers suggested that copper contained in the bracelets was dissolved in sweat and then absorbed through the skin. They suspected that copper's effectiveness may be related to its role as an antioxidant. They also believe that copper may function as both an anti-inflammatory agent and as an antioxidant. Thus, it is possibly effective in reducing inflammatory response to such conditions as rheumatoid arthritis.

Copper is contained in many multivitamin/mineral preparations. It is also available as a single ingredient in the form of tablets. These tablets should be swallowed whole with a cup of water, preferably with meals, to avoid stomach upset. A person may choose any of the following preparations: copper gluconate, copper sulfate, or copper citrate. However, copper gluconate may be the least irritating to the stomach.

Zinc and copper compete with each other for absorption in the gastrointestinal tract. As a result, excessive copper intake may cause zinc deficiency, and vice versa. Therefore, a person should take zinc and copper supplements together in ratios of 10:1 or 15:1.

## Precautions

Those adding copper supplements to their diets should consider:

- Informing their doctors for proper instruction and monitoring of side effects. Copper toxicity due to excessive doses of copper supplements has been reported.
- Although there currently is no recommended daily allowance (RDA) established for copper, 2 mg of copper per day is considered sufficient and safe. Nausea and vomiting may occur in persons taking more than 20 mg of copper daily.
- It is not known if copper supplementation may harm a growing fetus. However, as with any drugs, pregnant or nursing women should not take copper or any other supplements or drugs without first consulting their doctors.
- In certain areas, drinking water may contain high levels of copper. Periodic checks of copper levels in drinking water may be necessary.
- Because individual antioxidants often work together as a team to defend the body against free radicals, the balance between copper, zinc, and iron must be maintained. Excessive intake of one nutrient might result in a deficiency of other minerals and decreased resistance to infections and increased risk of heart disease, diabetes, arthritis, and other diseases.

## Interactions

### *Factors that increase copper concentrations*

Certain disorders have been known to increase copper levels. Persons with these conditions should not take copper supplements as they may cause copper toxicity.

- recent heart attacks
- lupus erythematosus
- cirrhosis of the liver
- schizophrenia
- leukemia and some other forms of cancer
- viral infections
- ulcerative colitis (This inflammatory bowel disease may cause accumulation of copper in the body. Excessive amount of copper may worsen many symptoms of this disease by increasing susceptibility to infections and inhibiting wound healing.)
- Wilson's disease (This disease causes accumulation of copper in the tissues. As a result, patients have liver disease, mental retardation , tremor and poor muscle coordination. They also have copper deposits in the cornea of the eye. To manage this disease, patients are put on a low-copper diet and given penicillamine, a drug that attaches itself to copper and increases its excretion.)

## Complications

A person should stop taking copper supplements and seek medical help immediately if having the following signs or symptoms:

- anemia
- nausea
- vomiting
- abdominal pain

### Resources

#### BOOKS

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# Coronary heart disease

## Definition

Coronary heart disease is the narrowing or blockage of the arteries and vessels that provide oxygen and nutrients to the heart. It is caused by a condition called atherosclerosis, which is the gradual buildup of fatty materials on the arteries' inner linings. The blockage that results from the buildup restricts blood flow to the heart. When the blood flow is completely cut off, a heart attack can occur.

## Description

Coronary heart disease also may be called coronary artery disease or simply heart disease. It is the leading cause of death in the United States among men and women.

When the heart works harder and needs more oxygen, the coronary arteries expand. But buildup of fatty materials, or plaque, from atherosclerosis causes the arteries to harden and narrow. If the arteries are unable to expand because of coronary artery disease, the heart is deprived of oxygen. The heart muscle can't work properly without oxygen. The reduced blood flow and oxygen supply may cause angina, which is pain in the chest. It also may cause shortness of breath or other symptoms. Complete blockage or clotting at the site where the blood enters the heart can cause a heart attack.

Coronary heart disease can worsen over time. The heart muscles may weaken, even though no symptoms may be evident. Eventually, this leads to heart failure. In heart failure, the heart doesn't suddenly stop, but fails to pump blood to the body the way that it should. Coronary heart disease also can lead to heart arrhythmias, or changes in the normal rhythm of heartbeat. These can be serious.

## Demographics

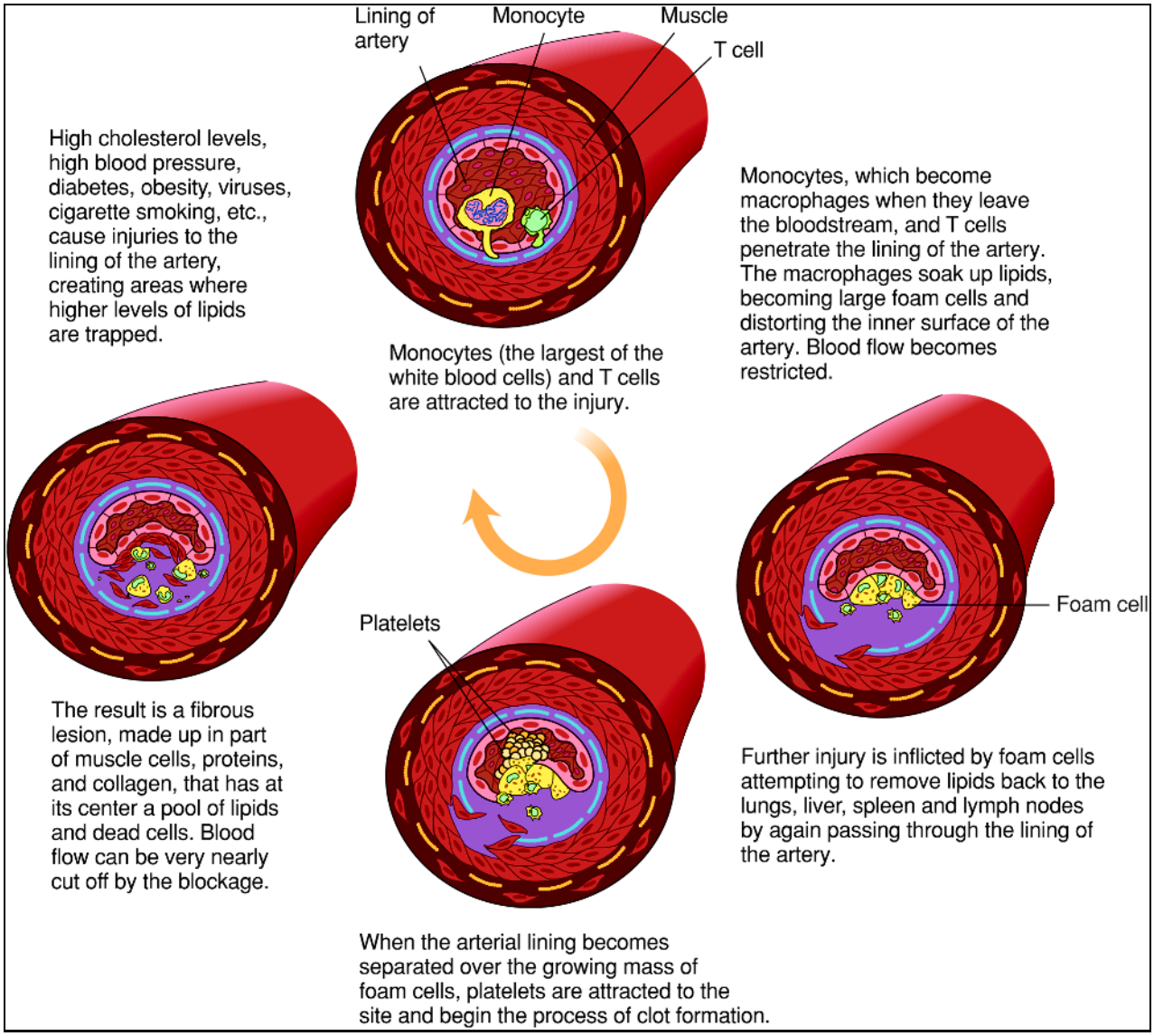
According to the American Heart Association, coronary heart disease caused more than 250,000 deaths in 2004. But the number of deaths from the disease declined 33% from 1994 to 2004. Although about 325,000 people a year die of coronary attacks in hospital emergency departments without even being hospitalized, more than 15 million people in America live with a history of heart attack, angina pectoris, or both. More of these are males, but not by a wide margin. Black males have a higher death rate per 100,000 than white males, and men generally have a higher chance of dying from coronary heart disease than women.

## Causes and symptoms

Coronary heart disease is caused by atherosclerosis. Some risk factors for coronary heart disease can't be changed, such as inheriting a genetic risk for the disease.

### *Causes and risk factors*

Age is a major risk factor for death from coronary heart disease. Over 83% of people who die from coronary heart disease are over age 65. Gender plays a role too, since men have a higher risk of heart attacks. Men tend to get heart disease earlier than women. While mean are at higher risk for coronary heart disease by about age 45, women are at risk for heart disease later in life, beginning at about age 55. People whose parents had heart disease also are at higher risk for coronary heart disease. Certain racial groups have higher risk as well, often because of a greater tendency toward **obesity**, high blood pressure, or diabetes.




**The progression of artherosclerosis.** *(Illustration by Electronic Illustrators Group/Thomson Gale.)*

Other risk factors can be affected by diet and lifestyle changes. Smoking is a big contributor to coronary heart disease. Not only do smokers have a risk two to four times that of nonsmokers of developing coronary heart disease, but they also have a higher risk of heart attack from the disease. In fact, a smoker with coronary heart disease is twice as likely as a nonsmoker with coronary heart disease to die suddenly from the disease.

Cholesterol and saturated fat play a role in developing coronary heart disease. The body produces cholesterol and a person's age, sex, and heredity can affect cholesterol levels. But diet also affects cholesterol. Both cholesterol and saturated fat tend to be found in the same foods. Dietary sources of both are meat, eggs, and other animal products. Risk of developing coronary heart disease rises steadily as levels of low-density lipoprotein (LDL) cholesterol rise or if a person has high cholesterol levels combined with high blood pressure and smoking.

Other diseases and conditions contribute to risk of coronary heart disease. High blood pressure makes the heart work harder and weakens it over time. **Diabetes mellitus** can be a serious risk for coronary heart disease and cardiovascular disease, which includes other disease to other arteries throughout the body. About three-fourths of people with diabetes die from heart disease or blood vessel disease.

## KEY TERMS

**Angina pectoris**—Chest pain or discomfort. Angina pectoris is the more common and stable form of angina. Stable angina has a pattern and is more predictable in nature, usually occurring when the heart is working harder than normal.

**Atherosclerosis**— The hardening and narrowing of the arteries caused by the slow build-up of fatty deposits, or plaque, on the artery walls.

**Triglyceride**—A fat that comes from food or is made up of other energy sources in the body. Elevated triglyceride levels contribute to the development of atherosclerosis.

Weight and physical activity play a role in risk of coronary heart disease. Being overweight makes the heart work harder to do its everyday job of pumping blood to the body. Even when people have no other risk factors, obesity greatly increases risk of heart disease, particularly if weight is concentrated at the waist. Excess weight also raises blood pressure and affects cholesterol and triglyceride levels. Losing as little as 10 pounds can decrease risk for coronary heart disease, though maintaining a healthy weight is best. Being inactive contributes to weight gain and all of the associated conditions that then lead to coronary heart disease.

Stress also may play a role in coronary heart disease risk. However, the real problem is how people react to stress. For instance, overeating in response to stress leads to risk factors listed above. Drinking too much alcohol can cause some of the conditions listed above and lead to heart failure. However, studies have shown that moderate amounts of alcohol, described as about 1.5 fluid oz. of 80-proof spirits, 1 fluid oz. of 100-proof spirits, 4 fluid oz. of wine, or 12 fluid oz. of beer per day, may be good for the heart. The American Heart Association does not recommend that people who do not drink begin drinking or that anyone increase alcohol intake to meet these amounts, however.

### *Symptoms*

The restricted blood flow to the heart caused by narrowing arteries may not produce any symptoms at first and many people are completely unaware that they have coronary heart disease. As the plaque builds up, symptoms begin to develop. One of the first signs may be chest pain that is triggered by physical or emotional stress. This pain often is referred to as angina. The pain feels much like pressure or tightening in the chest or it may be felt in the arm, neck, jaw, shoulder, or back. Sometimes the pain is confused with indigestion. Women may notice pain more often in the back or arm than in the chest and the pain may be brief and pass quickly.

Shortness of breath also is a symptom of coronary heart disease. This results from the heart's decreasing ability to pump enough blood to the body to meet its needs. The person with shortness of breath also may feel very tired.

The most serious symptom of coronary heart disease is heart attack. Although some heart attacks start suddenly and are clearly occurring, most start slowly with uncertain symptoms. Discomfort in the center of the chest that lasts for several minutes that feels like squeezing, fullness, or pain is a sign that a heart attack is occurring or about to occur. The pain also may go away and come back. The pain may occur in one or both upper arms, the back, neck, jaw, or stomach. A person may experience shortness of breath with or without chest pain. Some people break out in a sweat or experience nausea or lightheadedness.

## Diagnosis

A physician will ask questions about edical history, symptoms, and relatives with heart disease, as well as diet and lifestyle. A physical examination and routine blood tests also may be ordered as part of the evaluation. In addition, several examinations can be done to diagnose and evaluate coronary heart disease. These include:

- Resting electrocardiogram (ECG or EKG). This records electrical signals as they travel through the heart and usually is performed in a physician's office. It is noninvasive and involves placing electrodes on the body.
- Holter monitoring. Also called ambulatory electrocardiography, this involves wearing a portable EKG unit for 24 hours to monitor inadequate blood flow to the heart as a person goes about everyday activities.
- Exercise stress test. This test takes an EKG reading while a person is walking on a treadmill or riding a stationary bicycle. It often is used to evaluate people who experience symptoms when exercising. A nuclear stress test may be used as well. In this examination, the patient exercises and the flow of blood to the heart while at rest and during exercise is measured by injecting minor amounts of a radioactive material into the bloodstream. A special camera

can show which parts of the heart may receive less blood flow than normal.

- Angiogram. This is an x ray of the heart taken when a small tube, or catheter, is inserted into the arteries through a blood vessel in the groin or arm. The tip of the catheter can be guided to the coronary arteries and contrast is released. The contrast will be visible on x rays and will help show blood flow in the heart's chambers. Today, angiograms can be performed through the use of contrast and imaging with computed tomography or magnetic resonance imaging.
- Computed tomography (CT) scan. A CT scan, which is a cross-sectional x ray of the body or an organ of the body, can show images of the arteries to determine atherosclerosis. Ultra-fast CT imaging also can detect calcium within plaque.
- Magnetic resonance imaging (MRI). This noninvasive method may be used to examine the tissues of the heart. MRI uses no radiation. Magnetic resonance angiography provides an alternative to the more invasive method that involves introducing a catheter into the body.
- Other imaging methods may be used to detect coronary heart disease, such as single photon emission computed tomography (SPECT).

## Treatment

There are many ways to treat coronary heart disease, and the choice of treatment depends on the cause of the disease and its severity. Treatment ranges from lifestyle changes and use of medication to surgical procedures. People with less severe disease and fewer risk factors may be able to manage their disease through lifestyle changes and drug therapy. Changes in diet and an increase in exercise, as well as quitting smoking, can gain control of coronary heart disease. Often all treament procedures are used. Lifestyle factors such as diet and exercise are first line prevention and treatment methods. They are to be continued even after beginning medications and following surgery.

Medications used to treat coronary heart disease include:

- cholesterol-lowering medicines such as statins and fibrates
- blood thinners, or anticoagulants, to prevent blood clots from forming
- aspirin, also to help prevent clotting
- blood pressure medicines to lower blood pressure, such as angiotensin-converting enzyme (ACE) inhibitors
- calcium channel blockers, to relax blood vessels and lower blood pressure
- beta blockers to slow heart rate and lower blood pressure

Surgery or other procedures also may be recommended to treat coronary heart disease. A physician may be able to use a catheter to guide a tiny balloon into the artery. Once in place, the balloon is inflated and used to widen the artery by pushing the plaque up against the artery wall, Next, a stent, or mesh tube, is placed in the widened area to help keep the artery opened and clear for adequate blood flow.

Coronary artery bypass surgery reroutes, or bypasses, blood flow around the arteries that have clogged to improve blood flow to the heart. To perform the procedure, the surgeon takes a healthy blood vessel from another part of the body and uses it to create a detour around the clogged artery. This procedure requires open heart surgery and is reserved for people with multiple areas of artery blockage.

Heart attacks from coronary heart disease require emergency medical treatment.

## Nutrition/Dietetic concerns

Nutrition is key to preventing and controlling coronary heart disease. The American Heart Association recommends that adults get no more than 300 mg of cholesterol a day in their diet and that those with heart disease get no more than 200 mg a day. It also is important to limit cholesterol that comes from animal-based foods and from saturated **fats**. All animal foods contain some cholesterol, so eating lean meats, fish, and poultry in smaller servings helps to control the amount eaten. Eating fat-free or low-fat dairy products also helps keep cholesterol and fats in check.

Controlling blood pressure helps prevent or manage coronary heart disease. A diet low in salts and high in fruits, vegetables, and whole grains helps to control blood pressure. The **DASH diet** is a balanced approach to controlling **hypertension**.

Eating lots of sugars and simple **carbohydrates** can lead to or complicate diabetes and affect triglyceride levels, increasing risk of coronary heart disease. It is important for people with diabetes to control their intake of white bread, bagels, cakes, soft drinks, and other carbohydrates. Studies show that whole-wheat breads, brown rice, and legumes are healthier choices to provide carbohydrates and **protein** in the diet. Even people with coronary heart disease who do not have diabetes should try to eat the recommended daily amounts of grains and fats and to get them from whole grains when possible.

In the past, there have been recommendations to follow high-protein, high-fat diets to control coronary heart disease. Studies have not shown these types of diets, such as the **Atkins diet**, to be successful at controlling weight long term or to reducing coronary heart disease. Research has shown that diets lower in carbohydrates and higher in vegetable sources of fat and protein moderately reduce the risk of coronary heart disease in women. Certain foods, such as fish and foods high in **fiber** (whole grains, fruits, and fresh vegetables) are healthy foods for the diets of people with coronary heart disease.

The most important aspect of nutrition and diet for people with coronary heart disease is to eat a balanced diet that helps them to lose and manage weight. The United States Department of Agriculture (USDA) and the United States Department of Health and Human Services revised the *Dietary Guidelines for Americans* in 2005. The guidelines are science-based and outline advice for choosing a nutritious diet and maintaining a healthy weight. The 2005 guidelines also address physical activity and **food safety** and make recommendations for special population groups. Finally, calorie requirements and servings are based more on gender, age, and level of physical activity, while in 2000, the servings were more uniform for all adults. The USDA also revised the traditional food pyramid to make it customized for individuals. These guidelines form the basis for healthy eating. The American Heart Association and the American Dietetic Association also offer heart healthy diet recommendations, as do family physicians and cardiologists.

### Therapy

Some patients with coronary heart disease will be referred for cardiac rehabilitation, particularly following bypass surgery or if they have experienced angina or a heart attack. The rehabilitation may consist of an exercise plan to help regain stamina safely based on individual ability and needs, and education, counseling, and training. Training may include ways to better manage stress, as well as how to manage other lifestyle factors that contribute to coronary heart disease.

### Prognosis

Coronary heart disease can be successfully managed and treated in many cases. Advances in diagnosis and techniques such as stenting have helped to improve the lives of people with the disease, bringing about a significant decline in death rates from coronary heart disease since the mid-1980s. However, as the leading cause of death in the United States, coronary heart disease is a serious condition that is best prevented and that requires careful management and attention once diagnosed. The more risk factors a person has, the worse the prognosis.

### Prevention

Preventing coronary heart disease begins with knowing the risk factors and taking action to act on those factors. Managing all those contributing factors that can be avoided goes a long way in preventing the advancement of atherosclerosis and eventual coronary heart disease. By quitting smoking, moderating alcohol use, controlling blood pressure, preventing diabetes, and maintaining healthy cholesterol levels, people can prevent many of the causes of coronary heart disease. Maintaining a healthy body weight by eating a balanced diet with healthy-sized portions and participating in regular physical activity helps to prevent the disease. Those with known hereditary or other risk factors for coronary heart disease should have regular physical examinations with their physicians and should pay careful attention to the signs and symptoms of coronary heart disease and heart attack.

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American Heart Association. 7272 Greenville Ave., Dallas, TX 75231. (800) 242-8721. <http://www.americanheart.org>.

National Heart, Lung, and Blood Institute. P.O. Box 30105, Bethesda, MD 20284. (301) 592-8573. <http://www.nhlbi.nih.gov>.

Teresa G. Odle

## Cravings

### Definition

Most people, at some time, have a strong desire for some particular food, such as ice cream or pizza. Such a desire for a particular food, even when one is not hungry, is called a craving.

## Description

There are a number of theories as to why people crave certain foods, including:

- self-imposed food restriction
- a psychological desire for a "comfort" food
- hormonal changes
- gender differences
- response to stress

Food restriction. The theory of food restriction holds that people desire those foods that they feel should be avoided. According to the dietitian Debra Waterhouse, food cravings do not cause weight gain, but denying the cravings does. This creates a vicious cycle. For example, a person may feel guilty for wanting a giant cinnamon roll that he or she smells upon entering a shopping mall. The urge is avoided, but a couple of hours later, the person may want the cinnamon roll more than ever, give in to the craving, and quickly eat the entire cinnamon roll. This leads to even stronger feelings of guilt, along with the resolve not to eat anything remotely similar for some period of time. Soon, however, the craving strikes again. The cycle becomes one of denial leading to deprivation, then to overindulgence, and then back to denial. This denial-deprivation-overindulgence pattern confirms the negative view of all food as either good or bad. It would be better, however, to imagine a world where foods are not designated as bad and not allowed, but where reasonable portions of any food can be part of a healthful diet. Portion control is the key.

Comfort foods. Certain foods are usually served during holidays or special occasions. These foods become associated with comfort and happy times, eliciting feelings of relaxation and reduced stress, and are thus called "comfort foods." Some common comfort foods are ice cream, macaroni and cheese, meatloaf, pudding, cookies, and chicken. One's cultural background plays a large part in comfort-food choices. Mood also plays a roll in cravings for comfort food. Women are more likely to eat when they are sad, mad, or anxious, while men look to food when bored or lonely.

Those who find themselves reaching for comfort foods frequently should ask themselves if they are truly hungry, or whether they are using food to soothe their mood. For those who are feeding emotions with food, it is helpful to begin to replace the food with healthier activities, such as taking a walk, participating in a favorite form of exercise, or reading a good book.

### KEY TERMS

**Calorie**—Unit of food energy.

**Estrogen**—Hormone that helps control female development and menstruation.

**Neurotransmitter**—Molecule released by one nerve cell to stimulate or inhibit another.

**Serotonin**—Chemical used by nerve cells to communicate with one another.

**Testosterone**—Male sex hormone.

Hormones and cravings. How do hormone changes affect food cravings? For women, these cravings can be more intense than for men. Hormonal changes tied to the menstrual cycle are often a cause of cravings. Immediately prior to the menstrual period, the body's estrogen level drops, as does the serotonin level in the brain.

Serotonin is a neurotransmitter, or brain chemical, that plays a role in maintaining a relaxed feeling. When the level decreases, irritability and mood swings increase as does the craving for carbohydrate- and fat-rich foods such as chocolate, cookies, cake, potato chips, and roasted nuts. There is nothing wrong with eating a piece of chocolate, of course, but when chocolate and other craved foods become the mainstay of the diet and healthier choices get overlooked, then the cravings have gotten out of control and health may be compromised.

Gender differences. Is there a difference between the sexes when it comes to food cravings? According to Waterhouse, the foods most frequently craved or preferred by men include hot dogs, eggs, and meat, which are all **protein** foods, while women reach for chocolate, ice cream, and bread. She attributes these differences to sex hormones and body composition. Men have larger amounts of the hormone testosterone and about forty pounds more muscle mass than women. They eat increased amounts of protein to build, repair, and synthesize muscle.

Stress response. Many people today lead stressful lives, which can lead to stress eating. Increased stress results in a need for **carbohydrates** to provide energy for the stress response, also known as the *fight-or-flight* response (a defense reaction of the body that prepares it to fight or flee by triggering certain cardiovascular, hormonal, and other changes). When coping with stress, a person needs increased energy to deal with the demands placed on the body. Carbohydrates

provide a fairly rapid source of fuel to the body by raising blood-glucose levels. However, when life becomes hectic and feels out of control, it is common to reach for any available food regardless of calories or nutritional content.

### Conquering Cravings

Life will always have its stresses, but dealing with stress in a healthful, nutritional way can have a positive impact on self-esteem, energy level, emotional outlook, and weight. There are a number of positive ways to deal with cravings, including:

Start the day off with breakfast, which helps prevent overwhelming hunger later in the day.

Eliminate feelings of guilt related to labeling food as either good or bad. Some choices are healthier than others, but snacks and treats can be consumed in reasonable amounts.

Plan ahead for each new week. Think about one's school, work, and activity schedule and how healthful snacks can be incorporated into it.

Keep healthful snacks close at hand, both at home and at work.

Try not to go for long periods of time without eating.

Combine lean protein foods with high-fiber carbohydrate sources to provide energy that lasts for several hours, such as a slice of vegetable pizza or a bean burrito.

Cravings can be the exception instead of the rule when it comes to one's diet. Developing a lifestyle that includes healthful food selections and regular meals and snacks can help control cravings. The extra time it takes in planning meals or snacks, whether eating at home or eating on the run, is easily made up for in increased energy and improved mood.

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Susan Mitchell

## Crohn's disease

### Definition

Crohn's disease is a chronic inflammatory disorder that affects the digestive tract.

### Description

Crohn's disease is named for Dr. Burril Crohn who, with his colleagues, first described the disease in 1932. Crohn's disease can affect any part of the digestive system, however, it develops most often in the section of the small intestine just before the large intestine begins. This region is called the ileum, and Crohn's disease that develops there is sometimes called ileitus. The other common site for Crohn's disease is in the colon or large intestine.

Crohn's disease is one of several inflammatory bowel diseases. In can be mistaken for ulcerative colitis. Both these diseases cause watery diarrhea or bloody diarrhea and abdominal cramps or pain. However, ulcerative colitis affects only the layer of cells that line the intestine forming sores or **ulcers** on this surface. Crohn's disease begins in these same surface cells, but eats its way inward, damaging all four layers of the intestine and sometimes creating a hole (fistula) through the intestine and into other tissue. Another major difference between Crohn's disease and ulcerative colitis is that Crohn's disease can develop simultaneously in several spots in the digestive tract, resulting in areas of damaged with patches with healthy tissue in between. Ulcerative colitis, on the other hand, spreads uniformly across an area. Crohn's disease is somewhat treatable, but not curable, and can cause many complications beyond the digestive system. Eventually in Crohn's disease the walls of the intestine thicken and blockages may occur that can only be corrected by surgery.

### Demographics

About half a million Americans, or 7 people out of every 100,000 have Crohn's disease. Of these, about 4% are children under age 5, and 10% are under age 18. Most people are diagnosed with the disease between ages 15 and 35, although they may have had the disease before that. In the United States the rate of Crohn's disease has been increasing since the 1950s.

Although most common among non-Hispanic whites, the rate of Crohn's disease among American blacks, especially urban blacks, has been steadily increasing. Jews who trace their ancestry middle Europe are 2-4 times more likely to develop the disease than the

**Small intestine (lower right) infected by Crohn's disease.** *(John Bavosi/Photo Researchers, Inc. Reproduced by permission.)*

general white population or Jews who trace their origins to other regions. Internationally, Crohn's disease is rare in Africa, Asia, and South America. It is more common in urban areas than in rural areas, suggesting that environment plays a role in the disease.

## Causes and symptoms

At one time, researchers thought that stress and diet caused Crohn's disease. Now researchers know that these are not factors, although both stress and diet can worsen symptoms in people who already have the disease. What researchers do know is that Crohn's disease is caused by an inappropriate immune system reaction that affects cells in the digestive tract. Beyond that, the reasons why some people develop the disease are not clear.

There is almost certainly an inherited component that predisposes some people to the disease. Individuals who are blood relatives of a parent, sibling, or child with Crohn's disease are 30 times more likely to develop the disease than the general population. Scientists believe multiple genes are involved in development of the disease. However, more than genetics determines who gets Crohn's disease, because only about 44% of identical twins both develop the disease. Researchers have found several mutated (altered) genes in many, but not all, people who have Crohn's disease but do not yet have a clear understanding of what these genes do.

### KEY TERMS

**Abscess**—A pocket of pus formed by an infection.

**Antibody**—A protein produced by the immune system to fight infection or rid the body of foreign material. The foreign material that stimulates the production of antibodies is called an antigen. Specific antibodies are produced in response to each different antigen and can only inactivate that particular antigen.

**Anus**—The opening from the rectum to the outside of the body through which stools pass. The opening and closing of the anus is controlled by a strong ring of muscles under somewhat voluntary control.

**Mineral**—An inorganic substance found in the earth that is necessary in small quantities for the body to maintain a health. Examples: zinc, copper, iron.

**Vitamin**—A nutrient that the body needs in small amounts to remain healthy but that the body cannot manufacture for itself and must acquire through diet.

Current thinking is that interplay between genes, the environment, the individual's health, and body chemistry affect who develops Crohn's disease. When foreign materials (antigens) enter the body, the immune system produces antibodies, which are proteins that neutralize the foreign invader. One theory about Crohn's disease is that some foreign organism or material stimulates an immune system response in the digestive system, and then through an error in genetic control, the response cannot be "turned off." A second theory suggests that the cells of the immune system mistake good bacteria, food, or some other substance that is normally present in the digestive tract and make antibodies against this material as if it were a foreign substance. Either way, an inappropriate immune system response occurs that appears to be the root cause for the symptoms people with Crohn's disease experience.

Symptoms of Crohn's disease vary, depending on the location of the damaged cells and the length of time the individual has had the disease. Symptoms can be mild or severe. They can develop suddenly or gradually, and they may improve or even disappear, and then worsen many times throughout an individual's life. In general, symptoms can be divided into those

that affect the digestive tract and those that affect the rest of the body.

The most common symptoms that affect the digestive tract are:

- chronic diarrhea, the most common symptom
- abdominal pain or cramps, often in the lower right portion of the abdomen
- rectal bleeding
- blood in the stool, black tarry stool
- ulcers in the digestive tract, usually the in the intestine
- fistulas, or holes in the intestine that connect the intestine to other parts of the body such as the bladder, stomach, vagina, or another section of bowel
- nausea and vomiting , usually from Crohn's disease in the stomach
- abscesses, fistulas, and ulcers around the anus, usually from Crohn's disease in the colon. This occurs in about 45% of patients
- constipation, usually after many years when the bowel has thickened and the diameter of the intestine has narrowed

Symptoms of Crohn's disease also appear in other systems in the body. Some are the result of infection when fistulas develop. Others come from poor absorption of nutrients in the intestine over a long period. Some symptoms that occur outside the digestive tract include:

- persistent low-grade fever
- loss of appetite and weight loss
- fatigue
- anemia from blood loss and/or poor iron absorption
- skin infections
- eye infections
- arthritis and sore joints, usually in the large joints such as the knees or hip
- osteoporosis from poor calcium and vitamin D absorption
- poor blood clotting from inadequate vitamin K absorption
- stunted growth in children
- delayed puberty

## Diagnosis

Several gastrointestinal diseases can resemble the more common symptoms of Crohn's disease. These include ulcerative colitis, **irritable bowel syndrome**, intestinal parasites, and intestinal obstruction. Normally the physician will begin with a medical and family history and standard blood and stool tests. The next step toward diagnosis is usually imaging studies, most often an upper GI series. An upper GI series, sometimes called a barium swallow, includes x rays of the esophagus, stomach, and upper part of the intestine. The patient drinks a solution of barium to improve contrast on the x rays, thus the name barium swallow.

An upper endoscopy or a colonoscopy is another routine part of the diagnostic procedure. An upper endoscopy is done if abnormalities appear to be in the esophagus, stomach, or upper part of the small intestine (the duodenum). A colonoscopy uses the same technique examine the colon. These procedures are usually performed in a doctor's office or an outpatient clinic under light sedation. A tube called an endoscope is inserted down the throat and into the stomach and duodenum or up the rectum and into the colon. At the end of the endoscope is a tiny camera that allows the doctor to see if there is damage to the cells lining digestive tract. During this procedure, the doctor also removes small tissue samples (biopsies) in order to look for abnormal cells under the microscope.

Special blood tests are available that can help differentiate between Crohn's disease and ulcerative colitis. These tests may be done if the results of other tests are questionable. According to the Crohn's & Colitis Foundation of America, in about 10% of patients, it is quite difficult to tell these two diseases apart.

## Treatment

There is no cure for Crohn's disease. Treatment is aimed at controlling inflammation, preventing **vitamins** and **minerals** deficiencies, and relieving symptoms. Treatment options include a combination of drugs, biologic therapies, nutritional supplements, and surgery.

Individuals with mild to moderate Crohn's disease are usually treated first with anti-inflammatory drugs such as sulfasalazine (Azulfidine) or mesalamine (Asacol, Rowasa, Canasa). Individuals with moderate to severe Crohn's disease often are prescribed corticosteroid drugs. Prendisone (Deltasone, Orasone, Meticorten) is often the corticosteroid of choice. These drugs have significant side effects and cannot be used for long-term suppression of symptoms. Antibiotics are used to treat infection that may develop, for example, from fistula formation.

Biologic therapies use manmade antibodies. Infliximab (Remicade) is a laboratory-made antibody that blocks the production of an immune system factor that causes inflammation. This treatment is relatively new, but appears to have a good success rate for relieving symptoms. Additional biologic therapies for

Crohn's disease are under development. Individuals interested in participating in a clinical trial of a new drug or therapy for Crohn's disease at no cost can find a list of trials currently enrolling volunteers at <http://www.clinicaltrials.gov.>

Medical treatment becomes less effective over time. When medical treatment fails or if the intestine becomes thickened and so that blockages occur, surgery may be necessary. About 80% of all people with Crohn's disease eventually need surgery. Surgery to remove part of the intestine usually relieves symptoms for a few years, but surgery is not a cure for Crohn's disease, and symptoms almost always return within a few years.

## Nutrition/Dietetic concerns

People with Crohn's disease tend to have vitamin and mineral deficiencies because damage to the lining of the intestine interferes with the absorption of nutrients, and chronic diarrhea hastens the loss of other nutrients. These deficiencies can cause specific disorders in other parts of the body. In addition, children with Crohn's disease also may need special high-calorie, high-nutrient liquid supplements to maintain normal growth. A nutritionist consulting with the patient's gastroenterologist can help determine the best diet and supplements to prevent nutritional deficiencies.

Although eating certain foods does not cause Crohn's disease, specific foods can worsen symptoms. Many people with Crohn's disease become lactose intolerant and must limit or eliminate dairy products from their diet. Alcohol, high **fiber** foods such as popcorn, and spicy foods can worsen diarrhea and abdominal cramping. Individuals must be alert to the effect of food on their symptoms until they figure out which foods to avoid.

## Therapy

Crohn's disease can be very disruptive. Individuals may be reluctant to go places or do certain things because frequent diarrhea requires them to be near a toilet. Support groups, either on the Web or in person, help many people adjust to the difficulties of living with this chronic disease. Other people find that psychotherapy (talk therapy) guided by a psychologist or psychiatrist experienced in the stresses of chronic illness can help them make a better adjustment to life with Crohn's disease.

## Prognosis

Crohn's disease is a life-long disease. Symptoms may improve or disappear for periods, but overall, symptoms and complications tend to worsen, although the disease itself is rarely fatal. Most people with Crohn's disease eventually need surgery as the disease becomes less and less responsive to medication. Living with Crohn's disease can be a difficult challenge that requires major lifestyle adjustments.

## Prevention

Crohn's disease cannot be prevented.

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Crohn's & Colitis Foundation of America. 386 Park Avenue South, 17th Floor, New York, NY 10016. Telephone: (800) 932-2423. Website: <http://www.ccfa.org>

National Digestive Diseases Information Clearinghouse (NDDIC). 2 Information Way, Bethesda, MD 20892-3570. Telephone: (800) 891-5389. Fax: (703) 738-4929. Website: <http://digestive.niddk.nih.gov>

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Tish Davidson, A.M.

# CSIRO total wellbeing diet

## Definition

The CSIRO total wellbeing diet (TWD) is a high-protein, low-fat, moderate-carbohydrate weight-loss and maintenance diet developed by Australia's national science agency, the Commonwealth Scientific and Industrial Research Organization (CSIRO). It is a very structured, calorie-controlled, and nutritionally balanced diet that includes exercise and large amounts of **protein** from meat, fish, and poultry.

## Origins

The TWD was developed by CSIRO researchers at its Clinical Research Unit in Adelaide, South Australia. The CSIRO research was initiated in response to a large number of inquiries from dieticians concerning popular high-protein diets, whose use did not appear to be supported by scientific evidence. Previous CSIRO research had suggested that high-protein low-fat diets were at least as effective for weight loss as high-carbohydrate low-fat diets.

In research partially funded by Meat and Livestock Australia and Dairy Australia, the CSIRO team, led by Dr. Manny Noakes, developed the TWD for overweight and obese women. Dr. Grant Brinkworth was the exercise/nutrition physiologist on the team. The TWD was the culmination of eight years of research on diet composition, weight loss, and risks for developing diabetes and heart disease, conducted at CSIRO's Human Nutrition Clinic. In initial clinical studies the researchers claimed to have found clear health benefits and significant weight loss associated with their high-protein **low-fat diet**. They further claimed that clinical studies showed the diet to be superior to a high-carbohydrate low-fat diet with identical caloric intake, at least in a subset of women.

Meat and Livestock Australia distributed a booklet about the CSIRO diet in a women's magazine. The publisher Penguin then commissioned Noakes and Dr. Peter Clifton, director of the CSIRO Nutrition Clinic, to write the book, *The CSIRO Total Wellbeing Diet*. It was a runaway bestseller in Australia upon its publication in 2005. A sequel appeared in 2006.

## Description

### *Key components of the TWD*

The key components of the TWD are:

- high amounts of protein from lean meat, fish, and low-fat dairy products
- moderate amounts of carbohydrates
- low fat
- adequate fiber from whole grains, fruits, and vegetables
- caloric restriction
- exercise.

With the exception of its emphasis on meat, the TWD recommendations follow standard nutritional guidelines. The diet offers a variety of healthy food choices, including large amounts of fruits and vegetables, along with moderate exercise.

The basic daily TWD consists of:

- lean dinner protein, 7 oz (200 g) raw weight of lean red meat (beef, lamb, veal) four times per week, fish twice per week, chicken once per week
- lean lunch protein, up to 4 oz (110 g)
- wholegrain bread, two 1-oz (28-g) slices
- fruit, two medium pieces
- high-fiber cereal, 1.5 oz (42 g) or about one cup
- low-fat dairy, threde servings
- salad, one-half cup
- vegetables, four one-half-cup servings
- oil or margarine, three teaspoons
- indulgence foods, two servings per week
- exercise, 30 minutes daily.

### *Levels*

The TWD has four different diet levels, which are designed to cover the varying energy requirements of the majority of people. Level 1 is approximately 1,337 calories (5,600 kilojoules) per day. Levels 3 and 4 have higher allowances of lean protein, low-fat dairy, and high-fiber cereal. Before choosing a level, CSIRO recommends that people calculate their basal metabolic rate (BMR), which is based on height, weight, age, and gender. The Harris-Benedict Equation then uses the BMR and a factor based on a person's activity level to

## KEY TERMS

**Basal metabolic rate**—BMR; the rate of energy consumption when at complete rest.

**Calorie**—The heat- or energy-producing value of food when it is oxidized in the body; the amount of food having an energy-producing value of one calorie. Also called a large calorie or kilocalorie; equivalent to 4.2 kilojoules.

**Carbohydrates**—Sugars, starches, and celluloses produced by plants and ingested by animals.

**Cholesterol**—A steroid alcohol in animal cells and body fluids that controls the fluidity of membranes and functions as a metabolic precursor.

**Fiber**—Roughage; a complex mixture found in plant foods that includes the carbohydrates cellulose, hemicellulose, gum, mucilages, and pectins, as well as lignin.

**Glycemic index**—GI; a measure of the rate at which an ingested carbohydrate raises the glucose level in the blood.

**Glycemic load**—GL; a measure of the GI of a given food.

**HDL cholesterol**—High-density lipoprotein containing cholesterol in a healthy form.

**Kilojoule**—1,000 joules; a unit equivalent to 0.239 calories.

**LDL cholesterol**—Low-density lipoprotein containing a high proportion of cholesterol that is associated with the development of arteriosclerosis.

**Metabolic rate**—The BMR adjusted by an activity factor with the Harris-Benedict Formula to determine total daily energy expenditure in calories or kilojoules.

**Omega-3 fatty acids**—A type of polyunsaturated fat that may be beneficial for the heart.

**Syndrome X**—Metabolic syndrome; a metabolic condition characterized by excess abdominal fat, high blood pressure, low HDL cholesterol, high fasting blood-glucose levels, and high blood triglycerides, that may affect at least one in four women and increase their risk of developing type 2 diabetes and heart disease.

**Triglycerides**—Neutral fats; lipids formed from glycerol and fatty acids that circulate in the blood as lipoproteins.

determine daily energy expenditure in calories or kilojoules.

In general the level 1 and 2 plans are suitable for women and the level 3 and 4 plans are suitable for men, who tend to be taller and heavier than women. A basic daily TWD for men consists of:

- 7–9 oz (200–250 g) raw weight of lean meat, chicken, or fish for dinner
- 4 oz (110 g) cooked weight of meat, ham, chicken, or tuna for lunch
- wholegrain bread, two slices
- fruit, two pieces
- high-fiber cereal, 1.5 oz (40–50 g)
- low-fat dairy, three servings
- vegetables, two cups
- margarine/oil, four teaspoons
- one optional glass of wine.

### *Protein*

The TWD calls for a high amount of lean protein to prevent hunger. For dinner the TWD recommends 28 oz (800 g) raw weight of red meat per week or an average of 4 oz (110 g) per day, as well as at least 14 oz (400 g) of fish per week, or 2 oz (56 g) per day, and 7 oz (200 g) per week of skinless chicken with the fat removed. The diet calls for another 3.5 oz (100 g) of protein for lunch, based on the cooked weight of processed meat, chicken, or tuna.

An extra serving of dairy can be substituted for 1.7 oz (50 g) of protein at lunch. One dairy serving is:

- a low-fat or diet yoghurt
- a dairy dessert, 7 oz (200 g)
- low-fat milk, 8.5 oz (250 ml)
- cheddar or other full-fat cheese, 1 oz (28 g)
- reduced-fat cheese (10% fat), 1.7 oz (50 g).

### *Carbohydrates*

The TWD contains moderate amounts of slow-releasing **carbohydrates** that are necessary for energy and maintaining blood-glucose levels. These carbohydrates, primarily fruit and dairy, tend to have a low glycemic index (GI). They are digested slowly and help to keep blood-glucose levels steady. Since total carbohydrate is limited to 40% of the total calories or

kilojoules in the diet, the TWD has a low glycemic load (GL).

Fruits are limited to 11 oz (300 g) per day, as two servings of unsweetened fresh or canned fruit (5.3 oz, 150 g) or unsweetened juice (5 oz, 150 ml). Equal amounts of dried or frozen fruit, vegetables, or unsweetened vegetable juice (5 oz, 150 ml) may be substituted for one serving of a fruit or vegetable.

Simple sugars and refined carbohydrates are not recommended. Sugar or honey as sweeteners can be used only in small amounts. Small amounts of sweeteners or thickeners can be used occasionally in cooking. One level teaspoon of sugar is equivalent to 10–14 calories (40–60 kilojoules).

### *Fats*

The TWD contains very small amounts of fatty foods and oils. It calls for less than 30% of calories from fat or about 50 g of fat per day. The TWD assumes that low-fat foods contain no more than 3 g of fat per 3.5 oz (100 g) of solid food or 1.5 g of fat per 3.5 oz (100 g) of liquid. Fat-free foods contain no more than 0.15 g of fat per 3.5 oz (100 g). Reduced/low-fat milk contains 1–2% fat and skim/nonfat milk contains less than 0.16% fat.

The TWD recommends that the daily fat allowance be consumed as:

- canola oil
- olive oil
- sunflower oil
- soft/light margarine
- avocados
- nuts and seeds. Two teaspoons of lite margarine is equal to one teaspoon of oil. Three teaspoons of oil is equivalent to 2 oz (56 g) of avocado or 0.7 oz (20 g) of nuts.

### *Snacks*

Allowable snacks include:

- leftover portions from main meals
- low-calorie soup
- a cappuccino or café latte with skim milk from the milk allowance
- low-fat yogurt or custard
- fresh fruit from the fruit allowance.

### *Alcohol*

The level 1 TWD allows for two glasses (10 oz, 300 ml) of wine or about 205 calories (860 kilojoules) per week. Equivalent amounts of other alcohol or treats, such as 1.5 oz (40 g) of chocolate, may be substituted. It is suggested that **alcohol consumption** be kept to a minimum during the first few weeks of the diet because alcohol can increase the appetite. Presuming that other medical conditions do not limit the acceptable alcohol intake, other TWD levels and the maintenance diet allow for increased amounts. However alcohol intake should not exceed the recommended two standard drinks per day for women and four for men.

### *'Free' food*

The TWD includes a 'free' food list with minimal calories. Diet or low-calorie soups are an optional daily extra. Packet soups containing about 38 calories (160 kilojoules) per serving or vegetable soups made from the 'free' list are appropriate daily. The TWD includes an average of two–two and one-half cups of vegetables or about 14 oz (400 g) per day. Since vegetables tend to be very low in calories, eating more vegetables is acceptable and many vegetables are included in the 'free' list.

Foods that can be consumed as desired include:

- all green, orange, yellow, red, and most white vegetables, except potatoes and sweet potatoes
- diet soft drinks, unflavored bottled water, teas, coffee, cocoa
- stock cubes and clear soups
- diet jellies
- oil-free salad dressing
- sauces such as tomato, chili, and soy
- condiments
- garlic
- lemons
- herbs and spices.

### *Substitutions and adjustments*

Allowable diet adjustments include swapping the mid-day and evening meals or distributing the diet components differently over the course of the day. However the quantities and total intake should be the same each day. Other lean protein food can be substituted for meat. For example, a dinner might include 3.5 oz (100 g) of meat, chicken, or fish and a vegetable protein such as 4.5 oz (130 g) of cooked beans or 3.5 oz (100 g) of tofu. Eggs are protein foods and one egg can be substituted for 1.7 oz (50 g) of lean meat, chicken, turkey, ham, pork, fish, or low-lat cheese. Soy-milk products or low-lactose milk products may be used for the dairy requirement.

Allowable substitutions within food groups include:

- eggs for other protein
- non-dairy products for dairy
- rice or beans for bread
- toast for cereal
- frozen, canned, or dried fruit or vegetables for fresh fruit
- milk or yogurt for other dairy
- fruit juice for fruit
- vegetable juice for vegetables
- avocados or nuts for fats and oils
- other drinks or snacks for wine.

Wholegrain bread should be high in **fiber**, containing at least 3 g per serving. Wholegrain means that all of the components of the grain—the bran, germ, and endosperm—are present. One of the two daily slices of bread may be replaced with:

- one-third–one-half cup of chickpeas, lentils, or beans
- two pieces of crispbread
- one medium potato (about 5.3 oz or 150 g)
- one-third cup of cooked rice or noodles
- one-half cup of cooked pasta.

A low-fat coffee drink may be substituted for a similar drink such as tea with low-fat milk. Cocoa and herbal tea are on the 'free' list.

### *Vegetarians*

Vegetarians can substitute cooked beans or lentils (9 oz, 260 g) or tofu (7 oz, 200 g) for meat, chicken, or fish (7 oz, 200 g). One egg can be substituted for 1.7 oz (50 g) of meat, ham, pork, chicken, turkey, fish, or low-fat cheese. Legumes, including beans, split peas, lentils, and chickpeas, or tofu or other **soy** products can also be substituted for red meat. Vegetarians can substitute two eggs or 3.5 oz (100 g) of low-fat cheese for the 3.5 oz (100 g) of the lunch protein requirement.

### *Eating out*

When choosing from a restaurant menu the TWD recommends foods that are:

- grilled
- steamed
- poached
- stir-fried.

Foods to be avoided include:

- deep-fried
- pan-fried
- battered
- crumbed
- sauces with cheese, oil, butter, or cream
- fried potatoes.

### *Maintenance diet*

The weekly menu plans are repeated until the desired weight loss is achieved and then a maintenance plan is implemented. The maintenance plan is the same as the weekly diet plan with the addition of about 120 calories (500 kilojoules) to the diet, as long as weight is not regained. Each week the following foods can be added back in any order:

- week 1: two slices of wholegrain bread daily
- week 2: one-half cup cooked rice or pasta
- week 3: extra milk such as low-fat milk, yogurt, ice cream
- week 4: an extra potato
- week 5: an extra snack food
- week 6: one extra restaurant meal.

Snack choices for the maintenance diet include:

- 0.7 oz (20 g) of nuts
- two plain sweet biscuits
- one–two wholegrain biscuits or crackers and low-fat cheese
- 2 oz (56 g) of chips in canola or olive oil
- part of an avocado
- one fruit bar.

On the maintenance diet the following foods may be exchanged:

- 8 oz (250 ml) of wine or 2 fl oz (60 ml) of other alcohol for one snack
- one medium potato with skin, 2 oz (56 g) of fries, or 0.7 oz (20 g) of pretzels for one slice of bread or one piece of fruit
- three-quarter cup of boiled pasta or rice for two slices of bread
- 2 oz (56 g) or ten small squares of chocolate for one snack
- one fruit bar for one piece of fruit.

### *The books*

*The CSIRO Total Wellbeing Diet* explains and details the diet and contains over 100 recipes. *Book 2* includes some revisions and additions:

- The caloric intake is slightly higher.
- Calcium intake is increased by an extra daily serving of dairy.

- The daily folic-acid intake is increased to 400 mcg for adults and 600 mcg for pregnant and breastfeeding women.
- Eighty new recipes and substitutions have been added.
- Twelve weeks of sample menu plans give examples of how to organize the diet.
- New tips on eating out and packing a lunch are included.
- A simple, structured, do-anywhere exercise plan has been added.
- There is a section on maintaining focus on the diet.

## Function

The TWD is designed to result in a weight loss of 1–2 lbs (0.5–1 kg) per week. The subsequent maintenance diet is designed to maintain the desired weight. The higher protein in the TWD helps control appetite and prevent muscle loss. The TWD can be used to feed an entire family, although family members who do not need to lose weight may eat more carbohydrates with their meals, such as extra bread, pasta, rice, or potatoes.

## Benefits

Because the TWD diet is high in protein, it tends to satisfy hunger and prevent overeating. Men, in particular, seem to appreciate the amount of meat in this diet. It provides nutrients such as **iron**, **zinc**, and **calcium** that may be minimal on a lower-protein diet. There are additional benefits from a high-protein meat diet:

- Lean red meat is the best source of well-absorbed iron and meat is rich in zinc.
- Iron and zinc, which help boost the immune system, are more easily absorbed from meat than from plant foods.
- Meat, poultry, fish, and eggs are excellent sources of vitamin $B_{12}$, which is not found in plants.
- Fish and seafood are the best sources of omega-3 fats, which help protect the heart. Beef and lamb are the next best sources.

The TWD can significantly reduce **triglycerides** and LDL ('bad') cholesterol. Sustained weight loss, exercise, and moderate alcohol intake can increase HDL ('good') cholesterol. Therefore CSIRO researchers believe that the high protein in the TWD may help prevent heart disease and type 2 diabetes. Some experts also consider the TWD superior to other diets because it calls for a fiber intake in excess of 28 g per day.

The TWD has other advantages:

- It includes a large variety of foods.
- It is a very flexible diet and allows many substitutions.
- Daily meals can be consumed in any order.
- Tested recipes and menus are available online.
- Shopping lists can be downloaded from the CSIRO Website.
- The TWD is designed for long-term maintenance.

## Precautions

Dr. Rosemary Stanton, a leading Australian nutritionist, has pointed out that the high amount of red meat in the TWD contradicts the Australian government's own recommendations. Whereas the *Australian Guide to Healthy Eating* recommends 2–4 oz (56–112 g) of lean red meat three–four times per week, the TWD prescribes more than twice that amount. Consumers may be confused by these descrepancies. In addition, the trade organization Meat and Livestock Australia provided CSIRO with research funds and heavily promoted the book, suggesting possible conflicts of interest. Vegetarians in particular may have a difficult time following the TWD.

The TWD was based on clinical studies of overweight women, some of whom had metabolic dysfunction. Therefore the advantages of the TWD for men and healthy women are unclear.

CSIRO claims that the TWD is suitable for pregnant and **breastfeeding** women. However breastfeeding women may need up to 700 extra calories (3,000 extra kilojoules) per day. CSIRO recommends that breastfeeding women should start with level 1 or 2 and include three servings of dairy for calcium. Additional bread and fruit can be added to satiate hunger and increase energy. Furthermore, because of the large amount of fish and seafood in the diet, pregnant women should check for the types of fish that are safe to eat during pregnancy.

The TWD is suitable for overweight children, as long as it includes three units of dairy. However a dietician should adjust the number of calories for the age, size, and activity level of the child.

CSIRO claims that the TWD can be used effectively by people with diabetes, **celiac disease** (gluten intolerance), **fructose intolerance**, and **irritable bowel syndrome**. However diabetics should consult their doctor or dietician before using the TWD. People with gluten intolerance should choose gluten- or wheat-free substitutes or substitute rice, beans, chickpeas, or lentils for bread. Those with irritable bowel syndrome may substitute a lower-fiber cereal and take

## QUESTIONS TO ASK YOUR DOCTOR

- Am I a person who would be expected to lose weight and maintain my health and weight loss on the TWD?
- Do I have symptoms of 'syndrome X'?
- Should I be eating such a large amount of protein?
- Should I be eating such a large amount of meat?
- Have you had other patients try the TWD?
- Are there other types of diets that I should consider?

psyllium supplements of 30 g per day to obtain adequate fiber. CSIRO recommends that a dietician be consulted if significant adjustments to the diet are required.

The TWD was designed for foods readily available to Australians and assumes the intake of significant amounts of processed foods. It is not suitable for societies and cultures with eating habits that are very different from those of Australians. A high-carbohydrate diet may be better suited to those who prefer to not eat large amounts of protein.

### Risks

Although many people find it relatively easy to lose weight on high-protein low-carbohydrate diets during the first few weeks, some people find it difficult to maintain a diet that is high in meat. In addition some dieters find it difficult to maintain low-carbohydrate diets.

Nutritionist Patrick Holford has argued in the prestigious scientific journal *Nature* that the abnormally high amount of meat in the TWD could lead to long-term health problems, such as breast or **prostatecancer**, kidney stress, or reduced bone mass. Although some research has suggested that diets high in meat can increase the risk of colon cancer, other research has contradicted this or suggested that the risk is associated only with high-fat processed meat, which is not a part of the TWD.

### Research and general acceptance

#### *Research*

The TWD is based on research conducted by physicians at CSIRO, a highly-respected organization. Earlier research had indicated that high-protein diets were at least as good, if not better, for women than high-carbohydrate diets, in terms of weight loss and muscle preservation. As of 2007 CSIRO had completed five studies on the TWD, one funded by Meat and Livestock Australia and one by the dairy industry. The other studies were funded by CSIRO. According to CSIRO, their research proves that the TWD:

- is safe
- leads to improved nutritional status
- results in weight loss
- lessens the risk factors for diabetes and heart disease.

In the initial CSIRO study, 100 overweight and obese women were divided into two groups. One group was placed on a high-protein low-fat diet and the other group on a high-carbohydrate low-fat diet for 12 weeks. The **high-protein diet** consisted of 34% protein, 20% fat, and 46% carbohydrate. The high-carbohydrate diet consisted of 17% protein, 20% fat, and 63% carbohydrate. The caloric content of each diet was the same. The researchers monitored weight loss, changes in body composition, vitamin-$B_{12}$ status, bone-turnover markers, and disease-risk factors including LDL cholesterol and triglycerides.

Although on average the women in each group lost the same amount of weight—18–20 lb (8–9 kg)—women with high triglyceride levels lost significantly more weight on the high-protein diet. Only women with high triglycerides lost more abdominal fat than the women on the high-carbohydrate diet. The two groups of women did not differ in the other benchmarks that were examined. The researchers did find that more women dropped off the high-carbohydrate diet and that the women appeared to prefer the high-protein diet.

In subsequent studies CSIRO found that women with symptoms of 'syndrome X,' also called metabolic syndrome, a condition that increases the risk of developing heart disease and type 2 diabetes, lost more weight and twice the amount of body fat on a high-protein low-fat diet, as compared with similar women on a high-carbohydrate low-fat diet. It was pointed out in *Nature* that the TWD proved superior to the high-carbohydrate diet only for the subpopulation of overweight women with this type of metabolic dysfunction.

As of 2007, CSIRO was expanding its studies on the TWD to include male volunteers. However the TWD has not been compared with other alternative diets. In particular CSIRO has been criticized for not comparing the TWD to a high-protein vegetarian diet or comparing a high-protein vegetarian diet with a high-carbohydrate vegetarian diet. Furthermore the

long-term maintenance of weight loss with the TWD has not been determined.

### *General acceptance*

*The CSIRO Total Wellbeing Diet* became the number-one bestselling book in Australia when it appeared in 2005. Over 600,000 copies were sold in the first year, making it the fastest-selling book ever in that country. Since the diet is based on research from Australia's leading scientific agency and the books were written by internationally known scientists, many consumers have taken its advice very seriously. The scientific team that performed the research was awarded the 2005 CSIRO Research Achievement Medal. However the popularity of the diet has been primarily limited to Australia, in part because Australians tend to eat higher amounts of protein, particularly meat.

Many people object to the amount of meat in the TWD, from a health standpoint, from a cost standpoint, and because of the environmental consequences of producing large quantities of meat.

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### ORGANIZATIONS

Commonwealth Scientific and Industrial Research Organization (CSIRO). CSIRO Human Nutrition. P.O. Box 10041, Adelaide BC SA 5000, Australia. (61) 8-8305-0607. <http://www.csiro.au/twd>.

Dieticians Association of Australia. 1/8 Phipps Close, DEAKON ACT 2600, Australia. (02) 6282-9555. <http://www.daa.asn.au>.

The Institute for Optimum Nutrition. Avalon House, 72 Lower Mortlake Road, Richmond, Surrey, England TW9 2JY. (020) 8614-7817. <http://www.ion.ac.uk>.

Weight Loss Resources, Ltd. Remus House, Woodston, Peterborough, England, PE2 9JX. 01733 345592, <http://www.weightlossresources.co.uk>.

Margaret Alic, PhD

# D

Danish diet *see* **Scandinavian diet**

## DASH diet

### Definition

DASH stands for the Dietary Approaches to Stop **Hypertension**. The DASH diet is based on DASH Study results published in 1997. The study showed that a diet rich in fruits, vegetables and low fat dairy foods, with reduced saturated and total fat could substantially lower blood pressure. It is the diet recommended by the National Heart, Lung and Blood Institute (part of the National Institute of Health) for lowering blood pressure

### Origins

High blood pressure affects about one in four in the United States and United Kingdom and is defined as blood pressure consistently above 140/90 mmHg. The top number, 140, is the systolic pressure exerted by the blood against the arteries while the heart is contracting. The bottom number, 90, is the diastolic pressure in the arteries while the heart is relaxing or between beats. The concern is the higher the blood pressure, the greater the risk for developing heart and kidney disease and stroke. High blood pressure is known as the silent killer as it has no symptoms or warning signs.

The DASH study by the National Lung, Blood and Heart Institute (NHLBI), published in the *New England Journal of Medicine* in 1977, was the first study to look at the effect a whole diet rich in potassium, **magnesium** and **calcium** foods, not supplements, had on blood pressure.

The study involved 459 adults with and without high blood pressure. Systolic blood pressures had to be less than 160 mm Hg and diastolic pressures 80 to 95 mm Hg. Approximately half the participants were women and 60% were African Americans. Three eating plans were compared. The first was similar to a typical American diet—high in fat (37% of calories) and low in fruit and vegetables. The second was the American Diet, but with more fruits and vegetables. The third was a plan rich in fruits, vegetables, and low fat dairy foods and low fat (less than 30% of calories). It also provided 4,700 mg potassium, 500 mg magnesium and 1,240 mg calcium per 2,000 calories. This has become known as the DASH diet. All three plans contained equal amounts of **sodium**, about 3,000 mg of sodium daily, equivalent to 7 g of salt. This was approximately 20% below the average intake for adults in the United States and close to the current salt recommendations of 5–6 g. Calorie intake was adjusted to maintain each person's weight. These two factors were included to eliminate salt reduction and weight loss as potential reasons for any changes in blood pressure. All meals were prepared for the participants in a central kitchen to increase compliance on the diets.

Results showed that the increased fruit and vegetable and DASH plans lowered blood pressure, but the DASH plan was the most effective. It reduced blood pressure by 6 mmHg for systolic and 3 mmHg for diastolic, those without high blood pressure. The results were better for those with high blood pressure–the drop in systolic and diastolic was almost double at 11 mmHg and 6 mmHg respectively. These results showed that the DASH diet appeared to lower blood pressure as well as a 3 g salt restricted diet, but more importantly, had a similar reduction as seen with the use of a single blood pressure medication. The effect was seen within two weeks of starting the DASH plan, which is also comparable to treatment by medication, and continued throughout the trial. This trial provided the first experimental evidence that potassium, calcium, and magnesium are important

**DASH Eating Plan**

| Food group | Daily servings | Serving sizes |
|---|---|---|
| Grains* | 6–8 | 1 slice bread<br>1 oz. dry cereal†<br>½ cup cooked rice, pasta, or cereal |
| Vegetables | 4–5 | 1 cup raw leafy vegetable<br>½ cup cut-up raw or cooked vegetable<br>½ cup vegetable juice |
| Fruits | 4–5 | 1 medium fruit<br>¼ cup dried fruit<br>½ cup fresh, frozen, or canned fruit<br>½ cup fruit juice |
| Fat-free or low-fat milk and milk products | 2–3 | 1 cup milk or yogurt<br>1½ oz cheese |
| Lean meats, poultry, and fish | 6 or less | 1 oz cooked meats, poultry, or fish<br>1 egg |
| Nuts, seeds, and legumes | 4–5 per week | ⅓ cup or 1½ oz nuts<br>2 Tbsp peanut butter<br>2 Tbsp or ½ oz seeds<br>½ cup cooked legumes (dry beans and peas) |
| Fats and Oils | 2–3 | 1 tsp soft margarine<br>1 tsp vegetable oil<br>1 Tbsp mayonnaise<br>2 Tbsp salad dressing |
| Sweets and added sugars | 5 or less per week | 1 Tbsp sugar<br>1 Tbsp jelly or jam<br>½ cup sorbet, gelatin<br>1 cup lemonade |

*Whole grains are recommended for most grain servings as a good source of fiber and nutrients.
†Servings sizes vary between ½ cups, depending on cereal type. Check the product's Nutrition Facts label.

SOURCE: National Heart, Lung and Blood Institute, National Institutes of Health, Department of Health and Human Services

*(Illustration by GGS Information Services/Thomson Gale.)*

dietary factors in determinants of blood pressure than sodium alone.

The original DASH plan did not restrict sodium. As a result, a second DASH-Sodium trial from 1997-1999 (published 2001) looked at the effect the DASH diet with different sodium levels (3,300, 2,300 or 1,500mg) had on blood pressure. This is known as the DASH-sodium diet. The highest amount recommended by the 2005 U.S. **dietary guidelines** is 2,300 mg. The amount recommended by the Institute of Medicine, as a minimum to replace the amount lost through urine and to achieve a diet that provides sufficient amounts of essential nutrients, is 1,500 mg. The results showed that the combined effect of a lower sodium intake with the DASH diet was greater than just the DASH diet or a low salt diet. Like earlier studies, the greatest effect was with the lower sodium intake of 1,500mg (4 g or 2–3 tsp of salt), particularly for those without hypertension. For this group, the systolic dropped about 7.1 mmHg and the diastolic about 3.7 mmHg. However, the reduction in blood pressure for hypertensives was 11.5 mmHg for systolic and 5.7 mmHg for diastolic, quite similar to the reductions seen with the DASH diet.

## Description

The diet is based on 2,000 calories with the following nutritional profile:

- Total fat: 27% of calories
- Saturated fat: 6% of calories
- Protein: 18% of calories
- Carbohydrate: 55% of calories
- Cholesterol: 150 mg
- Sodium: 2,300 mg
- Potassium: 4,700 mg
- Calcium: 1,250 mg
- Magnesium: 500 mg
- Fiber: 30 g

These percentages translate into more practical guidelines using food group servings.

- Grains and grain products: 7-8 servings per day. One serving is equivalent to one slice bread, half a cup of dry cereal or cooked rice or pasta. These foods provide energy, carbohydrate and fiber.
- Vegetables: 4-5 servings per day. One serving size is one cup leafy vegetables, half cup cooked vegetables, half cup vegetable juice. Fruits and vegetables provide potassium, magnesium and fiber. Consuming the full number of vegetable servings is a key component of the diet.
- Fruits: 4-5 servings per day. One serving is one medium fruit, half cup fruit juice, one-quarter cup dried fruit.
- Low fat dairy foods: 2-3 servings per day. One serving is equivalent to one cup milk or yogurt or 1 oz (30 g) cheese. Dairy provides rich sources of protein and calcium.
- Meat, fish, poultry: 2 or fewer servings per day. One serving is 2.5 oz (75 g). The emphasis is on lean meats and skinless poultry. These provide protein and magnesium.
- Nuts, seeds, and beans: 4-5 servings a week. Portion sizes are half cup cooked beans, 2 tbl seeds, 1.5 oz (40 g). These are good vegetable sources of protein, as well as magnesium and potassium.
- Fats and oils: 2-3 servings per day. One serving is 1 tsp oil or soft margarine. Fat choices should be heart healthy unsaturated sources (canola, corn, olive or

## KEY TERMS

**Cardiac arrhythmia**—A group of conditions in which the muscle contraction of the heart is irregular or is faster or slower than normal.

**Cochrane reviews**—Evaluations based on the best available information about healthcare interventions. They explore the evidence for and against the effectiveness and appropriateness of treatments in specific circumstances.

**Dietary guidelines for Americans**—Dietary guidelines published every five years since 1980 by the Department of Health and Human Services (HHS) and the U.S. Department of Agriculture (USDA). They provide authoritative advice for people two years and older about how good dietary habits can promote health and reduce risk for major chronic diseases. They serve as the basis for federal food and nutrition education programs.

**High density lipoprotein (HDL)**—Often referred to as good cholesterol. HDL carries cholesterol away from cells and back to the liver where it is broken down or excreted.

**Hypertensives**—Individuals with high blood pressure.

**Low density lipoprotein (LDL)**—Often referred to as bad cholesterol. It carries cholesterol from the liver to the cells and can cause harmful build-up of cholesterol.

**MyPyramid**—A guide of what to eat each day created by the U.S. Department of Agriculture based on the 2005 dietary guidelines for Americans.

**Normotensives**—Individuals with normal blood pressure.

**PREMIER Study**—A research study that tested the effects of comprehensive and simultaneous lifestyle changes on blood pressure—weight loss, exercise, and a healthy diet.

sunflower). Saturated and trans fat consumption should be decreased.

- Sweets: 5 servings a week. A serving is 1 tbl pure fruit jam, syrup, honey, and sugar. The plan still allows for treats, but the healthier the better.

An example breakfast menu is: cornflakes (1 cup) with 1 tsp sugar, skimmed milk (1 cup), orange juice (1/2 cup), a banana and a slice of whole wheat bread with 1-tablespoon jam. Suggested snacks during the day include dried apricots (1/4 cup), low fat yogurt (1 cup) and mixed nuts (1.5 oz, 40g).

These guidelines are available in the National Institutes of Health (NIH) updated booklet "Your Guide to Lowering Your Blood Pressure with DASH", which also provides background information, weekly menus, and recipes.

Although the DASH diet provides two to three times the amount of some nutrients currently consumed in the average American diet, the recommendations are not dissimilar to the 2005 U.S. dietary guidelines (United States Department of Agriculture (USDA) and U.S. Department of Health and Human Services). It also resembles the **USDA Food Guide Pyramid**, which advocates low-fat dairy products and lean meats. The main difference is the emphasis on more fruit and vegetables servings, 8 to 10 as opposed to the 5 to 13 as in the U.S. dietary recommendations. In addition, it separates nuts, seeds, and beans from the meat, fish, and poultry food groups and recommends four to five weekly servings of nuts, seeds, and dry beans.

The Dash diet was not designed for weight loss but it can be adapted for lower calorie intakes. The NIH booklet provides guidelines for a 1,600-calorie diet. Vegetarians can also use the diet, as it is high in fruits, vegetables, beans, seeds, and low-fat dairy, which are the main sources of **protein** in a vegetarian diet.

### Function

The DASH meal plan is a healthy diet recommended for those with and without high blood pressure.

### Benefits

The DASH diet may lower blood pressure as much as taking medication, but without the risk of unwanted side effects. The dietary changes can also have immediate effects comparable with drug therapy. A blood pressure reduction of the degree seen in the DASH study is estimated to reduce the incidence of coronary artery disease by 15% and stroke by 27%.

The DASH plan may also lower blood pressure as well as restrictive low salt diets with 3-4 g of salt per day. Low salt foods tend to be bland and with 75-80% of salt intake coming from salt added to processed foods, including baked foods such as breads, adherence may pose a problem with low salt diets. The DASH diet is an adaptation on healthy eating, so it

has no restrictions but follows standard dietary guidelines for the general public.

## Precautions

Adding high **fiber** foods to the diet should be done gradually to avoid side effects such as gas, bloating, and diarrhea. It is important to increase fluid at the same time, as fiber draws **water** into the bowel. High fiber with inadequate fluid can cause hard stools and **constipation**.

Increasing fruits and vegetables increases the potassium content of the diet. For healthy people with normal kidney function, a higher potassium intake from foods does not pose a risk as excess potassium is excreted in the urine. However, individuals whose urinary potassium excretion is impaired, such as those with end-stage renal disease, severe heart failure, and adrenal insufficiency may be at risk of hyperkalaemia (high levels of potassium in the blood). Hyperkalaemia may cause cardiac arrthymias (irregular heart beat), which could be serious. Some common drugs can also decrease potassium excretion. Individuals at risk should consult a doctor before staring the DASH diet, as higher potassium intakes in the form of fruit and vegetables may not be suitable. Care should also be taken with potassium containing salt substitutes.

## Risks

Currently, there are no known risks associated with the DASH diet. However, the long-term effects of the diet on morbidity and mortality are still unknown.

## Research and general acceptance

Studies over the years have suggested high intakes of salt play a role in the development of high blood pressure so dietary advice for the prevention and lowering of blood pressure has focused primarily on reducing sodium or salt intake. A 1989 study looked at the response an intake of 3-12 g of salt per day had on blood pressure. The study found that modest reductions in salt, 5-6 g salt per day caused blood pressures to fall in hypertensives. The best effect was seen with only 3 g of salt per day with blood pressure falls of 11 mmHg systolic and 6 mmHg diastolic. More recently, the use of low salt diets for the prevention or treatment of high blood pressure has come into question. The Trials of Hypertension Prevention Phase II in 1997 indicated that energy intake and weight loss were more important than the restriction of dietary salt in the prevention of hypertension. A 2006 Cochrane review, which looked at the effect of longer-term modest salt reduction on blood pressure, found that modest reductions in salt intake could have a significant effect on blood pressure in those with high blood pressure, but a lesser effect on those without. It agreed that the 2007 public health recommendations of reducing salt intake from levels of 9-12 g/day to a moderate 5-6 g/day would have a beneficial effect on blood pressure and cardiovascular disease.

The effectiveness of the DASH diet for lowering blood pressure is well recognized. The 2005 Dietary Guidelines for Americans recommends the DASH Eating Plan as an example of a balanced eating plan consistent with the existing guidelines and it forms the basis for the USDA MyPyramid. DASH is also recommended in other guidelines such as those advocated by the British Nutrition Foundation, American Heart Association, and American Society for Hypertension.

Although results of the study indicated that reducing sodium and increasing potassium, calcium, and magnesium intakes play a key role on lowering blood pressure, the reasons why the DASH eating plan or the DASH-Sodium had a beneficial affect remains uncertain. The researchers suggest it may be because whole foods improve the absorption of the potassium, calcium and magnesium or it may be related to the cumulative effect of eating these nutrients together than the individual nutrients themselves. It is also speculated that it may be something else in the fruit, vegetables, and low-fat dairy products that accounts for the association between the diet and blood pressure.

The Salt Institute supports the DASH diet, but without the salt restriction. They claim that the DASH diet alone, without reduced sodium intake from manufactured foods, would achieve the desired blood pressure reduction. Their recommendation is based on the fact that there are no evidence-based studies supporting the need for dietary salt restriction for the entire population. The Cochrane review in 2006 showed that modest reductions in salt intake lowers blood pressure significantly in hypertensives, but a lesser effect on individuals with normal blood pressure. Restriction of salt for those with out hypertension is not recommended.

There is continued call for the food industry to lower their use of salt in processed foods from governments and health associations. These groups claim if the reduction of intake to 6 g salt/day is achieved by gradual reduction of salt content in manufactured foods, those with high blood pressure would gain significant health benefit, but nobody's health would be adversely affected. In 2003, the UK Department of Health and Foods Standards Agency, several leading supermarkets and food manufacturers set a target for

an average salt reduction of 32% on 48 food categories. In June 2006, the American Medical Association (AMA) appealed for a minimum 50% reduction in the amount of sodium in processed foods, fast food products, and restaurant meals to be achieved over the next ten years.

Researchers have evaluated other dietary modifications, such as the role of potassium, magnesium, and calcium on blood pressure. Substantial evidence shows individuals with diets high in fruits and vegetables and, hence, potassium, magnesium, and calcium, such as vegetarians, tend to have lower blood pressures. However, in studies where individuals have been supplemented with these nutrients, the results on their effects on blood pressure have been inconclusive.

There is some debate on whether patients can follow the diet long-term. The 2003 premier study (a multi-center trial), which included the DASH diet when looking at the effect of diet on blood pressure, found that the DASH diet results were less than the original study. This difference is thought to be because in the DASH study participants were supplied with prepared meals, while participants on the premier study prepared their own foods. As a result, only half the fruit and vegetable intake was achieved in the premier study, which affected the overall intakes of potassium and magnesium. The researches concluded that compliance to the DASH diet in the long term is questionable, but agreed that patients should still be encouraged to adopt healthy interventions such as the DASH diet, as it does offer health benefits.

In terms of heart health, the Dash diet lowered total cholesterol and LDL cholesterol, but it was associated with a decrease in high-density lipoprotein (HDL), the "good" cholesterol. Low HDL levels are considered a risk factor for **coronary heart disease** (CHD) while high levels are thought to be protective of heart disease. The decrease was greatest in individuals who started with a higher level of the protective HDL. Researchers agree that the reasons for the decrease in HDL levels needs further review, but concluded that the overall effects of the DASH diet are beneficial to heart disease.

While long term health effects of the DASH diet are yet to be established, the diet closely resembles the **Mediterranean diet**, which has been shown to have other health benefits including a reduced risk for heart disease and **cancer** rates. It is thought that the DASH diet is likely to offer similar health benefits.

## QUESTIONS TO ASK YOUR DOCTOR

- How will the Dash diet impact my need for blood pressure medication?
- What foods are recommended for the DASH diet?
- What is your opinion on using the DASH diet for weight loss?
- What modifications are necessary to accommodate vegetarians?
- How long will I need to stay on the DASH diet?

## Resources

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**ORGANIZATIONS**

American Heart Association. 7272 Greenville Avenue, Dallas, TX 7523 USA. Telephone: (800) 242-8721. Website: <http://www.americanheart.org/>.

American Medical Association. 515 N. State Street, Chicago, IL 60610 USA. Telephone: (800) 621-8335. Website: <http://www.ama-assn.org/>.

American Society for Hypertension. 148 Madison Avenue, Fifth Floor, New York, NY 10016 USA. Telephone: (212) 696-9099. Website: <http://www.ash-us.org/>.

British Heart Foundation (BHF). 14 Fitzhardinge Street, London W1H 6DH, UK. Website: <http://www.bhf.org.uk/>.

British Nutrition Foundation. High Holborn House, 52-54, High Holborn, London WC1V 6RQ, UK. Telephone: 020 7404 6504. Website: <http://www.nutrition.org.uk/>.

The Cochrane Collaboration. Summertown Pavilion, 18-24 Middle Way, Oxford, Oxfordshire OX2 7LG UK. Telephone: 44 1865 310138. Website: <http://www.cochrane.org/>.

Food Standards Agency UK (FSA). Eat well Be well, Healthy Heart Aviation House, 125 Kingsway, London WC2B 6NH UK. Website: <http://www.eatwell.gov.uk/>.

National Lung, Blood and Heart Institute (NHLBI). health information centre, PO Box 30105, Bethesda MD 20824-0105. Telephone: (301) 592-8573. USA. Website: <http://www.nhlbi.nih.gov/>.

Salt Institute. 700 N. Fairfax Street, Suite 600 Fairfax Plaza, Alexandria, VA 22314-2040 USA. Website: <http://www.saltinstitute.org/>.

Tracy J. Parker, RD

# Dean Ornish's Eat More, Weigh Less

## Definition

Dean Ornish's Eat More, Weigh Less diet focuses on eating a diet of plant products low in fat, oils, and simple **carbohydrates** to achieve weight loss and better health without feelings of deprivation and hunger. It also emphasizes stress reduction techniques and light exercise. Dean Ornish, M.D. not only recommends this style of diet for weight loss, but also believes it can prevent and even reverse some forms of heart disease.

## Origins

Dean Ornish is a professor of clinical medicine at the University of California, San Francisco, and a practicing physician. He received his Bachelor of Arts degree from the University of Texas, Austin, then attended Baylor College of Medicine and Harvard Medical School. He received further medical training at Massachusetts General Hospital. He is the founder and president of the Preventive Medicine Research Institute located in Sausalito, California.

While Dr. Ornish was a medical student he became interested in heart disease. In 1978 he began doing research on patients with coronary artery disease (a common form of heart disease). He created a diet that was very low in fat and completely vegetarian and studied its effects on the symptoms experienced by these patients. The patients also learned a variety of stress reduction techniques. He discovered that for many patients this diet caused a significant lessening of their symptoms. This was the beginning of Dr. Ornish's research on the effects of low fat, low or no-meat diets on weight loss, health, and heart disease. This original diet is the basis for his Eat More, Weigh Less diet, as well as his other related diets.

Over the years, Dr. Ornish has published many different books and articles, and has recommended diets with many different names. All his diets revolve around the same basic principles, with additions or changes in emphasis, based on the goal that the diet is intended to achieve. For example, Dr. Ornish's heart disease prevention diet allows small amounts of lean meat or fish, while his heart disease reversal diet is completely vegetarian.

## Description

Dr. Ornish presents his Eat More, Weigh Less diet as more of a spectrum of choices than a set of hard and fast rules. He believes that because people have many different goals, from moderate weight loss to actual heart disease reversal, no one set of dietary rules will fit everyone. He also emphasizes overall lifestyle change, not just through what a person eats but also through stress reduction, moderate exercise, and if applicable, quitting smoking.

The main component of the Dr. Ornish diet is eating more vegetable products and many fewer meat products. For people trying to lose moderate amounts of weight this may mean eating small amounts of lean chicken or fish as well as some skim milk or egg whites. For those with more ambitious goals, the diet may be almost completely vegan (containing no meat or animal products at all).

The diet is also extremely low in fat, with fewer than 10% of calories coming from fat. The strictest forms of the diet do not allow any nuts, seeds, or avocados. The only oil Dr. Ornish allows is a small amount of fish oil

## KEY TERMS

**Antioxidant**—A molecule that prevents oxidation. In the body antioxidants attach to other molecules called free radicals and prevent the free radicals from causing damage to cell walls, DNA, and other parts of the cell.

**Coronary Artery**—The arteries that supply blood to the tissues of the heart from the aorta.

**Mineral**—An inorganic substance found in the earth that are essential to the body in small quantities. Examples: zinc, copper, iron.

**Vegan**—A diet containing no meat or animal products.

**Vitamin**—A nutrient the body needs in small amounts to remain healthy but that the body cannot manufacture for itself and must acquire through diet.

each day because some research has shown it to be beneficial and may help prevent heart attack.

Foods that are encouraged include nearly all fruit and vegetable products. Especially recommended are leafy greens, **soy** products, and whole grains. Whole grains contain many **vitamins** and **minerals** that are removed when these grains are processed. Whole grains include things such as brown rice, oat bran, and wheat bran. They are broken down by the body more slowly than processed grains, meaning that energy is released more slowly and is available for a longer period of time.

A portion of food made up of processed foods and animal products usually contains many more calories and fat than a similarly sized portion consisting mainly of vegetables, whole grains, fruits, and soy. This means that a person can eat a larger quantity of food while still consuming fewer calories and fat if the foods are chosen correctly. This is the key to the idea that on Dr. Ornish's diet a person may be able to actually eat more and still lose weight. Eating more foods low in caloric density (calories per quantity) means the stomach is fuller and helps prevent feelings of hunger.

Dr. Ornish's diet does not just focus on food. It also makes recommendations for other lifestyle changes. He recommends moderate exercise of 20 to 30 minutes daily of at least a moderate walking pace. Dr. Ornish also suggests making small changes throughout the day to get more exercise, such as parking a few spaces further from the door, or even just walking up or down the stairs instead of taking the elevator. This kind of daily exercise adds up and is recommended over working out strenuously only occasionally.

Stress-reduction techniques are an important part of the total lifestyle plan. Dr. Ornish contends that doing even a few minutes of yoga, deep breathing, or meditation each day can have many positive effects on both the body and mind. Dr. Ornish also highly recommends that individuals quit smoking.

### Function

Dr. Ornish's diet can be used for weight loss, or for a variety of other healthy living goals including prevention or possible reversal of heart disease.

### Benefits

Because this diet includes almost only plant products, it is high in substances thought to promote health such as **antioxidants** and **fiber**, as well as low in substances that are harmful to the health such as fat and cholesterol. Following the diet's recommendation of light exercise can also be very beneficial. Walking 20 or 30 minutes a day instead of being completely sedentary has significant health benefits and may even reduce the chance of early death by half.

Although Dr. Ornish's diets are effective at causing weight loss and improved overall health, the most researched and discussed benefit of his diet program is the prevention and even reversal of heart disease. Dr. Ornish and colleagues have done extensive research showing that following a very strict, completely vegetarian form of his diet can not only prevent heart disease from occurring or getting more severe, but can actually cause a reversing of artery constriction allowing blood to flow to the heart better. Dr. Ornish also believes his diet may be effective at preventing or reversing other forms of disease such as **prostate cancer**.

### Precautions

Anyone thinking of beginning a new diet should consult their physician. Requirements of calories, fat, and nutrients can differ significantly from person to person, depending on gender, age, weight, and many other factors such as the presence of any diseases or conditions. Pregnant or **breastfeeding** women should be especially cautious because deficiencies of vitamins or minerals can have a significant negative impact on a baby.

Patients with heart disease should be especially careful when beginning a diet. Although Dr. Ornish has published data about how his diet may be able to

prevent or reverse heart disease, everyone reacts differently and no major dietary changes should be made without consulting a physician. Dr. Ornish's diet is not a replacement for cholesterol-lowering drugs or any other medications prescribed by a doctor, and is not a replacement for medically recommended procedures. It is important to discuss all possible options with a physician and make all decisions based on professional recommendations.

### Risks

Dr. Ornish's diet is very low in fat and limits meat and animal product intake to little or none. Many important vitamins and minerals such as **zinc** and vitamin $B_{12}$ are acquired from these sources in a normal diet. Without these sources there is a significant possibility of deficiency. Also, because of the very low fat allowance of the diet there is some concern that people on this diet may not get enough **vitamin E**, which is found mainly in nuts and oil. These are too high in fat to be eaten regularly while on this diet. Dr. Ornish often recommends taking supplements while following his diet, and taking a complete multivitamin may help reduce the risk of a deficiency. Multivitamins and supplements however have their own risks, especially for pregnant or breastfeeding women and individuals with medical issues such as renal disease.

### Research and general acceptance

The benefits of any diet low in fat that includes many different fruits, vegetables, and whole grains are generally accepted. However, some concern has been expressed about Dr. Ornish's Eat More, Weigh Less diet because of dietary deficiencies that may occur due to the restriction of so many food types. For some people this cause for concern may outweigh the possible benefits.

One benefit of the Dr. Ornish diet that he and other researchers have studied extensively is the possible prevention or reversal of heart disease in some people. Dr. Ornish has led many controlled research studies to test his diet, and published the results in peer-reviewed journals such as the *Journal of the Society of Behavioral Medicine*, the *Lancet*, and the *Journal of the American Medical Association*.

In 1990, Dr. Ornish and several coauthors published an article titled "Can Lifestyle Changes Reverse Coronary Heart Disease? The Lifestyle Heart Trial" in the *Lancet*. This was the first study to investigate whether changes in lifestyle alone, without the use of prescription drugs, could stop the progress of, or even reverse, coronary heart disease. The patients selected to participate had severe coronary heart disease and were divided randomly into two groups, those who would follow Dr. Ornish's program, and those who would follow the usual recommendations for such patients, including moderate lifestyle changes and cholesterol-lowering medications, if necessary.

Dr. Ornish's regimen included a diet very low in fat and completely vegetarian. It also emphasized moderate exercise, stress-reduction techniques, and, for those patients who smoked, quitting. The diameter of the coronary artery was measured at the beginning of the study, and again at the end of the study one year later. For patients following the usual recommendations for coronary patients, the average percentage of narrowing was 42.7% at the beginning of the study and increased 3.4% to 46.1% at the end of the study. For patients who followed Dr. Ornish's plan the average percentage of constriction was reduced 2.2% during the period of the study from 40.0% to 37.8%. For the patients with the most constriction the difference was even greater.

Since the original Lifestyle Heart Study, Dr. Ornish and various co-authors have continued to research how lifestyle changes alone can positively affect heart disease. He has also done research over longer periods of time to see if people are able to stay on his diet and continue to see positive effects. He has also studied very short time spans to see if improvement can occur very quickly. In 2007 he published a study in the *Journal of the Society of Behavioral Medicine* showing that, in as little as three months, his

### QUESTIONS TO ASK THE DOCTOR

- Is this diet the best diet to meet my goals? Why or why not?
- What special dietary needs do I have that this diet might not meet?
- What types of risk could this diet pose for me?
- What type of multivitamin or other dietary supplement would be appropriate for me if I begin this diet?
- How could I integrate this diet into our family meals?
- How long is it safe for me to follow this diet?
- What are the signs or symptoms that might indicate a problem while on this diet?

lifestyle change program could significantly reduce the risk factors of coronary heart disease.

### Resources


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American Dietetic Association. 120 South Riverside Plaza, Suite 2000, Chicago, IL 60606-6995. Telephone: (800) 877-1600. Website: <http://www.eatright.org>.

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Helen Davidson

# Dehydration

## Definition

Dehydration is a condition in which the body looses too much **water** usually as a result of excess sweating, vomiting, and/or diarrhea.

**Signs of dehydration**

**General dehydration**

- Thirst
- Less frequent urination
- Dry skin
- Fatigue
- Light-headedness
- Dark colored urine

**Dehydration in children**

- Dry mouth and tongue
- No tears when crying
- No wet diapers for 3 hours or more
- Sunken abdomen, eyes, or cheeks
- High fever
- Listlessness or irritability
- Skin that does not flatten when pinched and released

SOURCE: National Institute of Diabetes and Digestive and Kidney Diseases, National Institutes of Health, U.S. Department of Health and Human Services

*(Illustration by GGS Information Services/Thomson Gale.)*

## Description

Dehydration occurs because more fluid is lost from the body than is taken in. Water is essential for life. Transporting nutrients throughout the body, removing wastes, regulating body temperature, lubrication of joints and membranes, and chemical reactions that occur during cellular **metabolism** all require water.

The amount of water a person needs to prevent dehydration varies widely depending on the individual's age, weight, level of physical activity, and the environmental temperature. The individual's health and the medications they take may also affect the amount of water a person needs. Most dehydration results from an acute, or sudden, loss of fluids. However, slow-developing chronic dehydration can occur, most often in the frail elderly and infants and young children who must rely on others to supply them with liquids.

Healthy people lose water from urination, elimination of solid wastes, sweating, and breathing out water vapor. This water must be replaced through diet. Water makes up about 75% of the body weight of infants, 65% of the weight of children and 60% of the weight of an adult. In 2004, the United States Institute of Medicine (IOM) recommended that relatively inactive adult men take in about 3.7 L (about 15 cups) of fluids daily and that women take in about of 2.7 liters (about 10 cups) to replace lost water. These recommendations are for total fluid intake from both beverages and food. Highly active adults and those living in very warm climates need more fluids.

## KEY TERMS

**Diabetes**—a condition in which the body either does not make or cannot respond to the hormone insulin. As a result, the body cannot use glucose (sugar). There are two types, type 1 and type 2.

**Diuretic**—a substance that removes water from the body by increasing urine production

**Electrolyte**—ions in the body that participate in metabolic reactions. The major human electrolytes are sodium (Na+), potassium (K+), calcium (Ca 2+), magnesium (Mg2+), chloride (Cl-), phosphate ($HPO_4$ 2-), bicarbonate ($HCO_3$-), and sulfate ($SO_4$ 2-).

**Laxative**—A substance that stimulates movement of food through the bowels. Laxatives are used to treat constipation.

About 80% of the water the average person needs is replaced by drinking liquids. The other 20% is found in food. Below are listed some foods and the percentage of water that they contain.

- iceberg lettuce 96%
- squash, cooked. 90%
- cantaloupe, raw, 90%
- 2% milk 89%
- apple, raw 86%
- cottage cheese 76%
- potato, baked 75%
- macaroni, cooked 66%
- turkey, roasted 62%
- steak, cooked 50%
- cheese, cheddar 37%
- bread, white 36%
- peanuts, dry roasted 2%

Dehydration involves more than just water deficiency. **Electrolytes** are ions that form when salts dissolve in water or body fluids. In order for cells to function correctly, the various electrolytes, such as **sodium** (Na+) and potassium (K+), must remain within a very narrow range of concentrations. Often electrolytes are lost along with water. For example sodium is lost in sweat. To prevent the effects of dehydration, both water and electrolytes must be replaced in the correct proportions.

## Demographics

The very young and the very old are most likely to become dehydrated. Young children are at greater risk because they are more likely to get diseases that cause vomiting, diarrhea, and fever. Worldwide, dehydration is the leading cause of death in children. In the United States, 400–500 children under the age of 5 die every year of dehydration. The elderly are at risk because they are less likely to drink when they become dehydrated. The thirst mechanism often becomes less sensitive as people age. Also, their kidneys lose the ability to make highly concentrated urine. Older individuals who are confined to wheelchairs or bed and cannot get water for themselves (e.g. nursing home and hospital patients) are at risk of developing chronic dehydration.

## Causes and symptoms

Diarrhea, often accompanied by vomiting, is the leading cause of dehydration. Both water and electrolytes are lost in large quantities. Diarrhea is often caused by bacteria, viruses, or parasite. Fever that often accompanies disease accelerates the amount of water that is lost through the skin. The smaller the child, the greater the risk of dehydration. Worldwide, acute diarrhea accounts for the death of about 4 million children each year. In the United States, about 220,000 children are hospitalized for dehydration caused by diarrhea annually.

Heavy sweating also causes dehydration and loss of electrolytes. Athletes, especially endurance athletes and individuals with active outdoor professions such such as roofers and road crew workers are at high risk of becoming dehydrated. Children who play sports can also be vulnerable to dehydration.

Certain chronic illnesses that disrupt fluid balance can cause dehydration. Kidney disease and hormonal disorders, such as diabetes, adrenal gland, or pituitary gland disorders, can cause fluid and electrolyte loss through excessive urination. Disorders such as cystic fibrosis or other genetic disorders resultING in inadequate absorption of nutrients from the intestines can cause chronic diarrhea that leads to dehydration. Individuals with **eating disorders** who abuse laxatives, **diuretics**, and enemas, or regularly cause themselves to vomit are vulnerable to severe electrolyte imbalances and dehydration. The same is true of people with alcoholism. People who have severe burns over a large part of their body also are likely to become dehydrated

because they no longer have skin to act as a barrier to evaporation.

Dehydration can be mild, moderate or severe. Mild dehydration occurs when fluid losses equal 3–5%. At this point, the thirst sensation is felt, and is often accompanied by dry mouth and thick saliva.

Moderate dehydration occurs when fluid losses equal 6–9% of their body weight. This can occur rapidly in young children who are vomiting and/or have diarrhea. In an infant, a loss of as little as 2–3 cups of liquids can result in moderate dehydration. Signs of moderate dehydration include intense thirst, severely reduced urine production, sunken eyes, headache, dizziness, irritability, and decreased activity.

Severe dehydration occurs when fluid losses are 10% or more of their body weight. Severe dehydration is a medical emergency for individuals of any age. A loss of fluids equaling 20% of a person's body weight is fatal. Signs of severe dehydration include all those of moderate dehydration as well as lack of sweating, little or no urine production, dry skin that has little elasticity, low blood pressure, rapid heartbeat, fever, delirium, or coma.

## Diagnosis

Dehydration is diagnosed by physical symptoms. A healthcare professional or observant adult can usually tell by looking at someone that they are moderately or severely dehydrated. Blood tests and a urinalysis may be done to check for electrolyte imbalances and to determine if the kidneys are damaged. However, visual signs are enough to begin treatment.

## Treatment

The goal of treatment is to restore fluid and electrolyte balance. For individuals with mild dehydration, this can be done in infants and children by giving them oral rehydration solutions such as Pedialyte, Infalyte, Naturalyte, Oralyte, or Rehydralyte. These are available in supermarkets and pharmacies without a prescription. These solutions have the proper balance of salts and sugars to restore the electrolyte balance. Water, apple juice, chicken broth, sodas, and similar fluids are effective in treating mild dehydration. Oral rehydration fluids can be given young children in small sips as soon as vomiting and diarrhea start. They may continue to vomit and have diarrhea, but some of the fluid will be absorbed. Breastfed infants should continue to nurse on demand. Babies who are formula fed should continue to get their regular formula unless directed otherwise by a pediatrician.

Older children who are dehydrated can be given oral rehydration solutions or sports drinks such as Gatorade for moderate and severe dehydration, otherwise general fluids are fine. Athletes who are dehydrated should be given sports drinks. According to the American College of Sports Medicine, sports drinks are effective in supplying energy for muscles, maintaining blood sugar levels, preventing dehydration, and replacing electrolytes lost in sweat. Adults who are mildly or moderately dehydrated usually improve by drinking water and avoiding coffee, tea, and soft drinks that do not contain **caffeine**.

Individuals of all ages who are seriously dehydrated need to be treated by a medical professional. In the case of severe dehydration, the individual may be hospitalized and fluids given intravenously (IV; directly into the vein).

## Nutrition/Dietetic concerns

Dehydration is usually an acute condition, and once fluid balance is restored, there are no additional nutritional concerns. In the mobility-impaired elderly, the main concern is making sure that they have adequate access to fluids.

## Prognosis

Most people recover from dehydration with few complications so long as rehydration fluids are available and treatment begins before the condition becomes severe. However, severe dehydration can be fatal.

## Prevention

The best way to prevent dehydration is to be alert to situations in which it could occur, such as exercising in hot weather or vomiting and diarrhea in infants and young children. Athletes and people who work in hot conditions should drink regularly, whether or not they feel thirsty. Rehydration of young children should begin at the first sign of fluid loss. A healthcare provider should be consulted before the situation becomes serious. Caregivers of the mobility impaired elderly and infants and young children who cannot get water for themselves should be offered fluids on a regular basis.

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**ORGANIZATIONS**

American Academy of Pediatrics. 141 Northwest Point Blvd. Elk Grove Village, IL 60007. Telephone: (847) 434-4000. Website: <http://www.aap.org>

American College of Sports Medicine. 401 West Michigan Street, Indianapolis, IN 46202. Telephone: (317) 637-9200. Fax: (317) 634-7871. Website: <http://www.ascm.org.>

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# Denise Austin Fit Forever

## Definition

Denise Austin's Fit Forever is an Internet based diet and exercise program that focuses on developing a personalized plan for healthy eating and an active lifestyle. Individuals who join the Fit Forever program receive customized exercise regimens based on their body type; daily meal plans and recipes; as well as motivational assistance in the form or support groups, testimonials, and information on creating a healthier lifestyle.

## Origins

Denise Austin was born on February 13, 1957, and grew up in San Pedro, California. She attended the University of Arizona on an athletic scholarship and then earned a Bachelor of Arts degree in Physical Education from California State University, Long Beach in 1979.

After college, Austin's interest in exercise and fitness continued and she became an aerobics instructor in Los Angeles. She soon began hosting her own exercise program on local television. Her popularity grew and she quickly became a national fitness personality. In 2002 she was appointed to the President's Council on Physical Fitness and Sports, and she helped the United States Department of Agriculture to develop MyPyramid and primarily serves as a spokesperson for the food guidance system that replaced the Food Guide Pyramid in 2005. Austin has sold more than 20 million exercise videos and DVDs, and written nine books. She also writes a regular column in *Prevention* magazine, and appears in two daily fitness shows on the *Lifetime* television channel.

With Fit Forever, Austin continues to try to help people become more fit, more active, and enjoy better overall health. Through the Web site she delivers many different tips, inspirational messages, and guidelines to help people personalize their program.

## Description

Denise Austin's Fit Forever program operates primarily online. It is intended to help guide individuals through the weight loss process educating them on proper nutrition, exercise, and general healthy lifestyles. It is also intended to help people maintain their new healthy lifestyle once it has been achieved. The Fit Forever program has two main components, diet and exercise. Each provides many options so that it can be tailored to meet an individual's specific needs.

The diet plan offers choices of diets that provide 1,400, 1,600, or 1,800 calories a day based on an individual's weight loss goals and activity level. Meal plans for each day are provided, as are shopping lists associated with the meal plans. Substitutions are allowed whenever they are desired, as long as each day's total caloric intake is on target. Austin provides her own diet philosophy that involves six aspects of healthy eating:

- Control portions
- Maximize fiber
- Savor good fat
- Boost fruits and vegetables
- Hone in on hunger
- Change behaviors

## KEY TERMS

**Dietary supplement**—A product, such as a vitamin, mineral, herb, amino acid, or enzyme, that is intended to be consumed in addition to an individual's diet with the expectation that it will improve health.

**Mineral**—An inorganic substance found in the earth that is essential in small quantities for the body. Examples: zinc, copper, iron.

**Vitamin**—A nutrient the body requires in small amounts to remain healthy but the body cannot manufacture for itself and must acquire through diet.

To help control portions Austin suggests practicing until it is possible to accurately judge how much food is in one portion, and always checking nutrition labels to see how many servings are in a package. To maximize **fiber** she suggests eating a variety of high-fiber vegetables, such as fresh spinach, and whole grain foods, such as brown rice.

Denise Austin does not suggest completely cutting fat out of the diet. Instead, she suggests trying to limit foods that contain bad **fats** (i.e., saturated and trans fats) and more food that contain good fats (i.e., mono- and poly-unsaturated oils). Foods she suggests as sources of good fats include avocados, nuts, fish, and olive oil.

One of the most important aspects of Fit Forever is the emphasis on increasing fruits and vegetables in the diet. Austin provides many recipes and suggestions for eating fruits and vegetables as meals, snacks, and on-the-go treats.

Austin believes that **binge eating** and eating for reasons other than hunger are common sources of weight gain and are often the source of problems when trying to loose weight. She suggests paying more attention to the signals of hunger that the body sends, and only eating in response to those signals. Eating should not be a response to other signals such as stress or habit. She also suggests trying to remember the goal of being healthy, slim, and fit, and using that to overcome the desire to eat too much or when not actually hungry.

The behavioral changes Austin addresses in her program refer to eating for reasons other than hunger, such as stress, unhappiness, or even happiness. She recommends modifying this behavior by identifying the underlying problem for the unwanted eating behavior. Once the problem has been identified, an activity other than eating can alleviate the feeling or fix the problem. For example, if the problem is feeling overwhelmed, the activity may be talking to a close friend, taking a break, or spending some time alone. According to Austin, finding solutions that are more appropriate than food are also more likely to relieve the unwanted feelings.

Although diet is a very important part of the Fit Forever program, it only comprises about half of the overall regimen. Exercise is equally emphasized by Austin, if not more so. The Fit Forever program provides suggested exercises for beginner, intermediate, or advanced fitness levels. The program also provides exercise plans that target the midsection, upper body, or lower body. The basic workout suggested by Austin takes about 20 minutes, including stretching and cool down times. She also provides a "Body Blast" workout routine that only takes about 10 minutes, for when there is not enough time in the day for the usual workout. Daily routines and customized workouts are available online to members of the Fit Forever program. Nonmembers can access workouts using her books, videos, or television shows.

In addition to her main workout routines, Austin emphasizes the importance of getting exercise in other ways. She believes in the importance of walking regularly, and suggests ways to make it more fun such as listening to music or walking with friends. Austin encourages walking at least four times each week.

Austin believes workouts should vary throughout the week to make sure each muscle group is used. Her workouts involve cardio training to help the heart and cardiovascular system, weight training for muscle tone, and targeted workouts to focus on areas where excess fat may be a problem. She offers a variety of workouts including yoga, Pilates, a fat-burning dance mix, and boot camp interval training, and suggests ways in which shorter routines can be added or even substituted for certain parts to keep exercise interesting.

The Fit Forever diet and exercise plan includes not only suggestions about which foods to eat, and which exercises to do, but also provides motivational tips. On the Website, dieters can read messages or listen to audio clips from Austin providing encouragement and cheering them on. Individuals following the Fit Forever diet can support each other through online discussion boards. People from varying geographical areas and backgrounds can exchange helpful hints, ask questions, share frustrations and obstacles, and provide support for each another. A dietician is also available to answer questions and give advice.

## Function

The Fit Forever diet and exercise plan is intended to be a lifestyle changing regimen helping dieters lose weight and increase overall health and fitness. The diet and exercise aspects of Fit Forever are designed to be used together, with each providing increased benefits in the presence of the other. Although Fit Forever is largely about losing weight, the overall lessons of eating healthier foods and getting plenty of regular exercise are intended as long term lessons to keep weight off and provide better overall health.

## Benefits

There are many research supported benefits to eating less fat, more fiber, and more fruits and vegetables. The benefits of weight loss can be enormous. People who are obese are at higher risk of diabetes, heart disease, and many other diseases and disorders. Weight loss, if achieved at a moderate pace through a healthy diet and regular exercise can reduce the risk of these and many other obesity-related diseases.

## Precautions

Anyone thinking of beginning a new diet or exercise regimen should consult their physician. Requirements of calories, fat, and nutrients can differ significantly from person to person, depending on gender, age, weight, and many other factors such as the presence of any disease or conditions. Pregnant or **breastfeeding** women should be especially cautious because deficiencies of **vitamins** or **minerals** can have a significant negative impact on a baby. Exercise should be started gradually to see how the body responds.

## Risks

With any diet or exercise plan there are some risks. It is often difficult to get enough of some vitamins and minerals when eating a limited diet. Anyone beginning a diet may want to consult their physician or a registered dietitian about whether taking a vitamin or supplement might help them reduce this risk. Injuries can occur during exercise, such as strained or sprained muscles, and proper warm up and cool down procedures should be followed to minimize these risks. It is often best to begin with light or moderate exercise and increase the intensity slowly over weeks or months to minimize the risk of serious injury, such as heart attack, that could occur if strenuous exercise is begun suddenly and the body is not able to keep up.

## QUESTIONS TO ASK THE DOCTOR

- Why or why wouldn't this diet best meet my weight loss goals?
- At what level of intensity is it appropriate for me to begin exercising?
- What types of risks would this diet or exercise program pose for me?
- What type of multivitamin or dietary supplement would be appropriate for me if I were to begin this diet?
- How long is it safe for me to follow this diet?
- What are the signs and symptoms I should watch for after beginning this diet?

## Research and general acceptance

Denise Austin's Fit Forever has not been the subject of any significant scholarly research. However, moderately limiting caloric intake, eating a diet low in fats and **carbohydrates** and high in vegetable and plant products is generally accepted as a healthy diet for most people. The U.S. Center for Disease Control recommends a minimum of 30 minutes per day of light to moderate exercise for healthy adults. Following Austin's fitness and exercise program would meet, and in most cases exceed, this minimum recommendation.

### Resources

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Helen Davidson

Dental health *see* **Oral health and nutrition**

# Detoxification diets

## Definition

Detoxification diets, or detox diets for short, are a group of short-term diets intended to release accumulated toxins and waste products from the body. They are based on a theory of digestion and elimination usually associated with naturopathy, an alternative medical system that emphasizes the role of nutrition in restoring or improving the body's own self-healing properties. In general, detox diets emphasize the following:

- Minimal intake of chemicals on or in food by choosing organic or non-processed foods
- Increased intake of fruits, vegetables, and other foods thought to aid the process of detoxification
- Increased intake of foods and fluids that speed up the processes of urination and defecation

Detoxification diets can be categorized into several subgroups: raw food diets, which are based on the premise that uncooked foods prevent the accumulation of toxins in the digestive system; mono diets, in which the dieter consumes only one or two foods (sometimes in liquid form only) for a period of 10–14 days; juice fasting, in which the dieter consumes large quantities of fruit and vegetable juices along with **water** and herbal teas for one to three days; and vegetarian or semi-vegetarian detox diets, which allow the dieter some variety of cooked whole grains, steamed vegetables, fresh fruit, and small amounts of **protein** foods as well as several glasses of water and herbal teas each day.

## Origins

Detoxification diets as a general practice can be traced back for over 5,500 years to an annual ritual of bodily and spiritual preparation known as *pancha karma*, which is part of the practice of Ayurvedic medicine in India. Ayurveda is a traditional system of health care that dates back to about 3500 BC; its name is Sanskrit for "science of long life." Pancha karma is undergone for disease prevention, which in Ayurvedic practice requires spiritual renewal and the breaking of negative emotional patterns as well as physical purification. It has three phases: a preparation phase, in which the person eliminates sweets, caffeinated drinks, and processed foods from the diet, as well as spending more time in meditation and taking walks in natural surroundings; the cleansing phase, which includes bloodletting, emesis (forced vomiting), nasal cleansing, and the use of enemas and laxatives as well as a very restricted diet of grains and vegetables; and a rejuvenation phase, in which solid foods are gradually reintroduced to the diet. Practitioners of Ayurveda in Canada and the United States generally omit vomiting and bloodletting in the second phase of pancha karma.

COMMON HERBS USED FOR DETOXIFICATION

| *Antibiotics* | *Anticatarrhals (Help Eliminate Mucus)* | *Blood Cleansers* |
|---|---|---|
| Clove<br>Echinacea<br>Eucalyptus<br>Garlic<br>Myrrh<br>Prickly ash bark<br>Propolis<br>Wormwood | Boneset<br>Echinacea<br>Garlic<br>Goldenseal root<br>Hyssop<br>Sage<br>Yarrow | Burdock root<br>Dandelion root<br>Echinacea<br>Oregon grape root<br>Red clover blossoms<br>yellow dock root |
| ***Diaphoretics/Skin Cleaners*** | ***Diuretics*** | ***Laxatives*** |
| Boneset<br>Burdock root<br>Cayenne pepper<br>Elder flowers<br>Ginger root<br>Goldenseal root<br>Peppermint<br>Oregon grape root<br>Yellow dock | Cleavers<br>Corn silk<br>Horsetail<br>Juniper berries<br>Parsley leaf<br>Uva ursi<br>Yarrow dock | Buckthorn<br>Cascara sagrada<br>Dandelion root<br>Licorice root<br>Rhubarb root<br>Senna leaf<br>Yellow dock |

*(Illustration by Stanley Publishing/Thomson Gale.)*

In Europe and North America the most important factor in the popularity of detoxification diets is naturopathy, an alternative approach to health care developed out of the natural healing movement in Germany and North America in the late nineteenth century. Naturopathy is closely connected with **vegetarianism**, particularly its raw-food offshoot. Naturopaths of the twenty-first century use a variety of techniques in treating patients, including hydrotherapy, spinal manipulation, and physical therapy as well as nutrition and dietary advice. There has been a revival of interest in naturopathy in the United States since the 1980s.

Naturopaths frequently recommend detoxification diets as a way of ridding the body of various toxins that they identify as coming from several sources:

- Heavy metals. These include such substances as cadmium, arsenic, nickel, aluminum, chromium, mercury, vanadium, strontium, antimony, cobalt, and lead, which are used in various manufacturing processes and some medical procedures as well as being present in batteries, electronic equipment,

## KEY TERMS

**Amaranth**—An herb cultivated as a food crop in Mexico and South America. Its grains can be toasted and mixed with honey or molasses as a vegetarian treat.

**Ayurveda**—The traditional system of natural medicine that originated in India around 3500 BC. Its name is Sanskrit for "science of long life." Some historians of medicine think that detoxification diets can be traced back to Ayurvedic practice.

**Choline**—A compound found in egg yolks and legumes that is essential to liver function.

**Colonic**—Sometimes called colonic hydrotherapy, a colonic is a procedure similar to an enema in which the patient's colon is irrigated (washed out) with large amounts of water. This procedure is discouraged by mainstream physicians because of its potential risks to health.

**Fruitarian**—A vegetarian who eats only plant-based products (fruits, seeds, and nuts) that can be obtained without killing the plant.

**Methionine**—A crystalline amino acid found in many protein foods. It is sometimes taken as a supplement during a detox diet.

**Mono diet**—A type of detoxification diet based on the use of only one food or beverage, such as apples, grapes, lemonade, or other raw fruits or vegetables.

**Naturopathy**—A system of disease treatment that emphasizes natural means of health care, as water, natural foods, dietary adjustments, massage and manipulation, and electrotherapy, rather than conventional drugs and surgery. Naturopaths (practitioners of naturopathy) often recommend detox diets as a way of cleansing the body.

**Pancha karma**—An intensive one- to two-week ritual of detoxification practiced in Ayurvedic medicine that includes enemas, bloodletting, and nasal irrigation as well as fasting.

**Pasteurization**—A process for partial sterilization of milk or beverage juices by raising the liquid to a temperature that destroys disease organisms without changing its basic taste or appearance. Raw foodists avoid pasteurized food products.

**Pau d'arco**—A medicinal bark derived from a tree native to the Amazon rainforest. Pau d'arco is often brewed as a tea and taken as a diuretic or anti-inflammatory preparation.

**Quinoa**—An herb native to the Andes that produces starchy seeds that can be ground into flour and used as food.

**Raw foodism**—A term that refers to a group of dietary regimens composed entirely of foods that have not been raised above a certain temperature. Many raw foodists are vegans, although some eat raw meat or fish and use unpasteurized dairy products.

**Vegan**—A vegetarian who excludes all animal products from the diet, including those that can be obtained without killing the animal. Vegans are also known as strict vegetarians.

coins, cookware, food containers, and other common household items.

- Toxic chemicals taken directly into the digestive tract through alcoholic beverages, pesticide residues on supermarket produce, additives in processed foods, or drugs of abuse; or taken into the respiratory tract through breathing household solvents (nail polish remover, spot or stain removers containing benzene, etc.).
- Toxins in the digestive tract produced by yeast and other microorganisms. Ridding the body of this group of toxins is frequently cited as a reason for combining laxatives or enemas with detoxification diets. Mainstream physicians dispute the notion that normal digestion produces toxic substances in the colon that must be removed by a laxative or enema.
- Ammonia, urea, and other breakdown products of protein metabolism. Naturopaths often recommend a vegetarian lifestyle as well as periodic intensive detoxification practices in order to minimize the production of these byproducts of meat and dairy products consumption.

A third factor that has contributed to interest in detox diets in the 1990s and early 2000s is the environmental movement. Some people who are concerned about the impact on the environment of raising animals for food use detox diets as a transition into a long-term vegetarian or vegan lifestyle. In addition, growing awareness of the effects of exposure to industrial chemicals, pesticides, secondhand tobacco smoke, and other contaminants in the home environment as well as the workplace has led many people to consider detoxification diets as a preventive health practice to lower their risk of arthritis and other degenerative diseases.

## Description

Practitioners of alternative medicine generally recommend the warmer months as the best time of year for a detox diet, although some dieters prefer January in order to counteract the effects of overindulgence in food and drink during the holidays. Many people suggest beginning a detox diet on the weekend or scheduling time off from work in order to allow time for extra rest if needed. Detox diets are usually used only once or twice a year.

Many detoxification diet books include a questionnaire or symptom checklist to help readers evaluate whether they need detoxification. The following list is typical; more than four "yes" answers indicates the individual could benefit from a detox diet:

- Do you have only one bowel movement per day, or only one every other day?
- Do you take prescription, recreational, or over-the-counter drugs?
- Do you eat meat more than twice a week?
- Do you eat fast foods or processed foods?
- Do you smoke, or are you exposed to secondhand smoke?
- Do you have any skin problems or digestive gas and bloating?
- Do you drink alcohol?
- Do you live in a major city?
- Do you drink tap water, coffee, or soda?
- Do you feel tired, sleep poorly, or have low energy?

Individuals considering a detox diet should prepare by cutting down gradually on caffeinated beverages a week to 10 days before the diet, as sudden elimination of these drinks often causes headaches. Dieters should also reduce their intake of sugary foods, chocolate, alcohol, dairy products, foods high in fat, foods containing wheat or yeast, and grains containing gluten (an elastic protein found in barley and rye). Recommended foods for detox diets (except the mono diets) include fresh organic fruits and vegetables; rice (both brown and basmati rice), rice cakes, and rice pasta; other grains such as millet, quinoa, and buckwheat; beans, lentils, and dried green or yellow peas; unsalted nuts; seeds; olive oil; and herbal teas. The dieter should plan to drink at least eight glasses of filtered or other non-tap water per day on a detox diet.

At the end of a detox diet, the dieter should return gradually to a full diet, perhaps vegetable soup or steamed vegetables the first day. They should not add fruits or vegetables until the second or third day.

### *Raw food diets*

Raw food detox diets consist of foods that have not been heated above 92° to 118°F (33° to 48°C). These diets are based on the belief that raw foods have higher nutrient value and contain enzymes that assist digestion, allowing the other enzymes in the body to regulate other biological processes. Raw foodists also believe raw foods prevent **obesity** by lowering excessive food consumption, and their high **fiber** content helps detoxify the body by speeding up digestion and elimination.

### *Juice fasting*

In a juice fast, the dieter is instructed to drink between 32 and 64 oz of fruit or vegetable juice per day, in addition to six glasses of warm filtered water. Although some modified **juice fasts** allow a small quantity of steamed vegetables, most are short-term **liquid diets**. Some therapists recommend one or more cups of herbal tea each day in addition to the juice and water. The juice must be fresh, obtained from organic fruits and vegetables processed through a juicer or juice extractor. Prepackaged juices cannot be used for a juice fast because they have been pasteurized. In addition, fresh juice must be consumed within a half hour of extraction; it cannot be refrigerated.

### *Mono diets*

Mono diets are detox diets in which the dieter consumes only one food, usually apples, grapes, or some other fruit or vegetable, or one liquid, for a period of 10 to 14 days. The oldest mono diet is the so-called Miracle Grape Cure, attributed to Johanna Brandt, a woman from South Africa who claimed that eating grapes cured her of stomach **cancer**. In a book she published in 1928, Brandt stated that she alternated 12 hours of drinking only natural (unchlorinated) water with 12 hours of eating only purple grapes or drinking grape juice made from purple grapes. Recent modifications of this diet recommend following Brandt's plan to the letter for five weeks, followed by one week of a raw-food vegetarian diet.

The best-known mono diet is variously known as the Master Cleanser, lemonade diet, or maple syrup diet. Stanley Burroughs is generally credited with inventing this diet in 1941, although he did not publish it in book form until 1976. His book, which is only about fifty pages long, is still in print even though Burroughs died in 1991. The Master Cleanser involves drinking a mixture of lemon juice, cayenne pepper, and grade B maple syrup for a period of 10 to 14 days. The lemon/maple syrup drink is then followed

by drinking a "saltwater flush," which is supposed to purge toxins from the stomach and bowels. This diet was popularized in the early 2000s by a book by Peter Glickman titled *Lose Weight, Have More Energy and Be Happier in 10 Days*, which is a modernization of Burrough's regimen.

### *Vegetarian or semivegetarian diets*

Less stringent detox diets that allow some protein foods have been published; a typical example is the following diet plan for a week-long detox regimen by Elson Haas. Haas begins with general guidelines for the dieter:

- Eat slowly and chew the food well.
- Relax for a few minutes before and after each meal.
- Eat in a comfortable sitting position.
- Drink only herbal teas (peppermint, chamomile, or pau d'arco) after dinner.

The daily diet plan:

- Morning: two glasses of filtered or spring water, one glass with half a lemon squeezed into it.
- Breakfast: One piece of fresh fruit at room temperature, followed 15 to 30 minutes later by a bowl of cooked whole grains (millet, buckwheat, quinoa, brown rice, or amaranth), flavored with 2 tbl of fruit juice.
- Lunch: One or two medium bowls of steamed vegetables, using a variety of root vegetables, leafy vegetables, asparagus, cabbage, kale, or others. A maximum of 3 tsp daily of a mixture of butter and canola or olive oil can be used for seasoning.
- Dinner: Same as lunch.
- Midmorning and midafternoon: One or two cups of vegetable water saved from the steamed vegetables, with a little sea salt or kelp added.
- A small portion (3 or 4 oz) of a protein food (fish, organic chicken, lentils, black beans, or garbanzo beans) may be eaten midafternoon if the dieter feels weak or extremely hungry.

### *Supplemental recommendations*

An important part of many detoxification diets is the use of laxatives or enemas to cleanse the lower digestive tract. The removal of wastes is considered essential to prevent toxins in the intestines from being reabsorbed into the bloodstream. Some alternative therapists recommend mixtures of slippery elm or other herbs to cleanse the colon; others prefer saltwater laxatives, enemas, or colonics for cleansing the bowel. A colonic is a procedure in which a large amount of water, sometimes as much as 20 gal (76 L), is infused into the colon through the rectum a few pints at a time. It differs from an enema in that much more fluid is used; and a colonic is infused into the colon, whereas an enema infuses water or a cleansing solution into the rectum only. Mainstream physicians do not recommend colonics on the grounds that they are unnecessary, based on a nineteenth-century misunderstanding of the process of digestion, and very often uncomfortable for the patient. In some cases they pose serious risks to health.

Some therapists recommend the use of such **dietary supplements** as multivitamins, **vitamin C**, **choline** and methionine, milk thistle, or a laxative tea known as Smooth Move during a detox diet. These supplements are supposed to aid liver function and decrease such side effects of detox diets as headaches and nausea.

Many advocates of detox diets suggest the use of meditation, affirmations, yoga, and other spiritual practices in order to improve the mental and emotional well-being. Others recommend undertaking the detox diet at a health spa, where such services as massage therapy, sauna baths, and whirlpool therapy or other forms of hydrotherapy are available.

## Function

The primary function of detoxification diets is physical purification—removal of toxic substances from the body including the skin and respiratory system as well as the digestive tract—in order to raise energy levels; relieve such minor health complaints as poor skin, bad breath, or headaches; and improve the body's ability to heal from various diseases. These diets are not primarily intended as weight reduction regimens.

### *Spiritual or religious practice*

Some people undertake detoxification diets as part of a general religious or spiritual retreat. The first stage of Ayurvedic pancha karma includes extra time given to meditation and nature walks as well as gradual exclusion of stimulants and solid foods from the diet. Many people also report relief from insomnia or other symptoms of emotional stress as a side benefit of detoxification diets.

### *Treatment of specific illnesses*

Detoxification diets are sometimes recommended for the treatment of specific diseases and disorders, most commonly arthritis, autoimmune disorders, and depression, but they have also been claimed to be an effective treatment for severe infections (including

AIDS) and cancer. However, there is insufficient evidence to support such claims.

### Benefits

Claimed benefits of detox diets include higher energy levels, increased mental clarity and ability to concentrate, clearer skin, improved digestion, and more restful sleep. Many of these improvements may simply be due to better hydration as such diets encourage high fluid intake. Some people also lose weight on detox diets, but emphasize that weight reduction should never be the primary purpose of following one of these regimens.

### Precautions

In general, anyone considering a detoxification diet should consult a health professional beforehand. Some serious diseases, including cancer, may have minor symptoms at onset, including headaches, low back pain, and fatigue. These symptoms can easily be misattributed to stress or poor eating habits. Some therapists recommend requesting blood, urine, stool, and liver function tests from a physician before undergoing a detoxification diet.

Individuals who should not undertake a detoxification diet are:

- Pregnant or lactating women.
- Children.
- People with diabetes, hypothyroidism, heart disease, anorexia or bulimia nervosa, kidney or liver disease, stomach ulcers, impaired immune function, epilepsy, cancer, terminal illness, active infections, or ulcerative colitis.
- People who are underweight.
- People with alcohol or drug addictions.
- People who have recently undergone surgery or treatment for severe burns.

Prescription medications should be taken as usual during a detoxification diet. The dieter should not discontinue medications or reduce dosages without consulting a physician.

Anyone on a detoxification diet who feels faint or dizzy, develops an abnormal heart rhythm, feels nauseated or vomits, or has signs of low blood pressure, should discontinue the fast and consult their doctor at once.

Detox diets may encourage yo-yo dieting, which is detrimental to health. They should not be undertaken more than three times a year without medical supervision.

## QUESTIONS TO ASK YOUR DOCTOR

- What type of detoxification diet would you recommend for me?
- What is your opinion of alternative practitioners' explanations of the need for detoxification?
- Have any of your other patients ever tried a mono diet? If so, did they develop any health problems?

### Risks

The major risks to health from detoxification diets include metabolic crises in patients with undiagnosed diabetes; flare-ups or worsening of stomach **ulcers**; dizziness or fainting due to sudden lowering of blood pressure; diarrhea that may result in **dehydration** and an imbalance of **electrolytes** in the body; and protein or **calcium** deficiencies from unsupervised long-term juice fasts. Some people develop dental erosion from raw-food detoxification diets.

Other side effects reported include headaches (often caused by sudden withdrawal from **caffeine**), fatigue, **constipation** (from extra fiber combined with inadequate water intake), acne, irritability, dysmenorrhea (painful periods) in women, and intense hunger.

Raw-food detoxification diets increase the risk of contracting parasites or other foodborne illnesses caused by organisms normally destroyed in cooking or pasteurization. In addition, some raw vegetables, such as rhubarb leaves and stalks, buckwheat greens, kidney beans, kidney bean sprouts, and raw potatoes that have turned green are toxic, particularly if consumed in large quantities.

People on detoxification diets who undergo colonics are at risk of contracting an infection from improperly sterilized colonic equipment; of serious illness or death from electrolyte imbalances in the blood; or of serious illness or death resulting from perforation of the intestinal wall by improperly inserted equipment. Colonics can also worsen the symptoms of ulcerative colitis.

### Research and general acceptance

Detoxification diets are generally dismissed as fads by such professional nutritionists' organizations as the American Dietetic Association (ADA) and other mainstream medical groups. Most physicians point out that the human body is a remarkably efficient organism that

can rid itself of toxins through normal digestion, respiration, and excretion without elaborate diets or the assistance of enemas and laxatives. In addition, some fruits and vegetables may contain more toxins than meat, fish, and other protein-rich foods usually condemned by proponents of detoxification diets. Lastly, many physicians object to the naturopathic view of the digestive tract as a source of illness or toxicity.

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#### ORGANIZATIONS


American Association of Naturopathic Physicians (AANP). 4435 Wisconsin Avenue NW, Suite 403, Washington, DC 20016. Telephone: (866) 538-2267 or (202) 237-8150. Website: <http://www.naturopathic.org>.

American Holistic Medical Association (AHMA). P.O. Box 2016, Edmonds, WA 98020. Telephone: (425) 967-0737. Website: <http://www.holisticmedicine.org>.

American Vegan Society (AVS). 56 Dinshah Lane, P.O. Box 369, Malaga, NJ 08328. Telephone: (856) 694-2887. Website: <http://www.americanvegan.org/index.htm>.

National Center for Complementary and Alternative Medicine (NCCAM). 9000 Rockville Pike, Bethesda, MD 20892. Telephone: (888) 644-6226. Website: <http://nccam.nih.gov>.

National Institute of Ayurvedic Medicine (NIAM). 584 Milltown Road, Brewster, NY 10509. Telephone: (845) 278-8700. Website: <http://niam.com>.


Rebecca J. Frey, PhD

# DHEA

## Definition

Dehydroepiandrosterone (DHEA) is a precursor (prohormone) of the sex hormones estrogen and testosterone. It is a steroid produced naturally by the adrenal glands and is also sold as a dietary supplement.

## Purpose

Many claims have been made for DHEA including that it fights aging, burns fat, increases muscle mass, boosts the immune system, eliminated symptoms of menopause, prevents Alzheimer's disease, and can treat everything from inflammatory bowel syndrome to cocaine withdrawal. There is little or highly questionable evidence to support most of these claims. DHEA does have medical uses in treating adrenal insufficiency (Addison's disease) and systemic lupus erythematosus (SLE).


**Tablet form of DHEA.** *(James Keyser//Time Life Pictures/Getty Images. Reproduced by permission.)*

## Description

DHEA is a supplement with a long history of controversy. In the 1980s it was promoted by supplement makers as a "miracle" product that would improve athletic performance, build muscle, burn fat, restore sexual potency, and prevent aging. Many of these claims are still made by supplement makers today. In 1985, the Food and Drug Administration (FDA) banned DHEA for sale in the United States because of its potential for abuse and the high risk of serious side effects. DHEA was also banned by several sports organizations including the International Olympic Committee and the National Football League. However, in 1994, the United States Congress passed the Dietary Supplement Health and Education Act (DSHEA). Under this law, DHEA met the definition of a dietary supplement and could once again be sold without a prescription in the United States.

DSHEA regulates supplements such as DHEA in the same way that food is regulated. Like food manufacturers, manufacturers of **dietary supplements** do not have to prove that their product is either safe or effective before it can be sold to the public. Manufacturers of conventional pharmaceutical drugs, however, must prove both safety and effectiveness in humans before a new drug is approved for use. With dietary supplements, the burden of proof falls on the FDA to show that the supplement is either unsafe or ineffective before it can be restricted or banned. Information about a supplement's safety and effectiveness is normally gathered only after people using the product develop health problems or complain that the product does not work. In the mid-2000s, there was pressure to reclassify DHEA as a hormone and ban its over-the-counter sale, but dietary supplement manufacturers have successfully fought this move. Federal law requires that all manufacturers of dietary supplements and over-the-counter drugs report consumer complaints of adverse events (negative side effects) to the FDA. This makes accumulating information on the safety of DHEA faster and easier.

DHEA is produced mainly in the adrenal glands. These are small, compact hormone-producing tissues located just above each kidney. The adrenal glands convert cholesterol into DHEA and release it into the bloodstream. DHEA is also produced in smaller amounts by the testes, liver, and possibly the brain.

## KEY TERMS

**Conventional medicine**—Mainstream or Western pharmaceutical-based medicine practiced by medical doctors, doctors of osteopathy, and other licensed health care professionals.

**Dietary supplement**—A product, such as a vitamin, mineral, herb, amino acid, or enzyme, that is intended to be consumed in addition to an individual's diet with the expectation that it will improve health.

**Hormone**—A chemical messenger produced by one type of cell and travels through the bloodstream to change the metabolism of a different type of cell.

**Prohormone**—A substance the body can convert into a hormone.

**Steroid**—A family of compounds that share a similar chemical structure. This family includes estrogen and testosterone, vitamin D, cholesterol, and the drugs cortisone and prendisone.

**Systemic lupus erythematosus (SLE)**—A serious autoimmune disease of connective tissue that affects mainly women. It can cause joint pain, rash, and inflammation of organs such as the kidney.

DHEA is a prohormone, meaning that the body can convert it into several different hormones including the female hormone estrogen and the male hormone testosterone. During development, the fetal adrenal glands produce large amounts of DHEA. After birth, production drops and remains low during childhood. As adulthood approaches, the rate of DHEA production increases, reaching a peak between ages 25–30. From age 30 on, the level of DHEA declines steadily until by age 80, men have only about 10% as much DHEA in their blood as they did at age 25.

Some researchers, observing the relationship between aging and decreased levels of DHEA, hypothesized the decrease in DHEA caused age-related problems such as cardiovascular disease, decreased sexual function, and dementia. They theorized that aging could be delayed using dietary supplements to restore DHEA levels to those of a younger person. This was only a hypothesis and had not been tested, yet supplement manufacturers grabbed on to the cause and effect idea and began promoting DHEA as a miracle supplement that could increase longevity and ward off a number of age-related changes.

The researchers tended to be much more cautious. For one thing, humans and other primates (apes, monkeys) produce substantial amounts of DHEA, but common laboratory animals such as rats and mice produce almost none. Therefore, it is unclear whether results of testing DHEA in lab animals can be applied to humans. Some researchers have spoken out against supplement makers, complaining that their research has been taken out of context, misrepresented, or just plain altered to support the claims of manufacturers selling DHEA, especially those selling over the Internet.

### *DHEA's role in health care*

DHEA has two uses accepted by practitioners of conventional medicine. Under supervision of a physician, DHEA has been used to successfully treat Addison's disease. Addison's disease is the result of adrenal insufficiency. The adrenal glands do not produce enough hormones. DHEA supplements simply replace what the body should be making.

DHEA has also been used by physicians to treat symptoms of systemic lupus erythematosus (SLE). SLE is a complicated autoimmune disease where the body attacks and damages its own tissues. It is not clear why DHEA improves SLE symptoms such as joint pain and inflammation of the tissue surrounding the heart, but the majority of clinical trials in humans support this use.

There is mixed evidence to support two other claims for DHEA—that it helps with weight loss and that it relieves depression symptoms. A rigorous study led by researchers at the Mayo Clinic and published in 2006, found no anti-aging effects in elderly participants who took DHEA for two years. There were no measurable improvements in muscle strength, body fat, physical performance, insulin sensitivity, or quality of life.

DHEA is sold as a dietary supplement in the form of tablets, capsules, and a liquid injection. Dosages range from 25–250 mg per day. An independent study of DHEA supplements found that many supplements contained amounts DHEA ranging from 0–150% that were inconsistent with the amount described on the label.

Dietary supplement manufacturers continue to use unsubstantiated claims about DHEA that appeal to individuals searching for the fountain of youth. These include claims that DHEA improves memory, eliminates or improves symptoms of Alzheimer's disease, prevents cardiovascular disease, increases bone density, treats chronic fatigue syndrome, treats cocaine

withdrawal, improves symptoms of Crohn's disease and inflammatory bowel syndrome, slows the development of AIDS, restores fertility, cures erectile dysfunction, treats symptoms of menopause such as hot flashes, helps manage schizophrenia, increases muscle strength and athletic performance, stimulates the immune system, prevents skin aging, and treats the symptoms of fibromyalgia. There are no independent, controlled, rigorous studies to support any of these uses. The National Center for Complementary and Alternative Medicine (NCCAM) does not recommend the use of DHEA supplements as a means to improve any health problems. The National Institute for Aging (NIA) advises against the use of DHEA supplements due to the lack of evidence proving any form of anti-aging benefit.

DHEA remains of great interest to researchers. Clinical trials are underway to determine safety and effectiveness of DHEA in a variety of situations.

## Precautions

People under age 40 should not take DHEA supplements.

Pregnant women should not take DHEA. There is some evidence that it can induce early labor. The effect on the developing fetus is unknown.

**Breastfeeding** women should avoid DHEA supplementation because DHEA passes into breast milk and may affect development of the infant.

People who have a high risk of developing estrogen- or testosterone-sensitive cancers, such as breast **cancer** or **prostate** cancer, should not take DHEA supplements. DHEA is converted into estrogen or testosterone. These hormones appear to stimulate the growth of certain cancers.

Athletes should be aware that some athletic governing bodies ban DHEA supplement use and test for abnormally high levels of DHEA as part of routine drug testing.

## Interactions

High levels of DHEA may interfere with the way the liver processes certain drugs. As a result, these drugs may accumulate in the body in high levels and cause adverse effects or be more rapidly deactivated and not produce a therapeutic response. Drugs that may be affected by high levels of DHEA are anticonvulsants, antipsychotics, corticosteroids, oral contraceptives, hormone replacement therapy drugs, insulin, and drugs to treat insomnia.

## Complications

DHEA supplementation in healthy people can cause major side effects. Many of these come about because of the conversion of DHEA into high levels of testosterone and estrogen. These include:

- masculization of women, including deepening voice and increased body hair
- menstrual irregularities in women
- feminization of men including, enlarged breasts and shrunken testicles
- decreased HDL ("good") cholesterol
- high blood pressure (hypertension)
- liver damage

Less serious side effects include acne, increased sweating, breast tenderness, insomnia, nausea, and abdominal pain.

## Parental concerns

DHEA should never be given to children. Parents should keep this and all drugs and supplements stored safely out of reach of children to prevent accidental poisoning.

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National Center for Complementary and Alternative Medicine Clearinghouse. P.O. Box 7923, Gathersburg, MD 20898. Telephone: (888) 644-6226. TTY: (866) 464-3615. Fax: (866) 464-3616. Website: <http://nccam.nih.gov>.

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Tish Davidson, A.M.

# Diabetes mellitus

## Definition

Diabetes mellitus is a condition in which the pancreas no longer produces enough insulin or cells stop responding to the insulin that is produced, so that glucose in the blood cannot be absorbed into the cells of the body. Symptoms include frequent urination, lethargy, excessive thirst, and hunger. The treatment includes changes in diet, oral medications, and in some cases, daily injections of insulin.

## Description

Diabetes mellitus is a chronic disease that causes serious health complications including renal (kidney) failure, heart disease, stroke, and blindness. Approximately 17 million Americans have diabetes. Unfortunately, as many as one-half are unaware they have it.

**Target blood glucose levels for people with diabetes**

| | |
|---|---|
| Before meals | 90 to 130 |
| 1 to 2 hours after the start of a meal | less than 180 |

SOURCE: National Institute of Diabetes and Digestive and Kidney Diseases, National Institutes of Health, U.S. Department of Health and Human Services

*(Illustration by GGS Information Services/Thomson Gale.)*

### *Background*

Every cell in the human body needs energy in order to function. The body's primary energy source is glucose, a simple sugar resulting from the digestion of foods containing **carbohydrates** (sugars and starches). Glucose from the digested food circulates in the blood as a ready energy source for any cells that need it. Insulin is a hormone or chemical produced by cells in the pancreas, an organ located behind the stomach. Insulin bonds to a receptor site on the outside of cell and acts like a key to open a doorway into the cell through which glucose can enter. Some of the glucose can be converted to concentrated energy sources like glycogen or fatty acids and saved for later use. When there is not enough insulin produced or when the doorway no longer recognizes the insulin key, glucose stays in the blood rather entering the cells.

The body will attempt to dilute the high level of glucose in the blood, a condition called hyperglycemia, by drawing **water** out of the cells and into the bloodstream in an effort to dilute the sugar and excrete it in the urine. It is not unusual for people with undiagnosed diabetes to be constantly thirsty, drink large quantities of water, and urinate frequently as their bodies try to get rid of the extra glucose. This creates high levels of glucose in the urine.

At the same time that the body is trying to get rid of glucose from the blood, the cells are starving for glucose and sending signals to the body to eat more food, thus making patients extremely hungry. To provide energy for the starving cells, the body also tries to convert **fats** and proteins to glucose. The breakdown of fats and proteins for energy causes acid compounds called ketones to form in the blood. Ketones also will be excreted in the urine. As ketones build up in the blood, a condition called ketoacidosis can occur. This condition can be life threatening if left untreated, leading to coma and death.

### *Types of diabetes mellitus*

Type I diabetes, sometimes called juvenile diabetes, begins most commonly in childhood or adolescence. In this form of diabetes, the body produces

## KEY TERMS

**Cataract**—A condition where the lens of the eye becomes cloudy.

**Diabetic peripheral neuropathy**—A condition where the sensitivity of nerves to pain, temperature, and pressure is dulled, particularly in the legs and feet.

**Diabetic retinopathy**—A condition where the tiny blood vessels to the retina, the tissues that sense light at the back of the eye, are damaged, leading to blurred vision, sudden blindness, or black spots, lines, or flashing lights in the field of vision.

**Glaucoma**—A condition where pressure within the eye causes damage to the optic nerve, which sends visual images to the brain.

**Hyperglycemia**—A condition where there is too much glucose or sugar in the blood.

**Hypoglycemia**—A condition where there is too little glucose or sugar in the blood.

**Insulin**—A hormone or chemical produced by the pancreas, insulin is needed by cells of the body in order to use glucose (sugar), the body's main source of energy.

**Ketoacidosis**—A condition due to starvation or uncontrolled Type I diabetes. Ketones are acid compounds that form in the blood when the body breaks down fats and proteins. Symptoms include abdominal pain, vomiting, rapid breathing, extreme tiredness, and drowsiness.

**Kidney dialysis**—A process where blood is filtered through a dialysis machine to remove waste products that would normally be removed by the kidneys. The filtered blood is then circulated back into the patient. This process also is called renal dialysis.

**Pancreas**—A gland located behind the stomach that produces insulin.

little or no insulin. It is characterized by a sudden onset and occurs more frequently in populations descended from Northern European countries (Finland, Scotland, Scandinavia) than in those from Southern European countries, the Middle East, or Asia. In the United States, approximately three people in 1,000 develop Type I diabetes. This form also is called insulin-dependent diabetes because people who develop this type need to have daily injections of insulin.

Brittle diabetics are a subgroup of Type I where patients have frequent and rapid swings of blood sugar levels between hyperglycemia (a condition where there is too much glucose or sugar in the blood) and hypoglycemia (a condition where there are abnormally low levels of glucose or sugar in the blood). These patients may require several injections of different types of insulin during the day to keep the blood sugar level within a fairly normal range.

The more common form of diabetes, Type II, occurs in approximately 3–5% of Americans under 50 years of age, and increases to 10–15% in those over 50. More than 90% of the diabetics in the United States are Type II diabetics. Sometimes called age-onset or adult-onset diabetes, this form of diabetes occurs most often in people who are overweight and who do not exercise. It is also more common in people of Native American, Hispanic, and African-American descent. People who have migrated to Western cultures from East India, Japan, and Australian Aboriginal cultures also are more likely to develop Type II diabetes than those who remain in their original countries.

Type II is considered a milder form of diabetes because of its slow onset (sometimes developing over the course of several years) and because it usually can be controlled with diet and oral medication. The consequences of uncontrolled and untreated Type II diabetes, however, are the just as serious as those for Type I. This form is also called noninsulin-dependent diabetes, a term that is somewhat misleading. Many people with Type II diabetes can control the condition with diet and oral medications, however, insulin injections are sometimes necessary if treatment with diet and oral medication is not working.

Another form of diabetes called gestational diabetes can develop during pregnancy and generally resolves after the baby is delivered. This diabetic condition develops during the second or third trimester of pregnancy in about 2% of pregnancies. In 2004, incidence of gestational diabetes were reported to have increased 35% in 10 years. Children of women with gestational diabetes are more likely to be born prematurely, have hypoglycemia, or have severe jaundice at birth. The condition usually is treated by diet, however, insulin injections may be required. These women who have diabetes during pregnancy are at higher risk for developing Type II diabetes within 5–10 years.

Diabetes also can develop as a result of pancreatic disease, alcoholism, malnutrition, or other severe illnesses that stress the body.

## Causes and symptoms

### *Causes*

The causes of diabetes mellitus are unclear, however, there seem to be both hereditary (genetic factors passed on in families) and environmental factors involved. Research has shown that some people who develop diabetes have common genetic markers. In Type I diabetes, the immune system, the body's defense system against infection, is believed to be triggered by a virus or another microorganism that destroys cells in the pancreas that produce insulin. In Type II diabetes, age, **obesity**, and family history of diabetes play a role.

In Type II diabetes, the pancreas may produce enough insulin, however, cells have become resistant to the insulin produced and it may not work as effectively. Symptoms of Type II diabetes can begin so gradually that a person may not know that he or she has it. Early signs are lethargy, extreme thirst, and frequent urination. Other symptoms may include sudden weight loss, slow wound healing, urinary tract infections, gum disease, or blurred vision. It is not unusual for Type II diabetes to be detected while a patient is seeing a doctor about another health concern that is actually being caused by the yet undiagnosed diabetes.

Individuals who are at high risk of developing Type II diabetes mellitus include people who:

- are obese (more than 20% above their ideal body weight)
- have a relative with diabetes mellitus
- belong to a high-risk ethnic population (African-American, Native American, Hispanic, or Native Hawaiian)
- have been diagnosed with gestational diabetes or have delivered a baby weighing more than 9 lbs (4 kg)
- have high blood pressure (140/90 mmHg or above)
- have a high density lipoprotein cholesterol level less than or equal to 35 mg/dL and/or a triglyceride level greater than or equal to 250 mg/dL
- have had impaired glucose tolerance or impaired fasting glucose on previous testing

Several common medications can impair the body's use of insulin, causing a condition known as secondary diabetes. These medications include treatments for high blood pressure (furosemide, clonidine, and thiazide **diuretics**), drugs with hormonal activity (oral contraceptives, thyroid hormone, progestins, and glucocorticorids), and the anti-inflammation drug indomethacin. Several drugs that are used to treat mood disorders (such as anxiety and depression) also can impair glucose absorption. These drugs include haloperidol, lithium carbonate, phenothiazines, tricyclic antidepressants, and adrenergic agonists. Other medications that can cause diabetes symptoms include isoniazid, nicotinic acid, cimetidine, and heparin. A 2004 study found that low levels of the essential mineral chromium in the body may be linked to increased risk for diseases associated with insulin resistance.

### *Symptoms*

Symptoms of diabetes can develop suddenly (over days or weeks) in previously healthy children or adolescents, or can develop gradually (over several years) in overweight adults over the age of 40. The classic symptoms include feeling tired and sick, frequent urination, excessive thirst, excessive hunger, and weight loss.

Ketoacidosis, a condition due to starvation or uncontrolled diabetes, is common in Type I diabetes. Ketones are acid compounds that form in the blood when the body breaks down fats and proteins. Symptoms include abdominal pain, vomiting, rapid breathing, extreme lethargy, and drowsiness. Patients with ketoacidosis will also have a sweet breath odor. Left untreated, this condition can lead to coma and death.

With Type II diabetes, the condition may not become evident until the patient presents for medical treatment for some other condition. A patient may have heart disease, chronic infections of the gums and urinary tract, blurred vision, numbness in the feet and legs, or slow-healing wounds. Women may experience genital itching.

## Diagnosis

Diabetes is suspected based on symptoms. Urine tests and blood tests can be used to confirm a diagnose of diabetes based on the amount of glucose found. Urine can also detect ketones and **protein** in the urine that may help diagnose diabetes and assess how well the kidneys are functioning. These tests also can be used to monitor the disease once the patient is on a standardized diet, oral medications, or insulin.

### *Urine tests*

Clinistix and Diastix are paper strips or dipsticks that change color when dipped in urine. The test strip is compared to a chart that shows the amount of glucose in the urine based on the change in color. The level of glucose in the urine lags behind the level of glucose in the blood. Testing the urine with a test stick, paper strip, or tablet that changes color when

sugar is present is not as accurate as blood testing, however it can give a fast and simple reading.

Ketones in the urine can be detected using similar types of dipstick tests (Acetest or Ketostix). Ketoacidosis can be a life-threatening situation in Type I diabetics, so having a quick and simple test to detect ketones can assist in establishing a diagnosis sooner.

Another dipstick test can determine the presence of protein or albumin in the urine. Protein in the urine can indicate problems with kidney function and can be used to track the development of renal failure. A more sensitive test for urine protein uses radioactively tagged chemicals to detect microalbuminuria, small amounts of protein in the urine, that may not show up on dipstick tests.

### *Blood tests*

**FASTING GLUCOSE TEST.** Blood is drawn from a vein in the patient's arm after a period at least eight hours when the patient has not eaten, usually in the morning before breakfast. The red blood cells are separated from the sample and the amount of glucose is measured in the remaining plasma. A plasma level of 7.8 mmol/L (200 mg/L) or greater can indicate diabetes. The fasting glucose test is usually repeated on another day to confirm the results.

**POSTPRANDIAL GLUCOSE TEST.** Blood is taken right after the patient has eaten a meal.

**ORAL GLUCOSE TOLERANCE TEST.** Blood samples are taken from a vein before and after a patient drinks a thick, sweet syrup of glucose and other sugars. In a non-diabetic, the level of glucose in the blood goes up immediately after the drink and then decreases gradually as insulin is used by the body to metabolize, or absorb, the sugar. In a diabetic, the glucose in the blood goes up and stays high after drinking the sweetened liquid. A plasma glucose level of 11.1 mmol/L (200 mg/dL) or higher at two hours after drinking the syrup and at one other point during the two-hour test period confirms the diagnosis of diabetes.

A diagnosis of diabetes is confirmed if there are symptoms of diabetes and a plasma glucose level of at least 11.1 mmol/L, a fasting plasma glucose level of at least 7 mmol/L; or a two-hour plasma glucose level of at least 11.1 mmol/L during an oral glucose tolerance test.

Home blood glucose monitoring kits are available so patients with diabetes can monitor their own levels. A small needle or lancet is used to prick the finger and a drop of blood is collected and analyzed by a monitoring device. Some patients may test their blood glucose levels several times during a day and use this information to adjust their doses of insulin.

## Treatment

There is currently no cure for diabetes. The condition, however, can be managed so that patients can live a relatively normal life. Treatment of diabetes focuses on two goals: keeping blood glucose within normal range and preventing the development of long-term complications. Careful monitoring of diet, exercise, and blood glucose levels are as important as the use of insulin or oral medications in preventing complications of diabetes. In 2003, the American Diabetes Association updated its Standards of Care for the management of diabetes. These standards help manage health care providers in the most recent recommendations for diagnosis and treatment of the disease.

### *Dietary changes*

Diet and moderate exercise are the first treatments implemented in diabetes. For many Type II diabetics, weight loss may be an important goal in helping them to control their diabetes. A well-balanced, nutritious diet provides approximately 50–60% of calories from carbohydrates, approximately 10–20% of calories from protein, and less than 30% of calories from fat. The number of calories required by an individual depends on age, weight, and activity level. The calorie intake also needs to be distributed over the course of the entire day so surges of glucose entering the blood system are kept to a minimum.

Keeping track of the number of calories provided by different foods can become complicated, so patients usually are advised to consult a nutritionist or dietitian. An individualized, easy to manage diet plan can be set up for each patient. Both the American Diabetes Association and the American Dietetic Association recommend diets based on the use of food exchange lists. Each food exchange contains a known amount of calories in the form of protein, fat, or carbohydrate. A patient's diet plan will consist of a certain number of exchanges from each food category (meat or protein, fruits, breads and starches, vegetables, and fats) to be eaten at meal times and as snacks. Patients have flexibility in choosing which foods they eat as long as they stick with the number of exchanges prescribed.

For many Type II diabetics, weight loss is an important factor in controlling their condition. The food exchange system, along with a plan of moderate exercise, can help them lose excess weight and improve their overall health.

### *Oral medications*

Oral medications are available to lower blood glucose in Type II diabetics. In 1990, 23.4 outpatient prescriptions for oral antidiabetic agents were dispensed. By 2001, the number had increased to 91.8 million prescriptions. Oral antidiabetic agents accounted for more than $5 billion dollars in worldwide retail sales per year in the early twenty-first century and were the fastest-growing segment of diabetes drugs. The drugs first prescribed for Type II diabetes are in a class of compounds called sulfonylureas and include tolbutamide, tolazamide, acetohexamide, and chlorpropamide. Newer drugs in the same class are now available and include glyburide, glimeperide, and glipizide. How these drugs work is not well understood, however, they seem to stimulate cells of the pancreas to produce more insulin. New medications that are available to treat diabetes include metformin, acarbose, and troglitizone. The choice of medication depends in part on the individual patient profile. All drugs have side effects that may make them inappropriate for particular patients. Some for example, may stimulate weight gain or cause stomach irritation, so they may not be the best treatment for someone who is already overweight or who has stomach **ulcers**. Others, like metformin, have been shown to have positive effects such as reduced cardiovascular mortality, but but increased risk in other situations. While these medications are an important aspect of treatment for Type II diabetes, they are not a substitute for a well planned diet and moderate exercise. Oral medications have not been shown effective for Type I diabetes, in which the patient produces little or no insulin.

Constant advances are being made in development of new oral medications for persons with diabetes. In 2003, a drug called Metaglip combining glipizide and metformin was approved in a dingle tablet. Along with diet and exercise, the drug was used as initial therapy for Type 2 diabetes. Another drug approved by the U.S. Food and Drug Administration (FDA) combines metformin and rosiglitazone (Avandia), a medication that increases muscle cells' sensitivity to insulin. It is marketed under the name Avandamet. So many new drugs are under development that it is best to stay in touch with a physician for the latest information; physicians can find the best drug, diet and exercise program to fit an individual patient's need.

### *Insulin*

Patients with Type I diabetes need daily injections of insulin to help their bodies use glucose. The amount and type of insulin required depends on the height, weight, age, food intake, and activity level of the individual diabetic patient. Some patients with Type II diabetes may need to use insulin injections if their diabetes cannot be controlled with diet, exercise, and oral medication. Injections are given subcutaneously, that is, just under the skin, using a small needle and syringe. Injection sites can be anywhere on the body where there is looser skin, including the upper arm, abdomen, or upper thigh.

Purified human insulin is most commonly used, however, insulin from beef and pork sources also are available. Insulin may be given as an injection of a single dose of one type of insulin once a day. Different types of insulin can be mixed and given in one dose or split into two or more doses during a day. Patients who require multiple injections over the course of a day may be able to use an insulin pump that administers small doses of insulin on demand. The small battery-operated pump is worn outside the body and is connected to a needle that is inserted into the abdomen. Pumps can be programmed to inject small doses of insulin at various times during the day, or the patient may be able to adjust the insulin doses to coincide with meals and exercise.

Regular insulin is fast-acting and starts to work within 15–30 minutes, with its peak glucose-lowering effect about two hours after it is injected. Its effects last for about four to six hours. NPH (neutral protamine Hagedorn) and Lente insulin are intermediate-acting, starting to work within one to three hours and lasting up to 18–26 hours. Ultra-lente is a long-acting form of insulin that starts to work within four to eight hours and lasts 28–36 hours.

Hypoglycemia, or low blood sugar, can be caused by too much insulin, too little food (or eating too late to coincide with the action of the insulin), **alcohol consumption**, or increased exercise. A patient with symptoms of hypoglycemia may be hungry, cranky, confused, and tired. The patient may become sweaty and shaky. Left untreated, the patient can lose consciousness or have a seizure. This condition is sometimes called an insulin reaction and should be treated by giving the patient something sweet to eat or drink like a candy, sugar cubes, juice, or another high sugar snack.

### *Surgery*

Transplantation of a healthy pancreas into a diabetic patient is a successful treatment, however, this transplant is usually done only if a kidney transplant is performed at the same time. Although a pancreas transplant is possible, it is not clear if the potential

benefits outweigh the risks of the surgery and drug therapy needed.

### *Alternative treatment*

Since diabetes can be life-threatening if not properly managed, patients should not attempt to treat this condition without medical supervision. A variety of alternative therapies can be helpful in managing the symptoms of diabetes and supporting patients with the disease. Acupuncture can help relieve the pain associated with diabetic neuropathy by stimulation of certain points. A qualified practitioner should be consulted. Herbal remedies also may be helpful in managing diabetes. Although there is no herbal substitute for insulin, some herbs may help adjust blood sugar levels or manage other diabetic symptoms. Some options include:

- fenugreek (*Trigonella foenum-graecum*) has been shown in some studies to reduce blood insulin and glucose levels while also lowering cholesterol
- bilberry (*Vaccinium myrtillus*) may lower blood glucose levels, as well as helping to maintain healthy blood vessels
- garlic (*Allium sativum*) may lower blood sugar and cholesterol levels
- onions (*Allium cepa*) may help lower blood glucose levels by freeing insulin to metabolize them
- cayenne pepper (*Capsicum frutescens*) can help relieve pain in the peripheral nerves (a type of diabetic neuropathy)
- gingko (*Gingko biloba*) may maintain blood flow to the retina, helping to prevent diabetic retinopathy

Any therapy that lowers stress levels also can be useful in treating diabetes by helping to reduce insulin requirements. Among the alternative treatments that aim to lower stress are hypnotherapy, biofeedback, and meditation.

## Prognosis

Uncontrolled diabetes is a leading cause of blindness, end-stage renal disease, and limb amputations. It also doubles the risks of heart disease and increases the risk of stroke. Eye problems including cataracts, glaucoma, and diabetic retinopathy also are more common in diabetics.

Diabetic peripheral neuropathy is a condition where nerve endings, particularly in the legs and feet, become less sensitive. Diabetic foot ulcers are a particular problem since the patient does not feel the pain of a blister, callous, or other minor injury. Poor blood circulation in the legs and feet contribute to delayed wound healing. The inability to sense pain along with the complications of delayed wound healing can result in minor injuries, blisters, or callouses becoming infected and difficult to treat. In cases of severe infection, the infected tissue begins to break down and rot away. The most serious consequence of this condition is the need for amputation of toes, feet, or legs due to severe infection.

Heart disease and kidney disease are common complications of diabetes. Long-term complications may include the need for kidney dialysis or a kidney transplant due to kidney failure.

Babies born to diabetic mothers have an increased risk of birth defects and distress at birth.

## Prevention

Research continues on diabetes prevention and improved detection of those at risk for developing diabetes. While the onset of Type I diabetes is unpredictable, the risk of developing Type II diabetes can be reduced by maintaining ideal weight and exercising regularly. The physical and emotional stress of surgery, illness, pregnancy, and alcoholism can increase the risks of diabetes, so maintaining a healthy lifestyle is critical to preventing the onset of Type II diabetes and preventing further complications of the disease.

## Resources

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"Wider Metformin Use Recommended." *Chemist & Druggist*. January 11, 2003: 24.

### ORGANIZATIONS

American Diabetes Association. 1701 North Beauregard Street, Alexandria, VA 22311. (800) 342-2383. <http://www.diabetes.org.>

American Dietetic Association. 216 W. Jackson Blvd., Chicago, IL 60606-6995. (312) 899-0040. <http://www.eatright.org.>

Juvenile Diabetes Foundation. 120 Wall St., 19th Floor, New York, NY 10005. (800) 533-2873. <http://www.jdf.org.>

National Diabetes Information Clearinghouse. 1 Information Way, Bethesda, MD 20892-3560. (800) 860-8747. Ndic@info.niddk.nih.gov. <http://www.niddk.nih.gov/health/diabetes/ndic.htm.>

**OTHER**

*Centers for Disease Control*. <http://www.cdc.gov/nccdphp/ddt/ddthome.htm.>

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Altha Roberts Edgren
Teresa G. Odle

Diarrhea *see* **Traveler's diarrhea**

**Causes of diarrhea**

| Causes | Examples |
|---|---|
| Viral infections | Rotavirus, Norwalk virus |
| Bacterial infections | E. coli, Vibrio cholerae, Campylobacter, Shigella |
| Parasites | Giardia, Entamoeba |
| Helminths (intestinal worms) | Strongyloides |
| Allergic | Lactose intolerance, celiac sprue, medication side effects |
| Autoimmune | Ulcerative colitis, Crohn's disease |
| Malabsorptive | Pancreatic deficiency, biliary disease |
| Nutritional | Zinc deficiency, vitamin A deficiency, enteral feedings consisting of liquid nutritional formulas delivered straight to the bowels |
| Functional | Irritable bowel syndrome, short bowel syndrome, cancer |

*(Illustration by GGS Information Services/Thomson Gale.)*

# Diarrhea diet

## Definition

A diarrhea diet is used to help alleviate diarrhea, a condition characterized by unusually frequent bowel movements and excessive evacuations of watery stools.

## Origins

Diarrhea is a symptom that is not only uncomfortable, but also dangerous to health, as it is usually indicative of an underlying infection. Some causes of diarrhea include:

- Taking antibiotics. Some antibiotics have diarrhea as a side effect.
- Celiac disease. Disease that damages the small intestine in people who cannot tolerate gluten, a protein found in wheat, rye, and barley.
- Crohn's disease. Inflammatory disease that usually occurs in the last section of the small intestine (ileum), causing swelling in the intestines. It can also occur in the large intestine.
- Diverticulitis. Inflammation of the small pouches (diverticula) that can form in the weakened muscular wall of the large intestine.
- Dysentery. Inflammation of the intestine with severe diarrhea and intestinal bleeding, resulting from drinking water containing a parasite called *Entamoeba histolytica*.
- Food poisoning. Eating foods that are spoiled or tainted because they either contain harmful microorganisms, or toxic substances that make them unfit for consumption.
- Gardiasis. Infection of the intestine by the parasite *Giardia intestinalis*. The parasite is one of the most common causes of waterborne disease in the United States and can be found in both drinking and recreational water.
- Infectious diarrhea. Diarrhea resulting from bacterial or viral infections. Bacterial diarrhea is most commonly caused by *Campylobacter jejuni*, *Salmonella*, *Shigella*, *Escherichia coli* O157:H7. Rotavirus is the commonest cause of viral diarrhea in the United States. Other viruses causing diarrhea include Norwalk virus, and cytomegalovirus.
- Irritable bowel syndrome (IBS). IBS, also called spastic colon, or irritable colon, is a condition in which the colon muscle contracts more readily than it should.
- Lactose intolerance. The inability to digest significant amounts of lactose, the major sugar found in milk, due to a shortage of lactase, the enzyme produced by the cells lining the small intestine. Lactase breaks down milk sugar into two simpler forms of sugar that are then absorbed into the bloodstream. If not present, lactose is not broken down.
- Malabsorption. Poor absorption of nutrients by the small intestine.
- Traveler's diarrhea. Diarrhea resulting from eating or drinking food or water contaminated by infected human bowel waste. Travelers to developing

countries of the world are especially at risk, hence the name.

- Ulcerative colitis. Inflammation of the inner lining of the colon, characterized by open sores that appear in its mucous membrane.
- Viral gastroenteritis. Inflammation of the digestive tract, primarily of the stomach, small and large intestines. It is a mild viral infection that usually goes away on its own within a few days. It is often called "stomach flu".
- Excessive exercise.

## Description

In most diarrhea cases, treatment first seeks to prevent the body from losing too much fluid (**dehydration**) and the salts and **minerals** required by the body (**electrolytes**). A diarrhea diet accordingly includes drinking plenty of **water**. However, broths and soups that contain **sodium**, and fruit juices, mineral water, soft fruits, or vegetables that contain potassium, are also extremely important to restore the electrolyte levels and correct nutritional deficiencies. Until the diarrhea stops, it is also recommended to avoid **caffeine**, milk products, and foods that are high in **fiber**, or very high in simple sugars, as they tend to aggravate diarrhea. For example, soft drinks, undiluted fruit juices, and presweetened cereals should be avoided. Also, fried or fatty foods should be avoided because of their tendency to delay stomach emptying. Carbonated drinks can also affect intestinal contractions and make diarrhea worse. A heath care practitioner may also recommend the BRAT diet that includes bananas, plain rice, applesauce, and toast.

Some specific diarrheas have their own dietary requirements. For instance, avoiding dairy products in cases of lactose intolerance, or gluten in cases of malabsorption. Diarrhea caused by antibiotics can also be reduced by taking probiotic yogurt with live active cultures.

As the diarrhea improves, soft, bland foods can usually be added to the diet, supplementing bananas, plain rice, and toast with boiled potatoes, crackers, cooked carrots, and baked chicken without the skin or fat. Other recommended foods include cereals (rice, wheat, and oat cereals), and yogurt. Once the diarrhea has stopped, a person can usually return to a normal and balanced diet. The Schiffert Health Center offers the following dietary tips for the first several days after experiencing diarrhea:

- Begin eating bland, easy-to-digest foods after the first 24 hours of diarrhea.
- Slowly progress to other foods as you can tolerate them.
- Avoid food and drink that cause discomfort, cramping or gas for the first few days. Examples of food to avoid may include: spicy foods (black pepper, chili powder), caffeine, chocolate, carbonated drinks and cola drinks, alcohol, fried foods and greasy foods, acidic fruit juices (orange, grapefruit), gaseous vegetables (broccoli, cabbage, corn, cauliflower, onions).
- Initially, eat smaller meals evenly spaced throughout the day to reduce stomach acidity.
- Eat slowly and chew food well.

A progressive bland diet may propose the following eating plan:

- Day 1: Drinking clear liquids at room temperature such as sports drinks (Powerade/Gatorade), weak tea (decaffeinated), non-caffeinated sodas;
- Day 2: Slowly adding bland foods in small amounts as can be tolerated during the day. Examples are: oatmeal or cream of wheat made with water, dry cereal (without milk), plain rice or pasta (no butter, oil, or sauces), crackers or pretzels, gingersnaps, plain toast (no butter or jelly), mashed potatoes (no skins), ripe bananas (ripe), applesauce, chicken noodle soup.
- Day 3: Gradually adding more variety of foods in small, more frequent meals evenly spaced throughout the day. Examples are: soft boiled eggs or scrambled eggs, plain baked potato, fish or chicken (no skin) well-cooked, baked or grilled (not fried), plain yogurt, cottage cheese, cooked carrots or green beans, milk (skim or low-fat after diarrhea has stopped).

## Function

The primary function of a diarrhea diet is to assist the treatment seeking to correct the cause. This almost always includes preventing dehydration and replenishing lost electrolytes, especially serious in babies and young children. In serious cases, a physician may also recommend electrolyte solutions, available at drugstores. Medicines that stop diarrhea may be helpful, but they are not recommended for people whose diarrhea is caused by a bacterial infection or a parasite, because the diarrhea helps to purge the pathogen. Viral infections are either treated with medication or left to run their course, depending on the severity and type of virus.

## Benefits

Certain foods are considered beneficial such as bananas because they contain potassium, required to control the body's fluid balance, while boiled rice and toast provide low-fiber **carbohydrates** that do not irritate the bowel. Applesauce has a low GI and low fiber

## KEY TERMS

**Acidophilus**—Bacteria found in yogurt that, when ingested, helps restore the normal bacterial populations in the human digestive system.

**Acute**—Acute means sudden or severe. Acute symptoms appear, change, or worsen rapidly. It is the opposite of chronic.

**Bacteria**—Microorganisms found in the environment. Bacteria can multiply quickly in food, and can cause foodborne illnesses. Not all bacteria are harmful: some are used to make yogurt and cheese.

**Bland diet**—A diet that is free of irritating or stimulating foods.

**Chronic**—Chronic refers to a symptom or disease that continues or persists over an extended period of time.

**Colon**—Part of the large intestine, located in the abdominal cavity. It consists of the ascending colon, the transverse colon, the descending colon, and the sigmoid colon.

**Contamination**—The undesired occurrence of harmful microorganisms or substances in food.

**Digestive tract**—The tube connecting and including the organs and paths responsible for processing food in the body. These are the mouth, the esophagus, the stomach, the liver, the gallbladder, the pancreas, the small intestine, the large intestine, and the rectum.

**Duodenum**—The first section of the small intestine, extending from the stomach to the jejunum, the next section of the small intestine.

**Electrolytes**—Chemicals such as salts and minerals required for various functions in the body.

**Fecal**—Relating to feces.

**Feces**—Waste product of digestion formed in the large intestine. About 75% of its mass is water, the remainder is protein, fat, undigested roughage, dried digestive juices, dead cells, and bacteria.

**Foodborne illness**—Illness caused by pathogenic bacteria transmitted to humans by food.

**Ileum**—The last section of the small intestine located between the jejunum and the large intestine.

**Immune system**—The integrated body system of organs, tissues, cells, and cell products such as antibodies that protects the body from foreign organisms or substances.

**Inflammation**—A response of body tissues to injury or irritation characterized by pain and swelling and redness and heat.

**Intestinal flora**—The sum of all bacteria and fungi that live in the intestines. It is required to break down nutrients, fight off pathogens and helps the body build the vitamin E and K. An unbalanced intestinal flora can lead to many health problems.

**Jejunum**—The section of the small intestine located between the duodenum and the ileum.

**Large intestine**—The terminal part of the digestive system, site of water recycling, nutrient absorption, and waste processing located in the abdominal cavity. It consists of the caecum, the colon, and the rectum.

**Microorganism**—A general term for bacteria, molds, fungus, or viruses, that can be seen only with a microscope.

**Pathogen**—A disease-causing microorganism.

**Small intestine**—The part of the digestive tract located between the stomach and the large intestine. It consists of the duodenum, the jejunum, and the ileum.

content. To get the digestive system working properly after diarrhea, it is necessary to rebuild the intestinal flora, especially if antibiotics were taken. Eating probiotic yogurt (with acidophilus) helps restore the intestinal flora.

### Precautions

For most people, any liquid that they normally drink should be adequate to bring fluid levels back to normal (rehydration). However, too much water alone, at any age, can be harmful, because water does not have any sugars or important electrolytes, such as sodium. This is why the diet must include foods and drinks that restore electrolyte levels. In this respect, mineral water is recommended. Signs of dehydration include:

- Thirst
- Dry mouth and tongue, parched throat
- Reduced need to urinate
- Dry skin and hair

- Lack of energy, tiredness
- Light-headedness
- Dark urine

Very young infants also pose special problems because their risk of dehydration is much higher. They should be given a bottle frequently. A pediatrician may recommend solutions such as Pedialyte as these fluids also contain the necessary salts lost with diarrhea. Salt tablets should never be used as they may worsen diarrhea.

Diarrhea is often caused by foodborne or waterborne pathogens. The Mayo Clinic offers the following advice to prevent food contamination at home:

- Washing hands, utensils and food surfaces often to prevent cross-contamination, i.e. the transfer of harmful bacteria from one surface to another.
- Keeping raw foods separate from ready-to-eat foods, also to prevent cross-contamination.
- Cooking foods to kill harmful organisms (to temperatures between 140°F (60°C) and 180°F (82°C).
- Refrigerating or freezing perishable foods to avoid rapid growth of harmful bacteria.
- Throwing food out when in doubt.
- Drinking water only from a trusted source.

## Risks

There are no risks associated with a bland diet or with drinking liquids that replenish fluid levels as long as electrolytes are also provided.

## Research and general acceptance

There is broad consensus among health practitioners that a bland diet combined with replenishing lost fluids and electrolytes is beneficial to treat most cases of diarrhea.

The Division of Digestive Diseases and Nutrition at the National Institute of Diabetes and Digestive and Kidney Diseases (NIDDK) supports basic and clinical research into gastrointestinal conditions, including diarrhea. Among other areas, NIDDK researchers are studying how the processes of absorption and secretion in the digestive tract affect the content and consistency of stool, the relationship between diarrhea and pathogenic bacteria, motility in chronic diarrhea, and chemical compounds that may be useful in treating diarrhea.

## QUESTIONS TO ASK YOUR DOCTOR

- What is causing my diarrhea ?
- How long will it last ?
- How is diarrhea treated ?
- Are there tests that should be done ?
- Can Traveller's diarrhea be prevented ?
- Is drinking water enough to prevent dehydration ?
- What is causing my baby's diarrhea ?
- How do I know if my baby is dehydrated ?
- Are there foods that should be avoided ?
- Are there foods that are recommended ?
- Would seeing a dietician for an eating plan help ?
- If my antibiotics cause diarrhea, should I stop taking them ?

## Resources

### BOOKS

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### ORGANIZATIONS

Food and Drug Administration, Center for Food Safety and Applied Nutrition. 5100 Paint Branch Parkway, College Park, MD 20740-3835. 1-888-SAFEFOOD (1-888-723-3663). <vm.cfsan.fda.gov>.

U.S. Department of Agriculture, Food Safety and Inspection Service. Meat and Poultry Hotline: 1-888-MPHotline (1-888-674-6854). <www.fsis.usda.gov>.

U.S. Environmental Protection Agency. 1200 Pennsylvania Avenue, NW, Washington, DC 20460. 202-272-0167. <www.epa.gov>.
Centers for Disease Control and Prevention. 1600 Clifton Road, NE, Atlanta, GA 30333. 1-800-CDC-INFO (1-800-232-4636) or 404-639-3534.<www.cdc.gov>.
Crohn's and Colitis Foundation of America. 386 Park Avenue South, 17th Floor, New York, NY 10016. 1-800-932-2423. <www.ccfa.org>.
American Gastroenterological Association. 930 Del Ray Avenue, Bethesda, MD 20814. (301)654-2055. <www.gastro.org>.
International Foundation for Functional Gastrointestinal Disorders Inc. P.O. Box 170864, Milwaukee, WI 532176. 11. <www.iffgd.org>.

Monique Laberge, Ph.D.

# Diet drugs

## Definition

Diet drugs are medications that may help obese people lose weight when the drugs are used together with a program of diet and exercise. Historically, many drugs have been used as weight loss aids, and some ineffective products have been marketed with claims of helping in a program of weight loss.

## Purpose

All diet drugs are intended to reduce caloric intake or increase calorie usage, however the methods vary.

## Description

### *Appetite suppressants (anorexiants)*

Most FDA-approved weight loss drugs suppress appetite by affecting one or more neurotransmitters in the brain. These are hormones control appetite and mood. The model for these drugs is amphetamine, although there are many closely related drugs including the botanical product epehdrine. The mechanism of action of amphetamines on appetite suppression is not fully understood. It is known that amphetamines and amphetiamine-like drugs cause the release of norepinephrine and dopamine. Although they are stimulants, amphetamines do not increase the basal metabolic rate, the rate at which the body uses energy while in a resting state. Phenylpropanolamine had been approvel by the United States Food & Drug Administration as an over-the-counter aid to diet in 1983, but this approval was withdrawn after several reports of hemorrhagic stroke associated with use of the drug.

Most weight loss drugs are approved for only a few weeks, and weight rapidly returns once the drug is discontinued. Long-term studies do indicate that continued use of weight loss drugs may be effective in maintaining weight loss, but in most cases long-term studies have not been conducted to adequately demonstrate safety. This was a particular problem with amphetamine and its derivatives, which are classified as controlled substances. Sibutramine, sold under the brand name Meridia, was approved by the FDA in 1997 for use up to two years. Safety and efficacy beyond two years has not been established. Sibutramine reduces appetite by inhibiting the reuptake of norepinephrine, dopamine, and serotonin. One study found that patients taking sibutramine lost an average of 7–10 lb (3–5 kg) more over one year than those on a low-calorie diet alone.

High **fiber** foods have also been advocated as appetite syppressants. A typical example is glucomannan, a dietary fiber derived from the root of the elephant yam or konjac plant, which is native to Asia. The theory behind use of foods that contain nondigestable fiber had been that these foods caused abdominal distention, swelling of the stomach, which was believed to cause a feeling of fullness, without increasing calorie intake. Studies and reviews of the effects of glucomannan and other non-nutritive fiber products such as bran have had varying results, but several of these studies have been encouraging. One Norwegian study compared three different kinds of fiber along with a highly calorie restricted diet and reported "Glucomannan induced body weight reduction in healthy overweight subjects, whereas the addition of guar gum and alginate did not seem to cause additional loss of weight." A British study reviewed the effects of guar gum, a fiber which is often used as a thickening agent in food products, for its value in weight reduction. The researchers concluded that guar gum was not effective in aiding weight loss and the risks associated with taking guar gum outweight its benefits. It appears that fiber, or the stomach expansion which fiber causes, is not adequate to reduce calorie intake. If there is a special benefit to glucomannan as indicated by the positive studies, its mechanism of action has not been explained.

Past evidence indicated that elevated blood glucose reduced appetite. This belief was the basis for the claim that sweets before meals would ruin an appetite.

**Diet pills approved by the U.S. Food and Drug Administration**

| Generic name | Trade name(s) | Drug type | FDA approval date |
|---|---|---|---|
| **Approved for short-term use** | | | |
| diethylpropion | Tenuate, Tenuate dospan | appetite suppressant | 1959 |
| phendimetrazine | Bontril, Plegine, Prelu-2, X-Trozine, Adipost | appetite suppressant | 1982 |
| phentermine | Adipex-P, Fastin, Ionamin, Oby-trim, Pro-Fast, Zantryl | appetite suppressant | 1959 |
| **Approved for long-term use** | | | |
| orlistat | Xenical | lipase inhibitor | 1999 |
| sibutramine | Meridia | appetite suppressant | 1997 |

SOURCE: National Institute of Diabetes and Digestive and Kidney Diseases, National Institutes of Health, U.S. Department of Health and Human Services

**Most currently available weight-loss medications are FDA-approved for short-term use, meaning a few weeks, but doctors may prescribe them for longer periods of time. Sibutramine and orlistat are the only weight-loss medications approved for longer-term use in patients who are significantly obese. Their safety and effectiveness have not been established for use beyond two years.** *(Illustration by GGS Information Services/Thomson Gale.)*

High glucose diet aids were marketed based on this concept. One example was the Ayds diet candy, which contained more sugar than regular candy, and was widely marketed in the 1970s. These products were found to be ineffective as an adjunct to diet and exercise in a weight loss regimen. While Ayds was reformulated to contain phenylpropanolamine, the similarity of the name to the disease AIDS eventually drove this product off the market.

### *Topical anesthetics*

In 1983, the Food & Drug Administration approved the use of benzocaine, a topical anesthetic widely used in first aid sprays, as an aid to weight-loss programs. The claim was that benzocaine, in the form of lozenges or gums, would anesthetize the tongue, making food less attractive. More recent studies have failed to show any significant benefit to benzocaine as a weight loss.

### *Lipase inhibitors*

In 1999 the FDA approved orlistat—the first of a new class of anti-obesity drugs called lipase inhibitors—for long-term use. **Orlistat**, marketed under the brand name Xenical inhibits the pancreatic enzyme lipase that breaks down dietary fat. This decreases the body's absorption of dietary fat by as much as 30%. The undigested fat is excreted in the stool.

Orlistat is prescribed for overweight or obese patients who also have:

- high cholesterol
- diabetes
- high blood pressure
- heart disease.

On February 7, 2007, the FDA approved orlistat for non-prescription sale.

### *Other agents*

A large number of other agents have been offered for over-the-counter sale as weight loss agents, however they have not been either adequately studied or properly standardized, and so can not be recommended. One typical example is chitosan a fiberous material made of shellfish shells. This material may adsorb **fats**, preventing their digestion, and thereby reducing caloric intake. Several studies have reported favorably on the effects of chitosan, but a careful analysis of these studies indicates that in the best conducted studies, the overall weight reduction benefits are trivial, and preparations containing chitosan cannot be recommended.

Many of the products marketed as herbal have been found to be adulterated with active drugs, including sibutramine and amphetamine. People taking these agents under the impression that they are safe because they are labeled as natural products may be taking inappropriate doses of active drugs. One Chinese remedy was found to contain Aristolochic acid which was found to be responsible for six deaths due to kidney failure among patients at a Belgian health spa.

Another reviewer examined studies relating to complimentary and alternative treatments for **obesity**. None of the drugs reviewed appeared to show convincing evidence of value based on published studies, although hyponotherapy did appear to be of potential value in weight reduction. While the overwhelming majority of complimentary and alternative medicines marketed for weight reduction are harmless, the lack

## KEY TERMS

**Anorexiant**—A drug that causes loss of appetite

**Caloric**—Relating to heat or calories, also, full of calories, and so likely to be fattening.

**Dopamine**—A neurotransmitter and precursor of norepinephrine; found in high concentrations in the brain.

**Fiber**—Nutrients in the diet which are not digested by enzymes. Insoluable fiber travels through the digestive tract and has a laxative effect.

**Glucomannan**—A plant substance composed of long chains of the sugars glucose and mannose. It is not digested, and may be ised as a laxative. The material has been claimed to provide a feeling of abdominal and intestinal fullness.

**Hemorrhagic**—Relating to escape of blood from the vessels. Bleeding.

**Homeopathic**—Relating to homeopathy, a system of treating diseases by giving people very small doses of natural substances which, in healthy people, cause the same symptoms as the disease being treated.

**Norepinephrine**—A hormone that constricts blood vessels.

**Stroke**—The sudden death of brain cells when the blood supply is disrupted either through blockage or bleeding.

**Thermogenic**—Producing heat. Relating to diet drugs the term is used to indicate a drug which causes increased use of calories without exercise.

of evidence of efficacy makes their use inadvisable since there is no reason to accept any risk.

Some products claim to increase the body's thermogenesis. According to these claims, the body will burn more calories in the resting state, leading to increased weight loss. At one time, thyroid hormone was prescribed for this purpose, but because of the very high risks associated with thyroid, this use has been discontinued. Comparable claims have been made for **green tea** extract, but the weight loss benefits of these products are not clear. In one study, patients taking green tea had greater weight loss than the subjects in the control group, but on careful review, it was found that patients in the active group were exercising more than patients taking placebo.

Homeopathic remedies have been offered as weight loss products. Homeopathy itself is controversial at best, and there have been no reputable studies indicating that homeopathic remedies have any value in weight reduction.

Starch blockers are products which inhibit the digestion of starch, and so reduce its caloric value. This, in theory, should lead to reduced effective calorie intake, however the value of these products has not been demonstrated. Because these products are made from bean husks, there has been an ongoing dispute in the courts. The manufacturers argue that their products are animal feed, and not subject to regulation as drugs, while the FDA has argued that the intended use of the starch blockers is as a drug, and should be subject to regulation. The courts have been divided on how these products should be defined.

### Precautions

Because of the lack of standardization and high frequency of adulteration in some products marketed as herbal or natural weight loss remedies, people choosing to buy products of this type should deal only with a known and reputable supplier.

No weight loss product has demonstrated the ability to induce weight loss without diet, exercise, and behavioral modification. Although orlistat has been approved for long-term use, this is defined as up to two years, and in controlled studies, patients taking the drug showed increases in weight during the second year.

### Aftercare

Weight-loss drugs are used as short-term adjuncts to programs of diet, exercise, and behavioral changes, such as portion control, that are intended to maintain lifetime weight goals. These behaviors must be continued after the drugs are discontinued.

### Parental concerns

Weight-loss drugs are not normally indicated for children under the age of 16. Children should not use these drugs without proper medical supervision.

### Resources

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American Obesity Association. 1250 24th Street, NW, Suite 300, Washington, DC 20037. 800-98-OBESE (800-986-2373). <http://www.obesity.org>.
Food and Drug Administration. U.S. Department of Health and Human Services, Public Health Service, 5600 Fishers Lane, Rockville, MD 20857. <http://www.fda.gov>.
Weight-control Information Network (WIN). National Institute of Diabetes and Digestive and Kidney Diseases. 1 Win Way, Bethesda, MD 20892-3665. 877-946-4627. 202-828-1025. <http://www.niddk.nih.gov/health/nutrit/win.htm>.

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# Dietary cholesterol

## Definition

Cholesterol is a soft, white, waxy substance found in the lipids of the bloodstream and in the cells of the body. There are two sources of cholesterol. The first is the body, mainly the liver, which produces typically about 1g per day. The second are cholesterol-containing foods from animal sources, especially egg yolks, meat, poultry, fish, seafood and whole-milk dairy products. This is the cholesterol called dietary cholesterol, because it is obtained from the diet.

**Dietary cholesterol**

| Food | Cholesterol (mg) |
|---|---|
| Beef liver, cooked, 3 oz | 331 |
| Beef sweetbreads, cooked, 3 oz. | 250 |
| Squid, cooked, 3 oz. | 227 |
| Egg, whole, large | 212 |
| Shrimp, cooked, 3 oz. | 166 |
| Ice cream, gourmet, 1 cup | 90 |
| Salmon, baked, 3.5 oz. | 87 |
| Lamb chop, cooked, 3 oz. | 75 |
| Chicken breast, cooked, 3 oz. | 72 |
| Beef, round, cooked, 3 oz. | 71 |
| Beef, sirloin, cooked, 3 oz. | 71 |
| Pork chop, cooked, 3 oz. | 71 |
| Chicken, dark meat, cooked, 3 oz. | 70 |
| Beef, rib eye, cooked, 3 oz. | 65 |
| Ham, regular, cooked, 3 oz. | 50 |
| Tuna, water packed, drained, 3.5 oz. | 42 |
| Milk, whole, 1 cup | 33 |
| Butter, 1 tbsp. | 31 |
| Ice cream, light, 1 cup | 31 |
| Cheese, cheddar, 1 oz. | 30 |
| Scallops, cooked, 3 oz. | 27 |
| Hot dog, beef, 1 frank | 24 |
| Cheese, reduced fat, 1 oz. | 6 |
| Yogurt, part skim, 1 cup | 6 |

*(Illustration by GGS Information Services/Thomson Gale.)*

## Purpose

Cholesterol is found in every cell of the body and it has several important functions in maintaining health such as:

- keeping cell membranes intact
- boosting mental performance
- helping digestion
- building strong bones
- building muscle
- maintaining energy, vitality, and fertility
- regulating blood sugar levels
- repairing damaged tissue
- protecting against infectious diseases

However, excess cholesterol has been shown to accumulate in the bloodstream and on the walls of arteries, forming "plaques" that can clog the blood vessels (atherosclerosis) and lead to heart attacks and strokes. Because high blood cholesterol is one of the major risk factors for heart disease, dietary cholesterol has been the focus of much debate over what represents

## KEY TERMS

**Artery**—A blood vessel that carries blood from the heart to the body.

**Atherosclerosis**—Clogging, narrowing, and hardening of the large arteries and medium- sized blood vessels. Atherosclerosis can lead to stroke, heart attack, eye problems and kidney problems.

**Blood plasma**—The pale yellowish, protein-containing fluid portion of the blood in which cells are suspended. 92% water, 7% protein and 1% minerals.

**Cholesterol**—Soft, waxy substance found among the lipids present in the bloodstream and in all cells of the body.

**Extrahepatic**—Originating or occurring outside the liver.

**Fatty acid**—Any of a large group of monobasic acids, especially those found in animal and vegetable fats and oils, having the general formula CnH.

**Heart attack**—A heart attack occurs when blood flow to the heart muscle is interrupted. This deprives the heart muscle of oxygen, causing tissue damage or tissue death.

**Hyperlipidemia**—Elevation of lipid levels (fats) in the bloodstream. These lipids include cholesterol, cholesterol compounds, phospholipids and triglycerides, all carried in the blood as part of large molecules called lipoproteins.

**Lipids**—Group of chemicals, usually fats, that do not dissolve in water, but dissolve in ether.

**Saturated fat**—A type of fat that comes from animals and that is solid at room temperature.

**Stroke**—he sudden death of some brain cells due to a lack of oxygen when the blood flow to the brain is impaired by blockage or rupture of an artery to the brain.

**Triglycerides**—Triglycerides are the chemical form in which most fat exists in food as well as in the body.

**Unsaturated fat**—A type of fat derived from plant and some animal sources, especially fish, that is liquid at room temperature.

healthy or unhealthy levels of cholesterol in the blood and how to lower cholesterol in the diet.

### Description

Dietary cholesterol is found in animal food sources such as meat, poultry, seafood and dairy products. Foods from plants, such as fruits, vegetables, vegetable oils, grains, cereals, nuts and seeds, do not contain cholesterol. Major sources of dietary cholesterol include:

- beef liver, 3 ounces cooked (331mg)
- beef sweetbreads, 3 ounces cooked (250mg)
- squid, 3 ounces cooked (227mg)
- egg, whole, large (212mg)
- shrimp, 3 ounces cooked (166mg)
- scallops, 3 ounces cooked (27mg)
- milk, whole, 1 cup (33mg)
- cheese, regular cheddar, 1 ounce (30mg)
- cheese, reduced fat, 1 ounce (6mg)
- ice cream, gourmet, 1 cup (90mg)
- ice cream, light, 1 cup (31mg)
- beef, sirloin, 3 ounces cooked (71mg)
- beef, round, 3 ounces cooked (71mg)
- beef, rib eye, 3 ounces cooked (65mg)
- pork chop, 3 ounces cooked (71mg)
- ham, regular, 3 ounces cooked (50mg)
- lamb chop, 3 ounces cooked (75mg)
- chicken breast, 3 ounces cooked (72mg)
- chicken, dark, 3 ounces cooked (70mg)

Cholesterol does not dissolve in blood. It has to be transported to and from the cells by special carriers called lipoproteins. These are present in blood plasma and the most important are:

- Very high-density lipoprotein (VHDL). VHDL consists of proteins and a high concentration of free fatty acids.
- High-density lipoprotein (HDL). HDL helps remove fat from the body by binding with it in the bloodstream and carrying it back to the liver for excretion in the bile and disposal. A high level of HDL may lower chances of developing heart disease or stroke.
- Intermediate-density lipoprotein (IDL). IDLs are formed during the degradation of very-low-density lipoproteins; some are cleared rapidly into the liver and some are broken down to low-density lipoproteins.
- Low-density lipoproteins (LDL). LDL transports cholesterol from the liver and small intestine to

tissues outside the liver (extrahepatic) and other parts of the body. A high LDL level may increase chances of developing heart disease.

- Very low-density lipoprotein (VLDL). VLDLs carry triglycerides from the intestine and liver to fatty (adipose) and muscle tissues; they contain primarily triglycerides. A high VLDL level can cause the buildup of cholesterol in arteries and increase the risk of heart disease and stroke.
- Chylomicrons. Proteins that transport cholesterol and triglycerides from the small intestine to tissues after meals.

Generally speaking, LDL levels should be low, because LDL deposits cholesterol in the arteries and causes them to become clogged, and HDL levels should be high, because HDL helps clean fat and cholesterol from arteries, carrying it to the liver for removal from the body. This is why HDL is often called the "good cholesterol" and LDL the "bad cholesterol".

## Precautions

The National Heart, Lung and Blood Institute (NHLBI), through its National Cholesterol Education Program (NCEP), recommends that adults begin cholesterol screening at age 20 and repeat the screening every five years. Persons who have one or more risk factors for developing heart disease (for example diabetes, kidney disease, high blood pressure, vascular disease, a history of elevated cholesterol levels) should have their cholesterol levels checked more often.

Simple blood tests are done to check blood cholesterol levels. A lipoprotein test, also called a fasting lipid test, is commonly performed as part of a routine medical examination. A cholesterol test measures lipid levels and usually reports on four groups:

- Total cholesterol (normal: 100–199 mg/dL)
- LDL (normal: less than 100 mg/dL)
- HDL (normal: 40–59 mg/dL)
- Triglycerides (normal: less than 150 mg/dL)

## Interactions

Dietary **fats** are known to interact with cholesterol as follows:

- monounsaturated fats (olives, olive oil, canola oil, nuts, avocados) lower LDL, raise HDL
- polyunsaturated fats (corn, soybean, safflower, cottonseed oils, fish) lower LDL, raise HDL;
- saturated fats (whole milk, butter, cheese, ice cream, red meat; chocolate, coconuts) raise both LDL and HDL;
- trans fats (most margarines, vegetable shortening, partially hydrogenated vegetable oil, deep- fried chips, many fast foods, most commercial baked goods) raise LDL

## Aftercare

The American Heart Association (AHA) endorses the following dietary recommendations for people with high blood cholesterol:

- total fat: 25% of total calories
- saturated fat: less than 7% total calories
- polyunsaturated fat: up to 10% total calories
- monounsaturated fat: up to 20% total calories
- carbohydrates: 50–60% total calories
- protein: about 15% total calories
- cholesterol: less than 200 mg/dL
- plant sterols: 2g
- soluble fiber such as psyllium: 10– 25g

Categories of appropriate foods include:

- lean meat/fish: less than 5oz/day
- eggs: less than 2 yolks per week (whites unlimited)
- low-fat dairy products (<1% fat): 2–3 servings/day
- grains, especially whole grains: 6–8 tsp/day
- vegetables: less than 6 servings per day
- fruits: 2–5 servings per day

## Complications

If dietary cholesterol intake is excessive, it can lead to an elevation of lipid levels in the bloodstream (**hyperlipidemia**). These lipids include cholesterol, phospholipids and **triglycerides** (fats). Hypercholesterolemia is the term for high cholesterol levels, and **hypertriglyceridemia** is the term for high triglyceride levels. Because cholesterol-rich foods are also usually high in saturated fat, hypercholesterolemia is often combined to hypertriglyceridemia. Hyperlipidemias have been shown to represent a major risk factor for heart disease, the leading cause of death in the United States.

## Parental concerns

Parents can make dietary choices that can prevent cholesterol levels from being too high. For instance, they can follow these guidelines:

- Select only the leanest meats, poultry, fish and shellfish. Choose chicken and turkey without skin or remove skin before eating. Some fish, like cod, have less saturated fat than either chicken or meat.

- Limit goose and duck. They are high in saturated fat, even with the skin removed.
- Some chicken and turkey hot dogs are lower in saturated fat and total fat than pork and beef hot dogs. There are also lean beef hot dogs and vegetarian sausages that are low in fat and saturated fat.
- Dry peas, beans and tofu can be used instead of meat because they are low in saturated fat and cholesterol. Dry peas and beans also have a lot of fiber, which can help to lower blood cholesterol.
- Egg yolks are high in dietary cholesterol. A yolk contains about 213 mg. They should be limited to no more than 2 per week, including the egg yolks in baked goods and processed foods. Egg whites have no cholesterol, and can be substituted for whole eggs when baking.
- Regular dairy foods that contain fat, such as whole milk, cheese, and ice cream, are also high in saturated fat and cholesterol. But dairy products are an important source of important nutrients such as calcium and the diet should include 2 to 3 servings per day of low- fat or nonfat dairy products.
- When shopping for hard cheeses, select them fat-free, reduced fat, or part skim.
- Select frozen desserts that are lower in saturated fat, such as ice milk, low- fat frozen yogurt, low-fat frozen dairy desserts, sorbets, and popsicles.
- Saturated fats should be replaced with unsaturated fats. Select liquid vegetable oils that are high in unsaturated fats, such as canola, corn, olive, peanut, safflower, sesame, soybean, and sunflower oils.
- Limit butter, lard, and solid shortenings. They are high in saturated fat and cholesterol.
- Select light or nonfat mayonnaise and salad dressings.
- Fruits and vegetables are very low in saturated fat and total fat, and have no cholesterol. Fruits and vegetables should be eaten as snacks, desserts, salads, side dishes, and main dishes.
- Breads, cereals, rice, pasta, grains, dry beans, and peas are high in starch and fiber and low in saturated fat and calories. They also have no dietary cholesterol, except for some bakery breads and sweet bread products made with high fat, high cholesterol milk, butter and eggs.
- Select whole grain breads and rolls whenever possible. They have more fiber than white breads.
- Most dry cereals are low in fat. Limit high-fat granola, and cereal products made with coconut oil and nuts, which increases the saturated fat content.
- Restrict sweet baked goods that are made with saturated fat from butter, eggs, and whole milk such as croissants, pastries, muffins, biscuits, butter rolls, and doughnuts.
- Snacks such as cheese crackers, and some chips are often high in saturated fat and cholesterol. They can be replaced by low-fat snacks such as bagels, bread sticks, cereals without sugar, frozen grapes or banana slices, dried fruit, non-oil baked tortilla chips, popcorn or pretzels.

### Resources

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American Heart Association (AHA). 7272 Greenville Avenue, Dallas, TX 75231. 1-800-242-8721. <http://www.americanheart.org>.

Center for Disease Control (CDC). Division for Heart Disease and Stroke Prevention, 4770 Buford Hwy NE, Atlanta, GA 30341-3717. 770-488-2424. <http://www.cdc.gov/cholesterol/faqs.htm>.

National Heart Lung and Blood Institute (NHLBI). P.O. Box 30105, Bethesda, MD 20824-0105. 301-592-8573. <http://www.nhlbi.nih.gov>.

Nutrition.gov. USDA National Agricultural Library, Food and Nutrition Information Center, Nutrition.gov Staff, 10301 Baltimore Avenue, Beltsville, MD 20705-2351. <http://www.nutrition.gov>.

Monique Laberge, Ph.D.

# Dietary guidelines

## Definition

The Dietary Guidelines for Americans are the foundation of national nutrition policy for the United States. They are designed to help Americans make food choices that promote health and reduce the risk of disease. The guidelines are published jointly by the U.S. Department of Agriculture (USDA) and U.S.

Department of Health and Human Services (HHS). The first set of guidelines was published as *Nutrition and Your Health: Dietary Guidelines for Americans* in 1980. Since then, an advisory committee has been appointed every five years to review and revise the guidelines based on the latest research in nutrition and health.

## Description

### *Early Dietary Advice in the United States*

The first half of the twentieth century was a period of enormous growth in nutrition knowledge. The primary goal of nutrition advice at this time was to help people select foods to meet their energy (calorie) needs and prevent nutritional deficiencies. During the Great Depression of the 1930s, food was rationed and people had little money to buy food. They needed to know how to select an adequate diet with few resources, and the USDA produced a set of meal plans that were affordable for families of various incomes. To this day, a food guide for low-income families—the Thrifty Food Plan—is issued regularly by the USDA and used to determine food stamp allotments. In addition to meal plans, the USDA developed food guides—tools to help people select healthful diets. Over the years the food guides changed, based on the current information available.

### *Food Guides versus Dietary Guidelines*

Food guides are practical tools that people can use to select a healthful diet. Food guide recommendations, such as how many servings of grains to eat, are based on dietary guidelines that are overall recommendations for healthful diets. For example, the Dietary Guidelines for Americans include the recommendation that Americans "choose a variety of grains daily, especially whole grains." To help people reach this goal, the USDA's Food Guide Pyramid is built on a base of grain foods and recommends six to eleven servings daily with several servings from whole grains. Thus, the Food Guide Pyramid supports the recommendations of the Dietary Guidelines.

### *Evolution of the Dietary Guidelines*

During the 1970s, scientists began identifying links between people's usual eating habits and their risk for chronic diseases such as heart disease and cancer. They realized that a healthful diet was important not only to prevent nutrient deficiencies, but because it might play a role in decreasing the risk for chronic diseases. Since heart disease and **cancer** were, and still are, major causes of death and disability in the United States, there was a need to help Americans select health-promoting diets.

The first major step in federal dietary guidance was the 1977 publication of *Dietary Goals for the United States* by the Senate Select Committee on Nutrition and Human Needs, which recommended an increased intake of carbohydrates and a reduced intake of fat, saturated fat, cholesterol, salt, and sugar. There was heated debate among nutrition scientists when the Dietary Goals were published. Some nutritionists believed that not enough was known about effects of diet and health to make suggestions as specific as those given.

In 1980, the first edition of Dietary Guidelines for Americans was released by the USDA and HHS. The seven guidelines were: (1) Eat a variety of foods; (2) Maintain ideal weight; (3) Avoid too much fat, saturated fat, and cholesterol; (4) Eat foods with adequate starch and fiber; (5) Avoid too much sugar; (6) Avoid too much **sodium**; and (7) If you drink alcohol, do so in moderation. The second edition, released in 1985, made a few changes, but kept most of the guidelines intact. Two exceptions were the weight guideline, which was changed to "Maintain desirable weight" and the last guideline, in which "alcohol" was changed to "alcoholic beverages."

Following publication of the second edition of the Dietary Guidelines, two influential reports concerning diet and health were issued. The *Surgeon General's Report on Nutrition and Health* was published in 1988, and the National Research Council's report *Diet and Health—Implications for Reducing Chronic Disease Risk* was published in 1989. These two reports supported the goal of the Dietary Guidelines to promote eating habits that can help people stay healthy. In 1990, the third edition of the guidelines took a more positive tone than previous editions, using phrases such as "Choose a diet. . ." or "Use . . . only in moderation," rather than "Avoid too much. . ." This was seen as a positive step by many nutrition educators.

The fourth edition was the first to include the Food Guide Pyramid, which had been introduced in 1992. It also was the first edition to address vegetarian diets and the recently introduced "Nutrition Facts" panel for food labels. The fifth edition, issued in 2000, expanded the number of guidelines to ten and organized them into three messages: "Aim for Fitness, Build a Healthy Base, and Choose Sensibly" (ABC).

The Dietary Guidelines for Americans have evolved since they were first published in 1980. Their recommendations represent the latest research in diet and health promotion, and, as new research emerges,

the guidelines will continue to change to reflect new insights into diet and health. People can take steps toward healthier lifestyles by following the recommendations of the Dietary Guidelines and using tools like the Food Guide Pyramid to guide their food choices.

### The 2000 Dietary Guidelines for Americans

Aim for Fitness

- Aim for a healthy weight
- Be physically active each day

Build a Healthy Base

- Let the Pyramid guide your food choices
- Choose a variety of grains daily, especially whole grains
- Choose a variety of fruits and vegetables daily
- Keep food safe to eat

Choose Sensibly

- Choose a diet that is low in fat and cholesterol and moderate in fat
- Choose beverages and foods to moderate your intake of sugar
- Choose and prepare foods with less salt
- If you drink alcoholic beverages, do so in moderation

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Linda Benjamin Bobroff

Dietary practice *see* **Religion and dietary practice**

# Dietary reference intakes

## Definition

Dietary reference intakes (DRI) are a set of reference values for **vitamins**, **minerals**, and other nutrients important to human health. DRIs provide guidance about the appropriate amount of each nutrient that should be consumed based on American and Canadian diets. DRIs are specific to age group, gender, and for women, reproductive status.

## Purpose

DRIs are tools intended to be used in planning and assessing diets of individuals and groups. They are based on data that applies to American and Canadian populations and replace previously issued Recommended Dietary Allowances (RDAs) in the United States and Recommended Nutrient Intakes (RNIs) in Canada.

## Description

Health is strongly affected by the food that people eat, and proper diet can delay, prevent, or treat certain diseases and disorders. Research on dietary vitamins and minerals in the 1920s and 1930s led to the publication of the first RDAs in 1941 by the Food and Nutrition Board of the National Academy of Sciences. These early RDAs were based on the amount of each vitamin or mineral that was needed to prevent symptoms of the corresponding nutrient-deficiency disease. For example, the RDA for **vitamin A** was set at a level that would prevent symptoms of night blindness. The availability of RDAs gave a boost to food fortification programs that helped eliminate many vitamin deficiency disorders such as pellagra, which is caused by **niacin** deficiency.

The RDAs were reviewed about every five years and the values were adjusted as additional research became available, but for many years the underlying assumption remained one of setting dietary intake level of each nutrient to prevent disease. Multi-vitamin **dietary supplements** have been in use for many years. By the early 1980s single-ingredient dietary supplements, many claiming to boost athletic or sexual performance, increase energy, prevent disease, or control weight, had become much more common. Research on these dietary supplements showed that some vitamins and minerals taken in quantities larger than the RDA appeared to provide benefits to healthy individuals, but the same supplement taken in too large a quantity could be harmful. The Institute of Medicine

## KEY TERMS

**Amino acid**—Molecules that are the basic building blocks of proteins.

**Bioavailability**—The degree to which a compound can be absorbed and used by the body.

**Dietary supplement**—A product, such as a vitamin, mineral, herb, amino acid, or enzyme, that is intended to be consumed in addition to an individual's diet with the expectation that it will improve health.

**Fatty acids**—Complex molecules found in fats and oils. Essential fatty acids are fatty acids that the body needs but cannot synthesize. Essential fatty acids are made by plants and must be present in the diet to maintain health.

**Macronutrient**—A substance needed in large quantities to maintain growth and health such as the energy-producing molecules that come from proteins, carbohydrates, and fats.

**Micronutrient**—Substances that are needed in very small, even trace, amounts to maintain normal growth and health.

**Mineral**—An inorganic substance found in the earth that is necessary in small quantities for the body to maintain health. Examples include zinc, copper, iron.

**Toxic**—Harmful or poisonous to the body.

**Vitamin**—A nutrient that the body needs in small amounts to remain healthy but that the body cannot manufacture for itself and must acquire through diet.

of the National Academy of Sciences decided that an expanded set of reference values was needed to incorporate this new research and provide better nutrition guidance to both health professionals and consumers. In 1997, in cooperation with nutrition authorities in Canada, they began replacing RDAs (and RNIs in Canada) with the first Dietary Reference Intakes or DRIs.

### *Components of the DRIs*

DRIs cover micronutrients (e.g., vitamins and minerals) essential to human health. Dietary guidance in a different form is also given for **macronutrients** (e.g., **protein**, **carbohydrates**, and **fats**). The DRIs for vitamins and minerals consist of four values that reflect both the lower and upper daily intake limits beyond which adverse health effects may occur. They also include and an average or recommended daily value meets the health needs of most of the population.

DRIs are intended to apply only to people who appear healthy. They are calculated based on the nutritional needs of each age group and gender: infants 0–6 months and 6–12 months; children ages 1–3 years, 4-8 years, and 9–13 years; adolescents 14–18 years, and adults. The adult group is subdivided into women who are pregnant, women who are **breastfeeding**, and sometimes into younger and older adults, depending on the nutrient. The values for each nutrient are measured against a specific reference goal. Examples of these goals include preventing symptoms of a nutrient deficiency disease, maintaining normal growth, maintaining a specific level of the nutrient circulating in the blood, or preventing symptoms associated with nutrient excess.

Four reference values make up the DRI for micronutrients:

- Estimated Average Requirement (EAR). The EAR is the average daily intake of a nutrient that will meet the nutritional needs of half the individuals in the group. In other words, if half the healthy children between ages four and eight received the EAR for iron for their age group, about 50% would show signs of iron deficiency and 50% would not.
- Recommended Dietary Allowance (RDA). The RDA is the amount of a nutrient that meets the needs of 97–98% of all healthy individuals within the group. For example, if all children ages 4–8 years old were receiving the RDA for iron for their age group, only one or two of every hundred children would be iron deficient. The RDA is calculated using the EAR and the amount of variability (standard deviation [SD]) of the need for the nutrient within each group. Mathematically RDA = EAR + (2 x SD of the nutrient).
- Average Intake (AI). Calculating the RDA requires that enough information is available to calculate the EAR. This information is not always available because of practical and ethical limitation on experimenting with humans. When insufficient information is available to calculate the RDA, an estimate of the average daily intake is made. Just like the RDA, the AI expected to meet or exceed the nutritional need of almost everyone in the group. Although both the RDA and the AI are intended to give guidance about how much of a particular nutrient a healthy individual in a specific group should, on average, get daily, the AI is an estimate based on experimental evidence and observation, not a defined calculation like the RDA.

- Tolerable Upper Intake Level (UL). The UL is the highest daily amount that is unlikely to cause adverse (negative) risks to health in almost all of the members of the group. In other words, if all the children ages 4–8 were taking the UL for iron, most of them would remain healthy, but over time one or two per hundred might show signs of iron excess. The higher the amount of nutrient consumed above the UL, the higher the risk of adverse health effects. Some micronutrients such as folic acid, niacin, and magnesium, have ULs that apply only to dietary supplements and not the quantity of the nutrient obtained from food. The inclusion of a UL value for the first time acknowledges that too much of a nutrient can be toxic and harmful to health.

Macronutrients are what most people call food—nutrients that provide calories (energy). These include carbohydrates, fat, fatty acids, cholesterol, protein, and amino acids. **Fiber** is an included nutrient but it does not provide energy. In the body, carbohydrates, proteins, and fats can in some cases be used interchangeably. In addition, it is not possible to link specific quantities of these macronutrients to the prevention or development of chronic diseases such as diabetes and cardiovascular disease. In place of DRIs, the Institute of Medicine has developed Acceptable Macronutrient Distribution Ranges (AMDRs) for energy-yielding nutrients. AMDRs are expressed, not as absolute numbers, but as a percentage of total energy (calorie) intake.

## Controversies about DRIs

The four components of the DRI are intended to provide more guidance than a single number alone would provide. However, they are not without their critics. Some criticism stems from statistical assumptions made in the calculations. Other criticism is based on the fact that different forms of certain nutrients have a different bioavailability. For example, **iron** in meat is more easily absorbed than iron in plant foods, and the **vitamin E** in dietary supplements is more biologically active than vitamin E in food. Although this should not be a source of confusion to healthcare professionals, it can be confusing to the average consumer.

The greatest controversies among experts are over the UL. These center around four areas:

- Very little experimental data is available about the upper limit of certain nutrients in special populations such as children, pregnant women, and elderly individuals.
- Some experts are not comfortable with the way the Institute of Medicine derived UL values. Experts point out that in some cases the UL for one subgroup overlaps the RDA for another subgroup and that in other cases the typical intake of certain groups already exceeds the UL with no apparent harmful effects (e.g., iron in young children). The vitamin C UL appear to be especially controversial.
- No distinction is made between short-term (acute) and long-term (chronic) overdose of nutrients.
- The ULs do not take into consideration genetic diversity of the population and are much less sensitive to the life stage of the individual than RDAs. This is in part because of limited data available for certain age groups.
- Much of the data used to determine the UL is based on short-term (a few days) intake information and therefore has a high degree of unreliability. Human experiments with potentially toxic mega doses of nutrients is generally unethical, making an adequate amount of reliable data in the UL range difficult to obtain.

DRIs and AMRDs continue to be researched and revised as more data becomes available. Despite the controversy, they offer both healthcare professionals and individuals some guidelines about the benefits and dangers of nutrient consumption.

## Precautions

DRIs are intended as guidelines for population groups, not individuals. Although they give values for daily intake of nutrients, these values are intended to apply over time. Except in cases of acute mega doses, the effects of too much or too little of a nutrient develop gradually over time. In any given day, an individual may eat more or less than the DRI of a particular nutrient and still remain healthy.

DRIs are intended to be applied to a healthy population. Individuals under the supervision of a healthcare professional may be advised to take more or less of particular nutrients than the DRIs indicate. In this situation, the advice of the healthcare professional should be followed.

Nutrients interact with each other and with pharmaceuticals and herbal remedies. These interactions are not entirely understood and may affect the absorption, utilization, and excretion of various vitamins and minerals in ways that change the RDA.

Certain population groups, such as vegans, have dietary needs that may be satisfied only with dietary supplements or very carefully controlled diets.

## Parental concerns

Parents should discuss DRIs with a healthcare professional who can translate them into healthy

eating guidelines to provide a healthy diet for their children over time. A diet high in fruits and vegetables and low in fats will meet most DRIs for both children and adults.

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Council for Responsible Nutrition. 1828 L Street, NW, Suite 900, Washington, DC, 20036-5114. Telephone: (202) 776-7929. Fax: (202) 204-7980. Website: <http://www.crnusa.org>.

Food and Nutrition Information Center. National Agricultural Library, 10301 Baltimore Avenue, Room 105, Beltsville, MD 20705. Telephone: (301) 504-5414. Fax: (301) 504-6409. Website: <http://www.nal.usda.gov>.

International Food Information Council. 1100 Connecticut Avenue, NW Suite 430, Washington, DC 20036. Telephone: 202-296-6540. Fax: 202-296-6547. Website: <http://ific.org>.

Linus Pauling Institute. Oregon State University, 571 Weniger Hall, Corvallis, OR 97331-6512. Telephone: (541) 717-5075. Fax: (541) 737-5077. Website: <http://lpi.oregonstate.edu>.


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# Dietary supplements

## Definition

In the United States, dietary supplements are defined by the 1994 Dietary Supplement Health and Education Act as products that are not used exclusively as food, but are intended to be consumed in addition to an individual's diet. The law states that dietary supplements are taken by mouth and contain

**Drug interactions**

| Dietary supplement | Drug |
|---|---|
| Calcium | Heart medicine (e.g., Digoxin) thiazide diuretics (Thiazide, and aluminum- and magnesium-containing antiacids) |
| Magnesium | Thiazide and loop diauretics (e.g., Lasiz®), some cancer drugs (Cisplatin), and magnesium-containing antiacids. |
| Vitamin K | Blood thinners (e.g., Coumadin) |
| St. John's Wort | Selective serotonin reuptake inhibitor (SSRI) drugs (antidepressant drugs and birth control pills) |

SOURCE: Office of Dietary Supplements, National Institutes of Health, U.S. Department of Health and Human Services

*(Illustration by GGS Information Services/Thomson Gale.)*

one or more dietary ingredients. Examples of dietary ingredients include **vitamins**, **minerals**, herbs or other biological material, amino acids, and enzymes. Dietary supplements are sold in the form of tablets, capsules, powders, liquids, extracts, or teas. Products sold as dietary supplements are required to be clearly labeled as such.

## Purpose

Dietary supplements serve a wide range of purposes. Some of these are medically appropriate, while others may do nothing or harm the individual. Reasons for taking dietary supplements include:

- Replacing a necessary substance not found in large enough quantities in the diet
- Preventing or decreasing the risk of developing a disease or condition
- Boosting the immune system and improving general health
- Boosting energy levels
- Improving mental or physical performance
- Stimulating weight loss
- Reducing symptoms of a disease or health condition

## Description

Dietary supplements comprise a variety of products ranging from familiar multivitamins found in every supermarket to exotic botanicals such as the South African herb **hoodia**. Millions of Americans take dietary supplements daily; their use has become increasingly common since the 1990s. The United States Food and Drug Administration (FDA) estimates that in 1999 more than 12 million Americans were taking **ephedra**, a weight-loss supplement that was later banned because it can cause serious side effects. Due to the large number of different supplements and their range of uses, testing and regulation of these products is difficult and often ineffective.

### *Dietary supplements and the law*

The FDA regulates dietary supplements under the 1994 Dietary Supplement Health and Education Act (DSHEA). At the time the act was passed, legislators believed that because many dietary supplements come from natural sources such as plants and have been used for hundreds of years by practitioners of complementary and alternative medicine (CAM), these products did not need to be as rigorously regulated as prescription and over-the-counter drugs used in conventional medicine.

DSHEA regulates supplements in the same way food is regulated. Like food manufacturers, manufacturers of dietary supplements do not have to prove that a supplement is either safe or effective before it can be sold to the public. Manufacturers of conventional pharmaceutical drugs, however, must prove both safety and effectiveness in humans before a new drug is approved for use. With dietary supplements, the burden of proof falls on the FDA to show that the supplement is either unsafe or ineffective before the supplement can be restricted or banned. Information about a supplement's safety and effectiveness is normally gathered only after people using the product develop health problems or complain that the product does not work. Initially, supplement manufacturers were not required to report consumer complaints of complications or side effects to the FDA. However, beginning in 2007, a federal law requires all manufacturers of dietary supplements and over-the-counter drugs to report consumer complaints of adverse events (negative side effects) to the FDA. This makes accumulating information on the safety of these products faster and easier.

Dietary supplements are required to be clearly labeled with the word "supplement." The label must also show the volume or weight of the contents, the serving size, a list of dietary ingredients and non-dietary ingredients (e.g., artificial color, binders, fillers, flavorings), the name of the manufacturer, packer, or distributor, and directions for use. If the supplement is an herb, the label must contain its scientific name.

Unlike conventional drugs, the label for a dietary supplement does not have to provide statements about possible side effects. However, dietary supplements are not legally allowed to claim they can "cure,"

"treat," "mitigate," "prevent," or "diagnose" a specific disease. They may make the following claims:

- Health claims—Statements indicating a relationship between an ingredient in the supplement and the reduction in the risk of developing a disease or condition. (e.g., Increased intake of folic acid by pregnant women helps reduce the risk of neural tube defects in their offspring.)
- Nutrient content claims—Statements describing the amount of supplement in the product and may contain words such as "high in," "good source of," "fortified," "enriched," or "high potency."
- Structure or function claims—Description of how the supplement may affect organs or systems in the body without mentioning a specific disease or condition. (e.g., Calcium builds strong bones.) Labels with structure or function claims must also contain the words "This statement has not been evaluated by the FDA. This product is not intended to diagnose, treat, cure, or prevent any disease."

Manufacturers of supplements are required to follow federal Good Manufacturing Practices (GMPs) that regulate sanitary and other conditions under which these products are prepared, packaged, and stored. These GMPs are much less stringent than those that regulate the manufacture of conventional drugs. They do not, for example, assure that the amount of active ingredient in each pill or capsule of a dietary supplement is the same. Some supplement manufacturers try to assure consistency of their product by making sure each batch contains the same amounts of active ingredients. This type of standardization is not required by law, and the word "standardized" on the label is not an indication that the product meets any legal requirements as to quality or consistency of contents.

### *Dietary supplements in conventional medicine*

Conventional medicine, also called Western or mainstream medicine, is practiced by licensed medical doctors (MD) and doctors of osteopathy (DO), dentists (DDS or DMD), registered nurses (RN), licensed practical nurses (LPN), pharmacists, and similar health care professionals. Some dietary supplements are routinely used as an accepted part of conventional medicine. The most common of these are vitamin and mineral supplements taken in accordance with established **dietary reference intakes** (DRIs). DRIs are a set of values for different nutrients that indicate the daily amount of that nutrient necessary to meet the needs of most individuals, as well as the largest amount of the nutrient that can be consumed daily without harmful effects. Other supplements, such as folic acid, are prescribed for pregnant women in order to decrease the risk of neural tube defects in their offspring. Still other supplements, such as enzymes, may be given when the body fails to produce adequate amounts of the enzyme as the result of a genetic disorder such as cystic fibrosis. When taken under supervision of a conventional health care professional, dietary supplements tend to be extremely safe.

### *Dietary supplements in complementary and alternative medicine*

Most dietary supplements are used within a system of complementary and alternative medicine (CAM). Complementary medicine uses treatments that are not part of conventional medicine to supplement conventional medicine. Alternative medicine uses treatments that are not part of conventional medicine as a complete replacement for conventional medicine. Alternative medicine includes well-established treatment systems such as homeopathy, traditional Chinese medicine, and Ayurvedic, or traditional Indian medicine, as well as newer fad-driven treatments. Many CAM treatments have their roots in tradition and folklore.

Herbs are some of the most common dietary supplements used in CAM. Many have been used for hundreds of years and show evidence of effectiveness. Others are ineffective or may harm the individual either directly or when used as a replacement for conventional drugs and treatments whose effectiveness has been proven. Vitamin and mineral supplements used as part of conventional medicine become part of the CAM system when they are used in mega-doses that far exceed DRI values or when they are used to prevent or treat a specific condition (e.g., **vitamin C** to prevent colds). Likewise, enzymes and amino acids that have specific uses within conventional medicine become part of the CAM system of dietary supplements when they are used in non-conventional ways or in non-standard doses. Some dietary supplements, such as bee pollen, are used exclusively in CAM.

## Precautions

It is difficult to determine whether dietary supplements are safe or effective because of the way they are regulated. Many of the studies done on supplements are poorly designed, have a small sample size, or are sponsored by the manufacturer of the supplement, making the results questionable. Natural Standard is an independent organization that evaluates studies, scientific evidence, and expert opinion on CAM treatments and therapies and makes impartial judgments concerning their safety and effectiveness. The National Center for

Complementary and Alternative Medicine is a government organization within the National Institutes of Health that investigates CAM treatments and runs rigorous clinical trials to determine safety and effectiveness.

Individuals interested in using dietary supplements should consult their health care provider and other reputable sources of information before taking any new supplements. Pregnant or **breastfeeding** women should be especially careful to discuss the supplements they may want to take with their health care provider. Many herbs and other dietary supplements cross the placenta or are secreted into breast milk and may affect the fetus or nursing baby. In addition, care should be taken in giving children dietary supplements. Few studies have been done specifically on children and the recommended dosage for adults may be harmful to children. As with any medication, more is not necessarily better. Overdose is a common cause of adverse side effects in dietary supplements. In the event of side effects, the supplement should be stopped immediately and the side effects reported to a health care professional.

## Interactions

Dietary supplements may interact with both conventional drugs and other herbs or dietary supplements. Individuals should seek information about specific interactions from their health care provider. Many dietary supplements should be stopped several days before surgery to reduce the risk of excess bleeding.

## Complications

There is strong evidence that some dietary supplements can cause serious harm or death. For example, the weight-loss supplement ephedra was found to have contributed to the death of the Baltimore Oriole's pitching prospect Steve Belcher in 2003. The FDA later banned ephedra-containing supplements. According to the American Association of Poison Control Centers, there have been over 62,000 reports of vitamin poisonings, over 23,000 cases linked to minerals, and over 23,000 reports linked to herbs. Twenty-seven deaths were attributed to dietary supplements in 2005, of which 13 were attributed to herbs. It should be remembered that "natural" does not mean safe; for example, many wild mushrooms are completely natural and cause death when eaten.

Complications may arise from dietary supplements themselves or their misuse or poor regulation of the manufacturing process. This is especially true of those supplements imported into the United States from developing countries. Independent laboratory analyses of dietary supplements have found:

- Contamination with pesticides
- Contamination with heavy metals
- Presence of ingredients not listed on the label
- Amount of dietary ingredient not the same as the amount listed on the label

Some health professionals believe the number of complications related to dietary supplements is severely under-reported. This should improve with

### KEY TERMS

**Alternative medicine**—A system of healing that rejects conventional, pharmaceutical-based medicine and replaces it with the use of dietary supplements and therapies such as herbs, vitamins, minerals, massage, and cleansing diets. Alternative medicine includes well-established treatment systems such as homeopathy, Traditional Chinese medicine, and Ayurvedic medicine.

**Amino acid**—Molecules that are the basic building blocks of proteins.

**Botanical**—An herb; a dietary supplement derived from a plant.

**Complementary medicine**—Includes many of the same treatments used in alternative medicine, but uses them to supplement conventional drug and therapy treatments, rather than to replace conventional medicine.

**Conventional medicine**—Mainstream or Western pharmaceutical-based medicine practiced by medical doctors, doctors of osteopathy, and other licensed health care professionals.

**Enzyme**—Proteins that change the rate of a chemical reaction within the body without themselves being used up in the reaction

**Herb**—A plant used in cooking or for medical purposes. Examples include Echinacea and ginseng.

**Mineral**—An inorganic substance found in the earth that is necessary in small quantities for the body to maintain a health. Examples include zinc, copper, and iron.

**Vitamin**—A nutrient that the body needs in small amounts to remain healthy but that the body cannot adequately manufacture for itself and must acquire through diet.

the 2007 requirement that dietary supplement manufacturers report adverse side effects to the FDA.

### Parental concerns

Parents should be aware that the RDA and UL for vitamins and minerals are much lower for children than for adults. Accidental overdose may occur if children are give adult vitamins or dietary supplements.

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Alternative Medicine Foundation. P.O. Box 60016, Potomac, MD 20859. Telephone: (301) 340-1960. Fax: (301) 340-1936. Website: <http://www.amfoundation.org>.

National Center for Complementary and Alternative Medicine Clearinghouse. P.O. Box 7923, Gathersburg, MD 20898. Telephone: (888) 644-6226. TTY: (866) 464-3615. Fax: (866) 464-3616. Website: <http://nccam.nih.gov>.

Natural Standard. 245 First Street, 18th Floor, Cambridge, MA 02142. Telephone: (617) 444-8629. Fax: (617) 444-8642. Website: <http://www.naturalstandards>.

Office of Dietary Supplements, National Institutes of Health. 6100 Executive Blvd., Room 3B01, MSC 7517, Bethesda, MD 20892-7517 Telephone: (301) 435-2920. Fax: (301) 480-1845. Website: <http://dietary-supplements.info.nih.gov>.


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# Dietwatch

### Definition

Dietwatch is an online weight loss program that focuses on helping dieters lose weight at a moderate, healthy pace through healthy eating, regular exercise, and motivational support.

### Origins

Dietwatch was launched in 1999. It is an online only program, and can be found at <http://www.dietwatch.com>. In December 2000, Dietwatch acquired cyberdiet.com, which greatly expanded its operations. Since its launch, more than a million people have visited the Web site. Dietwatch has won a number of awards for excellence in Internet content, including a Best of the Web Award from Forbes Magazine. It is operated by DietWatch.com, Inc., which is headquartered in East Rockaway, New York.

The nutritional aspects of Dietwatch are headed by Jennifer May, the Manager of Nutritional Services. She is a registered dietician who holds both a Masters degree in Nutrition Science and a Masters degree in Exercise Physiology, both from Indiana University. The Mastering Eating program was developed by Dr. Roger Gould. Dr. Gould has published a variety of scholarly articles and was the head of the University of California, Los Angeles outpatient and community psychiatry department.

## KEY TERMS

**Dietary supplement**—a product, such as a vitamin, mineral, herb, amino acid, or enzyme, that is intended to be consumed in addition to an individual's diet with the expectation that it will improve health

**Mineral**—An inorganic substance found in the earth that is necessary in small quantities for the body to maintain a health. Examples: zinc, copper, iron.

**Vitamin**—A nutrient that the body needs in small amounts to remain healthy but that the body cannot manufacture for itself and must acquire through diet.

## Description

Dietwatch is an online program designed to support and guide dieters to healthy, maintainable weight loss. It provides advice from fitness and nutrition experts, meal plans, and tips and motivation, as well as an online community where dieters can help each other through dieting's rough patches.

There are four options for meal plans provided by Dietwatch. It offers a "no restrictions" plan that is simply a reduced calorie, well balanced diet. Dietwatch says that this is the plan for dieters who do not have any specific concerns or preferences, as it includes a variety of types and styles of food. Another available plan is the "reduced carbs plan," which limits **carbohydrates** to 40% of a dieters total caloric intake each day. This is not a low carbohydrate plan but a limited carbohydrate plan. Unlike popular low carb diets such as Atkins, it does not restrict carbohydrates to just a few grams each day.

Another diet option is the "heart healthy-Mediterranean plan," which limits saturated and *trans* **fats** while including a high level of unsaturated fats. The style of the food and diet is Mediterranean and combines many flavors and food groups. The last meal plan alternative is the "vegetarian plan," which is a plan specially designed to meet the **protein** and other needs of vegetarians who are on a diet. The plan does include eggs and milk products, but no chicken, fish, or meat.

Customers can personalize the meal plans offered by Dietwatch by switching meals or ingredients to meet individual preferences. The program also offers shopping lists that are customized to the dieter's meal plan. This makes the meal plan easier to fit into a busy schedule.

In addition to meal plans, Dietwatch offers exercise and fitness plans and advice that the dieter can use to help customize a fitness plan to meet individual needs. There are a variety or strength training, aerobic, relaxation, and other suggested workouts available.

Motivation and emotional health are important aspects of Dietwatch. There are motivational tips from nutritionists and other experts, as well as discussion boards where dieters share frustrations, achievements, and tips. Dieters can search based on age, sex, weight, or other characteristics to find dieters to partner with for more one-on-one motivation and help.

Behavior understanding and modification is an important aspect of the Dietwatch program. Dr. Roger Gould developed a program called Mastering Food that is available to Dietwatch members. It is a 12-week program designed to help dieters overcome negative eating habits. Its goal is to help dieters discover why they eat when they are not hungry and help them find ways to deal with the problems underlying their eating behaviors. Overcoming emotional eating problems can help dieters be more successful in sticking to their diets and allow for more productive, successful weight loss.

Dietwatch also offers a variety of tools that can be used at the dieter's discretion. A food journal lets dieters track everything that they eat each day. The tracker can tally calories, fat grams, and other information to help dieters ensure that they are getting all the nutrients they need. Also available is a tool for tracking a dieter's daily calorie balance. This tool combines information about activity level and exercise with information about food eaten during the day to come up with the total calorie balance. This way dieters can check to see that they are burning more calories than they are taking in and if they are on track for their desired weight loss.

There is a wealth of information available on Dietwatch for dieters who are interested in learning more about health and nutrition. There is information about different nutrients and how they work in the body and explanations about why certain nutrients are required for good health. Also available is nutritional information for many foods, including information about a number of different restaurants. There is also general information about good eating and maintain a healthy approach to food.

## Function

Dietwatch is intended to help dieters make long-term comprehensive lifestyle changes that will help them lose weight and keep it off. To do this, it helps dieters with healthy eating and moderate exercise, as

well as stress reduction and other techniques aimed at better emotional health. The newest program, the Mastering Eating program, is intended to help dieters identify and change negative eating habits for better control over food in their lives. Dietwatch is also intended to help dieters become more fit and to attain overall better health.

### Benefits

There are many benefits to losing weight if it is done at a moderate pace through healthy eating and increased exercise. **Obesity** is a risk factor for many diseases and conditions including type 2 diabetes, cardiovascular disease, and **hypertension**. People who are the most obese are generally at the greatest risk and are likely to have more severe symptoms if these diseases develop. Losing weight can reduce the risk of these and other obesity-related diseases, and in some cases it can help reduce the severity of symptoms if the diseases have already occurred.

The Dietwatch program is designed to provide dieters with support for all the phases and processes of weight loss. Many dieters may find having all this support and information available in one place to be very helpful. The nutritional information may help dieters make more informed eating decisions, especially when eating out. The inclusion of a vegetarian meal planning option makes this diet available for vegetarian dieters who may be underserved by other diets offering meal plans.

One of the main aspects of the Dietwatch program is motivation. This comes in many forms including helpful and motivational tips from nutritionists and other dieters. Many dieters may find that the opportunity to find a dieting buddy that shares their same goals and challenges provides support that is more personal and effective than is usually available in commercial diet programs. Many dieters may also appreciate the opportunity to ask dieticians and other health professionals specific questions instead of relying on general information.

### Precautions

Anyone thinking of beginning a new diet should consult a doctor or other medical professional. Individuals have different requirements for calories, **vitamins**, **minerals**, and other nutrients. Talking to a doctor can help dieters insure that a new diet is the right diet to meet all their personal needs and that weight loss can be achieved without sacrificing good health. Pregnant and **breastfeeding** women should be especially cautious when beginning a new diet because what a mother eats can have a significant impact on a baby.

#### QUESTIONS TO ASK THE DOCTOR

- Is this diet the best diet to meet my goals?
- Would a multivitamin or other dietary supplement be appropriate for me if I were to begin this diet?
- Do I have any special nutritional needs that this diet might not meet?
- At what level of intensity is it appropriate for me to begin exercising?
- Does diet or exercise pose any special risk for me that I should be aware of?
- Is this diet appropriate for my entire family?
- Is it safe for me to follow this diet over a long period of time?
- Are there any sign or symptoms that might indicate a problem while on this diet?

### Risks

There are some risks to any diet. Eating a limited diet can make it difficult for a dieter to get all of the vitamins and minerals required for good health. Generally, when following a good diet that contains many different fruits and vegetables this risk is not too significant, but dieters may want to consult a doctor about taking a multivitamin or dietary supplement to help reduce the risk of deficiency.

When beginning a new exercise routine, it is important that dieters begin with light or moderate exercise and slowly increase the intensity of the activity over weeks or months. Suddenly beginning a strenuous exercise routine can have many risks, especially if the dieter has been inactive for many years. Less serious risks include the risk of straining or spraining a muscle, but more serious risks can even include heart attack if the exercise is very strenuous and is begun suddenly. Risk of injury during exercise can be reduced if proper warm up and cool down procedures are followed, including stretching all appropriate muscle groups. Dieters should consult a doctor before beginning any new exercise routine, especially if it is possible that they have heart disease or other cardiovascular problems that might put them at high risk for serious injury.

## Research and general acceptance

The diets and activities recommended by Dietwatch generally meet the standards for moderate weight loss of 1–2 pounds a week. This weight loss can be achieved through moderately reduced calorie meal plans and regular exercise. This is the approach that most experts recommend to successfully achieve permanent weight loss and better health.

The United States Department of Agriculture makes recommendations about the number of servings from each food group required daily for good health. These recommendations are in its MyPyramid food guide, available online at <http://www.MyPyramid.gov> Any diet that follows these basic guidelines for good health is generally considered a safe and healthy diet for most people. Diewatch's personalized daily food log can help dieters determine how many calories, grams of fat, carbohydrates, and amounts of other nutrients are eaten each day. This can help dieters ensure that they are following guidelines for a healthy diet.

In 2007, the Centers for Disease Control recommended that healthy adults get 30 minutes or more of light to moderate exercise each day for good health. Although Dietwatch does not make specific exercise plans for each individual, most of their recommendations meet or exceed this minimum recommendation. Studies have shown that exercise and diet are more effective at producing weight loss when done together than either diet or exercise done alone. Dietwatch encourages dieters not only to combine diet and exercise, but also to alter problem eating behaviors, which many experts believe is important for long-term weight loss.

### Resources

#### BOOKS

Shannon, Joyce Brennfleck ed. *Diet and Nutrition Sourcebook*. Detroit, MI: Omnigraphics, 2006.

Willis, Alicia P. ed. *Diet Therapy Research Trends*. New York: Nova Science, 2007.

#### ORGANIZATIONS

American Dietetic Association. 120 South Riverside Plaza, Suite 2000, Chicago, Illinois 60606-6995. Telephone: (800) 877-1600. Website: <http://www.eatright.org>

#### OTHER

"DietWatch." 1997. <http:// www.dietwatch.com> accessed April 10, 2007.

DietWatch.com. "Skinny on Diets" 2007. <http://www.skinnyondiets.com/DietWatch.html?find=dietwatch> accessed April 10, 2007.

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# Digestive diseases

## Definition

Digestive diseases, also called gastrointestinal diseases, are the diseases that affect the digestive system, which consists of the organs and pathways and processes responsible for processing food in the body.

## Description

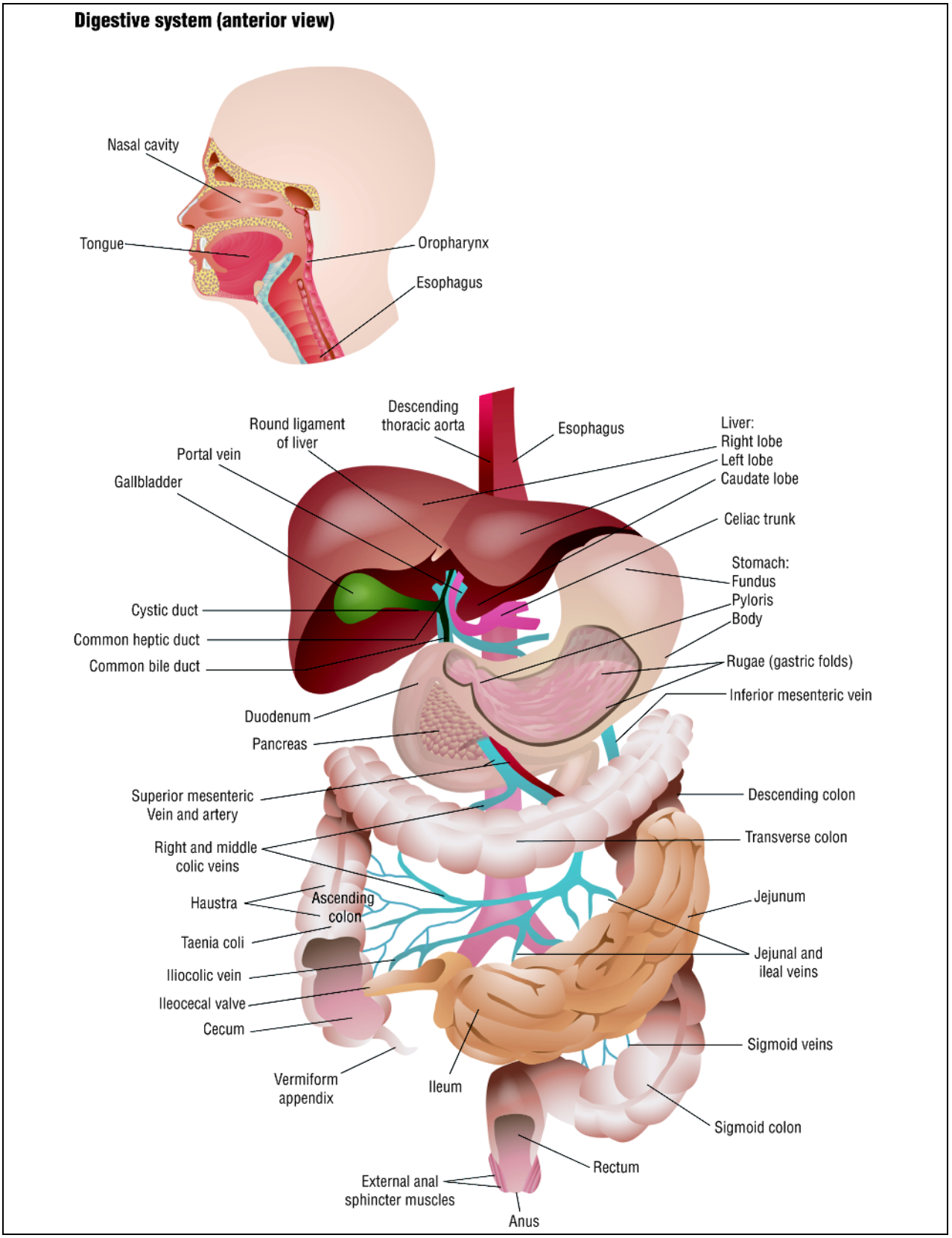
The digestive system, or digestive tract, includes the mouth, the esophagus, the stomach, the gallbladder, the small intestine, the large intestine, and the anus, all linked as a long twisting tube that starts at the mouth and ends at the anus. It also includes the liver and the pancreas, two organs that produce substances needed for digestion such as enzymes, reaching the intestine through small tubes. The function of the digestive system is to transform ingested food for use by the cells that make up the body. Food enters through the mouth and proceeds to the gut (digestive tract) where it is chemically modified (digestion) for absorption by the body or waste disposal. Digestive diseases are numerous and can affect any part of the digestive system. They can be grouped into the following five broad categories.

### *Diseases of the esophagus and stomach*

- Gastroesophageal reflux disease (GORD). GORD is the result of a malfunctioning lower esophageal sphincter (LES), the ring of muscle at the end of the esophagus that acts like a valve opening into the stomach. GORD prevents its proper closure and stomach contents return (reflux) to the esophagus, causing a burning sensation in the chest or throat (heartburn).
- Gastroparesis. Also called delayed gastric emptying, gastroparesis causes slow digestion and emptying, vomiting, nausea, and bloating.
- Peptic ulcer. A sore in the mucosal lining of the esophagus (esophageal ulcer) or stomach (gastric ulcer).

### *Diseases of the liver, pancreas, and gallbladder*

- Budd-Chiari syndrome. A rare liver disease in which the veins that drain blood from the liver are blocked or narrowed.
- Cholecystitis. Infection of the gallbladder.
- Cirrhosis. A life-threatening disease that scars liver tissue and damages its cells. It severely affects liver




**The parts of the human gastrointestinal tract.** *(Illustration by GGS Information Services/Thomson Gale.)*

function, preventing it from removing toxins like alcohol and drugs from the blood.

- Hepatitis. Inflammation of the liver that can result in permanent liver damage.
- Non-alcoholic fatty liver disease (NAFLD). Fatty inflammation of the liver related to insulin resistance, obesity, type II diabetes and high blood pressure.
- Pancreatitis. Irritation of the pancreas that can alter its structure and its function.
- Primary biliary cirrhosis (PBC). A liver disease that slowly destroys the bile ducts in the liver, thus preventing the release of bile.
- Primary sclerosing cholangitis (PSC). Irritation, scarring, and narrowing of the liver bile ducts. The accumulation of bile in the liver damages liver cells.

#### *Diseases of the small and large intestines*

- Appendicitis. Inflammation of the appendix, the small, finger-like structure attached to the first part of the large intestine.
- Celiac disease. Disease that damages the small intestine in people who cannot tolerate gluten, a protein found in wheat, rye, and barley.
- Crohn's disease. Inflammatory disease that usually occurs in the last section of the small intestine (ileum), causing swelling in the intestines. It can also occur in the large intestine.
- Diverticulosis. Small pouches (diverticula) that push outward through weak spots in the large intestine.
- Diverticulitis. Infection or rupture of the diverticula.
- Duodenal ulcers. Ulcers associated with alcoholism, chronic lung and kidney disease, and thyroid disorders.
- Dysentery. Inflammation of the intestine with severe diarrhea and intestinal bleeding, resulting from eating food or water containing a parasite called *Entamoeba histolytica* or *Shigella* bacteria.
- Giardiasis. Infection of the intestine by the parasite *Giardia intestinalis*. The parasite is one of the most common causes of waterborne disease in the United States and can be found in both drinking and recreational water.
- Infectious diarrhea. Illness resulting from bacterial or viral infections. Bacterial diarrhea is most commonly caused by *Campylobacter jejuni*, *Salmonella*, *Shigella*, *Escherichia coli* O157:H7. Rotavirus is the commonest cause of viral diarrhea in the United States. Other viruses causing diarrhea include Norwalk virus, and cytomegalovirus.
- Irritable bowel syndrome (IBS). IBS (also called spastic colon, or irritable colon) is a condition in which the colon muscle contracts more readily than it should.
- Lactose intolerance. The inability to digest significant amounts of lactose, the major sugar found in milk, due to a shortage of lactase, the enzyme produced by the cells lining the small intestine. Lactase breaks down milk sugar into two simpler forms of sugar which are then absorbed into the bloodstream. If not present, lactose is not broken down.
- Ulcerative colitis. Inflammation of the inner lining of the colon, characterized by open sores that appear in its mucous membrane.

#### *Diseases of the anus*

- Hemorrhoids. Commonly known as piles, hemorrhoids are characterized by swollen blood vessels that line the anal opening.
- Anal fissures. Splits or cracks in the lining of the anus resulting from the passage of very hard or watery stools.
- Perianal abscesses. These can occur when the tiny anal glands that open on the inside of the anus become blocked and infected by bacteria. When pus develops, an abscess forms.

## Demographics

According to the National Center for Health Statistics, 41.3 million Americans consulted physicians for digestive system disorders in 2005 and 6.9 million were diagnosed with **ulcers**. In the 1990-1992 period, 1.9 million people were disabled by digestive diseases with 234,000 deaths and over 6 million diagnostic and therapeutic procedures recorded in 2002.

In the United States, 100 million people are affected by acute diarrhea every year. Most diarrhea is believed to be viral and not bacterial in origin, but bacteria remain an important cause, as evidenced by the increasing public health warnings concerning contaminated foods. Nearly half of patients with acute diarrhea must restrict activities, 10% consult physicians, 250,000 require hospitalization, and approximately 3000 die.

## Causes and symptoms

#### *Causes*

The causes of some digestive diseases are well-known, especially for those resulting from viral (hepatitis, CMV), bacterial (diarrhea) or parasitic (gardiasis) infections, because the microorganisms can be clearly identified. Most peptic ulcers are also caused by a type of bacteria called *Helicobacter pylori* that weakens the protective mucous lining of the gut. As for the non-infectious

## KEY TERMS

**Abdominal cavity**—The hollow part of the body that extends from the chest to the groin.

**Anus**—The terminal opening of the digestive tract.

**Ascites**—Abnormal accumulation of fluid in the abdominal cavity.

**Bacteria**—Microscopic, single-celled organisms found in air, water, soil, and food. Only a few actually cause disease in humans.

**Bile**—Fluid made by the liver and stored in the gallbladder. Bile helps break down fats and gets rid of wastes in the body.

**Bile ducts**—Tubes that carry bile from the liver to the gallbladder for storage and to the small intestine for use in digestion.

**Cecum**—The pouch-like start of the large intestine that links it to the small intestine.

**Colon**—Part of the large intestine, located in the abdominal cavity.

**Colon polyps**—Extra tissue that grows in the colon.

**Diverticula**—Small pouches in the muscular wall of the large intestine.

**Duodenum**—The first section of the small intestine, extending from the stomach to the jejunum, the next section of the small intestine.

**Esophagus**—Muscular tube through which food passes from the pharynx to the stomach.

**Feces**—Waste product of digestion formed in the large intestine. About 75% of its mass is water, the remainder is protein, fat, undigested roughage, dried digestive juices, dead cells, and bacteria.

**Ileum**—The last section of the small intestine located between the jejunum and the large intestine.

**Insulin**—Hormone secreted by the pancreas that regulates carbohydrate metabolism in the body. It regulates the liver's ability to store or release glucose.

**Insulin resistance**—Condition in which normal amounts of insulin are inadequate.

**Jejunum**—The section of the small intestine located between the duodenum and the ileum.

**Large intestine**—The terminal part of the digestive system, site of water recycling, nutrient absorption, and waste processing located in the abdominal cavity. It consists of the caecum, the colon, and the rectum.

**Lower esophageal sphincter (LES)**—Ring of muscle at the bottom of the esophagus that acts like a valve between the esophagus and stomach.

**Mucosa**—Lining of the digestive tract. In the mouth, stomach, and small intestine, the mucosa contains glands that produce juices to digest food.

**Pancreas**—The pancreas is a flat, glandular organ lying below the stomach. It secretes the hormones insulin and glucagon that control blood sugar levels and also secretes pancreatic enzymes in the small intestine for the breakdown of fats and proteins.

**Pharynx**—Part of the neck and throat that connects the mouth to the esophagus.

**Rectum**—Short, muscular tube that forms the lowest portion of the large intestine and connects it to the anus.

**Small intestine**—The part of the digestive tract located between the stomach and the large intestine. It consists of the duodenum, the jejunum, and the ileum.

**Villi intestinales**—Microscopic hair-like structures covered with epithelial cells measuring 1–1.5 mm that line the mucous inner membrane of the small intestine.

diseases, medical researchers have only recently started to understand their numerous causes. For example, stomach ulcers can also result from the use of anti-inflammatory medications such as aspirin, ibuprofen, or naproxen. Similarly, it is also known that 80% of **gallstones** consist of hardened cholesterol and form when bile contains too much cholesterol, too much bilirubin, or not enough bile salts. It is also known that chronic alcoholism and hepatitis C are the most common causes of cirrhosis of the liver. As for diverticulitis, strong evidence suggests that it result mainly from a low-fiber diet. Gastroparesis is most often caused by diabetes, smooth muscle disorders and nervous system diseases while pancreatitis most often results from gallstones or alcohol abuse. Lactose intolerance is directly linked to a shortage of the enzyme lactase.

The causes of several digestive diseases however, are still unknown. In the case of colitis and **Crohn's disease**, the prevailing theories suggest that they are due to an immune system response to a virus or a

bacterium and causing ongoing inflammation in the intestinal wall. As for IBS, researchers suggest that affected people seem to have a colon that is more sensitive than normal to a variety of foods and stress while other evidence points to a malfunctioning immune system.

Increasingly however, researchers and physicians are realizing that one of the most common causes of digestive diseases is that people do not have healthy eating habits, and are also not aware of the many sources of food contamination. Besides bacterial or parasite infections, it is now understood that the digestive system can also be damaged by poor diets, prescription drugs, and food additives, especially antibiotics.

### *Symptoms*

Since there are many types of digestive diseases, symptoms can accordingly vary widely, depending on the organ that is affected. Telltale signs are blood in the stool, changes in bowel habits, and weight loss. Additionally, physicians look for symptoms that may include one or more of the following:

- Acute abdominal pain. A sharp pain in the lower right abdomen is one of the symptoms of colitis or Crohn's disease. A stomach that is very tender to the touch is indicative of diverticulitis or pancreatitis or an ulcer. Acute pain is also a symptom of gallstones.
- Ongoing abdominal pain. Depending on where the pain occurs, it will point to a specific digestive disease. For instance, if the pain goes away after taking antiacid medication, it points to a peptic ulcer. If it starts in the upper middle or upper right abdomen, and occurs after eating greasy or fatty foods, it is indicative of gallstones or infection of the gallbladder. If it occurs after eating milk products, it suggests lactose intolerance. Celiac disease is also accompanied by recurring abdominal pain.
- Bloating. Abdominal bloating is a symptom of lactose intolerance, Celia disease, IBS, and diverticulosis.
- Changes in bowel movements. Yellow and greasy stools that float are indicative of impaired pancreas function or celiac disease. Excess gas and loose, foul-smelling stools are a symptom of gardiasis or various bowel infections. Alternating loose and hard bowel movements are indicative of IBS.
- Bloody stools. Blood in the stools is one of the symptoms of Crohn's disease, colitis, dysentery and hemorrhoids.
- Dark urine. Dark urine, accompanied by a yellowing of the skin or the eyes is indicative of hepatitis.
- Diarrhea. Watery bowel movements that occur many times throughout the day. If not bacterial or viral, diarrhea can be indicative of celiac disease, Crohn's disease, gardiasis, or colitis.
- Fever. Fever accompanies several digestive diseases, in particular infectious diarrhea, dysentery, appendicitis, and colitis.

## Diagnosis

Diagnosis can be very difficult to establish because many digestive diseases share similar symptoms. For instance, **celiac disease** is commonly misdiagnosed as IBS, Crohn's disease, or diverticulitis. This is why physicians believe that the key to an accurate diagnosis is careful and detailed history-taking during patient medical interviews. Physicians accordingly combine the patient's gastrointestinal history to tests that can involve any of the following procedures:

- Barium enema. This test, also called a "lower gastrointestinal (GI) series", uses x rays to detect abnormal growths, ulcers, polyps, and small pouches (diverticula) in the large intestine and rectum. An enema tube is inserted into the patient's rectum and a barium solution is allowed to flow in to improve the contrast of the x rays.
- CAT Scan. Technique that uses a computerized x-ray scanner to take multiple views of a patient's abdominal organs. The information is analyzed by a computer that produces cross-sectional images of the organ of interest. CT is used for viewing the more solid digestive organs such as the liver and pancreas.
- Colonoscopy. Test that allows the physician to look inside the colon using a colonoscope, a long, flexible tube that has a miniaturized color-TV camera at one end. It is inserted through the rectum into the colon, and provides a view of the lining of the lower digestive tract on a television monitor. The test is used to evaluate intestinal inflammation, ulceration, bleeding, diverticulitis, and colitis.
- Endoscopic retrograde cholangiopancreatography (ERCP). ERCP is a technique used to diagnose problems in the liver, gallbladder, bile ducts, and pancreas. It uses both x rays and an endoscope, which is a long, flexible, lighted tube, inserted through the patient's esophagus, stomach, and duodenum. Using the endoscope, the examining physician can see the inside of the digestive tract, and inject contrast dyes into the bile ducts and pancreas so that they can be seen with x rays.
- Endoscopic ultrasound (EUS). Technique that uses sound waves to create a picture of the inside of the body. It uses a special endoscope that has an ultrasound device at the tip. It is placed in the gastrointestinal tract, close to the area of interest.

- Esophagogastroduodenoscopy (EGD). EGD is a technique used to look inside the esophagus, stomach, and duodenum. It uses an endoscope to investigate swallowing difficulties, nausea, vomiting, reflux, bleeding, indigestion, abdominal pain, or chest pain.
- Flexible sigmoidoscopy. Technique that allows to look at the inside of the large intestine from the rectum through the last part of the colon, called the sigmoid colon. It is used to investigate diarrhea, abdominal pain, or constipation.
- Stool tests. Collection of stool to identify microorganisms that may be infecting the intestine. Stools are examined under a microscope or analyzed for the substances they contain. For example, normal stool contains almost no fat. But, in certain types of digestive diseases, fat is not completely absorbed and remains in the stool.
- Swallowing test. In this procedure, the patient is asked to drink a solution of barium before the X-ray examination of the upper digestive tract (esophagus, stomach, and small intestine).

## Treatment

The treatment of digestive diseases varies depending on the condition being treated. Almost all treatment seeks the relief of symptoms and combine changes in eating habits with medications specific to the disease. In serious cases, surgical procedures are used, which can involve the complete removal of the affected organ.

- Gastroesophageal reflux disease GORD. Treatment may involve lifestyle changes, such as avoiding alcohol, loosing weight and eating smaller meals. Antacid medication, such as Alka-Seltzer, Maalox, Mylanta, Pepto-Bismol, Rolaids, and Riopan, can also relieve heartburn. Other drugs, such as foaming agents (Gaviscon), work by covering the stomach contents with foam to prevent reflux. H2 blockers, such as cimetidine (Tagamet HB), famotidine (Pepcid AC), nizatidine (Axid AR), and ranitidine (Zantac 75), can also reduce acid production. Proton pump inhibitors such as omeprazole (Prilosec), lansoprazole (Prevacid), pantoprazole (Protonix), rabeprazole (Aciphex), and esomeprazole (Nexium) are now considered more efficient. Surgery is an option when medications do not work. A standard surgical treatment is fundoplication which wraps the upper part of the stomach around the LES to strengthen it and prevent acid reflux.
- Gastroparesis. When related to diabetes, treatment seeks to control the blood sugar levels with insulin and oral medications, such as metoclopramide (Reglan) to stimulate stomach muscle contractions which helps empty food. In severe cases, intravenous feeding may be required to bypass the stomach entirely. This is achieved by inserting a jejunostomy tube through the skin of the abdomen into the small intestine. The procedure allows nutrients and medication to be delivered directly into the small intestine.
- Peptic ulcer. Ulcers caused by *Helicobacter pylori* are treated with drugs to kill the bacteria, reduce stomach acid, and protect the stomach lining. Antibiotics are usually prescribed. The acid-suppressing drugs commonly used are H2 blockers and proton pump inhibitors. Medications such as bismuth subsalicylate are also used as protectors in the case of stomach ulcers. Surgery may also be required, such as a vagotomy, a procedure that cuts parts of the vagus nerve that transmits messages from the brain to the stomach. This interrupts messages to produce acid, hence reducing acid secretion.
- Budd-Chiari syndrome. Treatment usually involves sodium restriction, diuretics to control the accumulation of fluid in the abdominal cavity (ascites), and prescription of anticoagulants such as heparin and warfarin. Surgical shunts that divert blood flow around the obstruction or the liver may be required. In very serious cases, liver transplantation is the only effective treatment.
- Cholecystitis. If acute, treatment may require hospitalization to reduce stimulation to the gallbladder. Antibiotics are usually prescribed to fight the infection as well as acid-suppressing medications. In some cases, the gallbladder may be surgically removed (cholecystectomy).
- Cirrhosis. Treatment depends on the cause of the cirrhosis and on the complications that may be present. Alcoholic cirrhosis is first treated by completely abstaining from alcohol. Hepatitis-related cirrhosis is treated with medications specific to the different types of hepatitis, such as interferon for viral hepatitis and corticosteroids for autoimmune hepatitis. Treatment also includes medications to help remove fluid from the body. When complications cannot be controlled or when the liver becomes so damaged that it can no longer function, a liver transplant is required.
- Hepatitis. Hepatitis A is treated by bed rest and medications to relieve symptoms such as fever, nausea and diarrhea if any. Hepatitis B is treated with a course of interferon injections, usually for some months. Additionally, drugs such as lamivudine and dipivoxil are prescribed for a period of one year. Over time, hepatitis B may cause the liver to stop functioning and require a liver transplant. As for hepatitis C, it is treated with peginterferon,

usually in combination with ribavirin. Hepatitis C may also require a liver transplant.

- Non-alcoholic fatty liver disease NAFLD. No single truly effective treatment has yet been found. If obese or overweight, patients are encouraged to loose weight and to follow a balanced diet. Increasing physical activity and avoiding alcohol is also recommended.
- Pancreatitis. If no complications occur, pancreatitis usually improves on its own. Treatment seeks to support body functions and prevent complications with hospitalization usually required to replace body fluids intravenously.
- Primary biliary cirrhosis. No treatment has been shown to be beneficial in slowing the progression of PBC. Patients are usually prescribed vitamins and calcium to help prevent loss of bone (osteoporosis), a common complication.
- Primary sclerosing cholangitis. There is no cure for PSC, but effective treatment is available for symptoms, such as the itching resulting from too much bile in the bloodstream, which can be controlled with drugs such as Questran or Actigall. Swelling of the abdomen and feet, due to fluid retention, can be treated with diuretics. In some cases, surgical procedures may be used to open major blockages in bile ducts. In the most severe cases, a liver transplant is performed.
- Infectious diarrhea. In healthy people, usual practice is to let the illness take its course, which can last from a few days to a week. Drinking plenty of liquids is required and medications such as Pedialyte, Ceralyte, and Infalyte can be provided to replace electrolyte losses. Treatment with antibiotics is increasingly complicated by the bacteria having developed drug resistance.
- Celiac disease. The only treatment for celiac disease is a gluten-free diet.
- Crohn's disease. There is no cure available, and the goal of treatment is to control inflammation in the intestine and reduce the symptoms of pain, diarrhea, and bleeding. Medications prescribed to reduce inflammation include Azulfidine (sulfasalazine), mesalamine or 5-ASA agents such as Rowasa, Pentasa or Asacol. Serious cases usually require more powerful drugs such as prednisone, antibiotics, or drugs that weaken the body's immune system such as Imuran (azothioprine), Purinethol (6-mercaptopurine, 6-MP), Methotrexate or Remicade (Infliximab).
- Lactose intolerance. Removing milk products from the diet is the standard treatment. Lactase enzymes can also be added to milk or taken in capsule or chewable tablet form.
- Appendicitis. Surgery is performed to remove the appendix with prescription of pain medication.
- Ulcerative colitis. Treatment seeks to control acute attacks, prevent new attacks, and promote healing of the colon. Corticosteroids are usually prescribed to reduce inflammation. Medications prescribed to decrease the frequency of attacks include mesalamine, azathioprine and 6-mercaptopurine. In severe cases, the colon may be removed surgically.
- Diverticulosis. Besides a fiber-rich diet, treatment depends on symptoms. When diverticulitis occurs, simple bowel rest and antibiotics are prescribed. In severe cases, patients may require intravenous antibiotics or surgery to remove the affected portion of the colon.
- Dysentery. Rest and drinking plenty of fluids is the usual treatment. Hospitalization may be required for intravenous therapy.
- Giardiasis. Anti-infective medications such as metronidazole (Flagyl, Protostat) or quinacrine may be used. In pregnant women, treatment is not started until after delivery, because the drugs can be harmful to the fetus.
- Irritable bowel syndrome. IBS has no cure and treatment is based on diet changes, medication and stress relief therapy.
- Hemorrhoids. Corticosteroid creams and lidocaine ointments are used to reduce itching, pain and swelling. For severe cases, surgical removal of the hemorrhoids may be performed (hemorrhoidectomy).
- Anal fissures. Treatment may include the application of a hydrocortisone cream to the anal area to help relieve irritation, oral pain-killers such as acetaminophen, a stool softener such as Colace or Surfak to prevent constipation until the fissure heals, soaking the anal area in a warm chamomile infusion for 20 minutes to prevent infection and provide soothing relief, and avoidance of strenuous effort to pass stool. If a fissure does not respond to conservative treatment, surgery may be required, involving an operation that removes the area of the fissure and any underlying scar tissue.
- Perianal abscesses. Treatment involves surgical drainage of the abscess as antibiotics are ineffective. A small incision is made over the area and pus is expelled with manual pressure. The wound is packed with iodophor gauze, removed after 24 hours, and the patient is instructed to take Sitz baths 3–4 times a day for some two weeks.

## Nutrition/Dietetic concerns

Some digestive diseases require special diets while others only require patients to follow the rules of basic

good nutrition, avoiding only those foods that cause problems. The vitamin **dietary supplements** recommended for all adults can also benefit patients. However the medical profession advises against taking megadoses of **vitamins**, special herbal extracts, and other unproven therapies. Digestive diseases with special dietary requirements include:

- Gastroesophageal reflux disease. Diets recommended for GORD are usually low-fat and include the basic food groups of cereals, vegetables, fruits, dairy products, and meats. A vitamin C supplement may be needed if the patient does not tolerate lemons, oranges, tomatoes, and grapefruits.
- Gastroparesis. Patients are asked to avoid foods that are high in fat and normally delay the emptying of the stomach. High fiber foods such as broccoli and cabbage also tend to stay in the stomach and are also restricted when symptoms are severe. Liquids always leave the stomach faster than solid food, so liquid foods are recommended.
- Peptic ulcer. In the past, physicians advised people with ulcers to avoid spicy, fatty, or acidic foods. Research has shown however that such diets are ineffective for treating ulcers. In most patients, no particular diet has emerged as being particularly helpful.
- Budd-Chiari syndrome. A low-sodium diet is required for the control of ascites.
- Cholecystitis. A low-fat diet is usually recommended with research showing that the pectin in apples may be beneficial, as well as the cellulose contained in celery and other crisp fruits and vegetables.
- Cirrhosis. Regardless of the type of cirrhosis, a healthy low-sodium diet is usually prescribed with total avoidance of alcohol.
- Hepatitis. Stimulating the liver can stress the liver and stimulants such as colas, chocolate, coffee, and tea are restricted. Fruit juices also, because they contain high levels of concentrated sugar which stress the digestive process and the pancreas, while feeding the virus.
- Non-alcoholic fatty liver disease NAFLD. A healthy diet controlling elevated cholesterol, triglycerides, and blood sugar is considered beneficial.
- Pancreatitis. Dietary guidelines recommend foods low in fat and high in carbohydrates and protein to decrease the work load of the pancreas. Pancreas stimulants such as coffee, alcohol, spicy and gas-forming foods are also restricted.
- Primary sclerosing cholangitis. A low-sodium diet is usually recommended to reduce fluid retention.
- Celiac disease. Patients work with a dietician to design a diet plan that is totally gluten-free. This means not eating foods that contain wheat, rye, and barley. Restrictions include most pasta, cereal, and processed foods.
- Infectious diarrhea. Diarrhea causes the body to loose too much fluid (dehydration) and electrolytes. Drinking plenty of water is accordingly extremely important. Broth and soups that contain sodium, and fruit juices, soft fruits, or vegetables that contain potassium, are required to restore the electrolyte levels.
- Lactose intolerance. If milk is removed from the diet, other sources of calcium are added, such as fermented milk products like yogurt that can usually be tolerated. Non-dairy foods that are high in calcium include fruits and vegetables such as kale, collard greens, broccoli, and oranges. Foods fortified with added calcium, such as soy milk, juices, cereals, and pasta, are also good sources of calcium.
- Colitis. Patients are advised to eliminate any foods or beverages from their diet that seem to make symptoms worse. This usually includes limiting dairy products, a low-fat diet high in fibers, eating small meals and drinking plenty of water.
- Diverticulosis. Since the lack of fiber and bulk in the diet is the major cause of diverticular disease, adding fiber and bulk to the diet is accordingly considered very important. Foods rich in fiber, such as bran cereals, whole wheat breads, a variety of beans, and fresh fruits and vegetables help keep the stools soft and bulky.
- Dysentery. Patients are asked to fast as long as acute symptoms are present, taking only orange juice and water or buttermilk. After the acute phase, rice, curd, fresh ripe fruits, especially banana and pomegranate and skimmed milk are allowed. Solid foods are reintroduced very carefully in the diet depending on the pace of recovery.
- Giardiasis. Drinking water to prevent dehydration is recommended, as well as replenishing the electrolytes lost as a result of diarrhea.
- Irritable bowel syndrome. People with IBS are usually asked to avoid food that is high in fat, insoluble fiber, caffeine, coffee, carbonated sodas, and alcohol.
- Hemorrhoids, anal fissures and perianal abscesses. A high-fiber diet consisting of fruits, vegetables, bran, whole-wheat grains with fiber supplements such as Metamucil, Citrucel, Fibercon is usually recommended along with a daily intake of plenty of water to prevent stool hardening.

## Therapy

The management and treatment of digestive diseases is disease-specific and pharmacologic and other

therapies are accordingly tailored to individual cases, depending on severity and patient history.

### Prognosis

Prognosis for some digestive diseases is excellent, for example the infectious diseases that clear up once the infectious agent is destroyed. Outcomes for most of the other diseases depends on the severity of complications and the underlying causes.

### Prevention

A healthy diet can help to prevent some digestive diseases altogether, such as diverticulitis, and lessen chances of developing others, such as colitis or alcoholic cirrhosis. Healthy nutrition is based on eating foods that meet the Recommended Dietary Allowances (RDA) of the National Research Council. These foods should be from the four major food groups: dairy products, meat and nuts, cereals and grains, and fruits and vegetables. It is also recommended to drink eight glasses of **water** per day to help eliminate ingested toxins and maintain the pH balance of the stomach.

Another important prevention area is being careful about food contamination, directly responsible for all the digestive infectious diseases. These diseases can be avoided by simple precautions such as washing fruits and vegetables, cooking meat thoroughly, drinking only water from trusted sources, and basic hygiene.

### Resources

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#### ORGANIZATIONS


American Gastroenterological Association. 930 Del Ray Avenue, Bethesda, MD 20814. (301)654-2055. <http://www.gastro.org>.

Cleveland Clinic Foundation. 9500 Euclid Ave. NA31 Cleveland, OH 44195. Department of Patient Education and Health Information: 1-800-223-2273). <http://www.clevelandclinic.org/health/>.

International Foundation for Functional Gastrointestinal Disorders Inc. P.O. Box 170864, Milwaukee, WI 53217-8076. 1-888-964-2001. <http://www.iffgd.org>.

National Institute of Diabetes and Digestive and Kidney Diseases (NIDDK), National Institutes of Health. 31 Center Drive, MSC 2560, Bethesda, MD 20892-2560. 1-800-891-5389. <http://digestive.niddk.nih.gov/ddiseases/pubs/facts/index.htm>.


Monique Laberge, Ph.D.

## Diuretics and diets

### Definition

Diuretics are a group of drugs given to help the body eliminate excess fluid through the kidneys in order to treat **hypertension** (high blood pressure), kidney and liver disorders, glaucoma, congestive heart failure (CHF), and idiopathic intracranial hypertension (pseudotumor cerebri), a condition characterized by increased fluid pressure within the blood vessels supplying the brain.

In addition to prescription diuretics, there are several types of diuretics available in over-the-counter formulations or commonplace beverages.

### Purpose

Diuretics have several purposes in mainstream clinical medicine:

- To lower blood pressure in people with hypertension.
- To lower fluid pressure inside the eyeball in patients with glaucoma.
- To reduce increased cerebrospinal fluid pressure in idiopathic intracranial hypertension.
- To reduce blood pressure and swelling during surgical procedures.
- To reduce bloating and discomfort associated with fluid retention in the premenstrual phase of a woman's monthly cycle.

## KEY TERMS

**Caffeine**—A plant alkaloid found in coffee, tea, hot chocolate, and some soft drinks that functions as a diuretic as well as a central nervous system stimulant.

**Edema**—Abnormal and excessive accumulation of fluid in body tissues or certain cavities of the body. Edema is a symptom of a number of different kidney, liver, and circulatory disorders and is commonly treated with diuretics.

**Electrolyte**—Any of several chemicals dissolved in blood and other body fluids that are capable of conducting an electric current. The most important electrolytes in humans and other animals are sodium, potassium, calcium, magnesium, chloride, phosphate, and hydrogen carbonate.

**Ethanol**—The chemical name of beverage alcohol.

**Glaucoma**—An eye disorder marked by increased fluid pressure within the eyeball that can lead to gradual loss of vision. Glaucoma is sometimes treated with diuretics.

**Hypercalcemia**—Abnormally high levels of calcium in the blood.

**Hypertension**—The medical name for high blood pressure.

**Idiopathic intracranial hypertension**—Increased fluid pressure within the blood vessels supplying the brain. Obese women are at increased risk of developing this disorder.

**Nephrotic syndrome**—A disorder marked by a deficiency of albumin (a protein) in the blood and its excretion in the urine.

**Ototoxicity**—Damage caused to the nerves in the ear that are involved in hearing or balance. Ototoxicity is a rare but serious adverse affect of loop diuretics.

**Pamabrom**—A mild diuretic found in several over-the-counter compounds for the relief of premenstrual discomfort and water retention.

**Purging**—A behavior associated with eating disorders that includes self-induced vomiting and abuse of laxatives as well as diuretics.

**Theobromine**—A breakdown product of caffeine that is responsible for the diuretic effect of coffee and tea.

The connection between diuretics and dieting is twofold. First, many of the conditions that are treated by administration of prescription diuretics—particularly hypertension, CHF, and idiopathic intracranial hypertension—are more common in obese patients, more difficult to treat in the obese population, or both. Thus weight loss and lifestyle change are commonly recommended to these patients along with prescription diuretics.

The second connection is that many dieters use or abuse diuretics as a means to quick weight loss. Abuse of diuretics frequently coexists with self-induced vomiting and abuse of laxatives in patients with **eating disorders**. This combination of behaviors is called purging. Purging may occur in some patients with eating disorders as a means to a slender appearance, but it is also common in high school and college athletes participating in such weight-related sports as rowing, wrestling, gymnastics, and long-distance running. Athletes may also abuse diuretics like furosemide (Lasix) in order to mask the fact that they are taking other drugs to enhance performance in competition. People who abuse diuretics may take herbal preparations reported to have diuretic effects or over-the-counter preparations containing **caffeine** or pamabrom as well as prescription diuretics.

## Description

### *Prescription diuretics*

There are five major types of prescription diuretics.

**LOOP DIURETICS.** Loop diuretics are the strongest of the prescription diuretics. They take their name from the fact that they work in the ascending limb of the loop of Henle, a structure in the kidney in which **magnesium** and **calcium** are ordinarily reabsorbed. By disrupting the reabsorption of these two ions, loop diuretics bring about increased urine production, which in turn lowers blood volume, leading to lowered blood pressure. Loop diuretics also cause the veins to dilate, which lowers blood pressure mechanically. This vasodilation is independent of the drug's diuretic effect.

Loop diuretics are usually given to treat edema (accumulation of fluid in body tissues) associated with heart failure; cirrhosis of the liver; impaired kidney function or nephrotic syndrome (a condition in which the kidneys leak **protein** from blood into the urine); hypertension; or severe hypercalcemia (abnormally

high levels of calcium in the blood). They are also given together with other drugs to treat edema of the brain or lungs, conditions that require rapid diuresis. Drugs classified as loop diuretics include furosemide (Lasix), bumetanide (Bumex), ethacrynic acid (Edecrin), and torsemide (Demadex).

**THIAZIDE DIURETICS.** Thiazide diuretics are derived from a chemical called benzothiadi(A)zene. Unlike the loop diuretics, which work in the loop of Henle, thiazide diuretics work in a different structure called the distal convoluted tubule, although they function in a similar way to increase urine production by decreasing the kidney's reabsorption of **sodium** and calcium. They are not as strong as loop diuretics and have fewer adverse effects.

Thiazide diuretics are commonly prescribed to manage high blood pressure because they help to dilate blood vessels as well as lower blood volume by increasing urine output. They are also sometimes given to patients with high levels of calcium in the urine to prevent the formation of kidney stones and lower the risk of **osteoporosis**. They include such drugs as hydrochlorothiazide (HydroDiuril, Esidrix), chlorothiazide (Diachlor, Diuril), and chlorthalidone (Hygroton, Hylidone).

**POTASSIUM-SPARING DIURETICS.** Potassium-sparing diuretics include such drugs as amiloride (Midamor) and triamterene (Dyrenium). They are usually given together with loop diuretics in treating CHF or high blood pressure to prevent the patient's potassium level from falling too low. They work by decreasing sodium reabsorption in the collecting tubules of the kidneys.

There are two formulations that combine the potassium-sparing diuretic triamterene with the thiazide diuretic hydrochlorothiazide in one pill—Maxzide and Dyazide—thus simplifying the patient's dosage schedule.

**OSMOTIC DIURETICS.** Osmotic diuretics are substances that cannot be reabsorbed in the kidney and so increase urine volume by osmosis. The most commonly used osmotic diuretic is mannitol, a sugar alcohol or polyol that is also added to sugar-free candies, mouthwashes, and similar products as an artificial sweetener. Mannitol (Osmitrol) is given intravenously to patients with glaucoma to lower fluid pressure inside they eyeball, and to patients with acute kidney failure following cardiovascular surgery.

Until early 2007, high-dose mannitol was recommended as treatment to reduce fluid accumulation inside the skull in cases of head trauma, on the basis of randomized trials conducted by a neurosurgeon in Brazil who committed suicide in 2005. His papers on the use of mannitol in head surgery were called into question in late 2006; neither his former coauthors nor the journal editors who published his studies have been able to verify his data; and the university he claimed as his affiliation has never employed him.

**CARBONIC ANHYDRASE INHIBITORS.** Carbonic anhydrase inhibitors are a class of diuretics that increase **water** loss through the kidneys by changing the acidity of urine. Their most common use, however, is to treat glaucoma by lowering the fluid pressure inside the eyeball. The most common diuretic in this group, acetazolamide (Diamox), is also used as an anticonvulsant (drug given to prevent seizures). Other carbonic anhydrase inhibitors include dichlorphenamide (Daranide) and methazolamide (Neptazane).

### *Nonprescription diuretics*

Nonprescription diuretics are often used by dieters to flush water from the body in the belief that this practice will promote rapid weight loss. According to the Centers for Disease Control and Prevention (CDC), 1% of adult male dieters in the United States and 2% of adult women have used over-the-counter diuretics as part of weight loss attempts.

**CAFFEINE.** Caffeine is a xanthine alkaloid found naturally in coffee beans, tea leaves, kola nuts, cocoa beans, and a few other plants. It is well known as a central nervous system (CNS) stimulant, enjoyed in brewed coffee, tea, hot chocolate, cola beverages, and energy drinks. It is also available in tablet form as an over-the-counter stimulant in such compounds as NoDoz. Caffeine is broken down in the liver to three substances, one of which is theobromine, which acts as a diuretic and increases urine volume. Some dieters drink coffee as much for its diuretic effects as for its effectiveness is counteracting the fatigue that often accompanies low-calorie diets.

**HERBAL PREPARATIONS.** Naturopaths and other practitioners of alternative medicine often recommend certain herbal preparations, including herbal teas, as diuretics available without a prescription. Herbs commonly recommended for their diuretic qualities include uva ursi, dandelion, hydrangea, parsley, butcher's broom, buchu, juniper, horsetail, buckthorn, and asparagus.

**ALCOHOL.** Beverage alcohol (ethanol) is known to have a diuretic effect; in fact, many of the symptoms of an alcohol hangover, such as headache, nausea, and diarrhea, are related to the **dehydration** resulting from alcohol intoxication. Many weight-reduction diets (the **Mediterranean diet** being a notable exception) forbid alcohol because it contains more calories than

most people realize—7 calories per gram, in comparison to 9 calories per gram for fat and 4 calories per gram for protein. Some women, however, drink an occasional glass of wine or beer for its diuretic effect, to relieve the discomfort of fluid retention before the onset of their menstrual period.

**PAMABROM.** Pamabrom is a mild diuretic related chemically to theophylline, one of the breakdown products of caffeine. It is compounded with acetaminophen in a number of over-the-counter (OTC) remedies for premenstrual bloating and backache associated with fluid retention, including New Tylenol for Women, Backaid, and Diurex.

## Precautions

Both prescription and nonprescription diuretics should be used with care.

### *Prescription diuretics*

Prescription diuretics should be used only under a doctor's supervision and monitored in long-term users, as dosage requirements may change or the doctor may recommend **dietary supplements** to compensate for **electrolytes** and nutrients lost through the use of some diuretics. In addition, patients should not stop taking prescription diuretics or change the dosage without consulting their doctor.

- Loop diuretics. Patients taking loop diuretics may require supplemental potassium, folic acid, and vitamin $B_1$. In addition, they should learn to recognize the symptoms of potassium depletion, as loss of potassium is a common adverse effect of this type of diuretic.
- Thiazide diuretics. Nursing mothers should not use thiazide diuretics during the first month of breastfeeding, as they can pass into the milk and in some cases decrease the flow of milk. Thiazide diuretics should also be taken with food or milk to lower the risk of upset stomach. They should be used very cautiously in patients with diabetes, as they tend to raise blood sugar levels.
- Potassium-sparing diuretics. Patients should avoid the use of salt substitutes containing potassium while taking this type of diuretic, as it may lead to overly high levels of potassium in the blood. In addition, patients should be advised to avoid driving or operating dangerous machinery until they know how these drugs affect them, because potassium-sparing diuretics may cause dizziness and blurred vision.
- Osmotic diuretics. Sodium levels in the patient's blood should be closely monitored, particularly if the patient develops muscle cramps.
- Carbonic anhydrase inhibitors. Acetazolamide should not be given to patients with a history of liver or kidney disorders, Addison's disease, known sensitivity to sulfonamide drugs, or angle-closure glaucoma; and used cautiously in patients with diabetes or gout. The patient should be advised to take this type of diuretic in the morning to prevent sleep interruption.

### *Nonprescription diuretics*

Nonprescription diuretics can still cause adverse effects even though they are weaker than prescription diuretics:

- Caffeine. A dose of caffeine higher than 400 milligrams (more than 3 or 4 cups of brewed coffee) will produce a state of caffeine intoxication in most adults. Over-the-counter caffeine tablets, however, typically contain more caffeine than brewed coffee, usually 100–200 mg per tablet. In very high doses (around 5 g), caffeine will produce nausea, coma, convulsions, and eventually death.
- Herbal preparations. Herbal preparations should be purchased only from reliable sources, as their potency may vary from batch to batch. In addition, herbal products made outside the United States may be adulterated with filler products or contaminated by industrial byproducts.
- Alcohol. Alcohol should always be consumed in moderation and never combined with driving or operating heavy machinery.
- Pamabrom. Pamabrom is a mild diuretic that causes skin rashes in a few people who take it for backache or menstrual cramps.

## Interactions

Prescription diuretics interact with some other prescription drugs as well as with herbal products:

- Loop diuretics. Loop diuretics are known to interact with licorice, digitalis, and buckthorn or alder buckthorn.
- Thiazide diuretics. Thiazide diuretics interact with insulin to inhibit its effects in lowering blood sugar; they intensify the toxic side effects of lithium therapy; and they increase the effects of corticosteroids in causing loss of potassium.
- Potassium-sparing diuretics. May increase the toxicity of lithium.
- Osmotic diuretics. None reported as of 2007.
- Carbonic anhydrase inhibitors. Enhance the effects of amphetamines and tricyclic antidepressants; increase the excretion of lithium and phenobarbital;

increase the risk of aspirin toxicity for patients taking aspirin or other salicylates.

### *Nonprescription diuretics*

Nonprescription diuretics, particularly alcohol, may interact with a variety of substances:

- Caffeine. Caffeine is known to intensify the effects of cimetidine (a drug that lowers the secretion of stomach acid) and theophylline.
- Herbal preparations. Herbal preparations with diuretic effects should be strictly avoided by people taking prescription diuretics, as the herbs may intensify the effects of the prescription drugs and lead to various cardiovascular side effects.
- Alcohol. Alcohol is known to interact with a wide number of prescription medications. It should never be taken together with other drugs that depress the central nervous system. These types of medications include antidepressants, benzodiazepines (tranquilizers), barbiturates, other sleeping medications, narcotic pain relievers (codeine and other derivatives of opium), and antihistamines. Alcohol may interact with antipsychotic medications to cause liver damage, with aspirin to cause stomach bleeding, and with some cardiovascular medications to cause dizziness and fainting.
- Pamabrom. No interactions between pamabrom and other medications have been reported as of 2007.

## Aftercare

Aftercare following abuse of diuretics varies according to the substance and the consumption pattern. Caffeine intoxication can usually be treated by tapering intake of caffeinated beverages and/or discontinuing use of caffeine tablets. Alcohol hangovers may require rehydration as well as administration of **vitamin $B_6$**. Abuse of diuretics in patients with eating disorders requires long-term medical nutrition therapy supervised by a professional nutritionist. The position statement of the American Dietetic Association (ADA) is as follows: "It is the position of the American Dietetic Association (ADA) that nutrition education and nutrition intervention by a registered dietitian is an essential component of the team treatment of patients with **anorexia nervosa**, **bulimia nervosa**, and eating disorders not otherwise specified (EDNOS) during assessment and treatment across the continuum of care." Similarly, adolescents who abuse diuretics as part of athletic training regimens require supervision by a registered dietitian as well as by a specialist in sports medicine.

## Complications

Prescription diuretics have a number of side effects:

- Loop diuretics. Loop diuretics may produce several different types of adverse reactions. The first type are related to diuresis and electrolyte balance. Loop diuretics may cause loss of potassium and magnesium from the body; the loss of magnesium may lead to the loss of additional potassium. Patients taking loop diuretics should be taught to recognize the signs of potassium deficiency (hypokalemia), which include weakness, loss of appetite, irregular heartbeat, constipation, muscle cramps, a weak or heavy feeling in the legs, mental confusion, or unusual tiredness. The second type of adverse reaction to loop diuretics is ototoxicity, or damage to the nerves in the ears that control hearing and the sense of balance. Symptoms of ototoxicity include ringing in the ears (tinnitus) and dizziness. The third type of adverse effect of loop diuretics is uncommon but may occur in patients who are also taking ACE inhibitors (medications to control blood pressure) and nonsteroidal anti-inflammatory drugs (NSAIDs). This so-called "triple whammy" may lead to kidney failure.
- Thiazide diuretics. Thiazide diuretics may cause low blood potassium levels, impotence in men, and increased levels of blood cholesterol. They also cause photosensitivity in some people, which means that the person will be more sensitive to sunlight and sunburn more readily. Last, thiazide diuretics can raise the levels of glucose and uric acid in the blood, which increases the patient's risk of developing gout.
- Potassium-sparing diuretics. Adverse effects may include loss of interest in sex (in both men and women), visual disturbances and dizziness, shortness of breath, nausea and vomiting.
- Osmotic diuretics. Use of mannitol causes high blood pressure, blurred vision, chills, fever, nausea, and vomiting in some patients.
- Carbonic anhydrase inhibitors. May depress the activity of bone marrow, leading to anemia; may contribute to liver dysfunction; increases the patient's risk of developing gut; may lead to overly low blood levels of sodium, potassium, magnesium, and calcium.

### *Nonprescription diuretics*

Adverse effects from nonprescription diuretics may include:

- Caffeine. Adverse effects from high doses of caffeine include nervousness, insomnia, restlessness, twitching,

tingling or flushing of the face, nausea or vomiting, diarrhea, and dehydration.

- Herbal preparations. Herbal preparations used as diuretics have a wide range of potential adverse effects, ranging from intensifying the effects of prescription diuretics to indigestion, skin rashes, headache, and diarrhea.
- Alcohol. Complications associated with ethanol consumption include the risks of dehydration and electrolyte imbalance caused by intoxication; alcohol abuse; trauma from alcohol-related accidents; and interactions with other medications.
- Pamabrom. Pamabrom has been reported to cause skin rashes and dependence in a very small minority of patients.

## Parental concerns

Parents do not ordinarily need to be concerned about children or adolescents abusing prescription diuretics, as these drugs do not produce mood alteration or relieve pain. Adolescents, however, are likely to abuse nonprescription diuretics in relation to eating disorders or athletic competition; one study found that 64% of adolescents diagnosed with eating disorders were using herbal diuretics. A few adolescents may develop caffeine-related disorders apart from eating disorders or sports.

### *Eating disorders*

Abuse of over-the-counter diuretics is common among adolescents with eating disorders accompanied by purging, although it is slightly less common than self-induced vomiting or abuse of laxatives. Although eating disorders are classified as **mental health** problems, they can have serious lifelong digestive and nutritional consequences, including erosion of tooth enamel, loss of bone density leading to eventual osteoporosis, and ongoing problems with water retention.

### *Athletic competition*

Numerous reports of diuretic abuse among athletes in high school and college sports programs have accumulated since the late 1980s. Abuse of OTC diuretics is higher among both males and females in such weight-related sports as wrestling and rowing than among participants in sports that do not classify athletes by weight (distance running, swimming, basketball, etc.). More males than females abuse diuretics at both the high school and college levels; the average age of initial misuse of diuretics in one sample was 15.6 years for males and 16.2 years for females. Abuse of diuretics puts young athletes, particularly males, at risk of dehydration, chest pains, fainting, and irregular heart rhythms, particularly when combined with ephedrine or other stimulants.

### *Caffeine dependence and intoxication*

According to *DSM-IV*, caffeine use typically begins in the mid-teens in the United States and Canada, with levels of consumption increasing into the early adult years (20s and 30s). Among teenagers, caffeine use is usually higher among boys than girls, and higher among smokers than nonsmokers. Most fatal cases of caffeine overdose occur among adults in their early 20s, usually as a result of taking OTC caffeine tablets by mouth or inhaling crushed tablets.

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**ORGANIZATIONS**

American Academy of Child and Adolescent Psychiatry (AACAP). 3615 Wisconsin Avenue NW, Washington, DC 20016-3007. Telephone: (202) 966-7300.

American College of Sports Medicine (ACSM). P. O. Box 1440, Indianapolis, IN 46206-1440. Telephone: (317) 637-9200. Website: http://www.acsm.org.

American Dietetic Association (ADA). 120 South Riverside Plaza, Suite 2000, Chicago, IL 60606-6995. Telephone: (800): 877-1600. Website: http://www.eatright.org.

American Society of Health-System Pharmacists. 7272 Wisconsin Avenue, Bethesda, MD 20814. Telephone: (301) 657-3000. Website: http://www.ashp.org.

Centers for Disease Control and Prevention (CDC). 1600 Clifton Road, Atlanta, GA 30333. Telephone: (404) 639-3311. Website: http://www.cdc.gov/.

Dietitians of Canada/Les diététistes du Canada (DC). 480 University Avenue, Suite 604, Toronto, Ontario, Canada M5G 1V2. Telephone: (416) 596-0857. Website: http://www.dietitians.ca.

Herb Research Foundation (HRF). 4140 15th Street, Boulder, CO 80304. Telephone: (303) 449-2265. Website: http://www.herbs.org.

U. S. Food and Drug Administration (FDA). 5600 Fishers Lane, Rockville, MD 20857-0001. Telephone: (888) INFO-FDA. Website: http://www.fda.gov/default.htm.

Rebecca J. Frey, PhD

# Diverticular disease diet

## Definition

A diverticular disease diet is a diet that increases dietary **fiber** to recommended levels.

## Origins

Diverticulosis is a condition characterized by small pouches (diverticula) that form and push outward through weak spots in the large intestine. Once diverticula have formed, there is no way to reverse the process. When diverticula become infected, the condition is called diverticulitis. Most people with diverticulosis do not experience symptoms. As for diverticulitis, the most common symptom is abdominal pain with tenderness around the left side of the lower abdomen. Fever, nausea, vomiting, chills, cramping, and **constipation** may occur as well. Diverticular disease is common in industrialized countries, especially in the United States, Canada, the United Kingdom, and Australia, and fairly rare in Asia and Africa. It affects about 50% of Americans by age 60 and nearly all by age 80. A low-fiber diet is believed to be the main cause of the disease. It was first described in the United States in the early 1900s, at the time when processed foods were introduced into the American diet and many of these foods contain refined flour. Unlike whole-wheat flour, refined flour has no wheat bran and is accordingly a low-fiber food. The prevalence of the disease in industrialized countries seems to confirm the connection of diverticular disease with a low-fiber diet, since it occurs rarely in Asia or Africa, where people eat high-fiber, vegetable-based diets.

## Description

It has been shown that increasing the amount of fiber in the diet may reduce symptoms of diverticular disease. The American Dietetic Association recommends a daily intake of 20–35 grams of fiber. A diverticular disease diet will accordingly seek to increase dietary fiber to these levels to prevent constipation and the undue colon pressure that causes diverticula.

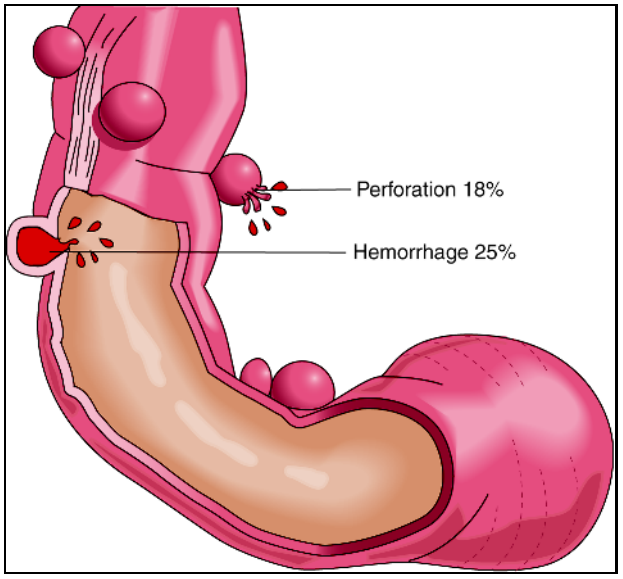


**Illustration of diverticula in the sigmoid colon. Diverticulosis is almost always located in the descending or sigmoid colon.** *(Delmar Publishers, Inc. Reproduced by permission.)*

Examples of foods that contain fiber and can be part of a diverticular disease diet include (amounts of fiber shown for a medium fruit or 1 cup of vegetable, fruit or grain):

- Apple, raw, with skin (3.3g)
- Peach, raw (1.5g)
- Pear, raw (5.1g)
- Pineapple (1.9g)
- Tangerine, raw (1.9g)
- Blueberries (4.0g)
- Cranberries (4.0g)
- Raspberries (8.3g)
- Asparagus, 4 spears, fresh, cooked (1.2g)
- Broccoli, fresh, cooked (5.2g)
- Brussels sprouts, fresh, cooked (4g)
- Cabbage, fresh, cooked (3g)
- Carrot, fresh, cooked (4.6g)
- Cauliflower, fresh, cooked (3.4g)
- Celery, raw (2.1g)
- Romaine lettuce (1.2g)
- Spinach, fresh, cooked (4.4g)
- Summer squash, cooked (2.5g)
- Tomato, raw (1g)
- Winter squash, cooked (5.7g)
- Baked beans, canned, plain (12.6g)
- Kidney beans, fresh, cooked (11.4g)
- Lima beans, fresh, cooked (13.2g)
- Potato, fresh, cooked (2.3g)
- Bread, whole-wheat, 1 slice (1.9g)
- Brown rice, cooked (3.5g)
- Cereal, bran flake (7.1g)
- Oatmeal, plain, cooked (4g)
- White rice, cooked (0.6g)

There are several types of dietary fiber, which makes it easy to include it in the diet:

- Cellulose. Found in bran, legumes, peas, root vegetables, the cabbage family, the outer covering of seeds, and most fruits.
- Hemicellulose. A major constituent of cereal fiber, found in bran and whole grains.
- Polyfructoses. Examples are inulins and oligofructans, found in onions, garlic, artichokes, soybean.
- Gums. These are substances secreted by a plant at injury sites. They are composed of various sugars and sugar derivatives. Found oatmeal, barley, and legumes.
- Mucilages. Gelatinous substances found in most plants.
- Pectins. Water-soluble and gel-forming substances found in apples, strawberries, and citrus fruits.
- Lignin. This is the primary noncarbohydrate component of fiber. It is highest in mature root vegetables like carrots or fruits with edible seeds like strawberries.
- Resistant starches. These are starches that are classified as fibers because they are not digested by the body. They are found in whole legumes, potatoes and bananas and plantains.

To help increase dietary fiber in the diet, breakfast should include a bowl of porridge made with millet, oats or brown rice, toast made with whole-grain bread instead of white bread, whole-grain ready-to-eat cereals with milk, and a bowl of fruit instead of fruit juice. During the day, snacks can include fresh fruit, or dried fruits like raisins, prunes, dates, apricots, or a few wholegrain crackers. In meals, brown rice should replace white rice. Pasta dishes should include more vegetables and fruit? to increase the fiber content of the meal. Serve fruit after meals instead of a dessert. Vegetables should also be eaten at each meal. Sandwiches should be made with whole-grain bread and include vegetables.

Besides adding fiber foods to a diverticular disease diet, the health practitioner may also prescribe a fiber supplement such as Citrucel or Metamucil once a day. These products supply 2–3.5g of fiber per tablespoon, mixed with 8 ounces of **water**. Some physicians also recommend to avoid nuts, popcorn, and sunflower, pumpkin, caraway, and sesame seeds as they believe that particles of these foods could enter, block, or

## KEY TERMS

**Abdomen**—Part of the body that extends from the chest to the groin.

**Abdominal cavity**—The hollow part of the body that extends from the chest to the groin. It is located between the diaphragm, which is the thin muscle below the lungs and heart, and the pelvis, the basin-shaped cavity that contains the reproductive organs, bladder, and rectum. The abdominal cavity contains the abdominal organs.

**Bile**—Digestive juice secreted by the liver and stored in the gallbladder; helps in the digestion of fats.

**Colon**—Part of the large intestine, located in the abdominal cavity. It consists of the ascending colon, the transverse colon, the descending colon, and the sigmoid colon.

**Diverticulitis**—Inflammation of the small pouches (diverticula) that can form in the weakened muscular wall of the large intestine.

**Feces**—Waste product of digestion formed in the large intestine. About 75% of its mass is water, the remainder is protein, fat, undigested roughage, dried digestive juices, dead cells, and bacteria.

**Gastrointestinal tract (GI tract)**—The tube connecting and including the organs and paths responsible for processing food in the body. These are the mouth, the esophagus, the stomach, the liver, the gallbladder, the pancreas, the small intestine, the large intestine, and the rectum.

**Immune system**—The integrated body system of organs, tissues, cells, and cell products such as antibodies that protects the body from foreign organisms or substances.

**Inflammation**—A response of body tissues to injury or irritation characterized by pain and swelling and redness and heat.

**Insoluble**—That cannot be dissolved.

**Insulin**—A hormone secreted by the pancreas and required for the regulation of the metabolism of carbohydrates and fats.

**Intestinal flora**—The sum of all bacteria and fungi that live in the intestines. It is required to break down nutrients, fight off pathogens and helps the body build the vitamin E and K. An unbalanced intestinal flora can lead to many health problems.

**Inulin**—Naturally occurring oligosaccharides (several simple sugars linked together) produced by many types of plants. They belong to a class of carbohydrates known as fructans.

**Large intestine**—The terminal part of the digestive system, site of water recycling, nutrient absorption, and waste processing located in the abdominal cavity. It consists of the caecum, the colon, and the rectum.

**Mucilage**—A sticky substance used as an adhesive. A gummy substance obtained from certain plants.

**Nutrient**—A chemical compound (such as protein, fat, carbohydrate, vitamins, or minerals) that make up foods. These compounds are used by the body to function and grow.

**Soluble**—Capable of being dissolved.

**Syndrome X**—A group of risk factors that together, put someone at higher risk of coronary artery disease. These risk factors include: central obesity (excessive fat tissue in the abdominal region), glucose intolerance, high triglycerides and low HDL cholesterol, and high blood pressure.

irritate the diverticula. However, no scientific evidence support this opinion. The seeds in tomatoes, zucchini, cucumbers, strawberries, and raspberries, as well as poppy seeds, are generally considered harmless. An eating plan for diverticular disease is usually based on what works best for each person. To help the colon rest, the treating physician may also recommend bed rest and a liquid diet.

### Function

Fiber is the edible part of fruits, vegetables, and grains that the body cannot digest. Since they are not absorbed into the body, dietary fibers are not considered a nutrient. Some fiber dissolves easily in water and becomes soft in the intestines, while insoluble fiber passes almost unchanged through the intestines. Both kinds of fiber are required to make stools soft and easy to pass. Fiber also prevents constipation, which makes the bowel muscles strain to move stool that is too hard. It is believed to be the main cause of increased pressure in the colon that may cause the weak colon spots to bulge out and become diverticula.

Many plant foods contain both soluble and insoluble fibers. For example, psyllium husks, contain a mixture of 70% soluble and 30% insoluble fibers. Despite the general use of the terms “soluble” and

"insoluble" to describe the health benefits of dietary fiber, many nutrition experts are now using the terms "viscous" and "fermentable" to describe the functions and health benefits of dietary fiber. These include:

- Reducing blood cholesterol levels: Viscous fibers lower cholesterol levels by reducing the absorption of dietary cholesterol. In addition, they combine with bile acids. These are compounds produced by the liver from cholesterol that are required for the breakdown of fats. After combining with bile acids, the compounds are removed from circulation and do not make it back to the liver. As a result, the liver must use additional cholesterol to manufacture new bile acids. Soluble fiber may also reduce the amount of cholesterol manufactured by the liver.
- Normalizing blood sugar levels: Viscous fibers are also involved in controlling blood glucose levels because they slow down the rate at which food leaves the stomach and delay the absorption of glucose after a meal. Viscous fibers also increase insulin sensitivity. As a result, viscous fibers are believed to play a role in the prevention and treatment of type 2 diabetes.
- Supporting bowel regularity: Fermentable fibers are fermented by the intestinal flora, the bacteria and fungi that live in the intestines. The fermentation of dietary fiber in the large intestine produces a short-chain fatty acid called butyric acid, which is used as fuel by the cells of the large intestine and helps maintain the health of the colon. Fermentable fibers also help maintain healthy populations of bacteria in the intestinal flora. Fibers that are not fermentable help maintain bowel regularity by increasing the bulk of the feces and decreasing the time required by fecal matter to move through the intestines.

## Benefits

Fiber keeps stool soft and lowers pressure inside the colon so that bowel contents can move through easily. This is why it is considered beneficial for diverticular disease. Eating a **high-fiber diet** will not only treat diverticular disease, it is also believed to play a role in the prevention and treatment of the following health conditions:

- breast cancer
- cardiovascular disease
- colon cancer
- diabetes
- gallstones
- high cholesterol
- irritable bowel syndrome
- obesity
- syndrome X

## Precautions

When increasing the fiber content of the diet, it is recommended to add fiber progressively, adding just a few grams at a time to allow the intestinal tract to adjust. Otherwise, abdominal cramps, gas, bloating, and diarrhea or constipation may result. Intake of dietary fiber exceeding of 50g per day may also lead to intestinal obstruction. Excessive intake of fiber can also cause a fluid imbalance, leading to **dehydration**. This is why people who start increasing their fiber intake are often advised to also increase their water intake. Excessive intake of dietary fiber has been linked with reduced absorption of **vitamins**, **minerals**, proteins, and calories. However, it is unlikely that healthy people who consume fiber in amounts within the recommended ranges will have problems with nutrient absorption.

Parents are urged to use caution when adding extra fiber to their child's diet. Excessive amounts of high-fiber foods may cause a child to fill up quickly, reducing appetite and possibly depriving the child of needed nutrients from a well-balanced diet. Elderly people and those who have had gastrointestinal surgery should also exercise caution when increasing their dietary fiber intake.

## Risks

Most people recover fully after treatment for diverticular disease. If not treated however, diverticulitis can lead to the following serious conditions:

- Intestinal perforation: The diverticula burst because of increased pressure within the intestine.
- Peritonitis: This is a serious infection of the abdominal cavity outside the intestine. It often occurs after perforation, when the contents of the intestine are leaked into the abdominal cavity.
- Abscess formation: Sacs of infected intestinal material and pus can form that are very difficult to cure.
- Fistula formation: An abnormal connection between the colon and another organ can form. This occurs when the colon, damaged by infection, comes in contact with other tissue, such as the bladder, the small intestine, or the inside of the abdominal wall, and sticks to it. Fecal material from the colon can then get into the other tissue.
- Blockage of the intestine: This can result from hard fecal matter reaching out of diverticula.
- Bleeding in the intestine: Stool that is trapped in a diverticulum may cause bleeding.

## QUESTIONS TO ASK YOUR DOCTOR

- What are diverticulosis and diverticulitis?
- How serious is this condition?
- What are the possible complications?
- What causes diverticular disease?
- What is the treatment for diverticular disease?
- Will tests be required?
- Will surgery be necessary?
- Are there foods that should be avoided?
- Are there foods that are recommended?
- How can I tell if I am getting enough fiber in my diet?
- How will I know if I am getting too much fiber in my diet?
- Would seeing a dietician for an eating plan help?
- How effective is diet in controlling this disease?
- Is there a cure for diverticular disease?
- What is the function of dietary fiber?
- Do you recommend intestinal cleansing?
- What are some simple steps for increasing the fiber intake of my meals?
- Should I eat one type of fiber more than another?

### Research and general acceptance

Most health practitioners agree that the lack of fiber and bulk in the diet is the major cause of diverticular disease. As foods are becoming more highly refined, more people are suffering from diverticular disease symptoms. Eating a high-fiber diet is accordingly the only requirement highly emphasized by the medical profession. Eliminating specific foods is not considered necessary as no research supports that it may improve the condition. A gradual switch to a diet with increased intake of soluble fiber (green vegetables, oat bran) usually leads to an improvement in bowel function. There is general agreement on food sources being more efficient fiber sources than supplements since they also supply additional nutrients. Excessive use of fiber supplements can also lead to acute digestive problems and blockages.

In its most recent 2005 public health recommendations for dietary fiber, the National Academy of Sciences established an Adequate Intake (AI) level of 38g of total daily fiber for males 19–50 years of age and 25g for women in this same age range. The report also states that individuals in this age range in the United States only get about half this much fiber each day. The recommendation for children older than 2 years is to increase dietary fiber intake to an amount equal to or greater than their age plus 5 g/day. There are currently no published studies that indicate optimal dietary fiber intakes for infants and children under 2 years of age. Until more information becomes available, a sensible guideline is to introduce a variety of fruits, vegetables, and easily digested cereals after weaning.

It is understood that, as the body ages, the outer layer of the intestinal wall thickens, which narrows the intestine. As a result, stool moves more slowly through the colon, increasing the pressure. Hard stools, such as those produced by a diet low in fiber, can further increase pressure. Repeated straining during bowel movements also increases pressure and contributes to formation of diverticula. As for the cause of diverticulitis, there is broad agreement that it occurs when diverticula become infected or inflamed, but medical experts are not know precisely what causes the infection. It is believed to start when stool or bacteria are caught in the diverticula.

The United States Food and Drug Administration (FDA) has approved the following claims about dietary fiber that can be listed on food labels:

- Good Source of Fiber, Contains Fiber or Provides Fiber: Any food product that contains 2.5 to less than 5g of fiber per serving (less than 20% of the daily value of dietary fiber) and is low in total fat per serving (3g or less fat per serving).
- High Fiber, Rich in Fiber, Excellent Source of Fiber: Any food product that contains at least 5g or more of dietary fiber per serving (20% or more of the fiber daily value) and is low in total fat per serving (3g or less fat per serving).

### Resources

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Wood, G. K. *The Complete Guide to Digestive Health: Plain Answers About IBS, Constipation, Diarrhea, Heartburn, Ulcers, and More*. Peachtree City, GA: FC&A Publishing, 2006.

**ORGANIZATIONS**

American Dietetic Association. 216 W. Jackson Blvd, Chicago, IL 60606-6995. 1-800-877-1600 ext. 5000.<www.eatright.org>.
American Gastroenterological Association. 930 Del Ray Avenue, Bethesda, MD 20814. (301)654-2055. <www.gastro.org>.
Food and Nutrition Information Center. 10301 Baltimore Avenue, Beltsville, MD 20705-2351. <www.nutrition.gov>.
International Foundation for Functional Gastrointestinal Disorders Inc. P.O. Box 170864, Milwaukee, WI 532176. 11. <www.iffgd.org>.

Monique Laberge, Ph.D.

# Dr. Feingold diet

## Definition

The Dr. Feingold diet is a diet that eliminates many different forms of additives and other compounds from the diet. It is intended to reduce the symptoms of Attention Deficit Disorder and Attention Deficit **Hyperactivity** Disorder. Many proponents of the diet suggest that it can be used to improve other common problems as well.

## Origins

The Dr. Feingold diet was developed by Dr. Ben F. Feingold during the 1970s. Dr. Feingold was born on June 15th, 1899 in Pittsburg, Pennsylvania. He received his Bachelor of Science degree from the University of Pittsburgh in 1921, and his Medical Degree from the same institution in 1924. Following this, he did an internship from 1924 to 1925 at Passavant Hospital, also in Pittsburgh, and then a fellowship in pathology at the University of Goettingen in Germany. He then spent 1928 and 1929 working with children in Austria before returning to the United States to be an instructor of pediatrics at the Northwestern University School of Medicine.

Dr. Feingold continued to work with children, specifically in the developing area of allergy studies. During World War II he was a commander in the US Navy, and then returned from the war to be chief of pediatrics at Cedars of Lebanon Hospital in Los Angeles, California. He worked at various other hospitals and established all of the Departments of Allergy for Northern California for Kaiser Foundation Hospitals and Permanente Medical Group in 1951. He died on March 23, 1982.

During his career Dr. Feingold mainly studied allergies in children. He noticed, however, that during his career the increase of children exhibiting symptoms of hyperactivity seemed to correspond with the increased consumption by children of various food additives. He hypothesized that these food additives were what was causing the symptoms he observed. During the 1970s he set out to study this relationship, and believed he had found a link. In 1975 be published the book "Why Your Child is Hyperactive," laying out his beliefs. The Dr. Feingold diet is derived from this book. Since then, the children he called "hyperactive" have been identified as having Attention Deficit Disorder (ADD) or Attention Deficit Hyperactivity Disorder (ADHD).

Although Dr. Feingold died in 1982, his followers and adherents continue to update his diet and ideas. Although he intended his diet only for the treatment of hyperactivity, the Feingold Association of the United States has identified many other problems that my be alleviated by the diet. They have also continued to update the foods and additives believed to cause behavior and other problems in children.

## Description

The Dr. Feingold diet involves eliminating from the diet all forms of additives and chemicals believed by its proponents to be the cause of a variety of diseases and disorders, most generally ADD and ADHD. The diet occurs in two stages, the first stage involves eliminating all of the offending foods, and the second stage involves reintroducing one substance at a time to see which can be tolerated.

There are four main groups of chemicals and additives that are eliminated during the Dr. Feingold diet. The first of these are all forms of synthetic coloring. These are often made from by-products of petroleum and are believed to be one of the causes of hyperactivity. This means that any food products that have artificial colors (which include many popular children's foods and treats) are strictly forbidden.

## KEY TERMS

**Calorie**—A measurement of the energy content of food, also known as a large calorie, equal to 1000 scientific calories.

**Dietary supplement**—A product, such as a vitamin, mineral, herb, amino acid, or enzyme, that is intended to be consumed in addition to an individual's diet with the expectation that it will improve health.

**Mineral**—An inorganic substance found in the earth that is necessary in small quantities for the body to maintain a health. Examples: zinc, copper, iron.

**Vitamin**—A nutrient that the body needs in small amounts to remain healthy but that the body cannot manufacture for itself and must acquire through diet.

The diet also requires that all forms of artificial flavoring be removed from the diet. The Feingold Association believes that many of these additives have not been studied carefully and can cause unwanted behaviors in children. Of special concern is the artificial vanilla flavoring vanillin, which is often made from by-products of paper production.

The Dr. Feingold diet also requires the elimination of aspartame, an artificial sweetener sold mainly under the brand name NutraSweet. This restriction is not as limiting as it may have been in the past because of the introduction of low calorie sweeteners derived from sugar during the mid 2000s.

**Artificial preservatives** are also eliminated completely when on this diet. These include the preservatives BHA (Butylated Hydroxyanisole) and BHT (Butylated Hydroxytoluene), which are derived from petroleum. The purpose of these preservatives is mainly to delay the oxidization of **fats** in foods. It is this oxidization that makes fats go rancid, so these preservatives give foods a longer shelf-life.

During stage one of the diet many salicylates are removed from the diet, but may be reintroduced later during state two. Salicylates are a group of chemicals, some of which are naturally occurring, which are related to aspirin. This eliminates certain natural foods such as apples, berries, grapes, oranges, peaches, plums, tangerines, and tomatoes, along with many others.

The Dr. Feingold diet can be very time consuming to follow, especially at first, because many of the forbidden substances occur under a variety of names on labels, all of which must be learned. The Feingold Association of the United States produces a set of materials intended to help people beginning the diet, including an 150 page food guide. These can be ordered for a fee from their website, www.feingold.com

### Function

The Dr. Feingold diet is generally used for children, although it may be effective for adults as well. It is intended to remove substances that some people believe cause ADD and ADHD. According to the Feingold Association of the United States it can also be effective in reducing or eliminating impulsiveness, compulsiveness, disruptive behaviors, poor self-control, abusive or unpredictable behavior, and destructive behaviors. They also believe it can change workaholic habits, chewing on clothing or other inappropriate objects, depression, frequent crying, irritability, panic, low self-esteem, mood swings, impatience, distraction, inability to follow directions, poor muscle coordination, speech difficulties, tics, seizures, and difficulty with comprehension. The association also states that it can help physical problems such as ear infections, asthma, bedwetting, and **constipation**, and sleep problems such as resistance going to bed, difficulty falling asleep, and nightmar! es.

### Benefits

There are many benefits for children who eat a balanced diet including many fresh fruits and vegetables. Because the Dr. Feingold diet excludes many forms of artificial additives, it may limit the amount of processed food available to consume, leading to a more balanced diet with more healthful food. This is not necessarily the case however, as many fresh fruits must be eliminated during stage one because of naturally occurring salicylates. The diet may result in reduced symptoms of ADD and ADHD and is reported by the American Feingold Association to be able to resolve other psychical, emotional, and sleep complaints.

### Precautions

When starting any diet there are some risks, especially when beginning a diet that is very restrictive. Although the Dr. Feingold diet does not restrict very many types of foods, it is inflexible on the point that all foods containing offending additives or compounds be completely eliminated from the diet. This can limit the availability of convenience and processed foods especially, although many other foods are forbidden as

well. It is important for all adults to get a balanced diet that follows the United States Department of Agriculture's MyPyramid guidelines, but this is especially important for children. Not getting the right amounts of **vitamins** and **minerals** each day can have negative effects on a child's growth and development. This may be a concern for children on the Dr. Feingold diet because stage one limits many child-friendly fruits such as apples, oranges, and grapes.

One problem some families may find when on the Dr. Feingold diet is that it is very time intensive. For adults who go on the diet there are significant amounts of time required to learn all the rules of the diet, and to learn to identify the various forbidden additives in all of the forms in which they may appear on labels. For parents putting a child on the diet, the time required is even greater. Not only must the parent learn to identify which foods are allowable for the child, but the time must be taken to educate the child on this complicated issue as well. This is especially true for older children who may make more of their own eating decisions outside of the watchful eyes of their parents. Children have to learn which foods can be eaten and how to read labels. They also need to learn coping skills to be able to explain to other children and any adults who might be offering them food (such as their friend's parents) which foods are not allowed. It may be a! dvisable also to go over some skills to help children explain to friends and classmates why they are on a special diet in a way which is not upsetting or embarrassing to them. Many people also choose to make chidlren's teachers, babysitters, and others aware of the new diet which can take time as well.

Although there are no specific studies investigating the social effects of the Dr. Feingold diet on children, there are many pieces of anecdotal evidence illustrating some of it possible negative effects. One concern for some parents may be that being an such a strict diet, that has to be followed all of the time including at school and at friends' houses, children may feel different than their peers. It can be very hard for children who feel or seem different than those around them, and other children might not understand why they cannot have the same candy, or have to eat special meals brought from home. Another issue brought up by some people who were on the diet as children is that it puts children who do give into temptation (and there are many temptations for children on this diet) into a very difficult position. Because the Feingold Association maintains the diet must be followed exactly at all times to be effective, children who have eaten something forbi! dden must decide whether to admit it or lie to their parents. It can also put children and parents into an antagonistic relationship because often if the diet does not cure the disease or disorder, it is assumed that it is because forbidden foods have been consumed. This can lead to a negative spiral of accusations, guilt, and anger. These problems certainly will not occur with every child in every family, but it may be something that parents considering this diet for their child or children would want to consider.

## QUESTIONS TO ASK THE DOCTOR

- Does my child have symptoms of ADD, ADHD or another problem that may be helped by this diet?
- Is this diet appropriate for the whole family?
- Will I or my child get all required vitamins and minerals if on this diet?
- Are other interventions, in addition to diet, appropriate to help my child at this time?
- Are there any signs or symptoms that may indicate a problem while on this diet?

### Risks

There are some risks associated with starting any diet. Although there are no significant scientifically documented risks for starting this diet there is some chance that it may cause feelings of isolation in the child because he or she feels different than those around him or her. There is also some risk that this diet may put significant stress on the family because it is very time intensive and must be followed strictly. The diet may also cause some tension in parent-child relationships because the child may react negatively to being put on the diet or may be tempted to eat forbidden foods.

### Research and general acceptance

The Dr. Feingold diet is extremely controversial. Since the 1970s many different experiments have been done in an attempt to determine if it capable of the results it claims. Dr. Feingold himself did some preliminary studies in the 1970s, the results of which are still hotly debated by many people. There are many methods used in attempts to determine the effectiveness of the diet. These include putting children on the diet and monitoring any improvement in behaviors. To study its effects in an opposite way, scientists have tried reintroducing additives thought to be harmful into the diets of children who have been on the diet and watching to see if behavior deteriorates. The

evidence has been mixed, and many studies are interpreted differently by each side of the debate. The Feingold Association of the United States cites many different studies on its websites, and gives short excerpts or summaries of some of the evidence. The Association cites these studies as proof t! hat the diet is effective for most children. There has not been any significant research done on whether the diet is effective in achieving positive results for problems not related to ADD or ADHD.

Some health professionals however, are not convinced that the diet can help children with ADD or ADHD. One common argument against the effectiveness of the diet is that there may be other causes for the improvement shown in children on the diet. Because the diet is extremely complicated and involves reading labels carefully, and closely monitoring everything that is eaten (as well as exposure to some things such as soaps and perfumes), parents are forced to become extremely involved in their child's life while their child is on this diet. Some experts have argued that any improved behavior is probably a result of this increased parental participation, and not a direct result of the diet. Another critcism of the studies on the effectiveness of the diet is that often the behavioral changes are reported by parents and are not confirmed by outside, unbiased observers.

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#### ORGANIZATIONS

American Dietetic Association. 120 South Riverside Plaza, Suite 2000, Chicago, Illinois 60606-6995. Telephone: (800) 877-1600. Website: <http://www.eatright.org>

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Helen M. Davidson

Dr. Kushner's diet *see* **Personality type diet**

Dr. Perricone diet *see* **Perricone diet**

# Dr. Phil's diet

## Definition

Dr. Phil's diet is named for Dr. Phillip C. McGraw, Ph.D., the psychologist and life strategist seen on syndicated television. Popularly known as "Dr. Phil" he developed a line of "Shape Up!" weight loss products and simultaneously developed and published a book titled "The Ultimate Weight Loss Solution: The 7 Keys to Weight Loss Freedom."

The Ultimate Weight Loss Solution was promoted as a combination of healthy diet, exercise, behavior modification, and thinking differently about food.

## Origins

Dr. Phil was a private practice psychologist in Wichita Falls, Texas, before starting a trial consulting firm. It was in this business that he worked with television star Oprah Winfrey, consulting with her during a 1995 trial brought against Ms. Winfrey by members of the beef industry. Shortly after, Dr. Phil began appearing on Ms. Winfrey's syndicated television show. By 2002, he was hosting his own syndicated daily television show and had become a well-known author and popular figure.

Dr. Phil has said that for 30 years, he counseled people battling weight problems and **obesity**. He has said that he wanted to more widely address the problem of obesity with a behavioral and nutritional approach. In 2003, he introduced the book and a line of nutritional products. The diet products were marketed by CSA Nutraceuticals, along with involvement of companies that have produced similar health and nutrition products. At the same time that the products and book were being marketed, Dr. Phil focused on weight loss themes on his television show. However, he did not refer to the weight loss products on the show. He introduced his diet on a nationally broadcast television special featuring Katie Couric and 13 weight loss challengers.

Dr. Phil's son Jay McGraw followed in his father's footsteps and authored a book with a similar plan written specifically for teenagers. This book also was published in 2003.

## Description

Dr. Phil's diet involved a book outlining a diet plan and a line of diet food products and supplement pills. The food products included flavored shakes and snack bars. The shakes and snack bars were fortified

## KEY TERMS

**Metabolize**—To produce the chemical changes in the body's living cells that provide energy for vital processes and activities.

with 24 **vitamins** and **minerals**. The products' supplements were geared toward helping people with apple or pear body shapes. The products were only on the market for about one year.

The introduction to Dr. Phil's book follows his "down-to-earth" delivery style. He tells readers that he is not going to tell them what they want to hear. He says that seven critical pieces, or keys, help achieve long-term weight loss. The book is filled with personal anecdotes, self-assessment quizzes, and chapters on each key. Dr. Phil writes that those who have kept their weight off use all seven keys. The seven keys are described below.

### *Right thinking*

Dr. Phil refers to a person's personal truth, or whatever it is about one's self and the weight problem that a person has come to believe. He says that part of learning to lose weight is learning to get rid of thoughts that don't work for weight loss and instead gain access to inner power and self-control. Dr. Phil says this helps people break the negative cycle of failed weight loss efforts and negative momentum. In the chapter, Dr. Phil lists 10 self-defeating messages that people often think about weight and weight control. For example, those who have problems with weight may label themselves or be labeled by others.

### *Healing feelings*

This key refers to the way that some people eat to medicate themselves. Dr. Phil says that often people eat in response to negative emotions such as loneliness, stress, or boredom. Dr. Phil says that admitting to emotional triggers for overeating and learning to overcome the connection between emotions and food helps gain control over eating. The key helps to identify a process that is broken down into five manageable steps. Dr. Phil talks about forgiving one's self and about learning to cope without food.

### *A no-fail environment*

This key helps people manage the environment so that they can be more successful when trying to lose weight. The book provides advice on how to prevent needless snacking, overeating, and bingeing by removing tempting foods from the home, then from other environments such as work. He talks about shopping strategies, bringing healthy food choices into the environment, and even removing large-size clothes from the closet.

### *Mastery over food*

Dr. Phil's fourth key advises people to control habits by gaining mastery over food and through impulse control. The fourth key focuses on wiping bad, weight-gaining habits from their lives and replacing them with healthier behaviors. He lists weight-gaining behaviors and various pay-offs they offer to people. The chapter concludes with suggested behaviors to replace the weight-gaining behaviors, as well as the payoffs from the healthier behaviors.

### *High-response, high-yield foods*

In this key, Dr. Phil discusses the nutritional value of various foods by describing a "high-response cost, high-yield food" plan. Instead of offering meal plans or calorie-cutting, Dr. Phil's diet talks about and lists foods that take longer to prepare and eat, and therefore are healthier. He contrasts these foods with those that take little time to prepare and eat, which normally offer higher calories and less nutritional value. He also mentions vitamin and mineral supplements in addition to high-yield foods.

### *Exercise*

Dr. Phil calls his sixth key to weight loss intentional exercise. He says that instead of becoming obsessed about exercise, people need to take a balanced approach of regular strength-building and heart-conditioning activities to burn calories. Dr. Phil says that intentional exercise can open the door to body control, a state where the body can better metabolize energy for losing weight and keeping weight off. He breaks exercise into categories of moderate activities and vigorous activities. In addition, the book lists the physical and psychological benefits of exercise.

### *Support*

The final key to weight loss provided by Dr. Phil involves social control. He says people can gain this by having a circle of support. People in a circle of support encourage a person trying to lose or maintain weight and also provide accountability to help achieve weight loss goals. He points out that the key to social support is not just having supportive friends and family in the

circle, but also managing or staying away from people who sabotage weight loss efforts.

The book concludes with several appendices, such as food lists, a workout diary, and a sample exercise for stress relief and relaxation. Dr. Phil reminds readers that weight is managed, not cured. He explains danger zones that allow people to drift off course in managing their weight, then discusses avoiding these danger zones.

## Function

Dr. Phil's weight loss solution is for people who want to lose or manage weight. He presents the diet as an alternative to crash and **fad diets**. As a psychologist, Dr. Phil approaches the diet from behavioral aspects as well as from the nutritional aspects.

## Benefits

Dr. Phil says that in typical diets, the emotion fades soon after starting the diet. In interviews about his weight loss solution, Dr. Phil said that people have better chances of succeeding on weight loss efforts if they reprogram their lives and follow the seven keys to success. He said that fear keeps people from addressing the emotions involved in overeating. The diet also focuses on being healthy and having realistic expectations for a person's age.

## Precautions

Some nutritionists and scientists have questioned the evidence quoted by Dr. Phil for the success rate of his plan and nutritional products. Following any particular diet plan should be done only after consultation with a physician and/or licensed dietician. The advice of involving a nutritionist comes late in Dr. Phil's book.

## Risks

Among concerns was the nutritional balance of some of the Shape Up food products. Although Dr. Phil's diet does not lean toward one food group and advises generally traditional diet advice of balanced diet mixed with exercise, it is best to involve a health care professional or registered dietary professional to ensure that the strategies are healthful and successful.

## Research and general acceptance

In the book, Dr. Phil cites a bibliography, a consulting nutritionist, and an 80% success rate. But there are no specific scientific studies published or referred to that prove the success of the program or its individual strategies. After developing the Shape Up products, which consisted of herbal supplements, shakes, and snack bars, a lawsuit was filed stating that Dr. Phil had made false claims about their benefits. Reports showed that although the nutrition shakes were in good ranges for **carbohydrates** and fat, the nutrition bars were in relatively high carbohydrate and fat ranges. The lawsuit was filed in 2004 on behalf of three disappointed consumers. They said that that Dr. Phil had defrauded fans, making false statements about the supplement pills. CSA Nutraceuticals agreed to stop making the supplements in early 2004 when it faced an investigation from the Federal Trade Commission concerning false-advertising claims. The plaintiffs sought class action status for the lawsuit and reached a $10.5 million settlement in September 2006.

In an article in *Food Processing* magazine, a diet expert at the University of California at Berkeley was quoted as saying that Dr. Phil's diet advice was not innovative. Yet she added that the advice was common sense. A review in the *Tufts University Health & Nutrition Letter* said there were several flaws with the book's advice and that some of the advice contradicted other points in the book or did not make sense. The review listed some good points, including the fact that a dieter does not have to be strong 24 hours a day, seven days a week.

An American Dietetic Association fact sheet said that some of the book's advice is good, such as behavior modification strategies that have been used in weight control programs for many years. But the review said that the book also contained nutrition and dietary recommendations that were mistaken or outdated. The review also stated that the advice for dealing with complicated emotional and other eating-related issues is made seemingly simple, but that managing these issues alone is not easy.

## QUESTIONS TO ASK YOUR DOCTOR

- What do you know about Dr. Phil's diet and its success?
- How can I use the strategies in the diet but incorporate more current nutritional information?

### Resources

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**ORGANIZATIONS**

American Dietetic Association. 120 South Riverside Plaza, Suite 2000. Chicago, IL 60605. (800) 877-1600. <http://www.homefoodsafety.org >

Teresa G. Odle

DRIs *see* **Dietary Reference Intakes**

# Dyspepsia

## Definition

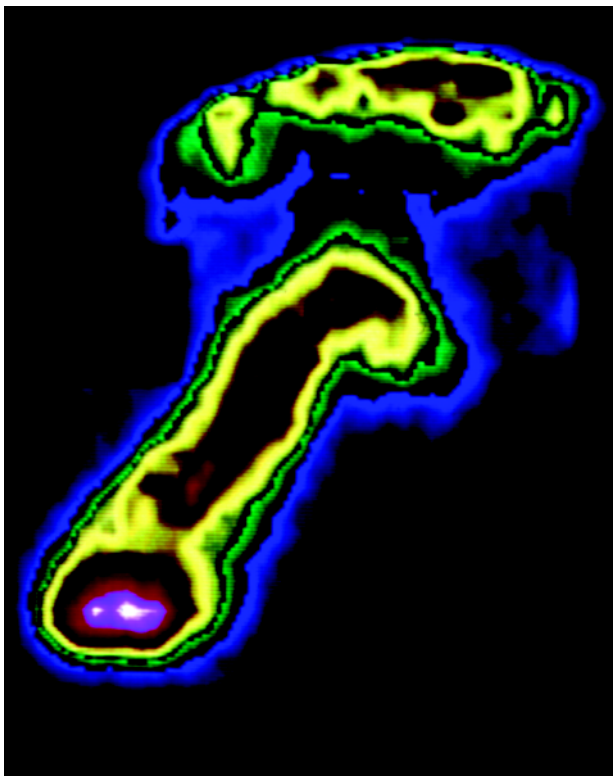
Dyspepsia is gastric upset due to the inability to digest one's food.

## Origins

Dyspepsia is a word that has been used in English since the early eighteenth century not only for a variety of stomach ailments but also for bad moods or temper outbursts that were thought to be caused by indigestion. The English word comes from two Greek words meaning "hard or difficult" and "digestion." For many years dyspepsia was a catchall term for any kind of stomach upset characterized by burning, nauseous, or gassy sensations in the upper abdomen. Several phrases that are still used almost interchangeably for the condition are gastric indigestion, nervous dyspepsia, and impaired gastric function.

Dyspepsia was not defined more closely until the mid-1980s, when an international group of gastroenterologists (doctors who specialize in treating disorders of the digestive system) met in Rome to create a set of criteria for distinguishing dyspepsia from other disorders of the upper digestive tract (known as the Rome criteria); and to distinguish between organic dyspepsia—stomach upset that can be shown to have a physical cause (for example, stomach irritation caused by **alcohol consumption**), and functional dyspepsia (FD)—dyspepsia that cannot be traced to any specific physical cause. FD accounts for a majority of cases of dyspepsia, as many as 60% in some studies, and for 30–50% of all referrals from primary care doctors to gastroenterologists.

Dyspepsia is considered a difficult condition to treat, even though it is widespread in the general population. An estimated 25–40% of adolescents and adults in North America experience dyspepsia each year. Most people with the disorder do not seek medical treatment because it may be intermittent as well as persistent. FD is responsible for high health care costs in terms of prescription as well as over-the-counter medications, diagnostic tests, and time lost from work.



**A false-color gamma scan of a human stomach with dyspepsia, or indigestion, during tests to study its rate of emptying.** *(Photograph by Jean-Perrin, Custom Medical Stock Photo, Inc. Reproduced by permission.)*

In the nineteenth and early twentieth centuries, FD was commonly treated with various forms of dietary therapies. Treatments commonly recommended by doctors in the 1920s included vegetarian diets as well as the use of laxatives and enemas to cure the patient of autointoxication—an imaginary disorder that originated in ancient Egypt and is based on the belief that the contents of the colon are toxic and capable of poisoning other body organs. Folk dietary remedies for dyspepsia included drinking peppermint tea or milk, eating spearmint leaves, or chewing mint-flavored chewing gum, which first became popular in the 1860s.

Although FD is not fully understood, there are several theories regarding its underlying mechanisms or possible causes:

- FD reflects greater than average sensitivity to uncomfortable sensations in the digestive tract. This theory

## KEY TERMS

**Autointoxication**—A belief, now discredited, that the contents of the intestine are toxic and produce poisons that can damage other body organs.

**Endoscope**—A special tube-shaped instrument that allows a doctor to examine the interior of or perform surgery inside the stomach or intestines. An examination of the digestive system with this instrument is called an endoscopy.

**Gastroenterologist**—A doctor who specializes in diagnosing and treating disorders of the digestive system.

**Gastroesophageal reflux disease (GERD)**—A disorder caused by the backward flow of stomach acid into the esophagus. It is usually caused by a temporary or permanent change in the sphincter that separates the lower end of the esophagus from the stomach.

***Helicobacter pylori***—A spiral-shaped Gram-negative bacterium that lives in the lining of the stomach and is known to cause gastric ulcers.

**Placebo effect**—A term that describes the improvement in symptoms that some patients experience when they are given a placebo (sugar pill or other inert substance that does not contain any medication) as part of a clinical trial. Patients with functional dyspepsia show a high rate of placebo effect in trials of new medications for the disorder.

**Prokinetic drugs**—A class of medications given to strengthen the motility of the digestive tract.

**Rome criteria**—A set of guidelines for defining and diagnosing functional dyspepsia and other stomach disorders, first drawn up in the mid-1980s by a group of specialists in digestive disorders meeting in Rome, Italy. The Rome criteria continue to be revised and updated every few years.

holds that patients with FD perceive sensations in the stomach or intestines as painful that most people experience as ordinary or do not feel at all.

- FD is a motility disorder. FD may result from a decreased ability of the digestive system to contract and push food through the system. This, in turn, causes lower than normal stomach emptying.
- FD is caused by *Helicobacter pylori* infection. *H. pylori* is a spiral-shaped bacterium that is the only known microorganism that can live in the acidic environment of the stomach. It is now known to be a cause of peptic ulcers, but doctors do not yet agree on its role in functional dyspepsia.

## Description

The Rome criteria for FD specify that the patient must have had 12 weeks (not necessarily consecutively) of the following symptoms in the previous 12 months:

- Persistent or recurrent pain or discomfort centered in the upper abdomen.
- No evidence of an organic disease (including the findings from an endoscopy of the upper digestive tract) that is likely to explain the symptoms; and
- No evidence that the dyspepsia is relieved exclusively by defecation or associated with the onset of a change in bowel habits.

The Rome criteria specify three subtypes of FD based on the most bothersome symptom: ulcer-like dyspepsia (pain in the upper abdomen); dysmotility-like dyspepsia (an unpleasant but nonpainful feeling of bloating, fullness, or nausea); and unspecified dyspepsia (patient's digestive discomfort does not fit either of the first two categories).

FD is widespread in the general population, however, the subtypes identified by the Rome working group appear to show slight gender differences. Ulcer-like dyspepsia appears to be more common in men and dysmotility-like dyspepsia more common in women. FD is equally widespread in all racial and ethnic groups.

Some medications other than aspirin and other over-the-counter pain relievers may cause dyspepsia: alendronate (Fosamax); codeine and aspirin fortified with codeine; **iron** supplements; metformin (Glucophage); oral antibiotics, particularly erythromycin; **orlistat** (Xenical); corticosteroids, especially prednisone; and theophylline. Patients should consult their doctors before discontinuing these drugs or changing the dosage.

## Treatment

### *Dietary*

Dietary treatment for dyspepsia generally consists of cutting down on alcohol intake; avoiding fatty or highly spiced foods; and avoiding any other food that appears to trigger episodes of dyspepsia. Therapeutic fasting, which is thought to give the digestive system a

period of rest before making other changes in the patient's diet or beginning medication therapy, may be recommended.

Patients with FD may also benefit from discontinuing certain herbal remedies that produce symptoms of dyspepsia. These include garlic, gingko, saw palmetto, feverfew, chaste tree berry, and willow bark.

### *Other treatments*

Other treatments for functional dyspepsia include complementary and alternative (CAM) therapies and psychotherapy. CAM treatments include such herbal remedies as peppermint, turmeric, and aloe vera gel taken by mouth, and such non-dietary treatments as yoga, meditation, relaxation techniques, acupuncture, and music therapy. Psychotherapy is most likely to be helpful for patients with a history of abuse or post-traumatic stress as well as functional dyspepsia.

Prokinetic drugs may be prescribed for patients with dysmotility-like FD. These medications speed up or strengthen the contractions of the small intestine. Available medications include metoclopramide (Reglan), cisapride (Propulsid), and domperidone (Motilium). Domperidone is not approved for use in the United States because its adverse effects include abnormalities of heart rhythm. In addition to prokinetic drugs, some doctors prescribe antidepressant medications in order to lower the patient's stress level and awareness of sensations coming from the stomach and intestines, but only a minority of patients with FD benefit from either prokinetics or antidepressants.

### *Medical*

Medical management of FD in patients typically begins with either testing and treating the patient for infection with *H. pylori* or by prescribing medications to lower the level of stomach acid secretions for a trial period of 4–8 weeks. The two classes of medications most commonly prescribed to reduce acid secretion are $H_2$-receptor blockers and proton pump inhibitors (PPIs). The first group, which is the older of the two, was developed in the late 1970s and early 1980s and includes such drugs as cimetidine (Tagamet) and ranitidine (Zantac). The proton pump inhibitors are more powerful than the $H_2$-receptor blockers and have fewer adverse effects. The PPIs include omeprazole (Prilosec), lansoprazole (Prevacid), esomeprazole (Nexium), pantoprazole (Protonix), and rabeprazole (Rabecid). In general, trial therapy with acid-reducing medications is considered more effective for FD than testing for and treating *H. pylori* infection, because only a small minority of patients with FD report improvement in their symptoms after treatment for the infection.

## QUESTIONS TO ASK YOUR DOCTOR

- What are the chances that dyspepsia in a person of my age and sex represents a serious disorder?
- What is your opinion of dietary changes in treating dyspepsia?
- Would you recommend therapeutic fasting before beginning medication treatment for dyspepsia?

## Function

The function of medical and dietary treatment of FD is to manage or relieve the patient's symptoms in order to improve his or her quality of life. Therapeutic fasting is intended to give the digestive system a brief period of rest prior to medication therapy or antibiotics to eradicate *H. pylori*. Since the cause(s) of FD are not yet known for certain, these treatments cannot be considered cures.

## Benefits

The benefits of medical and dietary treatment of FD are improved symptom management and better quality of life, with less time lost from school or work.

## Precautions

Patients who experience dyspepsia for several weeks or longer should consult their physician for an evaluation to rule out more serious disorders; even if the indigestion is intermittent rather than continuous. Patients over age 45 who develop dyspepsia suddenly should see their doctor immediately, particularly if the indigestion is accompanied by black tarry stools, loss of appetite, painful swallowing, bloody vomit, or unintentional weight loss.

Patients who experience indigestion unrelated to eating, or indigestion accompanied by sweating, shortness of breath, or pain radiating to the neck, jaw, or arm should also see a doctor at once, as these symptoms may indicate a heart attack.

## Risks

There are no known risks associated with modifying one's diet to relieve functional dyspepsia, although patients considering a therapeutic fast should consult

their doctor first. Medications given to treat FD may have any of the following adverse effects: skin rashes; **constipation** or diarrhea; confusion; higher risk of **osteoporosis** and bone fractures; headache; fatigue; dizziness; and low blood pressure. Cimetidine has been reported to cause impotence and loss of interest in sex in males; these symptoms disappear when the drug is discontinued.

## Research and general acceptance

A population-based case-control study of adults in Minnesota found that there was no detectable difference in the consumption of frequently suspected culprit foods by patients with FD and the control subjects. There is also no evidence that a strictly vegetarian diet is useful in treating FD. Recent studies carried out in Germany indicate that a brief period of fasting under a doctor's supervision is beneficial to patients with FD.

Research is ongoing to improve the number and effectiveness of treatment options for dyspepsia. In 2006, a new drug called itopride was tested for eight weeks on a group of 523 patients with functional dyspepsia. The drug requires further study, but the results of the initial trial are encouraging. Clinical trials sponsored by the National Institutes of Health are recruiting subjects to study medications or other forms of therapy for dyspepsia. They include studies of the effectiveness of acid-reducing therapy or eradication of *H. pylori*, and evaluation of food hypersensitivity in patients with dyspepsia.

In the field of CAM therapies, studies are being conducted of peppermint oil and turmeric as plant- or food-based treatments for dyspepsia. With regard to aloe vera, research indicates that it should not be taken by mouth as a remedy for dyspepsia because it has laxative qualities and can lower the body's absorption of prescription medications. Other CAM approaches for dyspepsia being studied are mind/body approaches like relaxation training, yoga, and hypnosis, and energy therapies like acupuncture and therapeutic touch. European studies indicate that hydrotherapy and massage therapy are beneficial to patients with functional FD.

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American College of Gastroenterology (ACG). 6400 Goldsboro Road, Suite 450, Bethesda, MD 20817. Telephone: (301) 263-9000. Website: <http://www.acg.gi.org>.

International Foundation for Functional Gastrointestinal Disorders (IFFGD). P.O. Box 170864, Milwaukee, WI 53217. Telephone: (888) 964-2001 or (414) 964-1799. Website: <http://www.iffdg.org>.

National Center for Complementary and Alternative Medicine (NCCAM). 9000 Rockville Pike, Bethesda, MD 20892. Telephone: (888) 644-6226. Website: <http://nccam.nih.gov>.

National Digestive Diseases Information Clearinghouse (NDDIC). 2 Information Way, Bethesda, MD 20892-3570. Telephone: (800) 891-5389. Website: <http://digestive.niddk.nih.gov/>.

North American Society for Pediatric Gastroenterology, Hepatology and Nutrition (NASPGHAN). P.O. Box 6, Flourtown, PA 19031. Telephone: (215) 233-0808. Website: <http://www.naspghan.org>.

U.S. Food and Drug Administration (FDA). 5600 Fishers Lane, Rockville, MD 20857-0001. Telephone: (888) INFO-FDA. Website: <http://www.fda.gov/>.

Rebecca J. Frey, PhD

# E

East African diet *see* **African diet**

Eat More, Weigh Less *see* **Dean Ornish's Eat More, Weigh Less**

## Eating disorders

### Definition

Eating disorders are psychiatric illnesses that result in abnormal eating patterns that have a negative effect on health.

### Description

Eating disorders are mental disorders. They develop when a person has an unrealistic attitude toward or abnormal perception of his or her body. This causes behaviors that lead to destructive eating patterns that have negative physical and emotional consequences. Individuals with eating disorders often hide their symptoms and resist seeking treatment. Depression, anxiety disorders, and other mental illnesses often are present in people who have eating disorders, although it is not clear whether these cause the eating disorder or are a result of it.

The two best-known eating disorders, **anorexia nervosa** and **bulimia nervosa**, have formal diagnostic criteria and are recognized as psychiatric disorders in the *Diagnostic and Statistical Manual for Mental Disorders Fourth Edition (DSM-IV-TR)* published by the American Psychiatric Association (APA). Other eating disorders have recognized sets of symptoms, but have not been researched thoroughly enough to be considered separate psychiatric disorders as defined by the APA.

#### *Well-known eating disorders*

In the North America and Europe, anorexia nervosa is the most publicized of all eating disorders. It gained widespread public attention with the rise of the ultra-thin fashion model. People who have anorexia nervosa are obsessed with body weight. They constantly monitor their food intake and starve themselves to become thin. No matter how much weight they lose, they continue to restrict their calorie intake in an effort to become ever thinner. Some anorectics exercise to extreme or abuse drugs or herbal remedies that they believe will help them burn calories faster. A few purge their body of the few calories they do eat by abusing laxatives, enemas, and **diuretics**. In time, they reach a point where their health is seriously, and potentially fatally, impaired.

People with anorexia nervosa have an abnormal perception of their body. They genuinely believe that they are fat, even when the clearly are life-threateningly thin. They will deny that they are too thin, or, if they admit they are thin, deny that their behavior will affect their health. People with anorexia will lie to family, friends, and healthcare provides about how much they eat. Many vigorously resist treatment and accuse the people trying to cure them of wanting to make them fat. Anorexia nervosa is the most difficult eating disorder to recover from.

Bulimia nervosa is the only other eating disorder with specific diagnostic criteria defined by the *(DSM-IV-TR)*. People with bulimia often consume unreasonably large amounts of food in a short time. Afterwards, they purge their body of calories. This is done most often by self-induced vomiting, often accompanied by laxative abuse. A subset of people with bulimia does not vomit after eating, but fast and exercise obsessively to burn calories. Both behaviors result in impaired health.

People with bulimia feel out of control when they are **binge eating**. Unlike people with anorexia, they

**Symptoms of eating disorders**

| Anorexia nervosa | Bulimia nervosa | Binge-eating disorder |
|---|---|---|
| Resistance to maintaining body weight at or above a minimally normal weight for age and height | Recurrent episodes of binge eating, characterized by eating an excessive amount of food within a discrete period of time and by a sense of lack of control over eating during the episode | Recurrent episodes of binge eating, characterized by eating an excessive amount of food within a discrete period of time and by a sense of lack of control over eating during the episode |
| Intense fear of gaining weight or becoming fat, even though underweight | Recurrent inappropriate compensatory behavior in order to prevent weight gain, such as self-induced vomiting or misuse of laxatives, diuretics, enemas, or other medications (purging); fasting; or excessive exercise | The binge-eating episodes are associated with at least 3 of the following: eating much more rapidly than normal; eating until feeling uncomfortably full; eating large amounts of food when not feeling physically hungry; eating alone because of being embarrassed by how much one is eating; feeling disgusted with oneself, depressed, or very guilty after overeating |
| Disturbance in the way in which one's body weight or shape is experienced, undue influence of body weight or shape on self-evaluation, or denial of the seriousness of the current low body weight | The binge eating and inappropriate compensatory behaviors both occur, on average, at least twice week for 3 months | Marked distress about the binge-eating behavior |
| Infrequent or absent menstrual periods (in females who have reached puberty) | Self-evaluation is unduly influenced by body shape and weight | The binge eating occurs, on average, at least 2 days a week for 6 months |
| | | The binge eating is not associated with the regular use of inappropriate compensatory behaviors (e.g., purging, fasting, excessive exercise) |

SOURCE: National Institute of Mental Health, National Institutes of Health, U.S. Department of Health and Human Services

*(Illustration by GGS Information Services/Thomson Gale.)*

recognize that their behavior is abnormal. Often they are ashamed and feel guilty about their behavior and will go to great lengths to hide their binge/purge cycles from their family and friends. People with bulimia are often of normal weight. Although their behavior results in negative health consequences, because they are less likely to be ultra-thin, these consequences are less likely to be life-threatening.

The APA does not formally recognize binge eating as an eating disorder. Binge eating is quite common, but it only rises to the level of a disorder only when bingeing occurs at least twice a week for three months or more. People with binge-eating disorder may eat thousands of calories in an hour or two. While they are eating, they feel out of control and may continue to eat long after they feel full. Binge eaters do not purge or exercise to get rid of the calories they have eaten. As a result, many, but not all, people with binge-eating disorder, are obese, although not all obese people are binge eaters.

Binge eaters are usually ashamed of their behavior and try to hide it by eating in secret and hording food for future binges. After a binge, they usually feel disgusted with themselves and guilty about their eating behavior. They often promise themselves that they will never binge again, but are unable to keep this promise. Binge-eating disorder often takes the form of an endless cycle—rigorous dieting followed by an eating binge followed by guilt and rigorous dieting, followed by another eating binge. The main health consequences of binge eating are the development of obesity-related diseases such as type 2 diabetes, sleep apnea, stroke, and heart attack.

### *Lesser-known eating disorders*

Quite a few eating problems are called disorders even though they do not have formal diagnostic criteria. They fall under the APA definition of eating disorders not otherwise specified. Many have only recently come to the attention of researchers and have been the subject of only a few small studies. Some have been known to the medical community for years but are rare.

Purge disorder is thought by some experts to be a separate disorder from bulimia. It is distinguished from bulimia by the fact that the individual maintains a normal or near normal weight despite purging by vomiting or laxative, enema, or diuretic abuse.

Anorexia athletica is a disorder of compulsive exercising. The individual places exercise above work, school, or relationships and defines his or her self-worth in terms of athletic performance. People with anorexia athletica also tend to be obsessed less with body weight than with maintaining an abnormally low percentage of body fat. This disorder is common among elite athletes.

Muscle dysmorphic disorder is the opposite of anorexia nervosa. Where the anorectic thinks she is always too fat, the person with muscle dysmorphic

## KEY TERMS

**Fast**—a period of at least 24 hours in which a person eats nothing and drinks only water.

**Type 2 diabetes**—sometime called adult-onset diabetes, this disease prevents the body from properly using glucose (sugar).

disorder believes he is always too small. This believe is maintained even when the person is clearly well muscled. Abnormal eating patterns are less of a problem in people with muscle dysmorphic disorder than damage from compulsive exercising (even when injured) and the abuse of muscle-building drugs such as anabolic steroids.

Orthorexia nervosa is a term coined by Steven Bratman, a Colorado physician, to describe "a pathological fixation on eating 'proper,' 'pure,' or 'superior' foods." People with orthorexia allow their fixation with eating the correct amount of properly prepared healthy foods at the correct time of day to take over their lives. This obsession interferes with relationships and daily activities. For example, they may be unwilling to eat at restaurants or friends' homes because the food is impure or improperly prepared. The limitations they put on what they will eat can cause serious vitamin and mineral imbalances. Orthorectics are judgmental about what other people eat to the point where it interferes with personal relationships. They justify their fixation by claiming that their way of eating is healthy. Some experts believe orthorexia may be a variation of obsessive-compulsive disorder.

Rumination syndrome occurs when an individual, either voluntarily or involuntarily, regurgitates food almost immediately after swallowing it, chews it, and then either swallows it or spits it out. Regurgitation syndrome is the human equivalent of a cow chewing its cud. The behavior often lasts up to two hours after eating. It must continue for at least one month to be considered a disorder. Occasionally the behavior simply stops on its own, but it can last for years.

Pica is eating of non-food substances by people developmentally past the stage where this is normal (usually around age 2). Earth and clay are the most common non-foods eaten, although people have been known to eat hair, feces, lead, laundry starch chalk, burnt matches, cigarette butts, light bulbs, and other equally bizarre non-foods. This disorder has been known to the medical community for years, and in some cultures (mainly tribes living in equatorial Africa) is considered normal. Pica is most common among people with mental retardation and developmental delays. It only rises to the level of a disorder when health complications require medical treatment.

Prader-Willi syndrome is a genetic defect that spontaneously arises in chromosome 15. It causes low muscle tone, short stature, incomplete sexual development, mental retardation, and an uncontrollable urge to eat. People with Prader-Willi syndrome never feel full. The only way to stop them from eating themselves to death is to keep them in environments where food is locked up and not available. Prader-Willi syndrome is a rare disease, and although it is caused by a genetic defect, tends not to run in families, but rather is an accident of development. Only 12,000–15,000 people in the United States have Prader-Willi syndrome.

### Demographics

In general, more women have eating disorders than men. About 90% of people with anorexia and bulimia nervosa are female. Almost as many men as women develop binge-eating disorder. Anorexia athletica, muscle dysmorphic disorder, and orthorexia nervosa tend to be more common in men. Rumination, pica, and Prader-Willi syndrome affect men and women equally.

Anorexia nervosa begins primarily between the ages of 14 and 18 and affects mainly white girls. Bulimia usually develops slightly later in the late teens and early twenties. Binge-eating disorder is a problem of middle age and affects blacks and whites equally. Prader-Willi syndrome begins in the toddler years. Not enough is known about the other disorders to determine when they are most likely to develop or which races or ethnic groups are most likely to be at risk.

Depression, low self-worth, and anxiety disorders are all common among people with eating disorders. Some disorders have obsessive-compulsive elements. The association between these psychiatric disorders and eating disorders is strong, but the cause and effect relationship is still unclear.

### Causes and symptoms

Eating disorders have multiple causes. There appears to be a genetic predisposition in some people toward developing an eating disorder. Biochemistry also seems to play a role. Neurotransmitters in the brain, such as serotonin, play a role in regulating appetite. Abnormalities in the amount of some neurotransmitters are thought to play a role in anorexia, bulimia, and binge-eating

disorder. Other disorders have not been studied enough to draw any conclusions. Interestingly, serotonin also helps regulate mood, and low serotonin levels are thought to play a role in causing depression.

Personality type can also put people at risk for developing an eating disorder. Low self-worth is common among all people with eating disorders. Binge eaters and people with bulimia tend to have problems with impulse control and anger management. A tendency toward obsessive-compulsive behavior and black-or-white, all-or-nothing thinking also put people at higher risk.

Social and environmental factors also affect the development and maintenance of eating disorders and may trigger relapses during recovery. Relationship conflict, a disordered, unstructured home life, job or school stress, transition events such as moving or starting a new job all seems to act as triggers for some people to begin disordered eating behaviors. Dieting (nutritional and social stress) is the most common trigger of all. The United States in the early twenty-first century is a culture obsessed with thinness. The media constantly send the message through words and images that being not just thin, but ultra-thin, is fashionable and desirable. Magazines aimed mostly at women devote thousands of words every month to diet and exercise advice that creates a sense of dissatisfaction, unrealistic goals, and a distorted **body image**.

## Diagnosis

Diagnosis involves four components: a health history, a physical examination, laboratory tests, and a mental status evaluation. Health histories tend to be unreliable, because many people with eating disorders lie about their eating behavior, purging habits, and medication abuse. Based on the health history and physical examination, the physician will order appropriate laboratory tests. Mental status can be evaluated using several different scales. The goal is to get an accurate assessment of the individuals's physical condition and her thinking in relationship to self-worth, body image, and food.

## Treatment

Treatment depends on the degree to which the individual's health is impaired. People with anorexia or bulimia may need to be hospitalized or attend structured day programs for an extended period. Some people are helped with antidepressant medication, but the mainstay of treatment is psychotherapy. An appropriate therapy is selected based on the type of eating disorder and the individual's psychological profile. Some of the common therapies used in treating eating disorders include:

- Cognitive behavior therapy (CBT) is designed to confront and then change the individual's thoughts and feelings about his or her body and behaviors toward food, but it does not address why those thoughts or feelings exist. Strategies to maintain self-control may be explored. This therapy is relatively short-term. CBT is often the therapy of choice for people with eating disorders.
- Psychodynamic therapy, also called psychoanalytic therapy, attempts to help the individual gain insight into the cause of the emotions that trigger their dysfunctional behavior. This therapy tends to be more long term than CBT.
- Interpersonal therapy is short-term therapy that helps the individual identify specific issues and problems in relationships. The individual may be asked to look back at his or her family history to try to recognize problem areas or stresses and work toward resolving them.
- Dialectical behavior therapy consists of structured private and group sessions in which the therapist and patient(s) work at reducing behaviors that interfere with quality of life, finding alternate solutions to current problem situations, and learning to regulate emotions.
- Family and couples therapy is helpful in dealing with conflict or disorder that may be a factor in perpetuating the eating disorder. Family therapy is especially useful in helping parents who are anorectics avoid passing on their attitudes and behaviors on to their children.

## Nutrition/Dietetic concerns

Eating disorders result in abnormal nutrition that can have life-threatening consequences. A nutritionist or dietitian who can provide nutritional counseling and healthy meal planning is an essential part of the treatment team for any eating disorder. However, nutritional counseling alone will not resolve an eating disorder.

## Prognosis

Recovery from eating disorders can be along, difficult process interrupted by relapses. About half of all anorectics recover. Up to 20% die of complications of the disorder. The recovery rate for people with bulimia is slightly higher. Binge eaters experience many relapses and may have trouble controlling their weight even if they stop bingeing. Not enough is known about the

other eating disorders to determine recovery rates. All eating disorders have serious social and emotional consequences. All except rumination disorder have serious health consequences. The sooner a person with an eating disorder gets professional help, the better the chance of recovery.

## Prevention

Prevention involves both preventing and relieving stresses and enlisting professional help as soon as abnormal eating patterns develop. Some things that may help prevent an eating disorder from developing are listed below:

- Parent should not obsess about their weight, appearance, and diet in front of their children.
- Parents should not put their child on a diet unless instructed to by a pediatrician.
- Do not tease people about their body shapes or compare them to others.
- Make it clear that family members are loved and accepted as they are.
- Try to eat meals together as a family whenever possible; avoid eating alone.
- Avoid using food for comfort in times of stress.
- Monitoring negative self-talk; practice positive self-talk
- Spend time doing something enjoyable every day
- Stay busy, but not overly busy; get enough sleep every night
- Become aware of the situations that are personal triggers for abnormal eating behaviors and look for ways to avoid or defuse them.
- Do not go on extreme diets.
- Be alert to signs of low self-worth, anxiety, depression, and drug or alcohol abuse and seek help as soon as these signs appear.

## Resources

### BOOKS


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Heaton, Jeanne A. and Claudia J. Strauss. *Talking to Eating Disorders: Simple Ways to Support Someone Who Has Anorexia, Bulimia, Binge Eating or Body Image Issues*. New York, NY: New American Library, 2005.

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### PERIODICALS


"Surfing for Thinness: A Pilot Study of Pro-Eating Disorder Web Site Usage in Adolescents With Eating Disorders." *Pediatrics*.118, no. 6 (December 2006): e1635-43. <http://pediatrics.aappublications.org/cgi/content/full/118/6/e1635>


### ORGANIZATIONS


American Psychological Association. 750 First Street, NE, Washington, DC 20002-4242. Telephone: (800) 374-2721; (202) 336-5500. TDD/TTY: (202)336-6123. Website: <http://www.apa.org>

National Association of Anorexia Nervosa and Associated Disorders (ANAD). P.O. Box 7 Highland Park, IL 60035. Telephone: (847) 831-3438. Website: <http://www.anad.org>

National Eating Disorders Association. 603 Stewart Street, Suite 803, Seattle, WA 98101. Help and Referral Line: (800) 931-2237. Office Telephone: (206) 382-3587. Website: <http://www.edap.org>


### OTHER


Anorexia Nervosa and Related Eating Disorders. "Athletes With Eating Disorders." October 6, 2006. <http://www.anred.com/ath.html>

Anorexia Nervosa and Related Eating Disorders. "The Better-Known Eating Disorders." January 16, 2006. <http://www.anred.com/defswk.html>

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Tish Davidson, A. M.

# Eating for Life

## Definition

Eating for Life refers to a diet and nutrition plan that recommends eating six small, low-fat meals daily, popularized in the 2003 book *Eating for Life*, written by Bill Phillips.

A person who follows the Eating for Life program consumes about 40–50% **protein**, 40–50% **carbohydrates**, and small amounts of fat. Meals should be consumed about two to three hours apart. The program can be used as a way to lose or maintain weight or to supplement a fitness or resistance training regimen.

## Origins

The Eating for Life plan was developed by Bill Phillips, a bodybuilder, former editor-in-chief of *Muscle Media* magazine, and former chief executive officer of EAS, a performance supplement company owned by Abbott Laboratories.

Prior to publishing Eating for Life in 2003, Phillips authored his first book, *Body for Life: 12 Weeks to Mental and Physical Strength*, a *New York Times* bestseller.

The Body-for-Life program began in the mid-1990s when Phillips first challenged dieters to make the best body transformation during a 12-week period, using the exercise and nutrition principles outlined in his now-defunct fitness magazine, *Muscle Media*. The first year of the challenge, Phillips offered his Lamborghini Diablo to the contestant who made the most radical transformation within 3 months. As of 2007, individuals and couples still compete for cash prizes and free exercise equipment in the annual Body-for-Life Challenge.

## Description

Phillips, the author of *Eating for Life*, calls his program the "anti-diet," claiming that enjoying food and eating often are the keys to healthy weight loss and maintenance. Instead of focusing on the deprivation that typical accompanies weight-loss plan, Eating for Life claims to help its followers make wise eating choices that are sustainable over a long period of time. Phillips maintains that food is not the enemy, but rather, it's an essential part of an overall lifestyle choice.

The first 10 chapters of *Eating for Life* that comprise Part I describe the extent of the overweight and **obesity** epidemic in the United States, identify common obstacles to health and fitness, such as easy access to fast food and restriction associated with traditional dieting, deconstruct popular dieting myths, and prepare the reader to begin using the Eating for Life nutrition plan and recipes.

The second part of the 405-page book includes photos and instructions for cooking the 150 recipes included in *Eating for Life*. The book includes recipes for dinner entrees, desserts, breakfasts, lunches, snacks, and nutrition shakes, as well as sample meal plans and a grocery guide. Sample recipes are also available on Phillips' Eating for Life website.

The final portion of the book includes motivational success stories of people who have lost weight with the Body for Life/Eating for Life diet and exercise plan, nutrition definitions, and tips for cooking healthy.

### KEY TERMS

**Aerobic exercise**—Moderate intensity exercise, done over a long duration, that uses oxygen. Aerobic exercise strengthens the cardiovascular system and lungs.

**Bodybuilding**—Developing muscle size and tone, usually for competitive exhibition.

**Carbohydrate**—A source of energy in the diet containing 4 calories per gram, often founds in foods such as breads, cereals, fruits, vegetables, and milk and dairy products. There are two kinds of carbohydrates: simple and complex.

**Cardiovascular**—Involving the heart and blood vessels.

**Fat**— A major source of energy in the diet. All food fats have 9 calories per gram. Fat is found in oils, nuts, seeds, avocadoes, meats, and high-fat dairy products, as well as in packaged, processed foods.

**Protein**—A nutrient that helps build many parts of the body, including muscle and bone. Protein provides 4 calories per gram. It is found in foods like meat, fish, poultry, eggs, dairy products, beans, nuts, and tofu.

**Resistance training**—Also called strength or weight training, this type of exercise increases muscle strength by working the muscles against a weight or force. Free weights, weight machines, resistance bands, or a person's body weight can be used in resistance training.

Six days a week, dieters are encouraged to eat six small meals consisting of one serving of protein and one serving of carbohydrate. Meals should be consumed about two to three hours apart. The benefit of this practice, according to Phillips, is that it keeps the **metabolism** elevated and energy levels stable.

Two of the daily meals should include vegetable servings, and 1 tablespoon of healthy fat is encouraged daily. Alternatively, three servings of fatty fish such as salmon could be consumed weekly to meet the healthy fat requirement.

On the seventh day, Eating for Life encourages a day of less restrained eating, in which dieters eat reasonable portions of unauthorized foods they've been craving throughout the week. Eating for Life does not prohibit particular foods, but encourages readers to save them for the "free day" and savor the pleasure they provide. This practice will help readers sustain healthy eating choices the rest of the time, Phillips maintains.

To aid in weight loss, Phillips says readers should choose from 82 "authorized foods," divided into five food categories, including proteins, vegetarian proteins, carbohydrates, vegetables, and **fats**. Recommended protein foods include lean red meat (including beef, buffalo, and venison), poultry (chicken and turkey), fish and shellfish, egg whites and egg substitutes, or low-fat cottage cheese; recommended carbohydrate sources include fruit, sweet potatoes, brown rice, oatmeal, barley, and whole-grain breads.

A sample daily menu might include:

- breakfast: zesty breakfast burrito
- midmorning: chocolate-mint nutrition shake
- lunch: grilled chicken soup
- midafternoon: strawberry-frost nutrition shake
- dinner: grilled salmon and potato
- late evening: cinnamon roll supreme nutrition shake

As part of the Eating for Life method, it is suggested that dieters plan their meals and grocery lists in advance and record their protein and carbohydrate servings daily. Phillips also suggests that dieters drink 10 cups of **water** each day.

Eating for Life does not prohibit alcohol or **caffeine** consumption, but suggests limiting both.

Eating for Life also advocates portion control as an essential practice for weight loss. For example, a protein serving is about the size of a person's palm, whereas a carbohydrate serving should be about the size of the person's clenched fist. Counting calories or points or measuring food portions with a scale do not play a role in the Eating for Life plan.

Eating for Life also recommends readers participate in weight or resistance training three days a week and cardiovascular exercise three times a week. Doing so will help dieters build and maintain muscle mass, which is crucial for the body's ability to burn fat, Phillips says.

## Function

Eating for Life is a program adopted by people who wish to lose weight or who are seeking a nutrition program to support their bodybuilding or resistance training efforts.

## Benefits

Because of the six-day-a-week recommended exercise plan described in Body for Life, Eating for Life may work well for people who are serious about weight training for health and fitness. This plan may also benefit people who desire regimented eating and exercise programs as they attempt to lose weight.

The six small meals a day and regular exercise recommended in the Eating for Life plan are sound strategies for weight loss. However, the strict nature of the diet (readers are admonished to adhere to a list of authorized foods) may make it difficult for a person to maintain any weight loss long-term.

## Precautions

Although *Eating for Life* does not formally require their use, supplements including meal replacement shakes and protein bars are frequently recommended by Phillips. Dieters are encouraged to consume up to three meal replacement products or shakes daily, such as the Myoplex brand marketed by EAS, the performance supplement company started by Phillips. These supplements can be difficult to find in conventional grocery outlets as well as expensive. For example, 20 servings of the Myoplex protein powder often recommended in Eating for Life and Body for Life starts at $59.95 on the EAS website (www.eas.com). Myoplex and other supplements recommended by Phillips are also available at health food and supplement chain stores, such as GNC, or online.

Eating for Life does not exclude vegetarian eaters, however, Phillips admits it may be difficult for vegans (people who do not eat any animal products, including eggs or dairy products) to find enough varied protein sources to eat according to the Eating for Life plan.

Most of the recipes in the *Eating for Life* book include some type of meat, such as chicken, beef, turkey, or fish.

In addition, the weightlifting program advocated in *Body for Life* and *Eating for Life* may be daunting for the inexperienced beginner. With little regard for a person's cardiovascular fitness level, weightlifting experience, or propensity for injuries, Phillips advocates readers to begin exercising six days a week, even if they have been couch potatoes in the past. This "all-or-nothing" approach may be difficult for people to achieve or maintain over the suggested 12 weeks required for a Body for Life challenge, and someone who experiences an injury that prevents exercise may find it difficult to maintain their dieting motivation.

## Risks

The protein intake suggested by Eating for Life, although not technically dangerous for most individuals, may be too much for the body to use on a daily basis. According to sports nutritionists, extra protein is broken down, the excess nitrogen is simply excreted in the urine, the carbon skeleton is used/stored as energy. For some people, however, the amount of daily protein recommended by a plan such as Eating for Life may be a problem. People with preexisting kidney or liver disease, such as cirrhosis or fatty liver, should not attempt a popular diet plan such as Eating for Life without checking with their health care providers first.

In addition, dieters may need to be conscious of consuming enough fruits and vegetables while Eating for Life. Phillips encourages dieters to eat only two servings of vegetables daily, however, as of 2007 the U.S. Department of Agriculture (USDA) urges people eating about 2,000 calories a day to consume at least 4.5 cups of fruits and vegetables with their daily meals. Dieters may find it difficult to eat enough fruit and vegetable servings to satisfy the USDA recommendations while on the Eating for Life nutrition plan, especially since counts fruit servings as carbohydrates on the plan, thereby limiting them to one per meal.

## Research and general acceptance

Although there is no scientific data to point to Eating for Life's effectiveness, Phillips provides anecdotal stories and dramatic before-and-after photos of people who have successfully lost weight using Body for Life and the accompanying Eating for Life plan.

Some nutritionists have also suggested that although the small meals and suggestions to exercise are important components of weight loss, in general the diet may be overly restrictive, making it difficult for dieters to maintain any losses long-term.

### QUESTIONS TO ASK YOUR DOCTOR

- What are the potential benefits for a person of my age, sex, and lifestyle in adopting the Eating for Life plan?
- What are the potential health risks, if any, for me as an individual?
- Are there any health concerns associated with the protein intake recommended in Eating for Life?
- Is it advisable for me to take the meal replacements or supplements recommended in Eating for Life?
- Do I need to worry about vitamin, mineral, or nutrient deficiencies if I eat according to the Eating for Life plan?
- Do I need to take precautions before starting the strength and cardiovascular conditioning recommended by Eating for Life?
- Have you had any patients who have used the Body for Life or Eating for Life plan? What were their results and did they maintain weight loss over the long term?

## Resources

### BOOKS

Phillips, Bill. *Body for Life: 12 Weeks to Mental and Physical Strength*. HarperCollins, 1999.

Phillips, Bill. *Body for Life Success Journal*. HarperCollins, 2002.

Phillips, Bill. *Eating for Life: Your Guide to Great Health, Fat Loss and Increased Energy!* High Point Media, 2003.

### ORGANIZATIONS

American Dietetic Association. 120 South Riverside Plaza, Suite 2000, Chicago, Illinois 60606-6995. (800) 877-1600. <http://www.eatright.org>

EAS/Abbott Laboratories. 100 Abbott Park Road, Abbott Park, Illinois 60064-3500. (847) 937-6100. <http://www.eas.com>

Eating for Life. <http://www.eatingforlife.com>

Body for Life. <http://www.bodyforlife.com>

Amy L. Sutton

# Echinacea

## Definition

Echinacea is a perennial plant native to North America that is farmed in both the United States and Europe for use in **dietary supplements**. Echinacea is a genus in the aster family containing nine plant species. Three species, *Echinacea angustifolia*, *E. purpurea*, and *E. pallida* are used in complementary and alternative medicine in the United States and Europe.

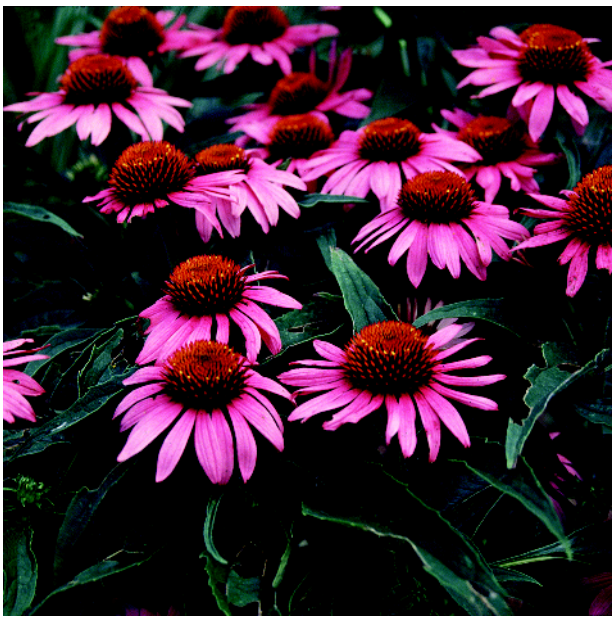
Echinacea species are commonly called coneflowers. The common name for *E. purpurea* is purple coneflower. *E. pallida* is known as pale purple coneflower and *E. angustifolia* as narrow-leaf coneflower. Echinacea is sold as an herbal dietary supplement under a variety of trade names. It is also a common ingredient in many supplements containing multiple ingredients.

## Purpose

Echinacea has been used as a medicinal herb in North America for more than 400 years. Native Americans used echinacea to treat wounds, snakebites, infections, and as a general booster of health. In the 1930s the herb was very popular in both the United States and Europe, as it was thought to fight infection by boosting the immune system. It was used to treat conditions as diverse as colds, influenza, eczema, many different types of infections, malaria, syphilis, **cancer**, and diphtheria. As antibiotics became more widely available after World War II, echinacea's popularity declined, only to rise again in the 1980s. It is one of the most frequently used herbal remedies in the North America and Europe. Echinacea is especially popular in Germany, where many practitioners of conventional medicine accept it as a safe and effective treatment for cold symptoms. In 2003, echinacea was one of the top three selling herbs in the United States, and in 2006 it was estimated to account for 10% of all dietary supplement sales in the United States.

## Description

Echinacea is a perennial herb with slender, rough leaves arranged opposite each other on a stem that grows to a height of about 18 in (45 cm) and produces a single large purplish flower. Both the above ground parts of the plant and the roots are used in dietary supplements. Fresh leaves are pressed and the resulting juice is used in extracts or tinctures, or it is combined with other ingredients to make a paste that can be applied to the skin. Dried leaves and roots are powered and made into tea or capsules. An injectable form of echinacea is available in Europe, but not in the United States. The active ingredients of echinacea have not been adequately identified. As a result, it is difficult to compare the strength and potency of different forms of the herb or the same formulation made by different manufacturers.



**Echinacea flowers, also called purple coneflowers.** *(Photo Researchers, Inc. Reproduced by permission.)*

### *Safety and effectiveness of Echinacea*

Although echinacea has been used for hundreds of years, only recently have researchers started to examine its effectiveness in large, independent, rigorously controlled studies. Many early studies done in Germany suggested that the herb was effective in treating certain conditions. In the United States, the National Center for Complementary and Alternative Medicine (NCCAM), a government organization within the National Institutes of Health, is currently conducting studies on the safety and effectiveness of echinacea in treating a variety of conditions.

In the United States, the Food and Drug Administration (FDA) regulates dietary supplements such as echinacea using the same laws that regulate food, rather than the laws that regulate prescription and over-the-counter medications. Unlike conventional drugs, dietary supplements are not required to undergo rigorous testing to show that they are safe and effective before they are marketed to the public. One consequence of this is that there are many fewer

## KEY TERMS

**Alternative medicine**—A system of healing that rejects conventional, pharmaceutical-based medicine and replaces it with the use of dietary supplements and therapies such as herbs, vitamins, minerals, massage, and cleansing diets. Alternative medicine includes well-established treatment systems such as homeopathy, traditional Chinese medicine, and Ayurvedic medicine, as well as more-recent, fad-driven treatments.

**Complementary medicine**—Includes many of the same treatments used in alternative medicine, but uses them to supplement conventional drug and therapy treatments, rather than to replace conventional medicine.

**Conventional medicine**—Mainstream or Western pharmaceutical-based medicine practiced by medical doctors, doctors of osteopathy, and other licensed health care professionals.

**Dietary supplement**—A product, such as a vitamin, mineral, herb, amino acid, or enzyme, that is intended to be consumed in addition to an individual's diet with the expectation that it will improve health.

**Perennial herb**—A plant that lives for several years with new growth appearing each year.

**Placebo**—A pill or liquid given during the study of a drug or dietary supplement that contains no medication or active ingredient. Usually study participants do not know if they are receiving a pill containing the drug or an identical-appearing placebo.

studies of dietary supplements, and some of those studies are sponsored by the manufacturers who have an economic investment in positive outcomes. Too often, studies of dietary supplements are small, poorly designed, poorly controlled, or incompletely reported, making it is difficult to draw hard conclusions about the effectiveness and safety of the product.

The most common use of echinacea in the United States and Europe is to prevent or shorten and reduce the severity of symptoms of the common cold, including sneezing, runny, nose, cough, and fever. Natural Standard, an independent organization that evaluates studies, scientific evidence, and expert opinion on complementary and alternative treatments and makes impartial judgments concerning their safety and effectiveness has found that the evidence of effectiveness of echinacea in treating cold symptoms is mixed. Some studies have shown that individuals who take echinacea during cold season are less likely to catch a cold, but more have found that echinacea has no effect on whether an individual catches a cold. On the other hand, more than half of a substantial number of well-designed European studies found that people who take echinacea at the first sign of a cold feel better sooner than those who take a placebo or who take nothing. These results have been contradicted by several large, well-designed American studies, including one in 2005 of children ages 2–11 that found on average echinacea did not reduce the length of time the children showed cold symptoms. Two studies sponsored by NCCAM also found echinacea did not shorten the symptoms of colds or influenza or prevent colds.

For years, echinacea has been taken to improve general health and to treat a variety of infections because it is thought to boost the immune system. Laboratory analyses of the ingredients in echinacea and some animal studies have suggested that echinacea does stimulate immune system cells. However, this result has not been confirmed in humans. Research continues on this use of echinacea.

Claims have also been made that individuals with AIDS, cancer, and genital herpes can benefit from taking echinacea. Although there is some theoretical basis for these claims, there is no clear evidence that echinacea has an effect on these conditions in humans.

Despite mixed evidence about the effectiveness of echinacea, the herb generally appears to be safe when taken by adults in moderate amounts. There is no standardization of the amount of active ingredient in products containing echinacea. Guidelines of normal doses for a 150 lb (70 kg) adult taken three times a day are:

- 1–2 g dried leaves or root brewed into tea
- 2–3 mL tincture
- 200 mg powdered extract

Lower doses of echinacea for children, based on the weight of the child, are generally thought to be safe, although in the cold study mentioned above, children showed an increased risk of developing a rash. One study of pregnant women using echinacea found that moderate use of the herb during the first three months of pregnancy did not increase the likelihood of the baby being born with major birth defects. The safety of echinacea use in **breastfeeding** women has not been adequately studied.

## Precautions

Individuals interested in taking echinacea should consult their health care provider and other reputable sources of information before starting the herb. Pregnant or breastfeeding women should be especially careful to discuss the use of echinacea and all other drugs and supplements with their health care provider. One animal study indicated that the increase in white blood cells normally seen during pregnancy was reduced or eliminated in women who took echinacea during pregnancy. This suggests that women who should avoid the drug during pregnancy. A separate study designed to evaluate the safety of echinacea during pregnancy failed to show any harm to either the mother or the fetus. In addition, care should be taken in giving children echinacea. Few studies have been done specifically on children.

As with any medication, more is not necessarily better, and the words "natural" or "organic" on the label do not mean the product is safe. Overdose can cause serious side effects. In the event of side effects, echinacea should be stopped immediately and the side effects reported to a health care professional. People with autoimmune diseases (e.g., AIDS, multiple sclerosis) are often counseled to avoid echinacea, because of theoretical, but unproven, negative effects on the immune system.

## Interactions

Echinacea may interact with both conventional drugs and other herbs or dietary supplements, but few rigorous studies have been done on potential interactions. Individuals should tell their health care provider about all the conventional drugs and dietary supplements they are taking before beginning any new drug or supplement.

Since echinacea may stimulate the immune system, it is recommended that individuals who are taking immune system suppressant drugs following cancer treatment or organ transplant avoid echinacea. This interaction has not been verified experimentally, and some trials suggest that echinacea can actually benefit cancer patients.

Echinacea may also interact with econazole, an antifungal drug. Individuals who take echinacea while taking econazole to treat fungal infections appear more likely to have reoccurrence of the fungal infection.

## Complications

People who are allergic to ragweed, chrysanthemums, marigolds, daisies, and related plants have a greater chance of being allergic to echinacea. Allergic reactions have on rare occasions been reported to be severe and cause breathing difficulties, especially in people with asthma. Much more common are allergic reactions consisting of a rash, sneezing, or runny nose.

## Parental concerns

Parents should be aware that the safe dose of many herbal supplements has not been established for children. Accidental overdose may occur if children are give adult herbal supplements.

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Alternative Medicine Foundation. P.O. Box 60016, Potomac, MD 20859. Telephone: (301) 340-1960. Fax: (301) 340-1936. Website: <http://www.amfoundation.org>.

National Center for Complementary and Alternative Medicine Clearinghouse. P.O. Box 7923, Gathersburg, MD 20898. Telephone: (888) 644-6226. TTY: (866) 464-3615. Fax: (866) 464-3616. Website: <http://nccam.nih.gov>.

Natural Standard. 245 First Street, 18th Floor, Cambridge, MA 02142. Telephone: (617) 444-8629. Fax: (617) 444-8642. Website: <http://www.naturalstandards.com>.

Office of Dietary Supplements, National Institutes of Health. 6100 Executive Blvd., Room 3B01, MSC 7517, Bethesda, MD 20892-7517 Telephone: (301)435-2920. Fax: (301)480-1845. Website: <http://dietary-supplements.info.nih.gov>.

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Tish Davidson, A.M.

# eDiets

## Definition

The eDiets.com website provides information on several diet programs, fitness regimens, as well as support from health professionals. The term e-diets may be used to describe any diet program found on the internet.

## Origins

American internet entrepreneur David R. Humble started eDiets.com in 1996. Unable to find investors for the site, Humble invested $500,000 of his own money to begin the company. Humble discovered a niche in the fee-based online dieting community. The eDiets website uses a unique software program to provide customized diet and fitness plans for individuals. From a small office in Deerfield Beach, FL, eDiets.com has grown into an international business with websites in Germany, Spain, and Portugal. Over two million members have joined eDiets.com since its inception. The company also operates eFitness.com and publishes *glee* Magazine*, a leading internet magazine focusing on lifestyle issues. In spring 2004 and 2005, eDiets.com was named "Best of the Web" for diet and nutrition by *Forbes* and was selected as "Editors' Choice" by *PC Magazine*.

## Description

The eDiets.com website asks prospective members to enter information about their physical description (height, weight, gender, body shape, etc.), activity level, and eating habits. This data is used to generate a customized weight loss program based on the 24 specialized options available. Program options include the **Mayo Clinic Plan**, Atkins, the Glycemic Impact Diet, the New **Mediterranean Diet**, as well as eDiets own program. **Trim Kids** is available for children and teens. Members can indicate special dietary restrictions, such as lactose or wheat intolerance, low-sodium, or vegetarian, which will be accounted for in the meal plans. The type of diet plan selected can be changed or modified at any time.

Pricing for the basic eDiets program is approximately four dollars a day. This typically provides the member with customized weekly meal plans complete with grocery shopping lists, fitness program based on the member's profile, access to community forums, newsletters, and articles on a variety of mind and body issues. Features that require an additional monthly fee include the recipe club, online chat groups and meetings, and access to experts for advice or consultation.

New members are paired with an existing member as part of the eDiets mentor program. The mentor offers support and assistance with the program. In addition, members can choose to participate in online meetings, chat rooms, take advantage of 24-hour support, or find emotional support through interactive tools. These resources aim to provide community and accountability that can help individuals maintain their weight loss program.

An online shopping section features fitness equipment, books, videos, nutritional supplements, and other health related products. To make the program even more convenient, a meal delivery plan is available allowing members to have their meals prepared and delivered to their door for approximately $15-25 per day.

## Function

The premise of eDiets.com is to provide an informative and supportive environment available to members at their convenience. This type of weight loss program appeals to individuals who are uncomfortable with face-to-face group programs or who cannot attend local support sessions. The flexibility and customization of meal and fitness plans is another highlight.

The eDiets.com proprietary software provides individuals with information on their **body mass index** (BMI) and offers diet plans based on the data entered. From the data provided in the member's profile, the program generates a meal guide that targets the member's optimal calorie intake to lose weight. A shopping list and recipe recommendations simplify food preparation. Additionally, members can switch from one weight-loss program to another at any time (such as from the New Mediterranean Diet to Atkins) while maintaining the other features and programs associated with their eDiets membership.

## Benefits

An eDiets membership offers a wide array of support methods, meal preferences, fitness programs, and other features that help individuals stay motivated to reach their weight loss goals. The low monthly membership fee is attractive, typically half the cost of joining a local program such as **Weight Watchers**.

The option of adjusting the meal plan to accommodate eating habits is a great benefit. Menus can include convenience foods (including fast-food), self-prepared meals, or both. They can also be modified to account for special diets or dietary restrictions. A prepared shopping list that corresponds to the menu selections adds to the ease.

An important advantage is the fitness program component. A customized workout is created based on an individual's lifestyle, age, and other personal information provided. The option to work one-on-one with a trainer or have more personalized fitness plans developed are available for an additional monthly fee.

Member support is an significant part of eDiets. The website offers six different support areas:

- Support Groups—Over 120 specialized groups cover age groups, language spoken, women's issues, relationships, type of diet, etc.
- Mentor Program—New members are paired with existing members for 30 days of one-on-one support and guidance.
- Chat Rooms—24-hour communication with other members as well as online meetings are available, an additional monthly fee is usually required.
- Experts—A panel of experts moderate online support groups and meetings, provide feedback to individual members, and write articles for the eDiets newsletter.
- Circle of Winners—Small support groups created by members to find other members with similar needs or interests.
- Success Stories—Members share their success with eDiets.com to offer inspiration to other members.

## Precautions

As with any weight loss program, it is important to talk with a physician about the intended changes. A disclaimer on eDiets.com states that the advice and recommendations on the website are not intended to be medical advice or take the place of a physician's advice. Recommendations for diet plans, optimal weight loss, and exercise programs on the website are calculated using a proprietary software program. They are based on data provided by the individual and, therefore, are only as accurate as the information entered. It is imperative to be honest when entering the requested data.

If an individual already has an ideal weight, the program indicates additional weight loss is not necessary. However, the individual may choose to join in order to improve their eating habits and/or fitness level.

In general, members should use the eDiets website with the same caution as other websites. Articles and information presented should be reviewed for timeliness and reliability. Members must be careful when providing personal identification information, especially in e-mail or chat rooms with other members. Members who falsify their identity are a possibility.

## Risks

Risks related to using eDiets.com are minimal. When registering for membership, individuals should carefully review the terms and conditions. Dissatisfied members complain about poor customer service and difficulty canceling membership. They also cite frustration with identifying plan pricing and fees for several features on the website.

Before beginning any of the diet plans or exercise programs individuals should talk with a physician to identify risks specific to the type of diet or exercise selected.

## Research and general acceptance

The University of Vermont Department of Nutrition and Food Sciences has performed several studies on the effectiveness of commercial online weight loss programs versus more traditional weight loss programs. Between February 2003 and March 2005 they

## QUESTIONS TO ASK YOUR DOCTOR

- What is an ideal target weight or body mass index?
- Which meal plan best accommodates special diets or dietary restrictions?
- What type of exercise should be avoided?
- How often should follow-up care be scheduled?

studied the effectiveness of a structured internet behavioral weight loss program (VTrim) compared to a commercial internet weight loss program (eDiets.com). The results found the structured behavioral weight loss program, led by a therapist, to be significantly more effective than the self-led commercial weight loss program. VTrim participants lost twice as much weight throughout the study and were nearly twice as likely to have kept it off after twelve months. While the internet is a practical medium for commercial weight loss programs, their impact would be more noticeable if they integrated more structure such as that used in VTrim.

Another study at the University of Vermont involved participants using an internet based behavioral weight loss program for one year. All participants used the same program, but half supplemented with face-to-face meetings once a month. The study concluded that participants lost approximately the same amount of weight whether or not they attended meetings in person.

The University of Pennsylvania School of Medicine began a year long controlled study in 2001 comparing eDiets.com to a weight loss manual to gage overall effectiveness for modifying an individuals lifestyle. Forty-seven female participants followed either eDiets.com or the LEARN Program for Weight Control. This small study concluded the manual had a greater impact on weight loss than eDiets since women following the manual lost approximately four percent of their body weight as compared to only one percent loss in women who used eDiets.com.

Research on the effectiveness of online diet programs remains limited. Studies at major universities demonstrate that websites such as eDiets.com can be effective tools for weight loss, but are usually most successful when coupled with personalized feedback.

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Stacey L. Chamberlin

# Electrolytes

## Definition

Electrolytes are ions that form when salts dissolve in **water** or fluids. These ions have an electric charge. Positively charged ions are called cations. Negatively charged ions are called anions. Electrolytes are not evenly distributed within the body, and their uneven distribution allows many important metabolic reactions to occur. **Sodium** ($Na^+$), Potassium ($K^+$), **Calcium** (Ca2+), **Magnesium** (Mg2+), chloride ($Cl^-$), phosphate ($HPO_4$2-), bicarbonate ($HCO_3$-), and Sulfate ($SO_4$-) are important electrolytes in humans.

## Purpose

Electrolytes play a critical role in almost every metabolic reaction in the body. For example, they:

- Help control water balance and fluid distribution in the body
- Create an electrical gradient across cell membranes that is necessary for muscle contraction and nerve transmission

## KEY TERMS

**Diuretic**—A substance that removes water from the body by increasing urine production.

**Glucose**—A simple sugar that results from the breakdown of carbohydrates. Glucose circulates in the blood and is the main source of energy for the body.

**Homeostasis**—The complex set of regulatory mechanisms that works to keep the body at optimal physiological and chemical stability in order for cellular reactions to occur.

**Hormone**—A chemical messenger produced by one type of cell and travels through the bloodstream to change the metabolism of a different type of cell.

**Serum**—The clear fluid part of the blood that remains after clotting. Serum contains no blood cells or clotting proteins, but does contain electrolytes.

- Regulate the acidity (pH) of the blood
- Help regulate the level of oxygen in the blood
- Are involved in moving nutrients into cells and waste products out of cells

## Description

Water is essential to life. **Dehydration** occurs when more water is lost from the body than is replaced. A loss of 20% of the body's water can be fatal. Water balance and electrolyte concentrations are closely intertwined. Dehydration is a major cause of electrolyte imbalances.

Electrolytes, proteins, nutrients, waste products, and gasses are dissolved in fluid in the body. This fluid is not distributed evenly. About two-thirds of it is found inside cells (intracellular fluid). The rest is found in the spaces between cells (interstitial fluid), in the circulatory system, and in small amounts in other places such as the stomach. Changes in the concentration of electrolytes results in changes to the distribution of water throughout the body as water moves into or out of cells.

The components of body fluid—electrolytes, proteins, and so forth—are not evenly distributed either. Different types of cells have membranes that allow some electrolytes (and other components of the fluid) to pass across them while blocking others. This difference in the distribution of electrolytes (and thus electric charges) on either side of cell membranes makes it possible for many metabolic reactions to take place.

Water passes easily across cell membranes. When fluid with two different concentrations of electrolytes is separated by a cell membrane, there is pressure (called osmotic pressure) for water to flow across the membrane from fluid that contains fewer electrolytes (less concentrated) into fluid that contains more electrolytes (more concentrated). The cell uses energy to resist osmotic pressure and maintain different concentrations of electrolytes on either side of the membrane because even small changes in the concentrations and distribution of electrolytes can result in large movements of water in and out of cells. Maintaining this difference, or gradient, across cell membranes is a major part of the complex regulatory events called homeostasis that keep conditions within the body stable within very narrow limits. When there is an imbalance in electrolytes many systems in the body are affected and serious, even fatal, health problems can result.

### *Causes of electrolyte imbalances*

An electrolyte imbalance occurs when the concentration of a specific electrolyte is either too high or too low. The concentration of electrolytes is strongly affected by the amount of fluid in the body. Fluid balance is largely controlled by hormones that act on the kidneys and regulate how much urine the kidneys produce. The average male adult loses about 1.5-2.5 L of water daily through urine production, sweating, breathing out water vapor, and bowel movements depending on exercise levels and environmental temperature. The United States Institute of Medicine recommends that adult men drink a minimum of 3 L of liquids a day, and that women drink a minimum of 2.2 L to replace lost water.

Dehydration is a major cause of electrolyte imbalance. It occurs whenever water is lost from the body and not replaced fairly quickly. When fluids are lost, electrolytes in those fluids are lost too, increasing the risk of electrolyte imbalance. Dehydration can be caused in many ways. These include:

- Heavy exercise, especially in hot weather. Sodium and water are both lost through the skin with heavy sweating.
- Limited fluid intake. This is a particular problem with the elderly, especially those who are unable to walk or are bedridden.
- Severe vomiting and diarrhea. Large amounts of water and many electrolytes that would normally be absorbed in the intestines are lost with diarrhea

and vomiting. Small children with diarrhea can become seriously dehydrated in less than one day. Infants can become dehydrated within hours.

- High fever. Increased water loss through the skin due to fever is especially serious in infants and young children.
- Severe burns. More water is lost from the surface of the body when the skin is not there to prevent evaporation, and damaged cells release their electrolytes into interstitial fluid, upsetting the electrolyte balance.

Electrolyte imbalances can have other causes unrelated to dehydration. These include:

- Kidney damage or kidney failure. This is a common cause of electrolyte imbalances in the elderly and can be fatal.
- Anorexia nervosa (self starvation) or bulimia nervosa (binge and purge eating).
- Excessive intake of water. Called water intoxication, this can result in swelling in the brain. In 2007, a Sacramento, California, woman died when she participated in a radio station contest that involved drinking large amounts of water in a short period of time.
- Some drugs, herbal supplements, and chemotherapy. Some medications/treatments selectively increase the excretion of certain electrolytes, cause the body to retain excess water, or stimulate the kidneys to produce excess urine.
- Hormonal imbalances in the production of hormones that regulate the kidneys. This causes too little or too much urine to be produced.
- Cancer. Some tumors produce chemicals that upset electrolyte balance.
- Abuse of electrolyte supplements.

### *Specific electrolyte imbalances*

Each electrolyte has a special function in the body, although if one electrolyte is out of balance, the concentrations and actions of other electrolytes are often affected. The serum concentration of sodium, potassium, and chloride can be measured in a simple blood test. Sodium, chloride, potassium, and calcium concentrations can also be determined from a urine sample. A urine test helps show how well the kidneys are functioning. Electrolyte imbalances are most common among the seriously ill and the elderly. Kidney (renal) failure is the most common cause of electrolyte imbalances.

**SODIUM.** Sodium affects how much urine the kidney produces and is involved in the transmission of nerve impulses and muscle contraction. Too high a concentration of sodium in the blood causes a condition called hypernatremia. Causes of hypernatremia include excessive water loss (e.g., severe diarrhea), restricted water intake, untreated diabetes (causes water loss), kidney disease, hormonal imbalances, and excessive salt (NaCL) intake. Symptoms include signs of dehydration such as extreme thirst, dark urine, sunken eyes, fatigue, irregular heart beat, muscle twitching, seizures, and coma.

Too low a concentration of sodium in the blood causes hyponatremia. This is one of the most common electrolyte imbalances, and occurs in about 1% of hospitalized individuals. It can result from vomiting, diarrhea, severe burns, taking certain drugs that cause the kidneys to selectively excrete sodium, inadequate salt intake, water intoxication (a problem among the elderly with dementia), hormonal imbalances, kidney failure, and liver damage. Symptoms include nausea, vomiting, headache, tissue swelling (edema), confusion, mental disorientation, hallucinations, muscle trembling, seizures, and coma.

**POTASSIUM.** Potassium ions play a major role in regulating fluid balance in cells, the transmission of nerve impulses, and in muscle contractions. Too high a concentration of potassium causes a condition called hyperkalemia that is potentially life threatening. The most common cause is kidney failure. It can also result from severe burns or injury (excess potassium released from injured cells), inadequate adrenal hormones (Addison's disease), the use of certain medications, and excessive use of potassium supplements. Sometimes hyperkalemia occurs in conjunctions with hypernatremia. Symptoms include nausea, diarrhea, weakness, muscle pain, and irregular heart beat, coma and death.

Abnormally low concentrations of potassium cause hypokalemia. Hypokalemia can result from excess adrenal hormones (Cushing's disease), kidney disease, long-term use of certain diuretic drugs, laxative abuse, bulimia, and kidney failure. Symptoms include increased production of urine, muscle pain, paralysis, irregular heart beat, and low blood pressure.

**CALCIUM.** Calcium is needed to build and maintain bones. It also plays a role in nerve impulse transmission and muscle contraction. Excess calcium results in a condition called hypercalcemia. Hypercalcemia can be caused by too much parathyroid hormone (PTH), certain cancers, some genetic disorders, and excessive use of antacids containing calcium in rare cases. Symptoms include bone and muscle pain, mental changes such as depression and confusion, increased urine production, fatigue, nausea, and vomiting.

Abnormally low concentrations of calcium cause hypocalcemia. Hypocalcemia can be caused by too little parathyroid hormone, kidney failure, and **vitamin D** deficiency. Vitamin D is necessary for the body to absorb calcium. Symptoms include muscle twitches and spasms, convulsions, mental changes such as depression and irritability, dry skin, and brittle nails.

**MAGNESIUM.** Magnesium is involved in **protein** synthesis and cellular **metabolism**. Abnormally high concentrations of magnesium, or hypermagnesemia, may occur with severe (end-stage) renal failure or by overdose of magnesium-containing intravenous fluids. Hypermagnesemia is rare. Symptoms include exhaustion, low blood pressure, depressed heart and breathing rate, and slow reflexes.

Abnormally low concentrations of magnesium, or hypomagnesemia, are most common among people with alcoholism and those who are severely malnourished. Other causes include digestive disorders that interfere with the absorption of magnesium from the intestines. Symptoms of hypomagnesemia include vomiting, weight lose, leg cramps, muscle spasms, seizures, and irregular heartbeat.

**CHLORIDE.** Chloride is involved in regulating blood pressure. High concentrations of chloride, called hyperchloremia, can be caused by kidney failure, kidney dialysis, and an overproduction of parathyroid hormone. Symptoms include weakness, headache, nausea, and vomiting. In people with diabetes, hyperchloremia makes it difficult to control blood glucose levels.

Hypochloremia often occurs along with hyponatremia or hypokalemia and is caused by excessive fluid loss (e.g., diarrhea). Serious deficiencies of chloride cause the blood to become less acidic, resulting in a condition called metabolic alkalosis. Symptoms of severe hypochloremia include confusion, paralysis, and difficulty breathing.

**PHOSPHATE.** Phosphate helps control the acidity level (pH) of the blood. Phosphate also causes calcium to be deposited in bones. High blood levels of phosphate, or hyperphosphatemia, often result in too low levels of calcium, or hypocalcemia. Hyperphosphatemia is usually caused by kidney failure. It can also result from kidney dialysis, parathyroid gland dysfunction, and several inherited diseases. Mild hyperphosphatemia usually produces no symptoms. Severe imbalance can cause tingling in the fingers, muscle cramps, and convulsions.

Hypophosphatemia, or abnormally low concentrations of phosphate in the blood, often occurs along with hypomagnesemia and hypokalemia. It can also be caused by kidney disease, kidney dialysis, vitamin D deficiency, and hormonal imbalances. Up to 30% of individuals admitted to hospital intensive care units have hypophosphatemia.

### *Electrolyte supplements*

Most people get all the electrolytes and water they need from a normal diet. However, some individuals, such as athletes, people with severe diarrhea and vomiting, **cancer** patients, people with hormonal imbalances, and other very ill people, need fluid and electrolyte replacement therapy. Short-term therapy often quickly restores electrolyte balances.

Electrolyte replacement supplements can be sold either over-the-counter or by prescription. Prescription supplements are used for seriously ill or hospitalized patients and can be given by mouth or intravenously under supervision of a physician.

In North America, commonly used over-the-counter electrolyte replacements include:

- Sports drinks formulated to replace electrolytes lost through sweating. These drinks, such as Gatorade and Powerade, also contain sugars and sometimes caffeine. According to the American College of Sports Medicine, sports drinks are effective in supplying energy for muscles, maintaining blood sugar levels, preventing dehydration, and replacing electrolytes lost in sweat.
- Dietary supplements in the form of tablets and powders containing electrolytes. These are popular among athletes who participate in endurance sports. Some also contain herbs and flavorings. They are regulated by the United States Food and Drug Administration (FDA) as dietary supplements.
- Electrolyte replacements for children such as Pedialyte, Naturalyte, or Rehydralyte. These are sold in supermarkets and pharmacies and are used primarily in children who have lost fluids through vomiting and diarrhea. Children should not be given sports drinks for this purpose.

## Precautions

As with any dietary supplement, electrolyte replacements can be abused. When used properly, they are of great benefit and have no undesirable side effects.

Sports drinks should not be given to children who need rehydration because of vomiting and diarrhea. Instead, oral rehydration liquids specially formulated for children should be used.

### Interactions

The goal of electrolyte replacement therapy is to restore the body to its natural condition. When used this way, electrolyte replacement does not interfere with other drugs. Many drugs, however, have the potential to cause electrolyte imbalances. When starting a new drug, individuals should discuss possible side effects with their healthcare provider.

### Complications

No complications are expected when electrolyte replacement therapy is used as directed. Seriously ill individuals and those using long-term electrolyte replacement therapy should have their electrolyte levels checked regularly.

### Parental concerns

Dehydration is a real threat to children, especially infants and toddlers. Parents should be alert to dehydration caused by illness or athletic activity and begin oral fluid and electrolyte replacement therapy immediately. Parents of young children with vomiting, diarrhea, or high fever should consult their healthcare provider promptly about steps to take to prevent dehydration.

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Helen Davidson

## Elimination diets

### Definition

Elimination diets are diets in which people stop eating specific foods for a period and then challenge their body by adding the food back into their diet and evaluating how the body responds. Elimination diets are used to detect food allergies and food intolerances. They are not nutritionally balanced and are intended to be used only for diagnostic purposes.

### Origins

For centuries it has been known that some people develop unpleasant symptoms (adverse reactions) to certain foods that other people can eat without any problems. However, it was not until the 1900s that food allergies began to be investigated in rigorous and scientific ways, and studies on food allergies started appearing in reputable medical journals. Elimination diets developed out of this scientific interest in the effects of food on the body.

### Description

Adverse reactions to food fall into two main categories, food allergies, and food intolerances. Food allergies cause a response by the immune system. When a person has a food allergy, his or her body responds to something in food by treating it like a threatening foreign material. Immune system cells produce proteins called antibodies that act to disable this material. This process often causes inflammation and results undesirable symptoms that range from mild and annoying to life threatening. The reason why some people respond to certain foods and others do not is probably genetically based.

Food intolerances, on the other hand, also cause adverse reactions, but these reactions do not involve the immune system and are not life threatening. Lactose (milk sugar) intolerance is an example of a food intolerance. It is caused by the body producing too little of the enzyme needed to digest lactose. Interestingly, although surveys show that in the United States up to 30% of families believe they have at least one

## KEY TERMS

**Antibody**—A protein produced by the immune system to fight infection or rid the body of foreign material. The foreign material that stimulates the production of antibodies is called an antigen. Specific antibodies are produced in response to each different antigen and can only inactivate that particular antigen.

member with a food allergy, the actual documented rate of food allergies is about 6% in infants and children and 3.7% in adults. On the other hand, in Hispanic, Jewish, and Southern European populations, the rate of lactose intolerance is about 70%, and it reaches 90% or more in Asian and African populations. Food intolerances are much more common, but true food allergies tend to be much more severe. In this article, **food sensitivities** are used to include both food allergies and food intolerance.

The most common symptoms of food sensitivities are nausea, diarrhea, bloating, excessive gas, hives, rashes, eczema, headaches, migraine, asthma, wheezing, and hay fever-like symptoms. These symptoms may occur immediately after eating the trigger food or may not develop for hours. Most immediate reactions are severe allergic responses that can result in anaphylactic shock, a condition in which the airways swell shut and the person cannot breathe. One study found that in about one-third of individuals in anaphylactic shock who were brought for treatment to the emergency room at the at the Mayo Clinic in Minnesota, the shock trigger had been a food. Foods most likely to cause immediate reactions are peanuts, tree nuts, and shellfish.

Delayed symptoms are difficult to detect and are sometimes called “maskedrdquo; food sensitivities. The most common causes of delayed sensitivities are dairy products, egg, wheat, and **soy**, however, sensitivities vary widely and can be caused by many foods. The amount of a trigger food that it takes to cause a response varies considerably from person to person.

A true elimination diet is very rigorous and needs to be implemented under the direction of a physician often in consultation with a dietitian or nutritionist. For the elimination diet to be useful, the patient must follow the diet strictly. Cheating invalidates the results.

For 2–3 weeks, a person on the elimination diet eats only the following foods (This list may be modified by the physician):

- grains: rice and rice products, sago, tapioca, buckwheat products, millet products
- proteins: veal, lamb, chicken, turkey, rabbit, tuna, bream, whiting, dried peas, lentils
- fruit: peeled pears, peeled apples, pawpaw.
- vegetables: potatoes, sweet potatoes, lettuce, parsley, bamboo shoots, celery, cabbage
- sweeteners and seasonings: sugar, maple syrup, sunflower oil, safflower oil, salt, garlic
- beverages: water, fresh pear juice

The individual must avoid all medicines containing aspirin (salicylates) and food colorings. After several weeks on these restricted foods, one new food is introduced in larger than normal amounts. This is the challenge food, and it is eaten for three days in a row. If no symptoms appear, the dieter continues to eat that food in normal amounts and adds another challenge food. If symptoms appear, the challenge food is stopped immediately and no new challenge food is introduced until symptoms disappear. During this time the dieter keeps a food journal, writing down everything that is eaten and any symptoms, either physical or emotional, that appear. It can take 2 to 3 months to work through all challenge foods.

### Function

Elimination diets are the first part of a diagnostic technique for determining what foods are causing undesirable symptoms. Their purpose is to prepare the patient for the second part of the diagnostic process, the food challenge by cleansing the body of all possible foods that could be causing the symptoms. During the challenge phase, the patient eats the suspect food and waits to see if symptoms reappear. Elimination and challenge give healthcare professionals a way to reproducibly pinpoint exactly which foods are causing an adverse reactions so that the patient can exclude these foods from their diet.

### Benefits

People with symptoms that interfere with their daily life benefit greatly from pinpointing which foods are causing the symptoms so that these foods can be eliminated from the diet. People with less severe symptoms may find the process of elimination and challenge too costly and disruptive to make it worthwhile.

### Precautions

Many people who suspect that certain foods are causing their symptoms try modified elimination diets

## QUESTIONS TO ASK THE DOCTOR

- Could my symptoms be caused by another disease? If so, should diagnostic tests be done before I begin the elimination diet?
- What do I need to do to get balanced nutrition while on this diet?
- Can you provide me with information about hidden sources of forbidden foods such as those in processed food and medications?
- Is there a better way to eliminate my food sensitivity symptoms?

found on the Internet or elimination diets they devise themselves. These diets have varying degrees of success. For example, many people try eliminating all dairy products to see if their symptoms of lactose intolerance—bloating, cramping, diarrhea, and gas—improve. This do-it-yourself approach may be adequate for people with mild sensitivities to only one food or food group, but it is risky for people with severe intolerances. People with moderate to severe sensitivities need professional guidance to eliminate non-obvious sources of the potential problem food.

### Risks

One risk of all elimination diets is that they are not nutritionally balanced. They increase the risk that vitamin and mineral deficiencies will develop. Anyone going on a full elimination regimen needs to consult a dietitian or nutritionist about how to use **dietary supplements** to assure adequate, balanced nutrition

A second risk is that people who self-diagnose symptoms as food intolerances using a non-medically-supervised elimination diet may be ignoring symptoms of more serious and progressive diseases such as **celiac disease**, Crohn's disease, **gastroesophageal reflux disease**, irritable syndrome, and other health problems that need medical treatment.

Finally, anyone suspected of having a moderate to severe food allergy should be under the care of a physician. Any food challenging must be done in a healthcare setting, as severe reactions can cause anaphylactic shock and death.

### Research and general acceptance

The medical community accepts elimination diets as a standard way to diagnose food sensitivities. A true elimination diet is quite restrictive, takes a long time to implement, and should be supervised by a healthcare professional. Many short cut do-it-yourself elimination-style diets are available on the Internet. Although people who believe they have a food intolerance often try these diets, they are not accepted by healthcare professionals as diagnostically accurate, and they may cause short-term vitamin and mineral deficiencies.

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# Encopresis

## Definition

Encopresis is defined as the repeated passage or leaking of feces in inappropriate places in a child over 4 years of age that is not caused by a physical illness or disability.

## Description

Over 80% of cases of encopresis begin with the child's experience of a painful bowel movement or passing a very large bowel movement. Over time, the child comes to associate using the toilet with pain and begins to hold in, or retain, his or her bowel movements to avoid the pain. The child may occasionally try to pass some of the hardened stool and develop a crack in the skin surrounding the anus known as an anal fissure. Anal fissures cause additional pain and usually reinforce the child's habit of retaining feces. As the mass of stool grows, the colon stretches to many times its normal diameter—a condition known as megacolon. The child also loses the natural urge to have a bowel movement because the muscles in the wall of the colon cannot contract and push the stool out.

Encopresis is thought to affect between 1–2% of children in the United States below the age of 10. Boys are six times as likely to develop encopresis. It is not known to be related to race or social class, the size of the family, the child's birth order, or the age of the parents.

## KEY TERMS

**Anal fissure**—A crack or slit that develops in the mucous membrane of the anus, often as a result of a constipated person pushing to expel hardened stool. Anal fissures are quite painful and difficult to heal.

**Biofeedback**—A technique for improving awareness of internal bodily sensations in order to gain conscious control over digestion and other processes generally considered to be automatic.

**Constipation**—Abnormally delayed or infrequent passage of feces. It may be either functional (related to failure to move the bowels) or organic (caused by another disease or disorder).

**Enema**—The injection of liquid through the anus into the rectum in order to soften hardened stools.

**Impaction**—The medical term for a mass of fecal matter that has become lodged in the lower digestive tract. Removal of this material is called disimpaction.

**Laxative**—A drug usually administered by mouth to produce a bowel movement. Laxatives are also known as cathartics.

**Megacolon**—A condition in which the colon becomes stretched far beyond its usual size. Children with long-term constipation may develop megacolon.

**Suppository**—A tablet or capsule, usually made of glycerin, inserted into the rectum to stimulate the muscles to contract and expel feces.

## Treatment

There is no universal agreement among doctors as to the best method of treatment for encopresis, including dietary recommendations. It is a disorder resulting from the interaction of bodily, psychological, and social factors in the child's life. As a result, there have been no large-scale controlled studies of different treatment methods.

### *Dietary treatment*

Dietary treatment of encopresis is intended to help the child develop regular bowel habits after disimpaction and to minimize the risk of recurrent **constipation**. Dietary modifications usually include:

- Reducing the child's intake of milk and other dairy products that tend to cause constipation. Some pediatricians recommend soy milk as a substitute for cow's milk during maintenance treatment.
- Adding dietary fiber to the child's diet in the form of high-fiber breads and cereals, vegetables and fruits that are high in fiber, or over-the-counter fiber supplements.
- Increasing the child's water intake, particularly during warm weather.
- Encouraging the child to participate in vigorous physical activity. Exercise helps to move food through the digestive system.
- Increasing the child's intake of fruit and fruit juices. Fruit juices, particularly prune juice, have a laxative effect. Fruit and fruit juices cannot be used by themselves as maintenance treatment for encopresis because few children are able to drink or eat the amounts required for laxative treatment. Fruit is recommended over fruit juice since it has more nutrients.

### *Medical approaches*

Medical treatment of encopresis begins with disimpaction, or softening and removal of the mass of fecal material in the lower colon. Disimpaction may be accomplished by administering enemas or a series of enemas; one or a series of suppositories; laxatives taken by mouth; or a combination of these treatments. Commonly used enemas include homemade soap-and-water solutions and commercial saline preparations. Dulcolax (bisacodyl) and BabyLax are popular brands of suppositories. Laxatives, which work by increasing the amount of **water** in the large intestine to soften the impacted stool, include citrate of magnesia, Fleet Phospho-soda, Colyte, or GoLYTELY. Other laxatives sometimes used are mineral oil and senna, a plant native to the tropics that has been used to treat constipation for over three thousand years.

Following disimpaction, the child is given maintenance medications intended to produce soft stools once or twice daily to prevent constipation from recurring. They also help the child break the mental and emotional connection between defecation and pain. The child may be given glycerine or bisacodyl suppositories once or twice a day, or mineral oil, senna syrup (Senokot), milk of magnesia, lactulose, or sorbitol twice a day by mouth. Maintenance treatment typically takes several months.

Glucomannan, a complex sugar derived from the roots of the Japanese konjac plant, is an effective **fiber** supplement for children that appears to be well tolerated and has fewer side effects than many laxatives. Glucomannan is a water-soluble fiber that forms a gel-like mass in the digestive tract and helps to push fecal matter through the lower bowel more rapidly.

### *Psychological treatment*

Psychological treatment is part of maintenance therapy for encopresis because of the emotional stress the condition causes the child and other family members. In many cases the child has become depressed or developed other behavioral problems as a result of punishment, teasing, or social rejection related to episodes of soiling. Psychological treatment begins with education; the doctor explains to the parents as well as the child how encopresis develops, what causes it, and why medications are used to treat it.

If the child's encopresis is involuntary, behavioral therapy is often used. This approach employs such techniques as star charts and daily diaries to teach the child to recognize the body's internal cues. Some doctors also recommend biofeedback for maintenance therapy in encopresis.

If the child's episodes of soiling are intentional rather than involuntary, he or she will usually be referred to a child psychiatrist for specialized evaluation and treatment.

## Function

The function of dietary treatment for encopresis is as a form of maintenance therapy. The goal is to prevent stool from building up in the child's colon, allow the colon to return to its normal shape and muscular function, and to help the child have bowel movements in the toilet at appropriate times.

## Benefits

The benefit of dietary treatment for encopresis is prevention of future episodes of constipation while providing adequate nutrition for the child. Medications are used to clear impacted fecal material from the colon and relieve discomfort associated with defecation.

## Precautions

Parents should follow the doctor's advice about laxatives and enemas during maintenance treatment for encopresis, as some of these products have side effects or interact with other medications that the child may be taking.

## Risks

There are no reported adverse effects of dietary treatment for encopresis.

Enemas and laxatives often produce side effects including abdominal cramping, intestinal gas, nausea, and vomiting. The child's doctor may be able to change the dosage or type of product for a child on maintenance treatment. Lactulose should not be given to patients with diabetes because it contains a form of sugar, while sorbitol may reduce the effectiveness of other medications. Mineral oil sometimes causes seepage into underwear and itching in the anal area. Senna and citrate of magnesia may lead to electrolyte imbalance if used in high doses over a long period of time.

## Research and general acceptance

Disagreements regarding treatment for encopresis focus on three subjects: whether enemas are preferable to laxatives taken by mouth or whether enemas are emotionally traumatic to the child; whether or not adding fiber to the child's diet is useful; and whether

placing the child on the toilet at set times helps in establishing bowel control or whether it creates emotional conflict between parents and child. Opinion is divided about the effectiveness of placing the child on the toilet at fixed times during the day; some doctors think that taking the child to the toilet after a meal helps to teach good bowel habits, while others think it is not a good idea if the child does not feel an urge to defecate.

There is no evidence that long-term use of laxatives creates dependency on them or causes colon **cancer**.

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American Academy of Child and Adolescent Psychiatry (AACAP). 3615 Wisconsin Avenue NW, Washington, DC 20016-3007. Telephone: (202) 966-7300. Website: <http://www.aacap.org/>.

American Academy of Pediatrics (AAP). 141 Northwest Point Boulevard, Elk Grove Village, IL 60007-1098. Telephone: (847) 434-4000. Website: <http://www.aap.org>.

American College of Gastroenterology (ACG). 6400 Goldsboro Road, Suite 450, Bethesda, MD 20817. Telephone: (301) 263-9000. Website: <http://www.acg.gi.org>.

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English diet *see* **Northern European diet**

# Ephedra

## Definition

Ephedra is a genus of plants found worldwide. One species, *Ephedra sinica* or Chinese ephedra, has a long history of use in complementary and alternative medicine (CAM). In the late twentieth century, ephedra gained popularity as a weight-loss supplement. The herb can cause life-threatening side effects, and since April 2004, sale of products containing ephedra have been banned in the United States. In Traditional Chinese Medicine (TCM) ephedra is called ma huang.

## Purpose

Ephedra (ma huang) has been used in TCM for about 5,000 years primarily to treat sneezing, runny nose, coughing and other symptoms of a cold,

**Ephedra (*Ephedra sinica*).** *(PlantaPhile Germany. Reproduced by permission.)*

influenza, bronchitis, and allergy. In the 1990s ephedra was marketed in the United States as a dietary supplement that stimulated weight loss. It was also marketed to adolescents as a mood-altering "herbal Ecstacy" and to athletes to improve performance. In 2005 use of ephedra-containing supplements in the United States was banned.

## Description

Ephedra is an evergreen plant with tiny leaves that grows to a height of about 12 in (30 cm). Many species of ephedra are found worldwide, but *E. sinica* used in herbal medicine grows mainly in dry, rocky areas of Mongolia and northern China. The stems and roots of the plant are used medicinally. Many other species of ephedra, for example, *E. nevadensis* or Mormon tea that grows in the western United States, do not have the same active ingredients as *E. sinica*.

The active ingredients in ephedra are the alkaloids ephedrine and pseudoephedrine. These chemicals have effects similar to amphetamines. They stimulate the central nervous system and affect the heart and circulatory system. Ephedra causes blood vessels to narrow, increases heart rate, and raises blood pressure. These effects are enhanced when ephedra is taken with **caffeine**. Ephedra also expands the airways, making breathing easier. Researchers generally agree that ephedra is effective in treating cold and allergy symptoms.

Standardized amounts of manufactured ephedrine and pseudoephedrine, the active ingredients found in ephedra, are used in many cold and allergy products made by traditional pharmaceutical companies and approved for sale by the FDA. For years, these drugs were sold in the United States over the counter without restrictions. Beginning in the early 2000s, a movement developed to limit access to these drugs by placing them behind the counter at the pharmacy, limiting the amount an individual could buy, and requiring identification to purchase the drugs. This came about more because ephedrine and pseudoephedrine are used in the manufacture of illicit methamphetamines (e.g., crystal meth) than because of safety concerns about the drugs.

Ephedrine and pseudoephedrine are also effective appetite suppressants, especially when combined with caffeine. Many people who took diet pills containing ephedra or a combination of ephedra and caffeine did lose weight. However, they also experienced an increased risk of dangerous, sometimes fatal, side effects. Ephedra was brought to the attention of the FDA in the mid-1990s by a large increase in the number of reports from poison control centers and health care providers about serious adverse effects related to ephedra-containing weight-loss supplements. These side effects included dangerously high blood pressure, fast heart rate, stoke, and heart attack. By 2003, at least 155 deaths were linked to ephedra use, including that of Baltimore Oriole's pitching prospect Steve Belcher. That same year, an analysis of side effects related to herbal therapy published in the *Annals of Internal Medicine* found that ephedra accounted for less than 1% of all herbal supplement sales, but was responsible for 64% of all reported negative events caused by herbs.

## Ephedra and the Law

The FDA regulates ephedra and other **dietary supplements** under the 1994 Dietary Supplement Health and Education Act (DSHEA). At the time the act was passed, legislators felt that because many dietary supplements come from natural sources such as plants and because they have been used for hundreds of years by practitioners of CAM, these products did not need to be regulated as rigorously as prescription and over-the-counter drugs used in conventional medicine. The legislators decided that dietary supplements should be regulated the same way food is regulated. As a result, manufacturers of ephedra supplements, just like the manufacturers of cheese or cereal, did not have to prove that ephedra was either safe or effective before it could be sold to the public. They also were not required to tell the public about possible side

## KEY TERMS

**Alternative medicine**—A system of healing that rejects conventional, pharmaceutical-based medicine and replaces it with the use of dietary supplements and therapies such as herbs, vitamins, minerals, massage, and cleansing diets. Alternative medicine includes well-established treatment systems such as homeopathy, traditional Chinese medicine, and Ayurvedic medicine, as well as more-recent, fad-driven treatments.

**Amphetamine**—A drug that stimulates the central nervous system and can be physically and psychologically addictive.

**Complementary medicine**—Includes many of the same treatments used in alternative medicine, but uses them to supplement conventional drug and therapy treatments, rather than to replace conventional medicine.

**Conventional medicine**—Mainstream or Western pharmaceutical-based medicine practiced by medical doctors, doctors of osteopathy, and other licensed health care professionals.

**Dietary supplement**—A product such as a vitamin, mineral, herb, amino acid, or enzyme, that is intended to be consumed in addition to an individual's diet with the expectation that it will improve health.

**Traditional Chinese Medicine (TCM)**—An ancient system of medicine based on maintaining a balance in vital energy or qi that controls emotions, spiritual, and physical well being. Diseases and disorders result from imbalances in qi, and treatments such as massage, exercise, acupuncture, nutritional and herbal therapy are designed to restore balance and harmony to the body.

effects of the herb. (Conventional pharmaceuticals must include potential side effects in their packaging.)

With ephedra and all other dietary supplements, the burden of proof falls on the FDA to show that the supplement is either unsafe or ineffective before the supplement can be restricted or banned. Information about a supplement's safety and effectiveness is normally gathered only after people using the product develop health problems or complain that the product does not work.

The FDA involvement with ephedra in weight-loss supplements began in 1996 after receiving more than 800 reports of adverse events in people taking products containing ephedra. In 1997 the FDA proposed regulating ephedra by requiring that the product carry a warning on the label stating that adults should take no more than 8 mg of ephedra at one time and no more than 24 mg in one day. The proposed regulation was fought by the diet supplement industry. During the course of public comment about the regulation, it became clear that there was little or no standardization of ephedra content among products or even within different batches of product from the same manufacturer. This lack of standardization made it difficult for consumers to know and control how much ephedra they were taking from day to day.

In 2002, the FDA commissioned and independent organization to study ephedra-related complications and deaths. As a result of this study, the FDA banned the uncontrolled sale of dietary supplements containing ephedra based on the what the FDA called an "unreasonable risk of illness or injury." The ban took effect on April 14, 2005.

Several supplement makers have challenged the ban on ephedra-containing supplements in federal and state courts. They argue that the FDA did not test supplements containing low doses of ephedra for safety and effectiveness and that a total ban on ephedra supplements based only on high-dose products was illegal. The FDA took the position that it was unethical to do more human testing of ephedra given the findings that ephedra-containing supplements increase the risk of stroke, heart attack, irregular heart beat, and similar serious cardiovascular events. On October 18, 2006, after several legal challenges, the United States Court of Appeals Tenth Circuit upheld the FDA ban on all ephedra-containing supplements regardless of dose. Nutraceutical Corporation, the plaintiff in the case, vowed to file another a petition for review with the United States Supreme Court.

The ban on ephedra-containing supplements continues to be controversial. There is general agreement that ephedra does treat cold symptoms and does help people with short-term weight loss. However, these benefits do not, in the opinion of FDA scientists, outweigh the health risks associated with the ephedra-containing products. Ephedra continues to be legal in countries such as Germany, Japan, India, and China where it is widely used. Ephedra-containing supplements are easily available over the Internet, and it is estimated that several million Americans continue to use them.

### Precautions

The FDA warns that no one should take dietary supplements that contain ephedra because they can

cause serious, sometimes fatal, side effects. Some individuals choose to ignore this warning. In that case, people with high blood pressure, heart problems, thyroid problems, enlarged **prostate**, and glaucoma, should avoid ephedra because there is a high risk the supplement will worsen their condition and could cause serious complications. Ephedra-containing supplements should not be given to children, pregnant women, or **breastfeeding** women.

### Interactions

Studies have shown that ephedra interacts with many drugs used in conventional medicine, especially those used to treat heart problems and monoamine oxidase inhibitors (MAOI) used to treat mental depression, anxiety, and phobias.

### Complications

At low doses, adverse side effects include headache, restlessness, anxiety, sleeplessness, nausea, difficulty urinating, and racing heart. At high doses, adverse reactions include sweating, enlarged pupils, fever, spasms, and death, usually through heart failure or stroke.

### Parental concerns

Ephedra is a dangerous herbal supplement and should not be given to children. Accidental use of ephedra by children can result in serious side effects. In the case of accidental poisoning in the United States, call the national poisoning hotline at 1-800-222-1222, the local hospital emergency room, or emergency services.

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#### ORGANIZATIONS

Alternative Medicine Foundation. P.O. Box 60016, Potomac, MD 20859. Telephone: (301) 340-1960. Fax: (301) 340-1936. Website: <http://www.amfoundation.org>.

National Center for Complementary and Alternative Medicine Clearinghouse. P.O. Box 7923, Gathersburg, MD 20898. Telephone: (888) 644-6226. TTY: (866) 464-3615. Fax: (866) 464-3616. Website: <http://nccam.nih.gov>.

Natural Standard. 245 First Street, 18th Floor, Cambridge, MA 02142. Telephone: (617) 444-8629. Fax: (617) 444-8642. Website: <http://www.naturalstandards.com>.

Office of Dietary Supplements, National Institutes of Health. 6100 Executive Blvd., Room 3B01, MSC 7517, Bethesda, MD 20892-7517 Telephone: (301)435-2920. Fax: (301)480-1845. Website: <http://dietary-supplements.info.nih.gov>.

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## Ergogenic aids

### Definition

Ergogenic aids are substances, foods, or training methods that enhance energy production, use or recovery and provide athletes with a competitive advantage.

### Purpose

New ergogenic products claiming to enhance performance appear on the market almost every week. Most are offered as supplements. Unfortunately, this means that both the contents of the product and the

claims on the label have not been evaluated by the United States Food and Drug Administration (FDA) and may not have any scientific basis. Surveys have shown that 76% of college athletes, and 100% of body builders take supplements. Athletes strive for the leading edge and they use ergogenic aids to improve their energy and performance. It is now known that the only healthy ergogenic aids are those that are legal, and have been proven safe. To gain a more competitive edge, the best aids are proper training, proper rest, good nutrition, correct technique, and good coaching.

## Description

Safe ergogenic aids include the following:

- Carbohydrate loading: It is now recognized that adequate dietary carbohydrate in the days and hours before strenuous training and competition is critical to maintaining adequate glycogen levels in the muscles. Increasing consumption of carbohydrates in liquid or food form normally three days prior to an endurance-type event is therefore a way to enhance performance. Endurance athletes, such as marathon runners, rely on their stores of glycogen as a source of energy during competition and carbohydrate loading is a method for boosting the amount of glycogen in the body before a competition.
- Proper nutrition: Proper nutrition means selecting good food choices and diets that lead to maintaining health while also reducing major risk factors for diseases. The estimated average daily calorie requirement is 1940 calories per day for women and 2550 for men. If the level of activity is increased, high performance can be achieved by increasing the calorie intake according on a sound nutrition basis.
- Electrolyte solutions: The body requires a certain amount of fluid intake on a daily basis to function and the minimum is about equal to four 8-ounce glasses (one liter or one quart). Strenuous activity and excessive sweating call for two to three times this basic amount. It has been shown that a fluid loss equivalent to 2% of body weight can impair performance and lead to heat exhaustion at 5%. Electrolyte solutions not only provide fluid, but also contain electrolytes, the salts and minerals required for various functions by the body and that are also lost by sweating.
- Stress management: The increased stress of competitive sports can affect athletes both physically and mentally such that their performance abilities are lowered. Stress may lead to excessive tension, increased heart rates, cold sweats, and anxiety about the outcome of the competition. Stress management techniques are recognized ergogenic aids that help maintain concentration, confidence, control and commitment.
- Relaxation techniques: Relaxation is especially important for high performance athletic activities. It promotes rest, recovery and recuperation while removing stress related reactions, such as increased muscular tension. In addition, relaxation contributes to the maintenance of positive physical and mental states.

## Precautions

Some ergogenic aids are known to have harmful side effects and this is the reason why they are banned by sports governing authorities because they are unsafe and unethical. The most abused aids include the following:

- Anabolic steroids: These are synthetic hormones used to increase muscle mass and strength. They also produce a "steroid rush", a state of euphoria and decreased fatigue that allows the athlete to train harder and longer. Many adverse effects have been documented from using these steroids.
- Blood doping: This is another dangerous ergogenic aid. It involves taking blood or blood products such as erythropoietin (EPO), a hormone that stimulates the bones to make red blood cells, to an athlete to improve endurance and speed. It can also have harmful side effects.
- Human growth hormone (HGH): HGH is a widely abused ergogenic aid by body builders. Some body builders take large doses to decrease fat and increase muscle mass. Many adverse effects have been documented.
- Caffeine: Caffeine affects the central nervous system by increasing mental alertness and lowering fatigue. Excessive use however, can cause irritability, restlessness, diarrhea, insomnia, and anxiety. It is found in coffee, tea, chocolate, and soft drinks.
- Ephedrine: Some athletes use ephedrine-containing supplements to improve their performance, have more energy or decrease their body fat. Unfortunately, athletes who use ephedrine may find that it helps them run farther and faster, but research findings have shown that it also puts them at risk of potentially life-threatening side effects. This is why the National Football League, the National Collegiate Athletic Association and the International Olympic Committee have all taken steps to keep it off the playing fields.
- Gene doping: Gene doping is the non-therapeutic use of cells, genes, genetic elements, to improve athletic

performance. Besides being a complex ethical as well as a philosophical issue, the long term effects on health have not been investigated to date.

## Interactions

Athletes who train hard frequently complain about energy drain and fatigue. Because they are regularly reminded to consume adequate fluids and fuel to minimize early fatigue and to maximize performance and recovery, many have turned to "energy" drinks". These are liquid food products that contain both fluid and energy together in one bottle. Recent research sponsored by the Food and Nutrition Information Center of the United States Department of Agriculture (USDA) has shown however, that some energy drinks were found to contain herbs, amino acids, **protein**, and other substances in such small amounts that they were unlikely to have any noticeable effect on performance. Other energy drinks were found to have contents that may result in inefficient absorption of fluid and nutrients from the intestine, with the possibility of gastrointestinal distress. The absorption of nutrients involves a delicate balance of interactions among various nutrients and the body and boosting intake of one may upset that balance.

Athletes are always looking for sound, effective aids to boost performance and many believe that herbs can improve athletic performance. Herbs are non-woody plants or parts of plants that have a long history of medicinal or therapeutic use. In fact, many common medications, such as aspirin and quinine, were first developed from herb extracts. However, if herbs can act as drugs, they are also associated with potential adverse effects or interactions with foods, other herbs, or medications.

## Aftercare

Treatment for excessive use of ergogenic supplements starts with complete avoidance. Depending on the supplement used and the medical complications, aftercare is tailored to individual cases and depend on the nature of the resulting medical condition.

## Complications

Harmful effects have been reported for several ergogenic products. Anabolic steroids have many adverse effects, most related to the unwanted androgenic effects, such as shrinking testicles, enlarged **prostate** gland, and lower sperm levels. Some of the adverse effects are potentially serious and irreversible and they include heart, liver, and immune system problems. Behavior changes may include aggression, paranoia, mood swings, low sex drive, and depression. Blood doping has been linked to strokes, allergic reactions, and infections. HGH adverse effects include heart and nerve diseases, glucose intolerance, and higher levels of blood **fats**. Other effects also come from the extra HGH levels in the body along with what is already produced by the pituitary glands. Ergogenic doses of **caffeine** may cause restlessness, nervousness, insomnia, and tremors. At least 17 deaths have been linked to products that combine caffeine and ephedrine. Additional risky supplements in the ephedrine class include androstenedione and other "prohormone" precursors to testosterone, yohimbine, and products that contain kava. Adverse effects have also been reported with carbohydrate supplementation. Increased insulin levels after carbohydrate consumption were shown to significantly decrease blood glucose levels in some athletes, and fructose-containing solutions have been associated with adverse gastrointestinal effects in some studies.

## Parental concerns

Parents should educate their teenagers concerning the use of ergogenic aids, and strive to increase their awareness of illegal ones. Most teens however, seem very smart in that they stay away from steroids. As part of a 2002 study funded by the National Institute for Drug Abuse, teens were asked if they had ever tried steroids, even if only once. Results were that only 2.5% of 8th graders had ever tried steroids, only 3.5% of 10th graders, and 4% of 12th graders. For teenagers, hormone balance is especially important since they are at the age of puberty. Hormones are involved in the development of feminine traits in girls and masculine traits in boys. When teenagers use steroids, there is a risk of gender mix-ups. Boys can experience shrunken testicles and can also end up with breasts (gynecomastia). Using steroids, girls can develop deeper voices and grow excessive body hair with a decrease of breast size.

Steroid users may be very pleased when they flex muscle in a mirror, but they may develop health problems that may hurt them for the rest of their lives, and even shorten their lives. Ergogenic supplements, unlike medicines and other drugs, do not undergo rigorous testing and screening for efficacy and safety, but information is still available, for instance from health care providers and sport medicine practitioners or at Supplement Watch (www.supplementwatch.com) and Consumer Lab (www.consumerlab.com), which provide independent test results and information to help people evaluate and select supplements.

## KEY TERMS

**Amphetamines**—Stimulant drugs whose effects are very similar to cocaine.

**Anabolic**—Pertaining to the putting together of complex substances from simples ones, especially to the building of muscle protein from amino acids.

**Anabolic steroid**—A group of synthetic hormones that promote the storage of protein and the growth of tissue, sometimes used by athletes to increase muscle size and strength.

**ATP**—Adenosine triphosphate, a high-energy phosphate molecule required to provide energy for cellular function. The energy source of muscles for short bursts of power.

**Blood doping**—Practice of illicitly boosting the number of red blood cells in the circulation in order to enhance athletic performance.

**Calorie**—A unit of food energy. In nutrition terms, the word calorie is used instead of the scientific term kilocalorie which represents the amount of energy required to raise the temperature of one liter of water by one degree centigrade at sea level. In nutrition, a calorie of food energy refers to a kilocalorie and is therefore equal to 1000 true calories of energy.

**Carbohydrate loading**—Increase consumption of carbohydrates in liquid or food form normally three days prior to an endurance type event.

**Central nervous system (CNS)**—The central nervous system (CNS) is composed of the brain and spinal cord. The brain receives sensory information from the nerves that pass through the spinal cord, as well as other nerves such as those from sensory organs involved in sight and smell. Once received, the brain processes the sensory signals and initiates responses.

**Ephedrine**—Central nervous system stimulant that that increases serum levels of norepinephrine. The herbs ma huang, ephedra sinica and sida cordifolia contain ephedrine, which structurally is similar to amphetamines.

**Erythropoietin (EPO)**—Hormone secreted by the kidneys which stimulates the bones to make red blood cells (erythrocytes).

**Gene doping**—Use of gene transfer technology by athletes to improve performance.

**Glucose**—A monosaccharide sugar occurring widely in most plant and animal tissue. In humans, it is the main source of energy for the body.

**Glycogen**—The storage form of glucose found in the liver and muscles.

**Heat exhaustion**—A mild form of heat stroke, characterized by faintness, dizziness, and heavy sweating.

**Hormone**—A chemical substance produced in the body that controls and regulates the activity of certain cells or organs.

**Human growth hormone (HGH)**—A hormone produced in the pituitary gland that stimulates growth of bone and muscle.

**Norepinephrine**—Hormone released by the sympathetic nervous system onto the heart, blood vessels, and other organs, and by the adrenal gland into the bloodstream as part of the fight-or-flight response.

**Steroid**—Naturally occurring or synthetic fat-soluble organic compounds having as a basis 17 carbon atoms arranged in four rings and including the sterols and bile acids, adrenal and sex hormones, certain natural drugs such as digitalis compounds, and the precursors of certain vitamins.

**Stimulant**—An agent, especially a chemical agent such as caffeine, that temporarily arouses or accelerates physiological or organic activity.

**Testosterone**—A hormone that promotes the development and maintenance of male sex characteristics.

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American Society for Nutrition (ASN). 9650 Rockville Pike, Bethesda, MD 20814. (301) 634-7050. <www.nutrition.org>.

Food and Drug Administration, Center for Food Safety and Applied Nutrition. 5100 Paint Branch Parkway, College Park, MD 20740-3835. 1-888-723-3663. <vm.cfsan.fda.gov>.

Office of Dietary Supplements, National Institutes of Health. National Institutes of Health, Bethesda, Maryland 20892 USA. <ods.od.nih.gov>.

U.S. Department of Agriculture, Food and Nutrition Information Center. National Agricultural Library,10301 Baltimore Avenue, Room 105, Beltsville, MD 20705. (301) 504-5414. <www.nal.usda.gov>.

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# F

## Fad diets

### Definition

Many fad diets defy logic, basic biochemistry, and even appetite appeal. They are popular because they promise quick results, are relatively easy to implement, and claim remarkable improvements in how their followers will look or feel. Unfortunately, the one thing most fad diets have in common is that they seldom promote sound weight loss. More important, they only work short-term. As many as 95% of people who lose weight gain it back within five years. It is not surprising that nearly 25% of Americans are confused when it comes to information about dieting.

### Purpose

Despite the popularity of dieting, the prevalence of overweight and **obesity** has increased steadily since the 1970s. In 1980, 25% of adults in the United States were overweight. By 1991, this figure had risen to 33 percent, and by 2001, over 66% of the adult population were classified as overweight or obese. Each year, Americans spend more than $30 billion fighting fat—often for gimmicks that do not work. Most people who are trying to lose weight are not using the recommended combination of reducing caloric intake and increasing physical activity. Fad diets provide advice counter to that provided by science-based governmental and nongovernmental organizations.

### Description

Fad diets take many forms. Over the years, they have promoted consumption of specific foods (e.g., the **Cabbage Soup diet**, the Drinking Man's diet, the **Grapefruit diet**), specific combinations of foods (e.g., the Zone) and specific times that foods must be eaten (e.g., the Rotation diet). Some popular diets recommend elimination of certain foods (e.g., carbohydrates in the **Atkins diet**, **Protein** Power, the Carbohydrate Addict's diet, Life without Bread, and Sugar Busters!). Others recommend eating based on a person's blood type (e.g., Eat Right for Your Type), or eating like a caveman (e.g., Neanderthin). Celebrities promote diets (e.g., Suzanne Somers' Get Skinny on Fabulous Food), and fad diets have taken the name of well-known places associated with wealth, fame, and thinness (e.g., the **Beverly Hills diet**, the **South Beach diet**). If any one of these fad diets worked, the problem of obesity would likely have been solved long ago.

Some fad diets have been popular for many years (e.g., Atkins Diet Revolution). Books appear as "new, revised" editions and continue to sell millions of copies. Unfortunately, there is nothing new or revised about the diets; they simply appeal to a new generation of overweight, frustrated dieters. The underlying reason why diets (including fad diets) work is that they result in decreased caloric intake. When energy intake is less than energy expenditure, people lose weight. Fad diets that lead to decreased caloric intake, whether by eliminating **carbohydrates**, eating cabbage soup all day, or adding grapefruit to every meal, will result in weight loss. If a person followed such a diet long-term, he or she would keep the weight off. Of course, no one wants to live on cabbage soup forever, or eliminate carbohydrates forever, so people break the "diet" and gain back the weight they lost—and often even more. The accompanying table provides information about some common fad diets.

The American Heart Association provides some tips that can be used to recognize a fad diet. First, does the diet contain magic or miracle foods or proprietary ingredients? There are no "super foods" or "magic ingredients" that can undo the long-term effects of overeating and lack of activity. Next, beware of fad diets that claim rapid weight loss (e.g., "lose 10 pounds this weekend!"). Though quite appealing, weight loss occurring this quickly is due to loss of fluid, not fat. Studies show that gradual weight loss increases a person's success at keeping it off permanently. Sound weight loss plans aim for losing no more than one to two pounds per week.

**Common fad diets: summary of information**

| Diet | Philosophy | Foods to eat | Foods to avoid | Practicality | Lose and maintain weight? |
|---|---|---|---|---|---|
| Dr. Atkins' New Diet Revolution | Eating too many carbohydrates (CHO) causes obesity and other health problems; elimination of CHO solves problems. | Meat, fish, poultry, eggs, cheese, low-CHO vegetables, butter, oil; no alcohol. | Carbohydrates, specifically bread, pasta, milk, most fruits and vegetables | Limited food choices. | Yes, but initial weight loss is mostly water. Difficult to maintain long-term due to food restrictions. |
| The Zone | Eating the right combination of foods leads to metabolic state at which body functions at peak level, and results in weight loss and increased energy. | Most foods, so long as they are consumed in the exact proportion (40/30/30) at each meal. | Carbohydrates, specifically bread, pasta, some fruits, and saturated fats | Difficult to calculate portions and follow. | Yes, because of lower caloric intake. Could result in weight maintenance if followed long-term. However, diet rigid and difficult to maintain long-term. |
| Protein Power | Eating CHO releases insulin that contributes to obesity and other health problems. | Meat, fish, poultry, eggs, cheese, low-CHO vegetables, butter, oil, salad dressings, alcohol in moderation. | Carbohydrates | Rigid rules. Not practical long-term. | Yes, via caloric restriction. Could result in weight maintenance if followed long-term. However, diet rigid and difficult to maintain long-term. |
| Sugar Busters! | Sugar is toxic, leads to insulin resistance, which then makes you overweight. | Protein and fat. Low-glycemic-index foods. Alcohol in moderation. | Potatoes, white rice, corn, carrots, beets, white bread, all refined white flour products | Eliminates many carbohydrates; discourages eating fruit with meals. | Yes, via caloric restriction. Difficult to maintain long-term due to food restrictions. |

*(Illustration by GGS Information Services/Thomson Gale.)*

Another sign of a fad diet is losing weight without exercise. Studies consistently show that the single most important variable that predicts long-term success at weight loss and maintenance (not gaining back the weight that was lost) is physical activity. Simple activities like walking or riding a bike (to and from school, for example) should be incorporated into one's life. Also, beware of the promotion of bizarre quantities of foods or the elimination of other types of foods (e.g., cabbage soup for breakfast, lunch, and dinner; avoiding dairy foods; and eliminating carbohydrates). Forbidding certain foods or entire food groups, in addition to being unhealthy, may increase the likelihood that one will cheat, binge, or just give up on the diet. Finally a rigid menu or rigid schedule of eating is a good sign that one should avoid the diet. Limiting food choices and adhering to specific eating times is a daunting task. Rather, one should look for a plan that can be followed not for a week or a month, but for an entire lifetime.

Knowledgeable practitioners do not recommend fad diets because such diets do not work long-term. Even though they might work in the short run, there is little value in losing weight if one is only going to regain it after the diet ends. With repeated dieting, weight loss becomes more difficult and results in frustration, feelings of failure, and loss of self-esteem.

From a nutritional standpoint, many fad diets lack important nutrients. For example, high-fat, low-carbohydrate diets (such as the Atkins Diet) are low in **vitamins** E, A, thiamin, $B_6$, **folate**, **calcium**, **magnesium**, **iron**, **zinc**, potassium, and dietary fiber, and they also require supplementation. In addition, they are high in saturated fat and cholesterol. On the other hand, when individuals are allowed to choose foods from all food groups, their diet is likely to be nutritionally adequate and healthful long-term.

Most fad diets do not result in long-term weight loss and are often nutritionally inadequate for long-term use.

## KEY TERMS

**Folate**—One of the B vitamins, also called folic acid.

**Saturated fat**—A fat with the maximum possible number of hydrogens; more difficult to break down than unsaturated fats.

## Resources

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National Center for Chronic Disease Prevention and Health Promotion. "Healthy Eating Tips" and "Obesity and Overwight." Available from <http://www.cdc.gov>
National Heart, Lung, and Blood Institute. <http:www.nhlbi.nih.gov>
Shape Up America. <http://www.shapeupamerica.org>

Marjorie R. Freedman

# Fat flush diet

## Definition

The fat flush diet is a combination weight-loss and detoxification ('detox') or cleansing diet, formulated by the well-known nutritionist Ann Louise Gittleman. It is a low-carbohydrate, restricted-calorie diet, which is designed to boost **metabolism**, decrease **water** retention, and promote loss of fat.

## Origins

Ann Louise Gittleman, a certified nutrition specialist with a Ph.D. in holistic nutrition, first introduced the idea of 'fat flush' in her 1988 book *Beyond Pritikin*. Gittleman created her diet after working as a nutritionist at the Pritikin Longevity Center in Florida, where she observed that many of her clients did very poorly on Nathan Pritikin's extremely **low-fat diet**. The author of some 25 books on nutrition, dieting, and health, Gittleman is America's self-described 'First Lady of Nutrition.' *The Fat Flush Plan* became a bestselling diet book in 2002. It received additional publicity in the 2006 film *Last Holiday* starring Queen Latifah.

## Description

### *Theory*

The theory behind the fat flush diet is that eating the correct combinations of foods and eating more often will increase the body's metabolism and lead to the efficient burning of fat. Therefore, rather than totally restricting fat, the fat flush diet calls for eating the correct **fats**, as well as the correct **carbohydrates** and proteins. However, in order to maximize the body's burning of stored body fat 24 hours per day, the liver and lymphatic system must first be detoxified.

According to Gittleman there are five 'hidden factors' that sabotage weight loss, lower energy levels, and interfere with good health:

- A liver that is overloaded with toxins and functioning poorly cannot burn fat properly.
- Food sensitivities and intolerances lead to water retention and 'waterlogged tissues.' The fat flush diet eliminates foods that cause water retention and prescribes protein-rich foods, filtered water, and diuretics to remove excess water.
- People are afraid of eating fat. The fats in Gittleman's diet accelerate fat burning, satisfy hunger, and maintain lean muscle mass.
- Insulin is a fat-storing hormone and excess insulin is caused by food that are high in rapidly released carbohydrates.
- The stress hormone cortisol causes the body to store fat, particularly around the abdomen. Cortisol levels can be controlled by timing meals.

### *Diet components*

The fat flush diet includes:

- 8 oz (225 g) daily of lean protein as lean meat, eggs, and fish
- fruits and vegetables
- omega-3-rich fats such as flaxseed oil and evening primrose oil
- spices such as ginger, cayenne, mustard, and cinnamon, to speed up metabolism
- 'long life cocktail' consisting of one teaspoon of powdered psyllium husks or one tablespoon of ground or milled flaxseed in 8 oz (237 ml) cran-water (one part unsweetened cranberry juice, four parts filtered water), a diuretic to speed the detoxification process and balance hormones
- a supplement called GLA. Gamma linolenic acid or GLA is an essential fat from black current seed oil that Gittleman sells as 90-mg capsules. Gittleman claims that GLA-90 boosts weight loss by activating brown adipose tissue (BAT) and 'balancing the body's sodium/potassium pump.'

Specific fat flushing diet rules include:

- only one protein item per meal, with the exception of eggs
- no fruits and vegetables together
- no milk and meat together
- no water with meals, fluids only between meals
- eating about every three hours.

There are three phases to the fat flush diet:

- Phase 1 is a two-week very restrictive cleansing diet.
- Phase 2 is a less restrictive diet that is continued until the desired weight or body size is achieved.

## KEY TERMS

**Brown adipose tissue**—BAT; brown fat; a heat-producing tissue found primarily in human fetuses and infants and hibernating animals.

**Cellulite**—Fat deposited in pockets just below the surface of the skin around the hips, thighs, and buttocks.

**Chromium**—An essential mineral that must be obtained from the diet and is important for the metabolism of fats and carbohydrates and for insulin metabolism, as well as for many enzymatic reactions in the body.

**Cortisol**—Hydrocortisone; a glucocorticoid that is produced by the adrenal cortex and regulates various metabolic processes and has anti-inflammatory and immunosuppressive properties. Blood levels may become elevated in response to stress.

**Cran-water**—A diuretic drink consisting of one part unsweetened cranberry juice in four parts filtered water.

**Detoxification**—Detox; cleansing; to remove toxins or poisons from the body.

**Diuretic**—An agent that increases urine excretion.

**Evening primrose oil**—Oil extracted from the seeds of the evening primrose, *Oenothera biennis*; contains GLA.

**Flaxseed**—Linseed; the seed of flax, *Linum usitatissimum*, used as a source of oil for treating inflammation of the respiratory, intestinal, and urinary tracts, and as a dietary supplement.

**GLA**—Gamma-linolenic acid; an essential fatty acid found in evening primrose oil.

**Insulin**—A hormone made in the pancreas that is essential for the metabolism of carbohydrates, lipids, and proteins, and that regulates blood sugar levels.

**L-carnitine**—A molecule in muscle that is responsible for transporting fatty acids across mitochondrial membranes; obtained from meat and milk.

**Lignan**—Compounds in plants that have antioxidant and estrogenic activities.

**Lipotropic**—Factors that promote the utilization of fat by the body.

**Long life cocktail**—A drink consisting of one teaspoon of powdered psyllium husks or one tablespoon of ground or milled flaxseed in 8 oz (237 ml) cran-water.

**Omega-3 fatty acids**—A type of polyunsaturated fatty acids that appear to be beneficial for the heart.

**Psyllium**—Fleawort; plants of the genus *Plantago* whose seed husks have laxative activity.

- Phase 3 is a typical low-carbohydrate diet that can be maintained for life.

**PHASE 1.** The two-week phase 1 of the fat flush diet is designed to detoxify the liver so that it can efficiently burn fat. It calls for eight glasses per day of cran-water to reduce water retention or 'bloating', lose fat, cleanse the lymphatic system, and reduce cellulite. Caloric intake is restricted to 1100–1200 calories per day. So-called 'metabolism blockers,' such as wheat and dairy, are prohibited.

The phase 1 diet consists of:

- cran-water
- long life cocktail
- one tablespoon twice daily of organic high-lignan flaxseed oil in non-heated food
- GLA supplements twice daily for a total of 360–400 mg
- hot water with the juice of one-half lemon before breakfast as a detox drink for the liver and kidneys
- 8 oz (225 g) of lean protein daily
- one–eggs per day
- at least two portions of fruit daily
- unlimited raw or steamed vegetables
- one chicken, beef, or vegetable stock without salt for cooking
- herbs and spices.

The lean **protein** may be:

- any fish or seafood
- lean beef, veal, or lamb
- skinless chicken or turkey
- tofu
- high-protein whey powder for thickening.

Allowable vegetables include:

- asparagus
- aubergine
- bamboo shoots
- black olives without oil
- broccoli
- Brussels sprouts

- cabbage
- cauliflower
- celery
- cucumbers
- green beans
- mushrooms
- onions
- peppers
- radicchio
- spinach
- tomatoes
- water chestnuts.

Acceptable fruits are:

- blackberries
- blueberries
- cherries
- cranberries
- grapefruit
- oranges
- nectarines
- peaches
- plums
- raspberries
- strawberries.

Allowable herbs and spices are:

- anise
- apple cider vinegar
- bay leaf
- cayenne
- cinnamon
- cloves
- coriander, cilantro
- cumin
- dill
- dried mustard
- fennel
- garlic
- ginger
- parsley
- tumeric.

Forbidden foods during phase 1 include:

- oils and fats, except flaxseed oil
- margarine
- grains
- bread
- cereal
- sugar
- starchy vegetables such as beans, potatoes, carrots, corn, and peas
- dairy products
- most herbs and spices
- alcohol.

A sample phase 1 daily meal plan calls for:

- upon waking: a long life cocktail
- before breakfast: 8 oz (237 ml) of hot water with lemon juice
- breakfast: 'vegetable scramble'—two scrambled eggs with spinach, green onions, scallions, and parsley; 8 oz (237 ml) of cran-water
- snack: one-half of a large grapefruit
- 20 minutes before lunch: 8 oz (237 ml) of cran-water
- lunch: 4 oz (110 g) of salmon with lemon and garlic, warm asparagus, mixed-green salad with broccoli florets and cucumber, one tablespoon of flaxseed oil, 8 oz (237 ml) of cran-water
- mid-afternoon snack: 16 oz (474 ml) of cran-water
- 4 P.M. snack: one apple
- 20 minutes before dinner: 8 oz (237 ml) of cran-water
- dinner: 4 oz (110 g) of grilled lamb chop with a pinch of cinnamon and dried mustard, sautéed kale in broth, baked summer squash with a bit of clove, one tablespoon of flaxseed oil
- mid-evening: long life cocktail.

**PHASE 2.** This ongoing phase of the fat flush diet is designed for continued weight loss with a more moderate cleansing program and a slightly increased variety of foods. The caloric allowance is raised to 1200–1500 calories. Phase 2 is continued until the desired weight loss or size is achieved.

Carbohydrates that may be added back into the diet, at the rate of one per week, include:

- sweet potato
- brown rice
- fresh or frozen peas
- carrots
- butternut squash.

**PHASE 3.** Phase 3 is a lifelong weight-maintenance plan with a daily caloric allowance of 1500 calories or more. The diet is made up of 40% carbohydrates, 30% protein, and 30% fat, and may include two dairy products and four carbohydrates per day. Some starchy vegetables, fruits, gluten-free grains, dairy products, and more oils are introduced into the diet one at a time, to check for any adverse reactions.

### *Other fat flush components*

There are very few options for eating out on the fat flush diet, although choices such as fish tacos or grilled chicken sandwiches are possible. Since **caffeine** stresses the liver and, according to Gittleman, impedes fat burning, coffee should be tapered off and eventually replaced with one cup of herbal coffee per day. Alcohol is strictly forbidden during phases 1 and 2 because of its damaging effects on the liver.

Exercise is an important component of the fat flush plan. The first two phases call for brisk walking for 20–30 minutes five times per week and five minutes daily of 100 jumping jacks on a mini-trampoline. Exercise is increased in phase 3 and includes lifting weights for strength training twice per week.

The fat flush plan calls for exactly eight hours of sleep per night and for the dieter to keep a journal.

### *Kits*

Gittleman runs residential fat flush and 'Fast Track' cleansing programs and an online forum. She sells a line of organic processed foods and a 30-day fat flush detoxification kit that includes **vitamins** and **minerals**, GLA-90, and a weight-loss formula. The latter contains high amounts of chromium and L-carnitine. Chromium is a nutrient that can assist the body in utilizing protein, sugar, and fat. According to Gittleman, L-carnitine maximizes fat burning by helping the body transform food into energy. Her formula is also advertised to contain blood-sugar-stabilizing agents, appetite controllers, fat burners, and lipotropic nutrients and herbs.

## Function

The fat flush diet first uses a detoxification regimen to improve fat burning and then implements a plan for losing weight rapidly, followed by a maintenance plan. It is considered to be a healthy weight-loss program. It is a balanced diet with a significant exercise component and is designed to be followed for life.

## Benefits

Benefits of the fat flush diet may include:

- detoxification or cleansing of the liver and lymphatic system
- rapid weight loss of up to 10 lb (4.5 kg) in the first two weeks
- elimination of bloating
- weight loss accompanied by body toning
- maintenance of weight loss
- decreased hips, waist, and thigh measurements

According to Gittleman, this plan will also:

- increase metabolism
- permanently eliminate cellulite
- increase energy
- improve sleep
- improve health and appearance
- manage hormones and stabilize mood swings
- improve attitude
- create a healthy lifestyle.

## Precautions

The fat flush diet is only appropriate for people who can maintain a very strict diet for the first few weeks in order to lose weight rapidly. It may not be appropriate for vegetarians because it specifies animal protein. Vegans should add an amino-acid supplement and possibly protein powder. It is not known how often the fat flush diet leads to permanent weight loss. As with most diets, if healthy eating habits are not maintained long term, any weight lost will be regained and the other benefits will be lost.

Some experts advise against following diets that eliminate entire food groups and/or require the taking of supplements whose effects are unknown. The fat flush diet prohibits wheat and dairy during phases 1 and 2 and requires supplements. Whole-wheat grains are considered to be one of the best foods for reducing the risk of heart disease. Low-fat dairy products provide **calcium** and nutrients such as **magnesium** and **riboflavin** that may be hard to obtain from other foods. The fat flush diet requires expensive supplements including **flaxseed** oil, evening primrose oil, GLA, and protein powders.

Those following the fat flush diet should be aware of additional precautions:

- The caloric allowance in phase 1 may be too low for some people, particularly men.
- The calorie levels in phases 1 and 2 are too low to support a strenuous exercise regimen.
- The low calories may slow down, rather than speed up, metabolism.
- Although eight hours of sleep is sufficient for many people, other people require more sleep, particularly with 40 minutes of brisk walking per day and two strength-training sessions per week.

- Medications should be taken an hour before or after the life long cocktail because the fiber in the cocktail may interfere with absorption of medicine.

## Risks

The fat flush plan can disrupt menstrual cycles. Gittleman suggests using black current seed oil rather than evening primrose oil as a GLA source to avoid this. According to Gittleman black current seed oil has a better omega-6 to omega-3 ratio for balancing hormones.

Gittleman's fast flush kit contains chromium, which has been linked to **ulcers** and liver and kidney damage. Large doses of chromium can be lethal.

## Research and general acceptance

### *Research*

There is little scientific evidence to support claims made for the benefits of detox diets. Gittleman claims that her plan speeds up metabolism, detoxifies the liver by flushing out waste and fat, and helps digest fatty globules in the lymphatic system. Registered dietician Jane Kirby, in her book *Dieting for Dummies*, says that there is no scientific evidence that the liver is a 'fat-burning furnace.' She says: 'It's just a low-calorie diet. Most people lose weight when calories are cut this low.' Dr. Donald Hensrud of the Mayo Clinic was quoted in *O: the Oprah Magazine* in August of 2006: 'There's no such thing as a metabolism-blocking food; the liver and lymphatic system have no link to weight loss that we know of; there's no medical purpose for cleansing the body with a diuretic; and while the fat-burning supplement recommended [GLA] has been tested in animals, there's very little data on its effect in humans.'

### *General acceptance*

The fat flush diet is very popular. Gittleman is a highly respected nutritionist who has written many articles and books on women's health, nutrition, and **detoxification diets**, and the fat flush diet has received much publicity in the popular press. Testimonials as to the success of the diet are abundant on the Internet. According to Gittleman's Website, some individuals have lost up to 12 inches (30 cm) from their buttocks, hips, and thighs in the two-week phase 1 of the diet. One individual claims that it eliminated 95% of her intractable chronic pain. The fat flush diet has proved so popular that other entrepreneurs are selling their own fat flush kits.

## QUESTIONS TO ASK YOUR DOCTOR

- Have you had other patients who have tried the fat flush diet?
- Is the calorie allowance in this diet adequate for my activity level?
- Is it healthy for me to completely eliminate grains and dairy from my diet?
- Is eight hours of sleep adequate for my needs?
- Should I be taking a diuretic?
- Should I take GLA and other supplements?
- Could the medications that I take interact with the herbs, supplements, and nutrients in the fat flush kit?
- Are there vitamin and mineral supplements that I should take while following this diet?

## Resources

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**ORGANIZATIONS**

American Dietetic Association. 120 South Riverside Plaza, Suite 2000, Chicago, IL 60606-6995. (800) 877-1600. <http://www.eatright.org>.

American Obesity Association. 1250 24th St. NW, Suite 300, Washington, DC 20037. (202) 776-7711. <http://www.obesity.org>. An organization dedicated to education, research, prevention, and treatment of obesity, as well as consumer protection and fighting disrimination against overweight individuals.

Key to Health Foundation. <http://www.annlouise.com/alg_keytohealth.asp>. Ann Louise Gittleman's foundation dedicated to education and research on women's health.

Margaret Alic, Ph.D.

Fat Loss 4 Idiots diet *see* **Weight Loss 4 Idiots diet**

# Fat replacers

## Definition

Fat replacers, also called fat substitutes, are substances that take the place of all or some of the fat in a food and yet give the food a taste, texture, and mouth feel similar to the original full-fat food.

## Purpose

Fat replacers serve two purposes. They reduce the amount of fat in food, and they usually reduce the calorie content of the food.

## Description

Fat is not a single substance, but a collection of different compounds that are all made of a glycerol molecule and three varying fatty acids. Fat is a necessary part of a healthy diet. It provides essential fatty acids, helps regulate cholesterol **metabolism**, carries fat-soluble **vitamins** and **carotenoids** throughout the body, contains the building blocks for prostaglandins, and provides nine calories of energy per gram.

Although there is no official recommended daily allowance (RDA) for fat, the American Heart Association strongly recommends that **fats** provide no more than 30% of one's total daily calories. The average American gets about 34% of his or her calories from fat (down from about 41% in the 1950s).

As of 2000, there were more than 5,000 reduced-fat foods on the market. New reduced- and low-fat foods were being introduced at the rate of about 1,000 per year. Concern about heart disease, **obesity**, diabetes, and their relationship to diet has turned processed foods containing fat replacers into a multi-billion dollar industry.

To be labeled "low fat" a product must contain 3 g of fat or less per serving. To be labeled "reduced fat" or "reduced calorie," a product must contain 25% less fat or 25% fewer calories than the regular version of the product. "Light" foods contain half the fat or one-third the calories of the regular product. "Fat-free" means the food has less than 0.5 g of fat per serving. Fat enhances food flavor, adds volume, and gives food a particular texture and mouth feel. Removing fat from food usually results in unappealing, unmarketable products. To achieve fat and calorie reduction, processors have turned to fat replacers.

### *Types of fat replacers*

Fat replacers are either carbohydrate-based, protein-based, or fat-based. Most foods use several different fat replacers that come from different sources. Many are substances that have been found in foods for years, but are now being used in different ways.

Carbohydrate-based fat substitutes include guar gum, polydextrose (Litess), gum Arabic, xanthum gum, carrageenan (an extract from seaweed), dried plum paste, modified food starches, oat **fiber**, and wheat fiber. Carbohydrate-based fat replacers have the creaminess of fat. They absorb **water**, add volume, thicken, and stabilize foods. They are used in baked goods, frozen desserts, yogurts, cheeses, sour cream, low-fat puddings, processed meats, salad dressings, sauces, and spreads. Because fat contains nine calories

**Carbohydrate-based fat replacers**

| | Brand names | Foods |
|---|---|---|
| Cellulose | Avicel® cellulose gel, Methocel™, Solka-Floc® | Dairy-type products, sauces, frozen desserts, salad dressings |
| Dextrins | Amylum, N-Oil® | Salad dressings, puddings, spreads, dairy-type products, frozen desserts |
| Fiber | Opta™, Oat Fiber, Snowite, Ultracel™, Z-Trim | Baked goods, meats, spreads, extruded products |
| Gums | KELCOGEL®, KELTROL®, Slendid™ | Reduced-calorie and fat-free salad dressings, other formulated foods, including desserts, processed meats |
| Inulin | Raftiline®, Fruitafit®, Fibruline® | Yogurt, cheese, frozen desserts, baked goods, icings, fillings, whipped cream, dairy products, fiber supplements, processed meats |
| Maltodextrins | CrystaLean®, Lorelite, Lycadex®, MALTRIN®, Paselli®D-LITE, Paselli®EXCEL, Paselli®SA2, STAR-DRI® | Baked goods, dairy products, salad dressings, spreads, sauces, frostings, fillings, processed meat, frozen desserts, extruded products, beverages |
| Nu-Trim | | Baked goods, milk, cheese, ice cream |
| Oatrim (hydrolyzed oat flour) | Beta-Trim™, TrimChoice | Baked goods, fillings and frostings, frozen desserts, dairy beverages, cheese, salad dressings, processed meats, confections |
| Polydextrose | Litesse®, Sta-Lite™ | Baked goods, chewing gums, confections, salad dressings, frozen dairy desserts, gelatins, puddings |
| Polyols | many brands available | Reduced-fat and fat-free products |
| Starch and Modified Food Starch | Amalean®I & II, Fairnex™VA15, & VA20, Instant Stellar™, N-Lite, OptaGrade®, Perfectamyl™AC, AX-1, & AX-2, PURE-GEL®, STA-SLIM™ | Processed meats, salad dressings, baked goods, fillings and frostings, sauces, condiments, frozen desserts, dairy products |
| Z-Trim | | Baked goods, burgers, hot dogs, cheese, ice cream, yogurt |

SOURCE: Calorie Control Council

**Fat replacers are ingredients that substitute fat in many foods and beverages. Most fat replacers are reformulations of existing food ingredients (e.g., starches, gums, cellulose). Additionally, the food industry has formulated a variety of new fat replacer ingredients. Fat replacers generally fall into one of three categories: carbohydrate-based, protein-based, or fat-based.** *(Illustration by GGS Information Services/Thomson Gale.)*

per gram and **carbohydrates** contain only four calories per gram, every gram of fat replaced with a gram of a carbohydrate-based fat substitute reduces the calorie content of the food by five calories as well as reducing the fat content. Carbohydrate-based fat replacers cannot be used in frying.

Protein-based fat replacers (e.g., Simplesse) are made from milk **protein** and/or egg white protein. These proteins are heated and then whirled violently in blenders to produce very tiny particles in a process called microparticulation. These microparticles give protein-based fat replacers the same mouth feel as fats. Like carbohydrate-based substitutes, protein provides four calories per gram so they reduce the calorie content of food by five calories per gram of fat replaced. Protein-based fat replacers are used in butter, cheese, frozen dairy desserts, mayonnaise, soups, salad dressings, and sour cream. They do not work well in baked goods and cannot be used for frying.

Fat-based fat replacers (e.g., Caprenin, Benefat, Olean) are made of fat molecules that are modified so that they cannot be absorbed (Olean) or can be only partially absorbed (Caprenin, Benefat) in the intestine. Olestra, now marketed under the name Olean, is the best known of these products. Olestra is made of six to eight fatty acids bound to a sucrose (sugar) molecule. Normal fats have only three fatty acids. Adding the extra fatty acids makes the olestra molecule too large to be absorbed, so it simply passes through the intestine and is eliminated as waste. In this way, it adds no calories to food. Proctor & Gamble spent 25 years and more than $200 million developing this fat replacement.

Olestra has all the properties of regular fat and can be used in frying. It is used mainly in crunchy snack foods such as potato chips. Other fat-based fat replacers such as Caprenin and Benefat are partially absorbed by the body and contain about five calories per gram. Emulsifiers can also be used as fat replacers. They contain the same number of calories per gram as fat, but fewer grams of emulsifier are needed to achieve the same taste, texture, and mouth feel as fat.

### *Health considerations*

All fat replacers on the market are on the generally recognized as safe (GRAS) list approved by the United States Food and Drug Administration (FDA). When olestra was first introduced for use in snack foods in 1996, it was required by the FDA to

**Protein and fat-based fat replacers**

| Protein-based fat replacers | Brand names | Foods |
|---|---|---|
| Microparticulated Protein | Simplesse® | Dairy products (ice cream, butter, sour cream, cheese, yogurt), salad dressing, margarine- and mayonnaise-type products, baked goods, coffee creamer, soups, sauces |
| Modified Whey Protein concentrate | Dairy-Lo® | Milk/dairy products (cheese, yogurt, sour cream, ice cream), baked goods, frostings, salad dressing, mayonnaise-type products |
| Other | K-Blazer®, ULTRA- BAKE™, ULTRA-FREEZE™, Lita® | Frozen desserts and baked goods |
| **Fat-based fat replacers** | | |
| Emulsifiers | Dur-Lo®, EC™-25 | Cake mixes, cookies, icing, dairy products |
| Salatrim | Benefat™ | Confections, baked goods, dairy, other applications |
| **Lipid (Fat/Oil) analogs** | | |
| Esterified Propoxylated Glycerol (EPG) | | Consumer and commercial applications, including formulated products, baking, frying. |
| Olestra | Olean® | Salty snacks and crackers |
| Sorbestrin | | Fried foods, salad dressing, mayonnaise, baked goods |

SOURCE: Calorie Control Council

**Fat replacers are ingredients that substitute fat in many foods and beverages. Most fat replacers are reformulations of existing food ingredients (e.g., starches, gums, cellulose). Additionally, the food industry has formulated a variety of new fat replacer ingredients. Fat replacers generally fall into one of three categories: carbohydrate-based, protein-based, or fat-based.** *(Illustration by GGS Information Services/Thomson Gale.)*

carry the following warning: "This Product Contains Olestra. Olestra may cause abdominal cramping and loose stools. Olestra inhibits the absorption of some vitamins and other nutrients. Vitamins A, D, E, and K have been added." In 2003, after additional controlled studies and consumer education, the FDA allowed the warning to be removed from olestra-containing foods. The FDA requires small amounts (far less than the RDA) of vitamins A, D, E, and K be added to foods containing Olestra. This helps compensate for the small amount of these fat-soluble vitamins that dissolve in Olestra and is carried out of the body rather than being absorbed. Other vitamins are not affected.

A diet too high in fat can increase levels of blood lipids and increase risk of plaque build up on the walls of arteries and result in the development of cardiovascular disease. Reducing the amount of fat intake along with other lifestyle changes can help reduce this risk. In addition, obesity increases the risk of developing diabetes and other health problems. Studies have shown reduced-fat foods can be part of an effective weight-loss program that combines a healthy diet, reduced calorie intake, and exercise. The American Heart Association states, "Within the context of a healthy dietary pattern, fat substitutes, when used judiciously, may provide some flexibility in dietary planning, although additional research is needed to fully determine the longer-term health effects."

## Precautions

People who have disorders that interfere with the absorption of nutrients from the intestine, such as **celiac disease**, Crohn's disease, or **inflammatory bowel disease**, should consider avoiding foods containing Olestra.

Fat replacers are often found in high-calorie foods. These foods may contain extra sugar to compensate for the absence of fat. Many reduced-fat products contain as many or almost as many calories as the full-fat equivalent. Consumers concerned about calorie intake should read the label and not assume that reduced-fat implies a reduced-calorie product.

## Interactions

Olestra reduces the absorption of the fat-soluble vitamins A, D, E, and K, and carotenoids. Olestra-containing products have extra fat-soluble vitamins, but not carotenoids, added to compensate for this.

## Complications

Large amounts of Olestra and the carbohydrate-based fat replacer polydextrose can cause loose stools and diarrhea in some people. Individuals should start with a small amount of foods containing these substances and see how they are affected.

## KEY TERMS

**Carotenoids**—Fat-soluble plant pigments, some of which are important to human health.

**Fat-soluble vitamin**—A vitamin that dissolves in and can be stored in body fat or the liver.

**Fatty acids** —Complex molecules found in fats and oils. Essential fatty acids are fatty acids that the body needs but cannot synthesize. Essential fatty acids are made by plants and must be present in the diet to maintain health.

**Prostaglandins**—A group of biologically important molecules that have hormone-like actions. They help regulate expansion of the blood vessels and the airways, control inflammation, are found in semen, and cause the uterus to contract. They are made from fatty acids.

### Parental concerns

Reduced-fat foods may appear healthy, but they may contain as many calories and more sugar than the equivalent full-fat product. Parents should encourage their children to eat a healthy diet high in fruits and vegetables and low in fats and not rely on fat substitutes to control fat and calorie intake.

### Resources

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#### ORGANIZATIONS

American Dietetic Association. 120 South Riverside Plaza, Suite 2000, Chicago, IL 60606-6995. Telephone: (800) 877-1600. Website: <http://www.eatright.org>.

International Food Information Council. 1100 Connecticut Avenue, NW Suite 430, Washington, DC 20036. Telephone: (202) 296-6540. Fax: (202) 296-6547. Website: <http://ific.org>.

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Tish Davidson, A.M.

# Fat smash diet

## Definition

The fat smash diet is a 90-day, four-phase weight-loss program that is designed to 'smash' bad habits and make permanent lifestyle changes in eating and physical activity.

## Origins

Dr. Ian Smith, M.D., developed the fat smash diet plan after he became weight-loss consultant and judge for the VH1 hit television program *Celebrity Fit Club*. The plan was originally designed for celebrities trying to lose weight on the show. Smith's bestselling book, *The Fat Smash Diet: The Last Diet You'll Ever Need*, was published in 2006. In April of 2007 Smith published the *Extreme Fat Smash Diet*, an alternative program for people wanting to lose weight in a short period of time.

## Description

### *Principles*

According to Smith, the fat smash diet plan is designed to 'rewire' the body and its relationship to food and physical activity. It is based on lifestyle changes that will enable people to maintain their weight once they have achieved their weight-loss goals. The aim of the plan is to eliminate bad habits, while enjoying food without overindulging. The fat smash diet is very flexible and utilizes a wide variety of healthy everyday foods, with the emphasis on whole grains, fresh produce, lean meat, fish, poultry, and healthy **fats**. Smith's book includes more than 50 quick and simple recipes. Although the diet does not involve calorie counting, quantities are suggested as a guide for keeping portions small.

The major principles behind the fat smash diet plan are:

- eating four–five small meals or large snacks daily, no more than three–four hours apart, with the last meal at least one and one-half hours before bedtime
- establishing a regular eating schedule to avoid hunger pangs
- eating small portions—just enough to feel full
- including fresh fruits and vegetables with meals
- eating 'good' carbohydrates and avoiding 'bad' carbohydrates
- eating foods raw, baked, steamed, or grilled
- a large exercise component, preferably with a partner
- avoidance of stress.

The rules for success on the fat smash diet are:

- not overeating
- always eating fruits and vegetables, regardless of the diet stage
- not eating fried foods
- not skipping meals
- continuing the exercise regimen
- maintaining emotional and mental focus.

Before beginning the fat smash plan dieters are instructed to:

- record their pre-diet weight
- determine their body mass index (BMI)
- take photographs of themselves.

### *The pyramid*

The fat smash diet is constructed as a pyramid, with each of the four phases building on the previous phases:

- Phase 1 is the nine-day detoxification, 'detox,' stage to rid the body of impurities.
- Phase 2 is the three-week foundation stage.
- Phase 3 is the four-week construction stage.
- Phase 4 is the lifelong temple stage.

The fat smash diet is designed to allow for mistakes. Dieters who overindulge or eat a prohibited food can return to phase 1 for about a week and then pick up the diet at the phase where they left off.

**PHASE 1—DETOXIFICATION.** The 9-day natural detoxification stage is not a fasting diet. Rather it is a vegetarian diet consisting primarily of fruits and vegetables, with some dairy and egg whites allowed. There are no absolute restrictions on how much to eat. The diet is designed to rid the body of toxins from processed foods and the environment, including the elimination of **caffeine** and alcohol, to make it easier to lose weight. Phase 1 includes 30 minutes of aerobic exercise five times per week, with a suggested 20–25-minute walk after dinner to increase the **metabolism**.

Foods allowed during phase 1 include:

- all fresh fruits in any quantity
- all vegetables in any quantity, except white or red potatoes and avocados; vegetables should be raw or lightly cooked (steamed or grilled)
- one cup daily of fresh-squeezed—not canned—fruit or vegetable juice
- one cup daily of cooked unsweetened oatmeal, grits, farina, or cream of wheat
- up to four egg whites daily
- any dried beans such as lentils or chickpeas
- 2 cups daily of cooked brown rice
- tofu
- a maxiumum of two tablespoons per day of tahini (sesame paste)
- 2 cups daily of low-fat or nonfat milk or soy milk
- 6 oz (170 g) of low-fat yogurt, maximum of 12 oz (340 g) daily
- a maximum of two pickles per day
- one–two teaspoons of low-fat virgin olive oil for grilling vegetables
- low-fat dressing, no more than three tablespoons per salad

## KEY TERMS

**Anaerobic exercise**—Brief, strength-based activity, such as sprinting or weight training, in which anaerobic (without oxygen) metabolism occurs in the muscles.

**Body mass index**—BMI, a measure of body fat determined from the ratio of one's weight in kg to the square of one's height in meters; the BMI from weight in lb and height in inches is determined from tables; an adult BMI of 25—29.9 is considered overweight and 30 or above indicates obesity.

**Detoxification**—Detox; cleansing; to remove toxins or poisons from the body.

**Fiber**—Roughage; a complex mixture found in plant foods that includes the carbohydrates cellulose, hemicellulose, gum, mucilages, and pectins, as well as lignin.

**Glycemic index**—GI; a measure of the rate at which an ingested carbohydrate raises the glucose level in the blood.

- herbs and spices
- hot-air popcorn without butter or margarine
- a maximum of two tablespoons per day of artificial sweetener
- 2 cups daily of unsweetened decaffeinated herbal or green tea
- unlimited water.

Foods prohibited during phase 1 include:

- meat
- bread
- cheese, including soy cheese
- fried food
- nuts
- fast food
- desserts
- soda
- coffee
- alcohol.

Canned foods should be rinsed thoroughly to remove excess salt.

Although phase 1 lasts only nine days, dieters can choose to stay with phase 1 for one to two extra weeks or longer.

**PHASE 2—THE FOUNDATION.** In phase 2 the quantity of food is increased slightly and exercise is increased by 10–15% over phase 1, to 35 minutes five times per week. Weight lifting and other types of anaerobic exercise are not recommended during phase 2.

Foods added during phase 2 include:

- 3–4 oz (85–110 g) daily of lean meat, turkey, chicken, or fish (no pork)
- an additional one-half cup of unsweetened hot cereal
- one and one-half cups of unsweetened cold cereal such as shredded wheat
- one whole egg daily
- 1 oz (28 g) of cheese
- 2 teaspoons of peanut butter
- one-half avocado
- up to four teaspoons of sugar or artificial sweetener or one tablespoon of honey per day
- up to two teaspoons of salt per day and unlimited herbs and spices.

**PHASE 3—THE CONSTRUCTION.** The four-week construction phase requires at least four meals per day. It adds **protein** and whole grains to the diet, allows for larger portions, and continues ample amounts of fruits and vegetables. Exercise levels are increased by another 25% to 45 minutes daily. Smith recommends exercising twice per day several days per week to boost metabolism.

Phase 3 allows:

- up to 5 oz (140 g) of meat daily, although seafood remains at 3 oz (85 g)
- two whole eggs daily
- four thin slices of wholegrain bread daily
- additional brown rice
- 1 cup of whole-wheat pasta
- up to 16 oz (475 ml) of fresh-squeezed fruit juice
- up to 3 cups of skim or soy milk daily
- 1.3 oz (37 g) of low-fat or fat-free cheese daily
- fat-free mayonnaise
- one daily dessert—one scoop of low-fat ice cream or two–three oreo-sized chocolate-chip or oatmeal-raisin cookies or graham crackers
- 2 cans of diet soda daily
- 10 oz (300 ml) of coffee.

Smith recommends that the phase 1 regimen be followed at least one day a week during phase 3 to expedite weight loss. If weight-loss goals have not been reached by the end of phase 3, phases 1–3 can be repeated as many times as necessary.

**PHASE 4—THE TEMPLE.** Any and all foods are allowed during the maintenance phase 4 including:

- white starches such as potatoes and white rice in limited amounts
- three glasses of wine or beer per week.

Phase 4 includes one hour of moderate to intense exercise, including weight training, five times per week. If weight is regained, the dieter can return to phase 1 for about a week.

### *Extreme fat smash*

Smith's extreme fat smash diet is an alternative to the fat smash diet for people who want to lose weight rapidly by raising their metabolism, with a goal of losing up to 12 lb (5.4 kg) in the first three weeks. He writes: 'Extreme fat smash is for people who are determined to reach what they might've considered unthinkable success in a weight-loss journey. The idea is simple: if you want big results, then you'll have to push yourself beyond the normal limits to attain them.'

Like the original fat smash, extreme fat smash utilizes healthy foods and relies on portion control—eating only to satisfy hunger, with the knowledge that another meal or snack will be coming soon. It differs

from the fat smash in that it requires organizing the day around meals and exercise:

- The diet is very specific and must be followed exactly.
- Meals and snacks are on a schedule that must be followed exactly.
- Meals are simple but repetitive.
- The diet includes increased fiber and foods with a lower glycemic index (GI) to stabilize blood sugar levels.
- It includes a 40-minute workout with a specific exercise program for conditioning the heart, muscles, and lungs.

The book *Extreme Fat Smash Diet* includes:

- 75 simple recipes for easily-prepared meals
- tips and strategies for sticking to the diet
- a newly designed maintenance plan
- meal plans and corresponding journal pages.

The extreme fat smash diet consists of three one-week cycles:

- The first cycle is a very strict diet with a set menu. Some fruits, such as bananas and pineapples, are prohibited.
- The second cycle adds back some fruit, bread, and peanut butter that were not allowed in the first week.
- The third cycle, although still a strict diet, is more flexible.

At the end of the three weeks, the dieter has the option of repeating the three cycles to lose more weight or of entering the maintenance phase. The same cycle cannot be followed for two weeks in a row.

There is an extensive snack food list that includes:

- fruit
- popcorn
- chocolate.

Unlike the original fat smash, the cycles are adjusted for individual body types, dieting profiles, and weight-loss goals of 5 lb (2.3 kg), 10 lb (4.5 kg), or 15 lb (7 kg) and up. For example an active person who has healthy eating habits but still can't lose weight should:

- increase the cardiovascular exercise by 10 minutes on some days
- reduce the carbohydrate option by one-half cup on some days
- consume fewer calories.

## Function

The fat smash diet is designed to make small but significant adjustments in food consumption and in attitudes toward food and physical activity. It can be followed easily by vegetarians and vegans as well as meat lovers. It is a diet for people who eat too much junk food and are not used to exercising very much; for people who need to lose anywhere from 50–100 lb (23–46 kg) or more. It is probably too strict a diet for active people with only a few pounds to lose.

The extreme fat smash diet is for people who want to lose 10–25 lb (4.5–11 kg) in a healthy manner in a short period of time and to maintain the weight loss.

## Benefits

The fat smash diet is a healthy, well-balanced, and flexible plan. It is a sustainable diet that allows unlimited fruits and vegetables and relies on regular inexpensive foods. Its calorie control, via portion control, and emphasis on exercise should lead to weight loss. Smith claims that people can lose from 6—10 lb (3—5 kg) during phase 1. He further claims that the fat smash diet:

- detoxifies the body
- promotes rapid weight loss
- teaches sustainable weight-maintenance skills
- reduces the risk of diet-related disease
- leads to a healthier lifestyle.

Portion control is a key to the fat smash diet and Smith claims that even people who eat unhealthy foods can lose 10–15 lb (5–7 kg) in a year by practicing portion control—eating smaller meals that still satisfy hunger—without making any other changes.

## Precautions

The fat smash diet may be difficult for some people to adhere to, particularly during the nine-day detoxification phase. The weight loss in phase 1 is due to its severe **calorie restriction**. There is little allowance for occasional indulgences. Eating out is almost impossible during phases 1 and 2. The recipes in the book are sometimes inconsistent, with some phase 1 recipes containing prohibited ingredients.

The extreme fat smash may be too extreme and inflexible for many people.

## Risks

The fat smash plan is a healthy well-balanced diet that should have few health risks. The extreme fat

## QUESTIONS TO ASK YOUR DOCTOR

- Is the fat smash diet plan a reasonable approach for me to lose weight?
- How much weight do I need to lose?
- Should I make any adjustments in following the plan?
- Should I take any vitamins or other supplements while on this plan?
- Is the exercise required by the plan suitable for me?
- Is the extreme fat smash diet a healthy option for me?

smash diet may be too rapid a weight loss for some people.

## Research and general acceptance

### *Research*

With its emphasis on fruits and vegetables, whole-grain foods, lean meats, portion control, and physical activity, the fat smash diet is considered to be scientifically sound. Tara Gidus of the American Dietetic Association told *AOL Diet & Fitness*: 'It helps people eat more low-calorie, nutrient dense foods, exercise more and get rid of unhealthy habits. I love that it encourages so much aerobic exercise.' Although the fat smash detox is relatively moderate, there is no scientific evidecne to show a person can detoxify their body through diet.

Most research suggests that slow, gradual, and consistent weight loss is the healthiest way to lose weight and increases the likelihood of maintaining the weight loss.

### *General acceptance*

Although *The Fat Smash Diet* earned mixed reviews among diet critics, Ian Smith enjoys a high degree of credibility among his audience. He is a Harvard-trained medical doctor and on the board of directors of the American Council on Exercise. Before joining the *Celebrity Fit Club* Smith was medical correspondent for the *Today* show and NBC News. Millions of viewers have watched celebrities lose as much as 41 lb (19 kg) in a season of *Celebrity Fit Club*. Thus Smith's legions of fans have been accepting of his diet plan.

On April 7, 2007, Dr. Ian, as he is commonly called, launched the '50 Million Pound Challenge.' Aimed primarily at the black community, he called on five million people to lose 10 lb (4.5 kg) each.

## Resources

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### ORGANIZATIONS

American Council on Exercise (ACE). 4851 Paramount Drive, San Diego, CA 92123, (888) 825-3636. <http://www.acefitness.org/>.

American Dietetic Association. 120 South Riverside Plaza, Suite 2000, Chicago, IL 60606-6995. (800) 877-1600. <http://www.eatright.org>.

Obesity Education Initiative. National Heart Lung and Blood Institute. P.O. Box 30105, Bethesda, MD 20824-0105. (301) 592-8573. <http://www.nhlbi.nih.gov/health/public/heart/obesity/lose_wt/index.htm>.

Margaret Alic, Ph.D.

# Fats

## Definition

Fats are also known as lipids. A lipid is a substance that is poorly soluble or insoluble in **water**. The term 'dietary fat' encompasses many different types of fat. Over 90% of dietary fats are called triacylglycerols or **triglycerides**. Other dietary fats include cholesterol.

Triacylglycerols contain three fatty acids attached to a glycerol molecule. Fatty acids vary according to their length, which is composed of carbon and hydrogen atoms joined together to form a hydrocarbon chain. The number of double bonds that occur between the carbon molecules also varies. The chemical structure of each type of fatty acid determines its physical characteristics and its nutritional and physiological function. Regardless of the type of fatty acid present, all triacylglycerols provide 9 kcal (37 KJ) per gram; this makes fat the most concentrated source of energy in the diet. Fatty acids should provide no more than 30–35% of dietary energy or approximately no more than 70 g a day for women and no more than 90 g a day for men.

Typical high sources of fat in the diet include cooking fats and oils, fried food, fatty and processed meats. These should form a very small part of the diet. Care should be taken to reduce fried foods; avoid adding fats and oils during cooking; to grill food, which allows fat to drip out; and to choose lean meats and low fat dairy products. A product is thought to be low in fat if it contains less than 3 g fat per 100 g and high in fat if it contains more than 20 g fat per 100 g or 21 g fat per serving.

## Purpose

Some types of fatty acids are essential nutrients. They must be consumed in the diet for the body to function properly. Fats form the structure of cell membranes, they are involved in the transport, breakdown and excretion of cholesterol and they are the building blocks for many important compounds such as hormones, blood clotting agents, and compounds involved in immune and inflammatory responses. Fats also transport fat soluble **vitamins** and **antioxidants**; provide the body with insulation and form a protective layer around organs; are a structural component of the brain and nervous system; and provide a reserve supply of energy in the form of adipose tissue (body fat). Excess amounts of adipose tissue defines **obesity** and may lead to health problems such as diabetes, **cancer** and heart disease.

## Description

### *Saturated fatty acids*

Saturated fatty acids have a hydrocarbon chain where each carbon atom carries its maximum number of hydrogen atoms except for the end carboxyl group and they do not have any double bonds. The molecules are straight, allowing them to pack closely together. For this reason, they are solid at room temperature with a high melting point. Saturated fatty acids are chemically stable both within the body and in food.

Saturated fatty acids are named according to the number of carbon atoms they contain. Each one has a common name (e.g., stearic acid), a systematic name (e.g., octadecanoic acid because stearic acid has 18 carbon atoms), and a notational name (e.g., 18:0 as stearic acid has 18 carbon atoms but no double bonds).

Animal products such as meat fat, dripping, lard, milk, butter, cheese and cream are the primary sources of saturated fatty acids. Most plant products have a lower amount of saturated fat with the exception of coconut and palm oil.

**SATURATED FATTY ACIDS AND HEALTH.** Saturated fatty acids increase the body's levels of cholesterol, including low density lipoprotein (LDL) cholesterol. LDL cholesterol is commonly known as 'bad' cholesterol. High levels of LDL cholesterol in the blood increase the risk of cardiovascular disease. LDL cholesterol transports excess cholesterol through the bloodstream where it can become deposited in the walls of the arteries and form a hardened plaque. This is called atherosclerosis. This thickening of the artery walls reduces the flow of blood supplying the heart, brain, and other organs. A heart attack or stroke is caused by a blood clot blocking these narrowed arteries. Saturated fatty acids also contribute to production of these blood clots as they are converted into substances that can increase the stickiness of the blood and increase its tendency to clot. For this reason **dietary guidelines** recommend that no more than 10% of dietary energy should come from saturated fatty acids. This means that on a daily basis approximately no more than 22 g saturated fat should be consumed

**Fats**

| Type of fat | Dietary source | Effect on cholesterol | How often to choose |
|---|---|---|---|
| Trans fat | • "Hydrogenated" or "partially hydrogenated" oils<br>• Vegetable shortenings, stick margarine, deep fried foods, some fast foods and snack foods (i.e., cookies and crackers) | Raises LDL | Less often |
| Saturated fat | • Tropical oils such as palm and coconut oils, cocoa butter, coconuts and coconut milk<br>• Red meat, the skin from chicken and other birds, butter, whole milk and milk products (i.e., cheese and ice cream) | Raises LDL | Less often |
| Monounsaturated fat | • Avocados, olives, certain nuts<br>• Olive, canola, and peanut oils | Lowers LDL when substituted for saturated fat | More often |
| Polyunsaturated fat (includes omega-3 and omega-6 fatty acids) | • Plant oils like corn, sunflower, and safflower<br>• Fish (especially salmon, trout, and herring)<br>• Flaxseed oil | Lowers LDL when substituted for saturated fat | More often |

SOURCE: Division of Nutrition Research Coordination, National Institutes of Health, U.S. Department of Health and Human Services

*(Illustration by GGS Information Services/Thomson Gale.)*

by a woman consuming 2,000 calories a day and no more than 28 g saturated fat should be consumed by a man consuming 2,500 calories a day. A product is considered low in saturated fat if it contains less than 1.5 g per 100 g and high in saturated fat if it contains more than 5 g of fat per 100 g.

### *Monounsaturated fatty acids*

Monounsaturated fatty acids have a hydrocarbon chain that contains one unsaturated carbon bond that is not fully saturated with hydrogen atoms. Instead, it has a double bond to the adjoining carbon atom. Double bonds are either in a *cis* or *trans* formation. In the *cis* formation the hydrogen atoms bonded to the carbon atoms in the double bond are positioned on the same side of the double bond. This creates a kink in the hydrocarbon chain. There is also a free electron or slightly negative charge surrounding the double bond causing them to repel each other. The molecules are not packed closely together and become liquid (oil) at room temperature. In the *trans* formation the hydrogen atoms are on opposite sides of the carbon-carbon double bond resembling the characteristics of a saturated fatty acid. There is less kinking of the hydrocarbon chain and the fat is more solid at room temperature. *trans* bonds are rarely seen in nature.

Monounsaturated fatty acids are named according to the number of carbons they contain and the position of their double bond. Like saturated fatty acids, they each have a common name, a systematic name, and a notational name. Fatty acids with double bonds in the ninth position are sometimes called n-9s or omega-9s.

The most concentrated sources of monounsaturated fatty acids in the diet are olive oil and rapeseed oil. They are present in many other foods including nuts and seeds, avocados, eggs, fish and meat fat.

**MONOUNSATURATED FATTY ACIDS AND HEALTH.** Monounsaturated fatty acids reduce the level of total and LDL cholesterol. It also has a significant effect on increasing and maintaining the body's level of high density lipoprotein (HDL) cholesterol. HDL cholesterol is commonly known as 'good' cholesterol because it removes cholesterol from the blood transferring it to body tissues where it is used to make hormones and other substances the body needs. Therefore, higher levels of HDL cholesterol are associated with a reduction in the risk of cardiovascular disease. Between 10–20% of dietary energy should come from monounsaturated fat.

### *Polyunsaturated fatty acids*

Polyunsaturated fatty acids have a hydrocarbon chain containing two or more double bonds not fully saturated with hydrogen atoms. The double bonds may either be in the *cis* or *trans* formation. The majority of naturally occurring polyunsaturated fats are in the *cis* form. In this form the hydrogen atoms bonded to the carbon atoms in the double bond are positioned on the same side of the double bond. This creates a kink in the hydrocarbon chain. There is also a free electron or slightly negative charge surrounding the double bond causing them to repel each other. The molecules are not packed closely together and become liquid (oil) at room temperature. The presence of one or more double bonds with free electrons and a negative charge makes them unstable molecules ready to

## KEY TERMS

**Antioxidant**—A chemical that has the ability to neutralize free radicals and prevent damage that would otherwise occur through oxidation.

**Atherosclerosis**—A thickening of the artery walls that impedes the flow of blood supplying the heart, brain, and other organs.

**Bile acids**—Produced by the liver, from cholesterol, for the digestion and absorption of fat.

**Carboxyl group**—The carbon atom at the end of a fatty acid hydrocarbon chain is attached by a double bond to oxygen and by a single bond to hydrogen forming the chemical structure carboxyl.

***cis* formation**—The arrangement of atoms where hydrogen atoms sit on the same side of the carbon to carbon double bond.

**Electron**—A component of an atom or molecule. It has a negative charge when a free or unpaired electron exists making it chemically unstable and likely to initiate chemical reactions.

**Essential fatty acid**—A molecule that cannot be made by the body and must be supplied by food in order to prevent deficiency.

**Fatty acid**—A molecule consisting of mainly carbon atoms joined together to form a carbon chain to which hydrogen atoms are attached. Fatty acids vary according to their degree of saturation (i.e., the number of hydrogen atoms attached and the length of the hydrocarbon chain).

**High density lipoprotein (HDL)**—One of several proteins in the blood that transports cholesterol to the liver and away from the arteries.

**Hydrogenated**—Usually refers to partial hydrogenation of oil, a process where hydrogen is added to oils to reduce the degree of unsaturation. This converts fatty acids from a *cis* to *trans* fatty acids.

**Omega-3**—Polyunsaturated fatty acid where the first double bond occurs on the third carbon-to-carbon double bond from the methyl end of the hydrocarbon chain.

**Omega-6**—Polyunsaturated fatty acid where the first double bond occurs on the sixth carbon-to-carbon double bond from the methyl end of the hydrocarbon chain.

**Omega-9**—Polyunsaturated fatty acids where the first double bond occurs on the ninth carbon-to-carbon double bond from the methyl end of the hydrocarbon chain.

**Oxidation**—A chemical reaction in which electrons are lost from a molecule or atom. In the body these reactions can damage cells, tissues, and deoxyribonucleic acid (DNA) leading to cardiovascular disease or cancer.

***trans* fatty acids**—Monounsaturated or polyunsaturated fats where the double bonds create a linear formation. They are formed largely by the manufacture of partial hydrogenation of oils, which converts much of the oil into *trans* fat. Hydrogenated fats and *trans* fats are often used interchangably.

react with other chemicals. Polyunsaturated fatty acids are susceptible to chemical changes or oxidation within food leading to cell damage in the body.

Polyunsaturated fatty acids are named similar to other fatty acids. They have a common name, a systematic name, and a notational name. Fatty acids with double bonds starting in the sixth position are commonly known as n-6s or omega-6s.

**POLYUNSATURATED FATTY ACIDS AND HEALTH.** Polyunsaturated fatty acids are divided into two groups, omega-6s and omega-3s. There is one essential fatty acid in each of these groups from which all other fatty acids can be made in the human body. These essential fatty acids cannot be made by the body and must be obtained from the diet. They are a necessary component of the diet; without them deficiency symptoms and poor health would result. Linoleic acid (omega-6) and alpha-linolenic acid (omega-3) are the essential fatty acids. Linoleic acid should provide at least 1% of dietary energy and alpha-linoleic acid should provide 0.2% dietary energy. These essential fatty acids are converted into longer chain fatty acids that form important substances in the body such as hormones, blood clotting agents, and compounds involved in immune and inflammatory responses.

These long chain fatty acids are not technically essential, but they have an important role in the body. Examples of long chain fatty acids include arachadonic acid (AA), eicosapentaenoic acid (EPA), and docosahexanoic acid (DHA). Long chain **omega-3**

**fatty acids** become essential if there is insufficient linoleic and aplha-linolenic acid available in the diet. These fats play a significant role in development of the brain, nervous system, and retina in fetal development and early life.

**OMEGA-6.** The most concentrated sources of omega-6 in the diet is vegetable oils, such as sunflower, safflower, corn, cottonseed, canola, and soya oils. They are also present in plant seeds, nuts, vegetables, fruit and cereals. In addition to being a source of linoleic acid, omega-6s have been shown to have a lowering effect on both LDL and HDL cholesterol. However, there are health concerns with excessive omega-6 intakes. Omega-6 fats are susceptible to oxidation within the body and may contribute to tissue damage that leads to atherosclerosis and cancer. Omega-6 fats should contribute no more than 10% of dietary energy. Antioxidant nutrients such as **vitamin E** are required to reduce this oxidation with higher intakes of omega-6 fats. Omega-6s compete with the more beneficial omega-3 fatty acids, so it is recommended that the omega-6:omega-3 ratio is reduced to 4:1.

**OMEGA-3.** Short chain omega-3 fats are found in **flaxseed** or linseed oil, walnut oil, canola oil, and rapeseed oil. The best sources of long chain omega-3s are fish and fish oil.

Evidence suggests that consuming long chain omega-3 fats has cadiovascular health benefits. This believed to be the result of their anti-clotting effect. Growing evidence also suggests that consuming long chain omega-3s has benefits beyond those achieved when consuming shorter chain fatty acids. The United Kingdom's government Food Standards Agency recommends that oily fish be consumed at least once a week.

There has been much interest in the effect of EPA and DHA deficiency and supplementation on behavior in children, particularly those with learning difficulties. Although there is some evidence of benefit with EPA, in 2006 the U.K. Food Standards Agency concluded that there was insufficient evidence to reach a firm conclusion and additional clinical trials were needed.

There is also interest in the anti-inflammatory properties of long chain omega-3s in inflammatory conditions such as Crohn's disease and rheumatoid arthritis. The role of omega-3s has been evaluated in treatment of depression and prevention of cognitive decline but more research is needed to confirm these benefits.

Omega-3 fats have been shown to reduce blood pressure and triglyceride levels (another fat in the blood that contributes to raising the risk of cardiovascular disease). To achieve these benefits, omega-3s must be taken in pharmacological doses and there are small risks associated with these high doses such as raised LDL cholesterol, poor control of diabetes, and increased risk of bleeding. Large doses of omega-3s should only be taken under the supervision of a qualified medical doctor.

### *Trans fatty acids*

***Trans* fatty acids** are monounsaturated or polyunsaturated fatty acids where the double bond is in the *trans* rather than *cis* formation. They occur naturally in small amounts in lamb, beef, milk, and cheese as they are created in the rumen of cows and sheep. The majority of *trans* fat in the diet comes from the partial hydrogenation of vegetable oils. This is a process in food manufacture that adds hydrogen atoms to unsaturated fatty acids so that oils become more hardened at room temperature. The process results in some of the double bonds of the fatty acid molecules becoming saturated and some of the remaining double bonds changing from a *cis* to a *trans* formation. For example, when partially hydrogenated oleic acid becomes elaidic acid or 9 *trans*-octadecenoic acid. *Trans* fats are semi-solid at room temperature and more stable within food. Partial hydrogenation of oils has traditionally been used to develop spreading fats and margarines, for fast food, and in cakes and biscuits. Manufacturers are using it less because of the health problems associated with it. In 2006, New York City adopted the United States' first major ban on all but trace amounts of artificial *trans* fats in restaurant cooking. As of July 2008, a serving of food must not contain more than half a gram of *trans* fat. Food legislation in the United States and the European Union states that hydrogenated or partially hydrogenated fats must be labeled in the ingredients of food and in some cases the amounts of *trans* fat must also be labeled.

***TRANS* FATTY ACIDS AND HEALTH.** *Trans* fat raises LDL cholesterol in a similar way to saturated fat and it reduces HDL cholesterol. It may also raise blood triglyceride levels. The combination of both these effects means that it is most likely to increase cardiovascular risk. The World Health Organization recommends phasing out *trans* fat in food manufacture and reducing *trans* fat consumption to no more than 1% of dietary energy or 2.5 g per day.

### *Cholesterol*

Cholesterol is essential to the structure of cell membranes and production of bile acids for digestion, steroid hormones, and **vitamin D**. **Dietary cholesterol**

## QUESTIONS TO ASK YOUR DOCTOR

- Why or why wouldn't you recommend a full lipid profile for me?
- What is my cholesterol level? Is it within a normal range?
- What is my risk of heart disease or stroke?

has little effect on blood cholesterol levels because an increased dietary intake reduces the amount the body produces. Only extreme dietary levels of cholesterol need to be restricted. For most individuals, dietary measures that reduce saturated fat also avoid excessive cholesterol consumption. However, individuals with familial hypercholesterolemia may need to consume less than 300 mg/day, which requires avoidance of most animal products.

The most concentrated dietary sources of cholesterol include liver, offal, and products made from egg yolk, mayonnaise, fish roes, and shellfish.

### Precautions

The guidelines for the recommended levels of dietary fat is not appropriate for those under two years of age, for those who are ill or malnourished, or for those diagnosed with **anorexia nervosa**.

### Parental concerns

A study conducted by the International Study of Asthma and Allergies in Childhood (ISAAC) found a strong correlation between *trans* fatty acids and increased occurrence of allergies in adolescents. Parents should provide healthy alternatives to foods containing fatty acids and monitor the amount and type of fats consumed in their diet. These preventative measures help avoid serious health problems including heart disease and stroke that can result from high levels of fatty acids in the diet.

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American Dietetic Association (ADA). 120 South Riverside Plaza, Suite 2000, Chicago, IL 60606-6995. Telephone: (800): 877-1600. Website: <http://www.eatright.org>.

American Heart Association. 7272 Greenville Avenue, Dallas, TX 75231. Telephone: (800) 242-8721. Website: <http://americanheart.org>.

British Dietetic Association. 5th Floor, Charles House, 148/9 Great Charles Street, Queensway, Birmingham, $B_3$ 3HT. Telephone: 0121 200 8080. Website: <www.bda.uk.com>.

British Heart Foundation. 14 Fitzgerald Street, London W1H 6DH. Telephone: 020 7935 0185. Website: <www.bhf.org.uk>.

British Nutrition Foundation. High Holborn House, 52-54 High Holborn, London WC1V 6RQ. Telephone: 020 7404 6504. Website: <www.nutrition.org.uk>.

Food Standards Agency. Aviation House, 125 Kingsway, London WC2B 6NH. Telephone: 020 7276 8000. Web sites: <www.food.gov.uk>.

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Feingold diet *see* **Dr. Feingold diet**

**Phen-fen pills in a nonprescription herbal form.** *(Leonard Lessin/Photo Researchers, Inc. Reproduced by permission.)*

# Fen-Phen

## Definition

Fen-Phen was an anti-obesity regimen composed of fenfluramine or the closely related drug dexfenfluramine (marketed under the brand name Redux) and phentermine (sold under several brand names including Adipex-P, Anoxine-AM, Fastin, Ionamin. Obephen, Obermine, Obestin-30 and Phentrol). The combination was found to cause damage to heart valves, and fenfluramine and dexfenfluramine were removed from the United States market in 1997.

## Purpose

The combination of these two drugs had been reported to be significantly more effective than placebo in promoting weight loss when used in combination with diet, exercise and behavior modification.

## Description

Phentermine was first approved for use by the United States Food & Drug Administration (FDA) in 1959. It's claimed advantage over other appetite suppressants available at the time was a reduced risk of abuse. While the drug was chemically related to the amphetamines, with the same side effects, the incidence of these side effects was reportedly lower than with the amphetamines.

Fenfluramine was approved by the FDA in 1973 and dexfenfluramine (Redux) was approved for use in 1996. Fenfluramine is the racemic form of dexfenfluramine. The drugs were approved for short term use as part of a program of diet and exercise. Although fenfluramine is chemically related to the amphetamines, its action appears to be based on increasing levels of *serotonin* in the brain and blood stream. Ddexfenfluramine had been marketed in Europe for over a decade without detection of an association between dexfenfluramine and heart valve problems, however the FDA noted that the number of patients having heart valve problems was very low compared to the total number of patients using the drug, and heart valve screening is not a routine part of drug monitoring.

Neither fenfluramine nor phentermine had been approved for use in long term treatment or combination therapy. The drugs were indicated only as short term adjuncts in patients with **obesity**.

In 1992, a research group from the University of Rochester published reports indicating that the combination of fenfluramine and phentermine might be a valuable adjunct to diet and exercise in a controlled program of weight loss. A total of 121 patients were initially enrolled in the study, and 9 dropped out during the active study period. After the first 34 weeks of the study, patients on the fen-phen regimen had lost an average of 14.2 Kg, compared with a 4.9 Kg. weight loss in the placebo control group. The researchers noted that upon discontinuation of the drugs, patients regained most of the weight lost during the study, and after 210 weeks, the agerage weight loss was only 1.4 Kg below the baseline. Patients who had received active drug tended to regain weight more rapidly than those who received placebo. The authors concluded that despite long periods of time at weights much lower than baseline, permanent resetting of weight control mechanisms could not be shown for most participants.

In spite of the disappointing long term results, these reports lead to the wide use of the fen-phen regimen for people attempting to lose weight. In

## KEY TERMS

**Anorectic**—A drug which suppresses the appetite.

**Dexfenfluramine**—An anorectic drug formerly marketed under the brand name Redux.

**Etiology**—The cause of a disease or medical condition.

**Fenluramine**—An anorectic drug formerly marketed under the brand name Pondimin.

**Fluoxetine**—An antidepressant drug, sold under the brand name Prozac

**Fluvoxamine**—An antidepressant drug sold under the brand name Luvox

**Indicated**—In medical terminology, reviewed and approved by the United States Food & Drug Administration, or the comparable agency in other nations, for a specific use.

**Mono-amine oxidase inhibitor**—A class of antidepressant drugs that act by blocking an ezyme that destroys some of the hormones in the bRain. These drugs have a large number of food and drug interactions.

**Mitral valve**—a heart valve, also called the *bicuspid valve* which allow blood to flow from the left auricle to the ventricle, but does not allow the blood to flow backwards.

**Paroxetine**—An antidepressant drug sold under the brand name Paxil

**Phentermine**—An anorectic drug sold under a large number of brand names

**Primary pulmonary hypertension**—Abnormally high blood pressure in the arteries of the lungs, with no other heart disease causing this problem.

**Racemic**—A chemical term, relating to the way a compound turns a bean of light. Racemic compounds are composed of equal amounts of left turning and right turning molecules. Molecules which turn a beam of light to the right are *dextrorotatory* while those which turn a beam to the left are *levorotatory*.

**Regurgitational valvular heart disease**—A type of damage to the heart valves which allows blood to leak back through the valve.

**Serotonine**—A hormone that stimulates brain cells and also causes blood vessels to constrict.

**Sertraline**—An antidepressant drug sold under the brand name Zoloft

1996, fenfluramine was the 46th most frequently prescribed drug in the United States. with sales of $176 million per year (roughly $209 million in 2006 dollars). No long term studies were performed for these dtrugs, and they were never approved for use in combination therapy.

On July 8, 1997, *The New England Journal of Medicine* published a report from the Mayo Clinic describing 24 cases of *regurgitational valvular heart disease* in women who had been treated with fenfluramine and phentermine. By September 30th, the FDA had received a total of 144 reports of heart value problems associated with fenfluramine, with or without phentermine.

On November 19, 1997, the Centers for Communicable Disease Cintrol published a review of the cases of heart valve damage associated with fenfluramine:

*. . . Of these 113 cases, 111 (98%) occurred among women; the median age of case-patients was 44 years (range: 22 68 years). Of these 113 cases, two (2%) used fenfluramine alone; 16 (14%), dexfenfluramine alone; 89 (79%), a combination of fenfluramine and phentermine; and six (5%), a combination of all three drugs. None of the cases used phentermine alone. The median duration of drug use was 9 months (range: 1 39 months). Overall, 87 (77%) of the 113 cases were symptomatic. A total of 27 (24%) case-patients required cardiac valve-replacement surgery; of these, three patients died after surgery….*

The Food & Drug Admibnistration removed fenfluramine from the market. Approximately 18,000 people sued American Home Products, which had marketed the drug, to recover damages, either from the costs of actual injuries, or the cost of tests to determine whether any damage had been done. In a class action lawsuit, American Home Products agreed to establish a trust fund with a reported value of $3.75 billion, with the money to be distributed among victims of the drug, depending on extent of injury. People exposed to fenflursamine will be monitored for heart valve problems for a period of 20 years.

Although fen-phen has been associeted with another very important adverse effect, *primary pulmonary hypertension*, the focus of all regulatory and legal problems has been on the heart valve problems associated with the drug.

## Precautions

Phentermine hydrochloride tablets and capsules are indicated only as short-term monotherapy for the management of exogenous obesity. The safety and efficacy of combination therapy with phentermine and any other drug products for weight loss, including selective serotonin reuptake inhibitors (eg, fluoxetine, sertraline, fluvoxamine, paroxetine), have not been established. Therefore, coadministration of these drug products for weight loss is not recommended.

Serious regurgitant cardiac valvular disease, primarily affecting the mitral, aortic and tricuspid valves, has been reported in otherwise healthy persons who had taken a combination of phentermine with fenfluramine or dexfenfluramine for weight loss. The etiology of these valvulopathies has not been established and their course in individuals after the drugs are stopped is not known. The possibility of an association between valvular heart disease and the use of phentermine alone cannot be ruled out; there have been rare cases of valvular heart disease in patients who reportedly have taken phentermine alone.

Tolerance to the anorectic effect usually develops within a few weeks. When this occurs, the recommended dose should not be exceeded in an attempt to increase the effect; rather, the drug should be discontinued.

## Interactions

Phentermine hydrochloride may decrease the hypotensive effect of guanethidine.

Mono-amine oxidase inhibitors (MAOIs) may increase the pressor response to the anorexiants. Possible hypertensive crisis and intracranial hemorrhage may occur. This interaction may also occur with furazolidone, an antimicrobial with MAOI activity. Avoid combining with phentermine hydrochloride. There should be a 14 day interval between use of any MAOI and phentermine.

## Aftercare

For those patients who had been exposed to fenfluramine, aftercare depends on the extent of damage. For those patients with significant heart valve damage, surgical valve replacement may be in order. Those who received the drug but show no damage should be monitored by a cardiologist for the possibility of late onset damage.

Although phentermine alone has been associated with rare instances of valvular heart disease, there are no recommendations for routine aftercare or monitoring.

## Parental concerns

Phentermine is not indicated for patients under the age of 16 years.

## Resources

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http://biotech.law.lsu.edu/cases/drugs/brown_v_AHPC.htm

### ORGANIZATIONS

American Obesity Association. 1250 24th Street, NW, Suite 300, Washington, DC 20037. 800-98-OBESE (800-986-2373).

Food and Drug Administration. U.S. Department of Health and Human Services, Public Health Service, 5600 Fishers Lane, Rockville, MD 20857.

Weight-control Information Network (WIN). National Institute of Diabetes and Digestive and Kidney Diseases. 1 Win Way, Bethesda, MD 20892-3665. 877-946-4627. 202-828-1025.

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# Fiber

## Definition

Fiber is found only in foods of plant origin. It occurs in the skins, seeds, leaves and roots of fruits and vegetables, and in the germ and bran layers of grains. Pectins, lignans, cellulose, gums and mucilages are all different forms of fiber found in these foods. Because humans lack the digestive enzymes to break down fiber, it passes through the digestive tract largely unchanged.

## Purpose

Depending on the type, fiber may either slow down or speed up the passage of food through the digestive tract. It contributes to stool bulk and stimulates the colon walls to contract. Foods rich in soluble fiber are often recommended to help improve blood glucose and cholesterol levels, while diets containing high amounts of insoluble fiber are known to contribute to bowel regularity and the prevention of diverticular disease. Since high-fiber diets tend to be satisfying but relatively low in calories, they are often promoted for weight management.

## Description

Dietary fiber belongs to one of two types, depending on whether or not it is able to dissolve in **water**. Fiber that dissolves in water is called *soluble*, while fiber that cannot be dissolved in water is known as *insoluble*. Upon ingestion, soluble fiber dissolves in the fluids secreted by the digestive tract, forming a gel. This gel moves slowly through the digestive tract, thus slowing the rate of digestion and absorption. Diets containing large amounts of soluble fiber have been shown to stabilize blood sugar levels in people with diabetes, and have been shown to reduce blood levels of unhealthy (LDL) cholesterol. Foods high in soluble fiber include beans, lentils, oats, psyllium, citrus fruits, barley and apples. In contrast, insoluble fiber acts as roughage. It contributes to stool bulk and promotes regularity. Foods rich in insoluble fiber include wheat bran, whole grains, dried beans, nuts, seeds, and those fruits and vegetables with an edible outer skin or seeds.

In 2001, the Food and Nutrition Board of the Institute of Medicine established its first recommendations for fiber intake. The recommendations are based on the findings of numerous studies showing a reduced risk of heart disease and type 2 diabetes with a daily fiber intake of approximately 14 grams for every 1,000 calories consumed. For adults who are 50 years of age and younger, the recommended fiber intake is 38 g/day for men and 25 g/day for women. For adults over 50 years of age, the recommendation is 30 g/day for men and 21 g/day for women.

On average, North Americans consume less than 50% of the dietary fiber recommended for good health.

**Fiber**

| Age | Recommended Intakes (g/day) |
|---|---|
| Children 1< yr. | Not established |
| Children 1–3 yrs. | 19 |
| Children 4–8 yrs. | 25 |
| Boys 9–13 yrs. | 31 |
| Girls 9–13 yrs. | 26 |
| Boys 14–18 yrs. | 38 |
| Girls 14–18 yrs. | 26 |
| Men 19–50 yrs. | 38 |
| Women 19–50 yrs. | 25 |
| Men 50> yrs. | 30 |
| Women 50> yrs. | 21 |
| Pregnant women | 28 |
| Breastfeeding women | 29 |

| Food | Fiber (g) |
|---|---|
| Beans, lima, fresh, cooked, ½ cup | 6.6 |
| Beans, baked, canned, plain, ½ cup | 6.3 |
| Beans, black, cooked, ½ cup | 6.1 |
| Beans, kidney, fresh, cooked, ½ cup | 5.7 |
| Winter squash, cooked, 1 cup | 5.7 |
| Spaghetti, whole wheat, plain, 1 cup | 5.6 |
| Cereal, bran flake, ¾ cup | 5.3 |
| Cereal, shredded wheat, 1 cup | 5.2 |
| Pear, raw, 1 med. | 5.1 |
| Turnips, cooked, ½ cup | 4.8 |
| Rice, brown, cooked, 1 cup | 3.5 |
| Apple, raw, with skin, 1 med. | 3.3 |
| Oatmeal, plain, cooked, ¾ cup | 3.0 |
| Broccoli, fresh, cooked, ½ cup | 2.6 |
| Summer squash, cooked, 1 cup | 2.5 |
| Carrot, fresh, cooked, ½ cup | 2.3 |
| Potato, fresh, cooked, 1 | 2.3 |
| Spinach, fresh, cooked, ½ cup | 2.2 |
| Brussels sprouts, fresh, cooked, ½ cup | 2.0 |
| Bread, whole-wheat, 1 slice | 1.9 |
| Tangerine, raw, 1 med. | 1.9 |
| Cauliflower, fresh, cooked, ½ cup | 1.7 |
| Cabbage, fresh, cooked, ½ cup | 1.5 |
| Peach, raw, 1 med. | 1.5 |
| Asparagus, fresh, cooked, 4 spears | 1.2 |
| Romaine lettuce, 1 cup | 1.2 |
| Peanuts, dry roasted, 1 tbsp. | 1.1 |
| Tomato, raw, 1 | 1.0 |
| Rice, white, cooked, 1 cup | 0.6 |
| Almonds, slivered, 1 tbsp. | 0.6 |

g = gram

*(Illustration by GGS Information Services/Thomson Gale.)*

## Potential Benefits

- A high fiber intake promotes bowel health by preventing constipation and diverticular disease.

- High-fiber diets may assist with weight management because they tend to be satisfying without being calorie-dense.
- Soluble fiber has been shown to help lower blood cholesterol by binding to cholesterol molecules in the digestive tract, thus encouraging their elimination from the body.
- High consumption of fiber-rich whole grains is associated with a lower risk of developing type 2 diabetes.
- Soluble fiber slows the emptying of food from the stomach to the small intestine, thus causing a gradual release of glucose into the bloodstream after a meal. For this reason, a diet high in soluble fiber may promote better blood sugar management in those with diabetes.
- A low-fat, high-fiber diet combined with daily exercise appears to be associated with a reduced risk of developing breast cancer.
- Studies investigating whether a high-fiber diet is protective against colon cancer are inconclusive. Those that support the protective effect of fiber suggest that fiber encourages the movement of food waste through the bowel, possibly reducing the body's exposure to carcinogens in the waste products.
- High-fiber foods tend to be rich in phytochemicals that have been linked to cancer protection.
- High-fiber diets that are comprised of large amounts of fruits, vegetables and whole grains are associated with better blood pressure control.

### Interactions

Fiber supplements such as psyllium may reduce the absorption of certain medications when taken at the same time. In general, medications should be taken at least one hour before or two hours after fiber supplements.

### Resources

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#### ORGANIZATIONS

American Dietetic Association.120 South Riverside Plaza, Suite 2000, Chicago, IL 60606-6995. (800) 877-1600. <http://www.eatright.org>.

American Heart Association. 7272 Greenville Avenue, Dallas, TX 75231. (800) 242-8721. <http://www.americanheart.org>.

#### OTHER

Jackson Gastroenterology. High Fiber Diet <http://www.gicare.com/pated/edtgs01.htm>

Linus Pauling Institute. Micronutrient Information Center (Fiber) <http://lpi.oregonstate.edu/infocenter/phytochemicals/fiber/>

Mayo Clinic. Dietary Fiber: An Essential Part of a Healthy Diet <http://www.mayoclinic.com/health/fiber/NU00033>

Medline Plus. Dietary Fiber <http://www.nlm.nih.gov/medlineplus/dietaryfiber.html>

Marie Fortin, M.Ed., RD

# Fit for Life diet

## Definition

Fit for Life is a combination diet diet that emphasizes eating foods in the correct combination and avoiding the wrong combinations of foods rather than counting calories or controlling portion size. Several aspects of this diet have been disputed by dietitians and nutritionists.

## Origins

Fit for Life is the creation of Harvey and Marilyn Diamond. The diet first came to the attention of the public in the mid-1980s with the publication of the book *Fit for Life*, which has sold millions of copies. On the official Fit for Life website, Diamond claims that the diet "spawned juice and salad bars, fruit sellers on the streets of New York, and the juice industry." He also claims the book "launched a nutritional awakening in the United States and other Western countries." These are impressive claims for a book written by a man whose "doctoral degree" came from the American College of Life Science, a non-accredited correspondence school founded in 1982 by a high school dropout.

Diamond has appeared on dozens of television talk shows explaining his theories on how eating foods in the correct combination and avoiding the "wrong" combinations of food can bring about weight loss without calorie counting or exercise. In the 2000s, the Fit for Life system added the Personalized FFL Weight Management Program. This program uses what they call Biochemical Analyzation, Metabolic Typing and Genetic Predispositions to individualize and personalize the dietary protocols. The resulting diet is said to be effective only for one specific

## KEY TERMS

**Alternative medicine**—a system of healing that rejects conventional, pharmaceutical-based medicine and replaces it with the use of dietary supplements and therapies such as herbs, vitamins, minerals, massage, and cleansing diets. Alternative medicine includes well-established treatment systems such as homeopathy, Traditional Chinese Medicine, and Ayurvedic medicine, as well as more-recent, fad-driven treatments.

**Cholesterol**—a waxy substance made by the liver and also acquired through diet. High levels in the blood may increase the risk of cardiovascular disease.

**Conventional medicine**—mainstream or Western pharmaceutical-based medicine practiced by medical doctors, doctors of osteopathy, and other licensed health care professionals

**Dietary fiber**—also known as roughage or bulk. Insoluble fiber moves through the digestive system almost undigested and gives bulk to stools. Soluble fiber dissolves in water and helps keep stools soft.

**Dietary supplement**—a product, such as a vitamin, mineral, herb, amino acid, or enzyme, that is intended to be consumed in addition to an individual's diet with the expectation that it will improve health

**Enzyme**—a protein that change the rate of a chemical reaction within the body without themselves being used up in the reaction

**Mineral**—an inorganic substance found in the earth that is necessary in small quantities for the body to maintain a health. Examples: zinc, copper, iron.

**Naturopathic medicine**—An alternative system of healing that uses primarily homeopathy, herbal medicine, and hydrotherapy and rejects most conventional drugs as toxic.

**Vitamin**—a nutrient that the body needs in small amounts to remain healthy but that the body cannot manufacture for itself and must acquire through diet

individual and can be used for that person's entire life. Diamond has also begun selling nutritional supplements, many of which are strongly recommended in his newest version of the Fit for Life system.

### Description

Fit for Life is a food combining diet based on the theory that to lose weight, one must not eat certain foods together. The philosophy behind the diet comes from Diamond's interest in natural hygiene, an offshoot of naturopathic medicine. In his original book, Diamond claimed that if a person ate foods in the wrong combination, they would "rot" in the stomach. He also categorized foods as "dead foods" that "clog" the body and "living foods" that cleanse the body. The newest version of Fit for Life talks less about rotting, dead, and living foods and more about "enzyme deficient foods." However, the general message about food combining is the same.

According to Diamond, dead foods are meats and starches. Living foods are raw fruits and vegetables. His diet plan requires that these foods not be eaten together. Some of the Fitness for Life rules include:

- Only fruit and fruit juice should be eaten from the time one awakes until noon. Fruits cleanse the body.
- Fruits are good for health only if they are eaten alone. They should never be eaten with any other food.
- Lunch and dinner can consist of either carbohydrates and vegetables or proteins and vegetables.
- Carbohydrates and proteins should never be put in the stomach at the same time.
- No dairy foods should ever be eaten.
- Water should never be drunk at meals.
- One day each week (the same day every week) is a free day, when the individual can eat whatever he or she wants."

### Function

The goal of the Fit for Life diet is to help people lose weight and keep their body healthy through diet. Diamond states that people do not gain weight because they eat too many calories and exercise too little. Instead, he considers the cause of weight gain to be eating protein-rich foods at the same time as carbohydrate-rich foods. He argues that enzymes that digest proteins interfere with enzymes that digest **carbohydrates**, and therefore, these two foods should not be eaten together. His program makes little mention of the role of different types of fats—saturated, unsaturated, and *trans* fat—in diet, dietary **fiber**, the role of **water** in health, or of the need to exercise.

The Fit for Life program says it is a lifestyle program that will teach people to be healthier. Along with the personalized diet program, dieters get a "Clinical Manual" that claims to teach them how their body works, what is healthy for them, and what is not. The program is heavily infused with an alternative medicine approach to health and diet, and many of the explanations it gives for the way the body works are scientifically questionable and not accepted by practitioners of conventional medicine.

## Benefits

The benefits claimed by Fit for Life are not supported by any scholarly research and are, in fact, refuted by some research (see below). The main claim, supported by testimonials and before and after pictures, is that people who follow Fit for Life will lose weight and keep it off. Along with weight loss will come a gnereral improvement in health. The official Fit for Life Website claims an "86% success rate" and mentions "clinical trials" without providing any details.

Some benefits of the plan are that it encourages people to increase their consumption of fresh fruits and vegetables. Unlike some diets, Fit for Life that it does not require dieters to buy special foods, keeping food costs moderate. It does, however, encourage dieters to purchase enzyme supplements from Fit for Life Industries.

## Precautions

The Fit for Life Web site is heavy on the theory behind the Fit for Life diet, but give few specifics on how the diet cam be put into effect in daily life. Sample meal plans and approved food lists are not available until the dieter signs up for the program at a substantial fee. This is very different from programs such as Body for Life or **Weight Watchers** which give potential program participants very specific information about diet, menus, and exercise before they pay for the plan.

Fit for life claims that their rules for eating benefit everyone from young children to pregnant women to older adults. Their personalized diet is intended to be a diet for a lifetime, but it does not take into account changes in lifecycle nutrition.

## Risks

Nutritionists feel that the Fit for Life diet can lead to serious vitamin and mineral deficiencies. Banning dairy products makes it extremely difficult for dieters to get the recommended daily allowance of **calcium**. Calcium is needed to keep bones strong and in many metabolic reactions in the body. Other potential vitamin deficiencies spotted by dietitians who have analyzed this diet include deficiencies in vitamin B and $B_{12}$.

### QUESTIONS TO ASK THE DOCTOR

- Do I have health conditions that might be affected by this diet?
- Is there another diet that would meet my weight and health goals better?
- If I go on this diet, will I need to take dietary supplements? If so, which ones?
- Will this diet meet my long-term dietary needs?
- Does this diet pose any special risks for me that I should be aware of?
- Is this diet safe and effective for all members of my family?
- Would you recommend someone in your family going on this diet?

## Research and general acceptance

Many professionals in the nutrition community consider Fit for Life an unhealthy fad diet. The concept behind food combining was tested in a study published in the April 2007 issue of the *International Journal of Obesity*. In this study, participants were fed a 1,100 calorie a day diet to promote weight loss. One group ate balanced meals containing all the major food groups. The other group ate a similar diet, but tested the food-combining theory by avoiding eating certain food groups at the same time. At the end of six weeks, the blood sugar, cholesterol, insulin, and blood **fats** were the same for each group. The balanced-meal group had lost an average of 16.5 lb and the food-combining group had lost 13.6 lb. This strongly suggests that eating a low calorie diet is much more important than eating foods in certain combinations.

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**ORGANIZATIONS**

American Dietetic Association. 120 South Riverside Plaza, Suite 2000, Chicago, Illinois 60606-6995. Telephone: (800) 877-1600. Website: <http://www.eatright.org>

Fit For Life Online Wellness Center. <http://www.fitforlife.com>

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Fit Forever *see* **Denise Austin Fit Forever**

# Flaxseed

## Definition

Flaxseed is the seed of the plant *Linum usitatissimum*. It is a rich source of alpha-linolenic acid (ALA), an essential nutrient in the human diet. Flaxseed has health and possibly medical benefits. Flaxseed oil is a vegetable oil derived from pressed flaxseed. Flaxseed and flaxseed oil have different properties and nutritional values.

**Golden flax seeds.** *(Phanie/Photo Researchers, Inc. Reproduced by permission.)*

## Purpose

Flaxseed is a good source of ALA and is thought to improve health by lowering blood cholesterol. Flaxseeds may also protect against certain cancers. It can also be used as a laxative.

## Description

*L. usitatissimum* is a slender plant with narrow leaves and blue flowers that grows anywhere from 8–45 in (20–130 cm) tall. The plant originated in India but has been farmed across the world for thousands of years. Archeologists discovered evidence that flax was cultivated in ancient Babylon as early as 3,000 B.C. Today, in Europe and Asia, a tall variety of flax is grown primarily for its fibers, which are used to make linen. A shorter, bushier variety is grown for its seeds in North America. The Canadian provinces of Alberta, Manitoba, and Saskatchewan are the leading producers of flax in North America. North Dakota produces most of the flax grown in the United States.

Seed flax is grown for both consumption and industrial use. The seed is about 42% oil. Solvent-extracted oil from flax seeds is used for industrial purposes and is often called linseed oil. It is used in manufacturing oil paints, varnishes, and linoleum. The material that remains after oil has been extracted from the seeds is called linseed cake or linseed meal. It is often added to animal feed as a **protein** and omega-3 fatty acid supplement. Omega-3 enriched eggs, for example, come from chickens fed flax. Omega-3 enriched pork is available in

## KEY TERMS

**Dietary supplement**—A product, such as a vitamin, mineral, herb, amino acid, or enzyme, that is intended to be consumed in addition to an individual's diet with the expectation that it will improve health.

**Fatty acids**—Complex molecules found in fats and oils. Essential fatty acids are fatty acids that the body needs but cannot synthesize. Essential fatty acids are made by plants and must be present in the diet to maintain health.

**Lignans**—A group of compounds found in plants that have characteristics similar to the female hormone estrogen. They appear to have some anti-cancer and anti-oxidant effects.

**Triglycerides**—A type of fat found in the blood. High levels of triglycerides can increase the risk of coronary artery disease.

Canada and Japan. The **fiber** in the stems of seed flax is used in the production of cigarette papers.

Human consumption of flaxseed and flaxseed oil has increased substantially since the mid-1990s. Flaxseed oil for human consumption is produced through solvent-free cold pressing at low temperatures. The oil is sold in bottles to be used as food or in capsules to be taken as a dietary supplement.

Flax seeds come in brown, golden, and yellow varieties and have a slightly nutty flavor. All colors of seed have the same nutritional value. Seeds are sold whole or ground (milled flax). Whole seeds can be stored at room temperature for up to one year. Ground seeds are easier to digest than whole seeds, but they spoil and develop an unpleasant taste more rapidly. Ground seeds can be kept in an airtight container in the refrigerator for up to three months. However, when ground flax is needed, it is preferable to grind whole seeds in a coffee grinder, blender, or food processor immediately before use. Flaxseed and flaxseed oil are sold primarily in health food stores or by mail order.

### *Nutritional information*

Flaxseed is an excellent source of alpha-linolenic acid. ALA is an essential fatty acid for humans. Essential fatty acids are molecules the body needs but cannot synthesize for itself from other nutrients. Thus, essential fatty acids, just like essential **vitamins**, must be obtained through diet. Eating 1 tbsp (8 g) of ground flax or 1 tsp (5 g) of flax oil provides enough ALA to meet daily diet requirements.

According to the Flax Council of Canada, 1 tbsp ground flaxseed provides about 36 calories, 1.8 g of ALA, 1.6 g of protein, and 2.2 grams of dietary fiber. Ground flax is preferred over whole seeds because it is easier to digest. One teaspoon of flax oil provides 44 calories and 2.8 g of ALA, but contains no protein or fiber. The oil in flaxseed is very high in polyunsaturated fat (a healthy type of fat) and contains no trans fat or cholesterol. Flaxseed also provides vitamins C, E, K, $B_1$ (**thiamin**), $B_2$ (**riboflavin**), and $B_6$, along with the **mineralscalcium**, **iron**, **magnesium**, phosphorous, **zinc**, copper, **manganese**, and **selenium**. Flaxseed is low in **sodium** and **carbohydrates**. The seed, but not the oil, is also an excellent source of lignin, a nutrient thought to have anti-cancer properties.

Flaxseed can be added to the diet in several ways. Ground, a daily serving can be sprinkled on hot or cold cereal or mixed into yogurt or smoothies. Larger amounts can be added to pancake or waffle mix or baked goods such as muffins or cookies. Flax oil can be added to salad dressings or smoothies. Frying in flax oil is not recommended. Three tablespoons of ground flax can replace one tablespoon of butter, margarine, or vegetable oil in recipes. One tablespoon of ground flax mixed with three tablespoons of **water**, when left to stand for two minutes before use, can replace one egg in many recipes.

### *Health claims*

Major health claims for flaxseed and flax oil arise from the fact that these products contain high levels of ALA. ALA can be converted by the body into two different long chain **omega-3 fatty acids**. Long chain omega-3 fatty acids have been shown to lower the risk of heart attack in people with heart disease. They appear to lower the level of cholesterol in the blood, especially low-density lipoprotein (LDL) or "bad" cholesterol. Other health claims for omega-3 fatty acids include lowering blood pressure, lowering **triglycerides** (**fats**) in the blood, and reducing the tendency of blood to clot in veins.

Cold-water oily fish such as salmon and fresh tuna (canned is not a source) are good sources of omega-3 fatty acids. Vegans and vegetarians use flaxseed, along with walnuts and canola oil, get enough ALA in their diet, which is then converted into beneficial omega-3 fatty acids. However, many of the health benefits claimed for omega-3 fatty acids require higher doses than necessary to meet daily dietary requirements. Flaxseed and flaxseed oil have been found to lower

blood cholesterol levels in animal studies, but few high-quality human studies have been done using flax products. Results that do exist have been mixed.

Another health claim for flaxseed (but not flax oil) is that it has anti-cancer properties. Flaxseed and sesame seed both contain large amounts of lignans. Lignans are naturally occurring molecules found in plants that mimic the effect of the female hormone estrogen. Lignans compete with estrogen for binding sites on cells. They can either act as antagonists and lessen the estrogen response where there is continual estrogen exposure (increasing risk of breast **cancer**) or they can mimic estrogen and boost the response where exposure is limited (post menopause) helping to prevent post menopausal symptoms. Few well-designed, well-controlled human studies of the effect of lignans on cancer have been completed. Although the results of animal studies are encouraging, there is not enough evidence to say that lignans, or flaxseed, can slow or prevent cancer.

Researchers generally agree that ground flaxseed is an effective laxative. Flaxseed provides dietary fiber and, along with the oil it naturally contains, helps move material through the bowel. Whole seed may have the reverse effect, swelling and blocking the bowel.

Some studies have shown that flaxseed oil supplements can reduce symptoms of attention deficit-hyperactivity disorder (ADHD) in some children. Other studies claim that flaxseed can lower blood sugar levels in people with diabetes. Initial results also suggest that flaxseed may reduce symptoms of menopause. None of these health claims have been substantiated with large, well-controlled human studies.

## Precautions

ALA, which is found in large quantities in flaxseed, appears to increase the risk of developing **prostate** cancer. This finding is preliminary and not yet substantiated. Individuals with prostate cancer or a history of prostate cancer should consult their oncologist before using flax products.

Although no health risks are known when flaxseed and flax oil are used in reasonable and moderate quantities, no studies have been done on the safety of flax in pregnant or **breastfeeding** women or in children.

## Interactions

No specific drug interactions are known.

## Complications

Complications are unlikely to occur when flax products are used to meet daily dietary needs. Whole flaxseed can cause blockage of the intestines when taken with inadequate amounts of liquids.

## Parental concerns

Parents should be aware that the safe dose of many herbal supplements has not been established for children. Accidental overdose may occur if children are given adult **dietary supplements**.

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Flax Council of Canada. 465-167 Lombard Avenue, Winnipeg, MB R3B 0T6. Telephone: (204) 982-2115. Fax: (204) 942-1841. Website: <http://www.flaxcouncil.ca>.

Natural Standard. 245 First Street, 18th Floor, Cambridge, MA 02142. Telephone: (617) 444-8629. Fax: (617) 444-8642. Website: <http://www.naturalstandards.com>.

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# Fluoride

## Definition

Fluoride is a naturally occurring element found in **water** and food. It is important for the development of strong bones and teeth.

## Purpose

In addition to occurring naturally in some water, fluoride is added to toothpastes, mouthwashes, and some public water supplies to prevent tooth decay (dental caries).

## Description

Fluoride is found naturally in seawater and in some drinking water and is present in small amounts in almost all soil, plants, and animals. In water, fluoride dissolves to form a negatively charged ion ($F^-$). In the body, this ion is absorbed into the bloodstream from the small intestine. It then binds with **calcium** in bones and teeth. The adult body contains less than one-tenth of one ounce (about 2.5 g) of fluoride. Ninety-five percent of this is found in bones and teeth.

The importance of fluoride for dental health has been recognized since the 1930s when an association between the fluoride content of drinking water and the prevalence of dental caries was first noted. Acids found in food or released by bacteria that feed on sugar in the mouth cause tooth erosion. These acids eat away at the enamel on the surface of the tooth. Fluoride prevents tooth decay two ways. First, the fluoride in saliva reacts with calcium and phosphate in teeth to repair damage to the tooth's surface. The new surface formed when the tooth is repaired is stronger than the original enamel and is better able to resist decay. This process is called tooth remineralization. Second, fluoride interferes with the metabolic processes of bacteria in the mouth so that they produce less decay-causing acid.

**Suggested amounts of dietary fluoride supplements**

| | Fluoride ion level in drinking water (ppm)* | | |
|---|---|---|---|
| **Age** | **< 0.3 ppm** | **0.3–0.6 ppm** | **> 0.6 ppm** |
| Birth–6 months | None | None | None |
| 6 months–3 years | 0.25 mg/day** | None | None |
| 3 years–6 years | 0.50 mg/day | 0.25 mg/day | None |
| 6 years–16 years | 1.0 mg/day | 0.50 mg/day | None |

* 1.0 part per million (ppm) = 1 milligram/liter (mg/L)
** 2.2 mg sodium fluoride contains 1 mg fluoride ion

SOURCE: American Dental Association

**It is suggested that children between the ages of 6 months to 16 years living in non-fluoridated areas use dietary fluoride supplements. Your dentist can prescribe the correct dosage for your child based on the level of fluoride in your drinking water.** *(Illustration by GGS Information Services/Thomson Gale.)*

Since teeth containing fluoride become stronger, some researchers have suggested that fluoride might also make bones stronger and prevent or delay **osteoporosis** (age related thinning of the bones). These researchers have generally found that the amount of fluoride that prevents tooth decay does not affect the strength or density of bones. High doses of fluoride are potentially toxic, and very large doses (5–15 times the daily adequate intake) taken over time cause bones to become chalky and brittle. Consequently, researchers have concluded that fluoride supplements are not an appropriate way to prevent or treat osteoporosis.

### *Normal fluoride requirements*

Fluoride, in the proper amount, can cut the level of tooth decay in half and substantially reduce the amount of money spent on dental care. Too much fluoride, especially in children, results in a condition called dental fluorosis. The surface of the teeth becomes discolored by chalky white splotches. This is a cosmetic problem only and does not affect the health of the teeth.

High doses of fluoride can be toxic. Doses between 20–80 mg per day can result in changes in bone that can be crippling, as well as changes in kidney function, and possibly nerve and muscle function. Doses as high as 5–10 g per day can be fatal.

The United States Institute of Medicine (IOM) of the National Academy of Sciences developed values called **Dietary Reference Intakes** (DRIs) for many **vitamins** and **minerals**. The DRIs consist of three sets of numbers. The Recommended Dietary

## KEY TERMS

**Osteoporosis**—A condition found in older individuals in which bones decrease in density and become fragile and more likely to break. It can be exacerbated by lack of vitamin D and/or calcium in the diet.

Allowance (RDA) defines the average daily amount of the nutrient needed to meet the health needs of 97–98% of the population. The Adequate Intake (AI) is an estimate set when there is not enough information to determine an RDA. The Tolerable Upper Intake Level (UL) is the average maximum amount that can be taken daily without risking negative side effects. The DRIs are calculated for children, adult men, adult women, pregnant women, and **breastfeeding** women. Similar recommendations have been defined elsewhere, e.g., Canada, the United Kingdom, and other European countries.

Fluoride is not considered an essential nutrient so the IOM has not set RDAs for it. Instead, it has set AI and UL levels for all age groups. The daily AIs and ULs for fluoride for healthy individuals as established by the IOM are:

- Children birth–6 months: AI 0.01 mg; UL 0.7 mg
- Children 7–12 months: AI 0.5 mg; UL 0.9 mg
- Children 1–3 years: RDA 0.7 mg; UL 1.2 mg
- Children 4–8 years: RDA 1.0 mg; UL 2.2 mg
- Children 9–13 years: RDA 2.0 mg; UL 10 mg
- Adolescents 14–18 years: RDA 3.0 mg; UL 10 mg
- Men age 19 and older: RDA 4.0 mg; UL 10 mg
- Women age 19 and older: RDA 3.0 mg; UL 10 mg
- Pregnant women of all ages: 3.0 RDA mg; 10 UL mg
- Breastfeeding women of all ages: 3.0 RDA mg; 10 mg

### *Sources of fluoride in diet*

The overwhelming source of fluoride for most people is water. In 1945, Grand Rapids, Michigan, was the first city to add fluoride to its public water supply. About two-thirds of Americans now drink fluoridated water. From the 1950s to the 1970s, the issue of fluoridating public water supplies caused heated debate. Some scientists claimed that fluoridation caused birth defects, **cancer**, and liver disease. Multiple independent, well-designed studies have conclusively demonstrated that this is false. Fluoridation of water at a level that prevents tooth decay does not increase health risks.

Critics of fluoridation still persist. Some reject existing scientific research and claim that fluoridation is ineffective and/or harmful. For others, fluoridation of public water raises moral issues about personal rights versus the government's rights. The decision to fluoridate drinking water has generally rested with local governments and communities. The recommended rate of fluoride in water is between 0.7 and 1.2 parts per million (ppm). The fluoridation rate is usually at the low end of the range in warm places and at the high end of the range in cold places because people drink more water and thus get more fluoride where it is warm.

A few foods contain significant amounts of fluoride. Since it is found in seawater, ocean fish contain fluoride. It is also concentrated in tea leaves. The approximate fluoride content for some common foods:

- Tea, 3.5 ounces (100 mL): 0.1–0.6 mg
- Canned sardines with bones, 3.5 oz (100 g): 0.2–0.4 mg
- Fish without bones, 3.5 oz (100 g): 0.01–0.17 mg
- Chicken, 3.5 oz (100 g): 0.06–0.10 mg

Toothpaste and mouthwashes containing fluoride provide significant protection against tooth decay. For children who do not drink fluoridated water, the American Dental Association (ADA) and the American Academy of Pediatrics recommend prescription fluoride supplements from age six months onward. Supplements come as liquids and chewable tablets of varying strengths and are prescribed by a pediatrician, family physician, or dentist. In addition, dentists may apply fluoride pastes or varnishes directly to children's teeth for additional protection. This is usually done at six-month intervals at regular dental check-ups.

## Precautions

The amount of fluoride occurring naturally in drinking water varies widely depending on location. People who use wells should have them tested for fluoride. People on public water supplies should call their local public health office to determine if their water is fluoridated. People who primarily use bottled water should consult their supplier about whether or not it contains fluoride. Some built-in home water softening systems may remove fluoride from water. Consult the manufacturer or installer for specific information.

## Interactions

Antacids containing aluminum hydroxide and calcium supplements can decrease the absorption of fluoride from the small intestine.

## Complications

No complications are expected for people who get daily doses of fluoride falling between the AI and UL limits.

Too little fluoride results in increased tooth decay. Too much fluoride can cause illness or death. A 40 lb (18 kg) child would likely begin to show symptoms of fluoride poisoning after consuming about 55 mg of fluoride (3 mg/kg of body weight), and a dose of 290 mg (16 mg/kg of body weight) would likely be fatal. In 2004, the American Association of Poison Control Centers reported 24,180 incidents involving toothpaste with fluoride, 440 of which required emergency room treatment. About 22,000 of these incidents were with children under age six who ate toothpaste. Symptoms of fluoride poisoning include nausea, vomiting, diarrhea, headaches, muscle spasms, irregular heart beat, coma, and death. Besides toothpaste and mouthwash, fluoride is also found in pesticides, rodent poisons, and chrome polish for automobiles.

## Parental concerns

Children should be taught not to eat toothpaste, and an adult should supervise tooth brushing for children under age six. Mouthwash containing fluoride and prescription fluoride supplements should be kept out of reach of children. A child who eats fluoridated toothpaste or mouthwash should receive an immediate medical evaluation.

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American Academy of Pediatric Dentistry. 211 East Chicago Ave., Suite 700, Chicago, IL 60611-2616. Telephone: (312) 337-2169. Fax: Fax (312) 337-6329. Website: <http://www.aapd.org.>.

American Dental Association. 211 East Chicago Avenue, Chicago, IL 60611-2678. Telephone: (312)-440-2500. Website: <http://www.ada.org>.

American Dietetic Association. 120 South Riverside Plaza, Suite 2000, Chicago, Illinois 60606-6995. Telephone: (800) 877-1600. Website: <http://www.eatright.org>.

Safe Drinking Water Coalition. P.O. Box 443, Lehi, UT 84043. Telephone: (801) 766-8825 or (801) 765-1995. Fax: (801) 776-8826 or (801) 492-0210. Website: <http://www.stopfluoridation.homestead.com>.

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# Folate

## Definition

Folate is a naturally occurring water-soluble vitamin that the body needs to remain healthy. Folic acid is a stable synthetic form of folate that is found in **dietary supplements** and is added to fortified foods such as flour and cereal. Humans cannot make folate or folic acid, so they must get it from foods in their diet or as a dietary supplement. Folic acid and folate are both converted into an active form in that the body can use, although folic acid is more easily used (more bioavailable) in the body. Folic acid is also called vitamin $B_9$

## Purpose

Folate is necessary to create new DNA (genetic material) and RNA when cells divide. It plays a critical role in developing healthy red blood cells. Folate also helps protect DNA from damage that may lead to diseases such as **cancer**. Along with **vitamins** $B_6$ and

**Folate (Folic Acid)**

| Age | Recommended Dietary Allowance (mcg) | Tolerable Upper Intake Level (mcg) |
|---|---|---|
| Children 0–6 mos. | 65 (AI) | Not established |
| Children 7–12 mos. | 89 | Not established |
| Children 1–3 yrs. | 150 | 300 |
| Children 4–8 yrs. | 200 | 400 |
| Children 9–13 yrs. | 300 | 600 |
| Children 14–18 yrs. | 400 | 800 |
| Adults 19≥ yrs. | 400 | 1,000 |
| Pregnant women | 600 | 1,000 |
| Breastfeeding women | 500 | 1,000 |

| Food | Folate (Folic Acid) (mcg) |
|---|---|
| Cereal, 100% fortified, ¾ cup | 400 |
| Beans, pinto, cooked, ½ cup | 147 |
| Turnip greens, cooked, ½ cup | 135 |
| Asparagus, cooked, ½ cup | 132 |
| Spinach, cooked, ½ cup | 131 |
| Beans, navy, cooked, ½ cup | 127 |
| Beans, great northern, cooked, ½ cup | 90 |
| Broccoli, steamed, ½ cup | 85 |
| Beets, boiled, ½ cup | 68 |
| Rice, long-grain white, enriched, cooked, ½ cup | 65 |
| Corn, yellow, cooked, ½ cup | 37 |
| Tomato juice, canned, 6 oz. | 35 |
| Bread, white, enriched, 1 slice | 25 |
| Bread, whole wheat, enriched, 1 slice | 25 |
| Raspberries, ½ cup | 16 |

AI = Adequate Intake
mcg = microgram

*(Illustration by GGS Information Services/Thomson Gale.)*

$B_{12}$, folate helps regulate the level of the amino acid homocysteine in the blood. Homocysteine regulation is related to cardiovascular health. In the fetus, folate is necessary for the proper development of the brain and spinal cord.

## Description

Folate is one of eight B-complex vitamins. Its function is closely intertwined with that of vitamins $B_6$ and $B_{12}$. Folate, from the Latin word *folium* meaning leaf, was discovered in the late 1930s in yeast and later found in spinach and other green leafy vegetables and in liver. Starting in 1998, the United States Food and Drug Administration (FDA) required certain foods, such as flour, corn meal, bread, cereal, rice, and pasta, to be fortified with a folic acid. In Canada and Chile fortification of flour is mandatory.

### *Folate's role in health*

Folate is essential for the normal development of the neural tube in the fetus. The neural tube develops into the brain and spinal cord. It closes between the third and fourth week after conception. Too little folate at this time can lead to serious malformations of the spine (spina bifida) and the brain (anencephaly). Because many women do not realize that they are pregnant so soon after conception, the United States has included folic acid in its fortified foods program. Adding folic acid to common foods made with grains has substantially reduced the number of babies born with neural tube defects in the United States.

The body also needs folate to produce healthy red blood cells. When not enough folate is present, the red blood cells do not divide; instead they grow abnormally large. These malformed cells have a reduced ability to carry oxygen to other cells in the body. This condition is called megaloblastic anemia. It is identical to the condition of the same name caused by too little vitamin $B_{12}$. Folate also aids in the production of other new cells. Adequate supplies of folate are especially important in fetuses and infants because they are growing rapidly. However, since the lifespan of a red blood is only about four months, the body needs a continuous supply of folate throughout life to create healthy new replacement blood cells.

Folate acts together with vitamin $B_6$ and vitamin $B_{12}$ to lower the level of homocysteine in the blood. Homocysteine is an amino acid that is naturally produced when the body breaks down **protein**. Moderate to high levels of homocysteine in the blood are linked to an increased risk of cardiovascular disease (e.g. atherosclerosis, heart attack, stroke). The trio of folate, vitamin $B_6$, and vitamin $B_{12}$ lower homocysteine levels. However, it is not clear whether taking large doses of these vitamins, either alone or in combination, will prevent heart disease from developing in healthy individuals. The official position of the American Heart Association stated in its Diet and Lifestyle Recommendations Revision 2006 is that "Available evidence is inadequate to recommend folic acid and other B vitamin supplements as a means to reduce CVD [cardiovascular disease] risk at this time."

Damage to DNA appears to contribute to the development of many different cancers. Because folate helps protect against DNA damage, researchers have looked at whether it can reduce the risk of developing cancer. Results are mixed, with benefits seen for some cancers, but not for others. The American Cancer Society in its 2006 Guidelines on Nutrition and Physical Activity for Cancer Prevention states: "Folate deficiency may increase the risk of cancers of the colorectal and breast, especially in people who consume alcoholic beverages. Current evidence suggests that to reduce cancer risk, folate is best obtained through consumption of vegetables, fruits, and enriched grain

## KEY TERMS

**Alzheimer's disease**—an incurable disease of older individuals that results in the destruction of nerve cells in the brain and causes gradual loss of mental and physical functions

**Amino acid**—molecules that are the basic building blocks of proteins

**B-complex vitamins**—a group of water-soluble vitamins that often work together in the body. These include thiamine ($B_1$), riboflavin ($B_2$), niacin ($B_3$), pantothenic acid ($B_5$), pyridoxine ($B_6$), biotin ($B_7$ or vitamin H), folate/folic acid ($B_9$), and cobalamin ($B_{12}$).

**Dietary supplement**—a product, such as a vitamin, mineral, herb, amino acid, or enzyme, that is intended to be consumed in addition to an individual's diet with the expectation that it will improve health

**Diuretic**—a substance that removes water from the body by increasing urine production

**Enzyme**—a protein that change the rate of a chemical reaction within the body without themselves being used up in the reaction

**Ribonucleic acid (RNA)**—A molecule that helps decode genetic information (DNA) and is necessary for protein synthesis

**Vitamin**—a nutrient that the body needs in small amounts to remain healthy but that the body cannot manufacture for itself and must acquire through diet

**Water-soluble vitamin**—a vitamin that dissolves in water and can be removed from the body in urine

products." The American Cancer Society does not endorse taking megadoses of folic acid to prevent cancer.

Clinical trials are underway to determine safety and effectiveness of folate/folic acid both alone and in combination with other vitamins in preventing cancer, cardiovascular disease, and dementias such as Alzheimer's disease. Cognitive decline and some forms of dementia, including Alzheimer's disease, are associated with lower folate levels, which is common amongst older people in some countries. Individuals interested in participating in a clinical trial at no charge can find a list of open trials at <http://www.clinicaltrials.gov>.

### *Normal folate requirements*

The United States Institute of Medicine (IOM) of the National Academy of Sciences has developed values called **Dietary Reference Intakes** (DRIs) for vitamins and **minerals**. The DRIs consist of three sets of numbers. The Recommended Dietary Allowance (RDA) defines the average daily amount of the nutrient needed to meet the health needs of 97–98% of the population. The Adequate Intake (AI) is an estimate set when there is not enough information to determine an RDA. The Tolerable Upper Intake Level (UL) is the average maximum amount that can be taken daily without risking negative side effects. The DRIs are calculated for children, adult men, adult women, pregnant women, and **breastfeeding** women.

The IOM has not set RDAs for folate in children under one year old because of incomplete scientific information. Instead, it has set AI levels for this age group. RDAs and ULs for folate are measured in micrograms (mcg). Unlike the UL for many vitamins, the UL for folate/folic acid refers only to folic acid that comes from fortified food or that is in folic acid dietary supplements, multivitamins, or B-complex vitamins. There is no UL for folate found in natural plant and animal foods. Dietary supplements containing more than 1,000 mcg (1 mg) of folic acid require a prescription. 1 mcg of folate from natural food sources is equal in biological activity in humans to 0.6 mcg of folic acid from supplements or fortified food.

The following are the daily RDAs and IAs and ULs for folic aside for healthy individuals:

- children birth–6 months: AI 65 mcg; UL not established
- children 7–12 months: AI 89 mcg; UL not established
- children 1–3 years: RDA 150 mcg; UL 300 mcg
- children 4–8 years: RDA 200 mcg; UL 400 mcg
- children 9–13 years: RDA 300 mcg; UL 600 mcg
- children 14–18 years: 400 RDA mcg; UL 800 mcg
- adults age 19 and older: RDA 400 mcg; UL 1,000 mcg
- pregnant women: RDA 600 mcg; UL 1,000 mcg
- breastfeeding women: RDA 500 mcg; 1,000 mcg

### *Sources of folate*

People need a continuous supply of folate from their diet because of the role it plays in creating new blood cells. Because folate is water-soluble, little is stored in the body; any excess is excreted in urine. Since the folic acid fortification program began in 1998, most healthy Americans get enough folate from their diet. The exception is pregnant women who should, under medical supervision, take a folic

acid supplement (400 mcg for most women and higher does for those who have already had a baby with a neural tube defect). Good natural sources of folate include beef liver, green leafy vegetables, and dried beans. Cooking animal products does not reduce the folate content much, but cooking vegetables can reduce the amount of folate by up to 40% depending on the vegetable and the cooking method.

The following list gives the approximate folate/folic acid content for some common foods:

- asparagus, cooked, 1/2 cup: 132 mcg
- spinach, cooked, 1/2 cup: 131 mcg
- turnip greens, cooked, 1/2 cup: 135 mcg
- broccoli, steamed 1/2 cup: 85 mcg
- beets, boiled; 1/2 cup: 68 mcg
- great northern beans, cooked 1/2 cup: 90 mcg
- pinto beans, cooked, 1/2 cup: 147 mcg
- navy beans, cooked, 1/2 cup: 127 mcg
- tomato juice, canned, 6 ounces: 35 mcg
- raspberries 1/2 cup: 16 mcg
- corn, yellow, cooked, 1/2 cup: 37 mcg
- breakfast cereal, fortified 100%, 3/4 cup: 400 mcg
- bread, white or whole wheat 1 slice: 25 mcg
- rice, white, enriched long-grain, cooked, 1/2 cup: 65 mcg
- bread, whole wheat, 1 slice: .07 mg
- bread, white, enriched, 1 slice: .09 mg

### *Folate deficiency*

Most healthy people in the United States get enough folate in their diet because folate is added to many common foods such as bread; however, this is not the case elsewhere.In Europe, low intakes are commonly reported particularly in teenage girls and older people. Causes of folate deficiency include inadequate intake, impaired absorption, (**celiac disease**, Crohn's disease, certain medications), inability of the body to use folate (enzyme deficiencies), increased folate needs (pregnancy, cancer), or increased loss or excretion (kidney dialysis, alcoholism). As a group, the elderly are the largest group at risk to develop folate deficiency.

The major symptom of folate deficiency in pregnant women is having a baby born with a brain or spinal cord abnormality. Other symptoms of folate deficiency include slow growth in infants and children, megaloblastic anemia, digestive problems such as diarrhea, sore tongue, irritability, forgetfulness and changes in mental state. These changes can also have other causes and should be evaluated by a healthcare professional.

## Precautions

Since many pregnancies are unplanned and unrecognized until after the critical period for brain and spinal cord formation, any woman who may become pregnant should be careful to include enough folate in her diet and folic acid supplements should be taken before and in the first trimester of pregnancy.

Folic acid may mask vitamin $B_{12}$ deficiency. Folic acid supplements will reverse anemia symptoms, but they do not stop nerve damage caused by $B_{12}$ deficiency. Permanent nerve damage may result. People with suspected folate deficiency who begin taking folic acid supplements should also be evaluated for vitamin $B_{12}$ deficiency.

## Interactions

The following medications may interfere with the ability of the body to absorb and use folate. Individuals taking these medications should check with their physician about the effects they may have on folate/folic acid levels in the body:

- seizure medications such as dilantin, phenytoin, and primidone
- metaformin (Fortamet, Glucophage, Glucophage XR, Riomet) used to treat type 2 diabetes
- sulfasalazine used to treat Chron's disease and inflammatory bowel disease
- triameterene, a diuretic or "water pill"
- barbiturate sedatives
- methotrexate, used to treat cancer, rheumatoid arthritis, and psoriasis
- drugs used to treat gastroesophageal reflux disease (GERD), such as omeprazole (Prilosec), lansoprazole (Prevacid), cimetidine (Tagamet), famotidine (Pepsid), nizatidine (Axid), or ranitidine (Zantac)

## Complications

No complications are expected when folate/folic acid is taken within recommended levels. Complications related to deficiencies are discussed above. Complications of excess folic acid intake at levels above 1,000 mcg daily over an extended period can include seizures in individuals taking anticonvulsant medications and general irritability, and restlessness in otherwise healthy individuals.

## Parental concerns

Parents need to be aware that infants and rapidly growing children are at higher risk for folate deficiency. Parents of children with digestive disorders or allergies to wheat products should discuss the need for a folic acid supplement with their pediatrician.

### Resources

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#### ORGANIZATIONS


American Cancer Society. 1599 Clifton Road NE, Atlanta GA 30329-4251. Telephone: 800 ACS-2345. Website: <http://www.cancer.org>

American Heart Association. 7272 Greenville Avenue, Dallas, TX 75231. Telephone: (800) 242-8721. Website: <http://www.americanheart.org>

British Nutrition Foundation. 52-54 High Holborn, London WC1V 6RQ telephone: 0207 404 6504, fax: 0207 404 6757. Website: <http://www.nutrition.org.uk>

Linus Pauling Institute. Oregon State University, 571 Weniger Hall, Corvallis, OR 97331-6512. Telephone: (541) 717-5075. Fax: (541) 737-5077. Website: <http://lpi.oregonstate.edu>

Office of Dietary Supplements, National Institutes of Health. 6100 Executive Blvd., Room 3B01, MSC 7517, Bethesda, MD 20892-7517 Telephone: (301)435-2920. Fax: (301)480-1845. Website: <http://dietary-supplements.info.nih.gov>

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Folic acid *see* **Folate**

# Food additives

## Definition

The United States Food and Drug Administration (FDA) defines food additives as "any substance, the intended use of which results or may reasonably be expected to result, directly or indirectly, in its becoming a component or otherwise affecting the characteristics of any food." In other words, an additive is any substance that is added to food.

**Food additives**

| Types of ingredients | What they do | Examples of uses | Names found on product labels |
|---|---|---|---|
| Preservatives | Prevent food spoilage from bacteria, molds, fungi, or yeast (antimicrobials); slow or prevent changes in color, flavor, or texture and delay rancidity (antioxidants); maintain freshness | Fruit sauces and jellies, beverages, baked goods, cured meats, oils and margarines, cereals, dressings, snack foods, fruits and vegetables | Ascorbic acid, citric acid, sodium benzoate, calcium propionate, sodium erythorbate, sodium nitrite, calcium sorbate, potassium sorbate, BHA, BHT, EDTA, tocopherols (Vitamin E) |
| Sweeteners | Add sweetness with or without the extra calories | Beverages, baked goods, confections, table-top sugar, substitutes, many processed foods | Sucrose (sugar), glucose, fructose, sorbitol, mannitol, corn syrup, high fructose corn syrup, saccharin, aspartame, sucralose, acesulfame potassium (acesulfame-K), neotame |
| Color Additives | Offset color loss due to exposure to light, air, temperature extremes, moisture and storage conditions; correct natural variations in color; enhance colors that occur naturally; provide color to colorless and "fun" foods | Many processed foods (candies, snack foods margarine, cheese, soft drinks, jams/jellies, gelatins, pudding and pie fillings) | FD&C Blue Nos. 1 and 2, FD&C Green No. 3, FD&C Red Nos. 3 and 40, FD&C Yellow Nos. 5 and 6, Orange B, Citrus Red No. 2, annatto extract, beta-carotene, grape skin extract, cochineal extract or carmine, paprika oleoresin, caramel color, fruit and vegetable juices, saffron (Note: Exempt color additives are not required to be declared by name on labels but may be declared simply as colorings or color added) |
| Flavors and Spices | Add specific flavors (natural and synthetic) | Pudding and pie fillings, gelatin dessert mixes, cake mixes, salad dressings, candies, soft drinks, ice cream, BBQ sauce | Natural flavoring, artificial flavor, and spices |
| Flavor Enhancers | Enhance flavors already present in foods (without providing their own separate flavor) | Many processed foods | Monosodium glutamate (MSG), hydrolyzed soy protein, autolyzed yeast extract, disodium guanylate or inosinate |
| Fat Replacers (and components of formulations used to replace fats) | Provide expected texture and a creamy "mouth-feel" in reduced-fat foods | Baked goods, dressings, frozen desserts, confections, cake and dessert mixes, dairy products | Olestra, cellulose gel, carrageenan, polydextrose, modified food starch, microparticulated egg white protein, guar gum, xanthan gum, whey protein concentrate |

SOURCE: Center for Food Safety and Applied Nutrition, Food and Drug Administration, U.S. Department of Health and Human Services

*(Illustration by GGS Information Services/Thomson Gale.)*

## Purpose

Direct additives are those that are intentionally added to foods for a specific purpose. Indirect additives are those to which the food is exposed during processing, packaging, or storing. Preservatives are additives that inhibit the growth of bacteria, yeasts, and molds in foods.

## Description

Additives and preservatives have been used in foods for centuries. When meats are smoked to preserve them, compounds such as butylated hydroxyanisole (BHA) and butyl gallate are formed and provide both antioxidant and bacteriostatic effects. Salt has also been used as a preservative for centuries. Salt lowers the water activity of meats and other foods and inhibits bacterial growth. Excess water in foods can enhance the growth of bacteria, yeast, and fungi. Pickling, which involves the addition of acids such as vinegar, lowers the pH of foods to levels that retard bacterial growth. Some herbs and spices, such as curry, cinnamon, and chili pepper, also contain antioxidants and may provide bactericidal effects.

### *Uses of Additives and Preservatives in Foods*

Additives and preservatives are used to maintain product consistency and quality, improve or maintain nutritional value, maintain palatability and wholesomeness, provide leavening, control pH, enhance flavor, or provide color. Food additives may be classified as:

- Antimicrobial agents, which prevent spoilage of food by mold or microorganisms. These include not only vinegar and salt, but also compounds such as calcium

**Food additives**

| Types of ingredients | What they do | Examples of uses | Names found on product labels |
|---|---|---|---|
| Nutrients | Replace vitamins and minerals lost in processing (enrichment), add nutrients that may be lacking in the diet (fortification) | Flour, breads, cereals, rice, macaroni, margarine, salt, milk, fruit beverages, energy bars, instant breakfast drinks | Thiamine hydrochloride, riboflavin (Vitamin B2), niacin, niacinamide, folate or folic acid, beta carotene, potassium iodide, iron or ferrous sulfate, alpha tocopherols, ascorbic acid, Vitamin D, amino acids (L-tryptophan, L-lysine, L-leucine, L-methionine) |
| Emulsifiers | Allow smooth mixing of ingredients, prevent separation. Keep emulsified products stable, reduce stickiness, control crystallization, keep ingredients dispersed, and help products dissolve more easily | Salad dressings, peanut butter, chocolate, margarine, frozen desserts | Soy lecithin, mono- and diglycerides, egg yolks, polysorbates, sorbitan monostearate |
| Stabilizers and thickeners, binders, texturizers | Produce uniform texture, improve "mouth-feel" | Frozen desserts, dairy products, cakes, pudding and gelatin mixes, dressings, jams and jellies, sauces | Gelatin, pectin, guar gum, carrageenan, xanthan gum, whey |
| pH Control agents and acidulants | Control acidity and alkalinity, prevent spoilage | Beverages, frozen desserts, chocolate, low-acid canned foods, baking powder | Lactic acid, citric acid, ammonium hydroxide, sodium carbonate |
| Leavening agents | Promote rising of baked goods | Breads and other baked goods | Baking soda, monocalcium phosphate, calcium carbonate |
| Anti-caking agents | Keep powdered foods free-flowing, prevent moisture absorption | Salt, baking powder, confectioner's sugar | Calcium silicate, iron ammonium citrate, silicon dioxide |
| Humectants | Retain moisture | Shredded coconut, marshmallows, soft candies, confections | Glycerin, sorbitol |
| Yeast nutrients | Promote growth of yeast | Breads and other baked goods | Calcium sulfate, ammonium phosphate |
| Dough strengtheners and conditioners | Produce more stable dough | Breads and other baked goods | Ammonium sulfate, azodicarbonamide, L-cysteine |
| Firming agents | Maintain crispness and firmness | Processed fruits and vegetables | Calcium chloride, calcium lactate |
| Enzyme preparations | Modify proteins, polysaccharides and fats | Cheese, dairy products, meat | Enzymes, lactase, papain, rennet, chymosin |
| Gases | Serve as propellant, aerate, or create carbonation | Oil cooking spray, whipped cream, carbonated beverages | Carbon dioxide, nitrous oxide |

SOURCE: Center for Food Safety and Applied Nutrition, Food and Drug Administration, U.S. Department of Health and Human Services

*(Illustration by GGS Information Services/Thomson Gale.)*

propionate and sorbic acid, which are used in products such as baked goods, salad dressings, cheeses, margarines, and pickled foods.

- Antioxidants, which prevent rancidity in foods containing fats and damage to foods caused by oxygen. Examples of antioxidants include vitamin C, vitamin E, BHA, BHT (butylated hydroxytolene), and propyl gallate.
- Artificial colors, which are intended to make food more appealing and to provide certain foods with a color that humans associate with a particular flavor (e.g., red for cherry, green for lime).
- Aritificial flavors and flavor enhancers, the largest class of additives, function to make food taste better, or to give them a specific taste. Examples are salt, sugar, and vanilla, which are used to complement the flavor of certain foods. Synthetic flavoring agents, such as benzaldehyde for cherry or almond flavor, may be used to simulate natural flavors. Flavor enhancers, such as monosodium glutamate (MSG) intensify the flavor of other compounds in a food.
- Bleaching agents, such as peroxides, are used to whiten foods such as wheat flour and cheese.
- Chelating agents, which are used to prevent discoloration, flavor changes, and rancidity that might occur during the processing of foods. Examples are citric acid, malic acid, and tartaric acid.
- Nutrient additives, including vitamins and minerals, are added to foods during enrichment or fortification. For example, milk is fortified with vitamin D, and rice is enriched with thiamin, riboflavin, and niacin.
- Thickening and stabilizing agents, which function to alter the texture of a food. Examples include the emulsifier lecithin, which, keeps oil and vinegar blended in salad dressings, and carrageen, which is used as a thickener in ice creams and low-calorie jellies.

## Precautions

### *Regulating Safety of Food Additives and Preservatives*

Based on the 1958 Food Additives Amendment to the Federal Food, Drug, and Cosmetic (FD&C) Act of 1938, the FDA must approve the use of all additives. The manufacturer bears the responsibility of proving that the additive is safe for its intended use. The Food Additives Amendment excluded additives and preservatives deemed safe for consumption prior to 1958, such as salt, sugar, spices, vitamins, vinegar, and monosodium glutamate. These substances are considered "generally recognized as safe" (GRAS) and may be used in any food, though the FDA may remove additives from the GRAS list if safety concerns arise. The 1960 Color Additives Amendment to the FD&C Act required the FDA to approve synthetic coloring agents used in foods, drugs, cosmetics, and certain medical devices. The Delaney Clause, which was included in both the Food Additives Amendment and Color Additives Amendment, prohibited approval of any additive that had been found to cause cancer in humans or animals. However, in 1996 the Delaney Clause was modified, and the commissioner of the FDA was charged with assessing the risk from consumption of additives that may cause cancer and making a determination as to the use of that additive.

The FDA continually monitors the safety of all food additives as new scientific evidence becomes available. For example, use of erythrosine (FD&C Red No. 3) in cosmetics and externally applied drugs was banned in 1990 after it was implicated in the development of thyroid tumors in male rats. However, the cancer risk associated with FD&C Red No. 3 is about 1 in 100,000 over a seventy-year lifetime, and its use in some foods, such as candies and maraschino cherries, is still allowed. Tartrazine (FD&C Yellow No. 5) has been found to cause dermatological reactions ranging from itching to hives in a small population subgroup. Given the mild nature of the reaction, however, it still may be used in foods.

Nitrites are also a controversial additive. When used in combination with salt, nitrites serve as antimicrobials and add flavor and color to meats. However, nitrite salts can react with certain amine in food to produce nitrosamines, many of which are known carcinogens. Food manufacturers must show that nitrosamines will not form in harmful amounts, or will be prevented from forming, in their products. The flavoring enhancer MSG is another controversial food additive. MSG is made commercially from a natural fermentation process using starch and sugar.

### KEY TERMS

**Bacteria**—Single-celled organisms without nuclei, some of which are infectious.

**Bactericidal**—A state that prevents growth of bacteria.

**Bateriostatic**—A substance that kills bacteria.

**Carcinogen**—A cancer-causing substance.

**Enrichment**—The addition of vitamins and minerals to improve the nutritional content of a food.

**Fermentation**—A reaction performed by yeast or bacteria to make alcohol.

**Fortification**—The addition of vitamins and minerals to improve the nutritional content of a food.

**Leavening**—Yeast or other agents used for rising bread.

**Microorganism**—Bacteria and protists; single-celled organisms.

Despite anecdotal reports of MSG triggering headaches or exacerbating asthma, the Joint Expert Committee on Food Additives of the United Nations Food and Agriculture Organization, the World Health Organization, the European Community's Scientific Committee for Food, the American Medical Association, and the National Academy of Sciences have all affirmed the safety of MSG at normal consumption levels.

In the United States, food additives and preservatives play an important role in ensuring that the food supply remains the safest and most abundant in the world. A major task of the FDA is to regulate the use and approval of thousands of approved food additives, and to evaluate their safety. Despite consumer concern about use of food additives and preservatives, there is very little scientific evidence that they are harmful at the levels at which they are used.

In Europe, food additives and preservatives are evaluated by the European Commission's Scientific Committee on Food. Regulations in European Union countries are similar to those in the United States. The Food and Agricultural Organization (FAO) of the United Nations and the World Health Organization (WHO) Expert Committee on Food Additives work together to evaluate the safety of food additives, as well as contaminants, naturally occurring toxicants, and residues of veterinary drugs in foods. Acceptable Daily Intakes (ADIs) are established on the basis of toxicology and other information.

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# Food allergies

## Definition

Food allergies are the body's response to proteins found in food. For more than 12 million Americans alone, food allergy is a significant medical condition. All food contains proteins that enter the body when the food is eaten, or in some cases if it is touched. Allergic reaction occurs when the body reacts to these proteins as if they were harmful, and for individuals with food allergy, the offending food is harmful.

Symptoms of food allergy vary and can range from mildly annoying to dangerous and life threatening. Symptoms of food allergy include:

- tingling of the mouth
- tingling or numbness in arms or legs
- rash or hives
- itching
- abdominal cramps
- vomiting
- diarrhea
- breathing difficulties
- sudden drop in blood pressure (hypotension)
- swelling of the tongue
- swelling of the throat
- loss of consciousness
- death

The most serious symptom of food allergy is anaphylaxis. Anaphylaxis, also called anaphylactic shock, is a sudden and potentially life threatening allergic reaction in which the whole body reacts to an allergen. During anaphylaxis the airway constricts making breathing difficult. Vomiting and diarrhea may also occur as the digestive tract constricts. The skin may swell and become itchy with rash or hives especially in the face. This swelling may block airways as well. The heart may race and the heart beat may become irregular as blood vessels around the heart expand.

**Hives on the back of a young woman's legs. The accompanying inflammation develops as an allergic reaction which ranges in size from small spots to patches measuring several inches across.** *(© Custom Medical Stock Photo, Inc. Reproduced by permission.)*

Anaphylaxis is caused when the body encounters a substance it believes is toxic. This substance is an allergen and is also called IgE. When this occurs, the body produces a substance called histamine. Histamine is a protein that the body releases in reaction to a substance in the blood that the body believes is toxic. Histamine causes blood vessels to dilate or become larger and this causes the symptoms of anaphylaxis. The treatment for anaphylaxis is medication called antihistamine. The most common antihistamine is diphenhydramine hydrochloride which is found over–the–counter drugs such as Benadryl. If taken immediately, this antihistamine can stop anaphylaxis before it becomes too serious.

In cases of severe allergy, an injection of a strong antihistamine called epinephrine or adrenaline may be needed. If allergy is suspected or if an individual has had a previous allergic reaction, an injectable form of epinephrine may be prescribed. An auto–injectable form of epinephrine that looks similar to a large ball point pen is kept on hand at all times. If a severe

## KEY TERMS

**Adrenaline**—(also called epinephrine) A hormone released by the body during times of stress, it increase heart rate and blood pressure. As a medication, it may be used to constrict blood vessels, relax breathing tubes, and as a treatment for anaphylaxis.

**Allergen**—Any substance that produces an allergic reaction.

**Anaphylaxis (Anaphylactic shock)**—A sudden, severe, and potentially fatal allergic reaction characterized by difficulty breathing, low blood pressure, hives, and swelling.

**Antibody**—Proteins in the blood that help defend the body against infection.

**Antihistamine**—Medication that stops the action of histamines.

**Anti–inflammatory**—Medication such as aspirin or Ibuprophen that reduces swelling.

**Diphenhydramine hydrochloride (Benadryl)**—An antihistamine that relieves allergy symptoms.

**Epi-Pen**—A the brand name of the auto–injectable form of epinephrine. Used to stop or prevent anaphylaxis after expose to an allergen.

**Epinephrine**—(also called adrenaline) A hormone released by the body during times of stress, it increase heart rate and blood pressure. As a medication, it may be used to constrict blood vessels, relax breathing tubes, and as a treatment for anaphylaxis.

**Histamine**—A substance that is released by the body in the presence of allergens. It stimulates dilation of blood vessels, constriction of breathing tubes, and decreased blood pressure.

**IgE**—A substance in the body that triggers the body to release histamine when an allergen enters the body. IgE is measured in allergy tests.

allergic reaction occurs,the auto–injector (brand named Epi-Pen) is held against the skin and the medication is administered with a shot. Epinephrine is a strong antihistamine that stops anaphylaxis very quickly.

There is no cure for food allergies; however, food allergies may be prevented. By avoiding foods that cause allergic reactions, an individual can prevent allergic reaction. Avoiding foods that cause allergic reactions is called an elimination diet.

Before food allergies can be avoided, the offending food must be identified. There are eight foods that cause 90% of all food allergies these foods include:

- milk
- eggs
- peanuts
- tree nuts (walnuts, cashews, pecans, etc.)
- fish
- shellfish
- soy
- wheat

### Origins

The fact that some foods cause physical illness has been recognized throughout history. It was the ancient Greek, Lucretius who first said, "One man's food may be another man's poison." Throughout history, people have avoided foods that seemed to cause ill health. In the 1960s researchers began to document food allergies and to verify that avoiding these foods reduced or eliminated the allergy symptoms all together.

In the following 50 years, screening tests such as blood tests and skin tests were developed to assist in identifying food allergies. Treatment including antihistamines and anti–inflammatory medications have helped relieve symptoms, but an elimination diet remains the single most effective method to treat food allergies.

### Description

Food allergies occur when the body has an abnormal reaction to a food eaten or touched. In some individuals, certain foods cause the body to produce histamine. This histamine travels throughout the body causing symptoms such as hives, swelling, wheezing, vomiting, or diarrhea. Once a food allergy has been identified, an elimination diet is the only effective treatment. By eliminating the food that causes the allergic reaction, allergic reaction to food may be prevented.

To identify food allergies, a doctor first records a detailed medical history. The patient will usually keep a food diary documenting exactly what is eaten and when. The patient will also record any physical symptoms and when they occur. In most cases, patterns of reaction to specific foods can be seen in the food diary. Other means of diagnosis food allergies includes

- Blood tests (RAST, CAP–RAST)—A sample of blood is drawn and sent to the lab. These tests measure antibodies in the blood. These antibodies form in response to specific foods. These antibodies occur after the body has been exposed to a food and has

become allergic. This test measures IgE which is specific for each food. Individual food allergies may be identified by this test.

- Skin Tests—In a skin allergy test, a small amount of extract of a food that is suspected of causing an allergic reaction is placed on the skin, the skin is scratched in that area, and observed for reaction. If an allergy exists, a small bump (similar to a mosquito bite) will appear usually within 15 minutes. This is a rapid way to see if a food allergy exists.
- Food Challenge—This is a food test in which neither the testing doctor nor the patient knows what food is given. Opaque capsules are filled (by an assistant or another doctor) with foods that are suspected of causing allergies and foods that are not. The capsules prevent the patient from tasting or smelling the food. The patient swallows a capsule, and the doctor observes to see if a reaction occurs. This teat is not appropriate a person who has had a severe allergic reaction. It is time consuming and is usually performed when a doctor suspects the allergic reaction is not being caused by food. The test can rule out food as a cause for allergic reactions.

After a food allergy is diagnosed, an elimination diet may be implemented. Avoiding foods that cause allergic reaction may sound simple, but it can be quite difficult. It is easy to avoid eating scrambled eggs or a handful of raw peanuts; however, many common food allergy foods are ingredients in many foods.

### *Reading Food Labels*

It is essential that individuals with food allergies read the labels of every food they eat. Federal law called the Food Allergen Labeling and Consumer Protection Act (FALPCA) took effect January 1, 2006. This law mandates that all food containing milk, eggs, fish, crustacean shell fish, peanuts, tree nuts, wheat, or soy must note this on the label. To follow an elimination diet, it is essential to read these labels.

Ingredients that may cause allergies are listed on the label after the word "Contains". If these ingredients have names which are not readily known as versions of foods that may cause allergic reactions, the manufacturer will list the allergen in parenthesis. For example, albumin (egg) or casein (milk) Foods that may be present as additives for coloring or texture must be listed as well. Manufacturer must also list the individual ingredient used and 160 foods that have been identified as causing food allergies must be listed.

According to the American Academy of Allergy, Asthma, and Immunology, many other foods and ingredients may contain parts of foods that cause allergies. These foods should be avoided when on an elimination diet.

Here is a list of other foods and ingredients that may contain foods which cause allergies:

- These may contain milk: Butter flavor, butter, butter fat, butter oil, buttermilk, casein, casemates, rennet casein, cheese, cream, half and half cottage cheese, custard, yogurt, pudding, ghee, all forms of milk from animals such as goats, sour cream, milk solids, lactalbumin, lactalbumin phosphate, lactoglobulin, and lactulose.
- These may contain eggs: eggnog, albumin or albumen, lysozyme, mayonnaise, meringue, surimi, lecithin, pasta, marzipan, marshmallows, and nougat.
- These may contain peanuts or ingredients that may affect people with peanut allergies: any nut or nut product, any nut butter, peanut oil, arachis oil, goobers, mandelonas, many candies and baked goods, nougat, sunflower seeds, and foods from ethnic restaurants such as—African, Chinese, Indonesian, Mexican, Thai, and Vietnamese.

Be aware of the date of manufacturing of the foods in the pantry or on the store shelf. The new labeling requirements went into effect on January 1, 2006. Any food packaged prior to that date may not list all potentially allergy causing foods.

## Function

The function of an elimination diet is to prevent potentially life threatening allergic reactions caused by food. Food allergies begin the second time an allergy–causing food is eaten or, in some cases, touched. The first time the food is consumed, the body reacts with an abnormal biological alarm. As the food is digested and broken down into proteins that enter the blood stream, protective cells called antibodies are formed. Normally, antibodies are used to attack germs such as bacteria or viruses that invade the body. In this case, antibodies protect from disease by destroying the germs. Antibodies prompt other reactions in the body such as fever to kill disease cells or dilating of blood cells so that blood can reach infected areas of the body more rapidly.

The second time the food is ingested, these antibodies alert the body that an invader is present, and the body mounts an attack. The body responds causing the symptoms of itching, rash, hives, breathing difficulties, swelling, or irregular heart beat. Doctors suspect that the reason some people become allergic to foods and other do not is genetic. Children of parents who have a significant allergic reaction to a food are more likely to have that food allergy as well.

## Benefits

The benefits of following an elimination diet to prevent symptoms of food allergies include avoiding the discomfort of symptoms such as itching, stomach upset, and diarrhea. For individuals with severe food allergies, following an elimination diet may be lifesaving.

## Precautions

If food allergy is suspected, it is best to consult a doctor. Removing foods from the diet can cause an unbalanced diet that may be deficient in necessary nutrients. Since some of the most common foods that cause allergies include milk, eggs, and wheat, significant sources of protein, calcium and fiber may be removed. With the assistance of healthcare professions, diets may be modified and healthy substitutions may be found.

Food allergy is becoming more common in children. Food allergies in children may be more severe. Anaphylaxis generally occurs suddenly. Symptoms of food may initially be more subtle in children. It is important to discuss any suspected food allergies with a doctor.

Most individuals with food allergy are allergic to only one food; however, peanut allergy may indicate reaction to tree nuts as well. Many manufacturers who process peanut products, process other nut products as well. Machines that handle and package these products may spread small pieces of peanut to other products. The FALPCA mandates that labels note this fact as well.

## Risks

Risks of food allergy range from minor discomfort to death. Allergic reactions to food are serious and should be discussed with a doctor. Food allergy can come on suddenly. A food that did not previously cause a reaction may suddenly cause a severe reaction as the levels of antibodies in the body increase and allergy develops.

If food allergy is suspected, or if an allergic reaction has occurred, a doctor should be consulted. It may be necessary to keep an auto–injector of epinephrine on hand in case a sudden allergic reaction occurs again. These antihistamine injectors require a prescription and should only be used if a doctor has advised it.

There are few risks of following an elimination diet. However, a doctor should be consulted before eliminating foods rich in necessary nutrients such as milk, eggs, or bread. Suitable substitutions should be incorporated to insure that all necessary vitamins and minerals are maintained in the diet. Many children have food allergies. It is especially important to maintain a balanced diet in children during the important years of development.

Individuals following a special diet to treat other medical conditions should consult with a doctor before altering that diet. Eliminating foods from a previously prescribed diet may aggravate a medical condition and may be harmful.

## Research and general acceptance

### *General acceptance*

The elimination diet is standard treatment for preventing allergic reactions to food once food allergy has been diagnosed. Virtually all doctors agree and there is much data to support the effectiveness of an elimination diet.

Some individuals report food sentivities. Food sensitivity is more subtle than food allergy and rarely causes anaphylaxis. Many people report being sensitive to a variety of foods and food additives. Food sensitivity is less well understood than food allergy. However, the numbers of individuals reporting food sensitivity is increasing, especially in the Western world. In response, there are more studies investigating food sensitivity.

Some doctors doubt the validity of claims of multiple food sensitivities. Food allergy has been well studied and well documented. Most individuals with a food allergy are allergic to only one food. Many people with food sensitivities report reactions to many foods. These reactions are sometimes vague but can be marked and significant. Reported symptoms of food sensitivity include:

- rash
- itching
- stomach upset
- chronic diarrhea
- insomnia
- forgetfulness
- asthma
- inflammation of the joints
- hyperactivity (especially in children)

Children may be affected by food sensitivity. Many parents report changes in behavior after a child has eaten a food for which they may be sentitive. Currently, researchers are investigating the role of diet, food allergy, and food sensitivity in children

## QUESTIONS TO ASK YOUR DOCTOR

- Could I have more than one food allergy?
- Is an elimination diet safe for me?
- Are there any special precautions I should follow?
- Are there any drug precautions I should be aware of while following this diet?
- Do I need an Epi–Pen?

who have been diagnosed with attention deficit disorder and autism. Both conditions are affecting more children each year.

Doctors disagree about the impact of food on children with these conditions. However, many parents report successfully improving symptoms such as inability to concentrate, hyperactivity, and sleep disturbances by eliminating foods such as wheat from the diets of their children.

### *Research*

In the early 20th century, pediatricians, Clements von Pirquet and Bela Schick coined the term allergy from the Greek words *allos*, meaning changed or altered, and *ergon*, meaning reaction. Dr. von Clements was one of the first doctors to study reactions to what would later be called allergens.

In 1943 the American Academy of Allergy, Asthma, and Immunology was formed. This and other organizations of physicians help coordinate and implement many of the research finding of the many studies conducted on allergies each year.

Allergy reportedly affects 38% of all Americans. The Royal College of Physicians reports that one in three adults have an allergy. In a survey of over 3000 adults, 43% reported food allergies.

Multiple studies report a decrease of symptoms when foods that cause allergic reactions are eliminated from the diet.

## Resources

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### OTHER


*Food Allergy Fact Sheet*, American Academy of Allergy, Asthma, and Immunology, (2007) Website: http://www.aaaai.org/patients/resources/fact_sheets/food_allergies.pdf.


### ORGANIZATIONS


American Academy of Allergy, Asthma and Immunology. 611 East Wells Street, Milwaukee, WI 53202. Telephone: (800) 822-2762. Website: http://www.aaaai.org.

The Food Allergy and Anaphylaxis Network. 11781 Lee Jackson Hwy., Suite 160, Fairfax VA 22033. Telephone: (800) 929-4040. Website: http://www.foodallergy.org/.

The Food Allergy Initiative, 1414 Avenue of the Americas, Suite 184, New York, NY 10019, Telephone: (212) 207-1974. Website: http://www.foodallergyinitiative.org.

Deborah L. Nurmi, MS

Food combining *see* **Hay diet**

# Food contamination

## Definition

Food contamination refers to foods that are spoiled or tainted because they either contain microorganisms, such as bacteria or parasites, or toxic substances that make them unfit for consumption.

## Purpose

Food contamination is a serious issue because it results in foodborne diseases that each year affect an estimated seventy-six million people in the United States, while leading to some 325,000 hospitalizations and 5,000 deaths. Hence, awareness of potential sources of food contamination is an important component of good nutrition.

## Description

Food contamination can be microbial or environmental, with the former being more common. Environmental contaminants that can enter the food supply chain include pesticides, heavy metals, and other chemical agents. Many opportunities exist for food to become contaminated as it is produced and distributed. Toi start with, bacteria are present in the animals raised for food. Meat and poultry can become contaminated during slaughter through cross-contamination from intestinal fecal matter. Similarly, fresh fruits and vegetables can be contaminated if they are washed using water contaminated with animal manure or human sewage. During food processing, contamination is also possible from infected food handlers. Lastly, poor hygiene in the home is also a factor.

### *Bacterial food contamination*

Many bacteria can contaminate food. The most common include the following:

- *Campylobacter jejuni*. Mishandling of raw poultry and consumption of undercooked poultry are the main causes of *C. jejuni* contamination.

**Cutting boards and food safety**

- **Type of boards**

  Choose either wood or a nonporous surface cutting board such as plastic, marble, glass, or pyroceramic. Nonporous surfaces are easier to clean than wood.
- **Avoid cross-contamination**

  Use one cutting board for fresh produce and bread and a separate one for raw meat, poultry, and seafood. This will prevent bacteria on a cutting board that is used for raw meat, poultry, or seafood from contaminating a food that requires no further cooking.
- **Cleaning cutting boards**

  To keep all cutting boards clean, wash them with hot, soapy water after each use; then rinse with clear water and air dry or pat dry with clean paper towels. Nonporous acrylic, plastic, or glass boards and solid wood boards can be washed in a dishwasher (laminated boards may crack and split).

  Both wooden and plastic cutting boards can be sanitized with a solution of 1 tablespoon of unscented, liquid chlorine bleach per gallon of water. Flood the surface with the bleach solution and allow it to stand for several minutes. Rinse with clear water and air dry or pat dry with clean paper towels.
- **Replace worn cutting boards**

  All plastic and wooden cutting boards wear out over time. Once cutting boards become excessively worn or develop hard-to-clean grooves, they should be discarded.

SOURCE: Food Safety and Inspections Service, U.S. Department of Agriculture

*(Illustration by GGS Information Services/Thomson Gale.)*

- *Clostridium botulinum*. Bacteria producing a toxin in food responsible for botulism, the deadly paralytic nerve illness.
- *Escherichia coli*. A leading cause of food contamination. Based on a 1999 estimate, 73,000 cases of infection and 61 deaths occur in the United States each year. The *E. coli* 0157:H7 strain is found in ground beef, raw milk, chicken, vegetables, and fruit.
- *Salmonella typhimurium*. Salmonella contamination can occur in meats, poultry, eggs or milk products.
- *Shigella*. The most common food that these bacteria can contaminate include: salads (potato, chicken, seafood, vegetable), raw vegetables, milk and other dairy products, and meat products especially poultry.
- *Staphylococcus aureus*. Can be found in custard or cream-filled baked goods, ham, poultry, eggs, potato salad, cream sauces, sandwich fillings.
- *Vibrio cholera*. These bacteria cause the well-known disease cholera that has caused many outbreaks all over the world. It can be transmitted by water or food.
- *Vibrio vulnificus*. Free-living ocean bacteria that can cause food borne illnesses from contaminated seafood. Especially dangerous in the warm weather months when eating shellfish that are undercooked or raw.

- *Yersinia enterocolitica*. Often found in raw milk, chocolate milk, water, pork, other raw meats.

Spoiled milk is also mostly caused by bacteria such as *Lactococcus cremoris* or *Enterobacter aerogenes*, that cause the milk to form long white strands.

Water contamination is usually due to the presence of three bacteria, *E. coli*, *Clostridium perfringens*, and enterococci, the bacteria normally found in the feces of people and many animals.

### *Parasitic food contamination*

Parasites are organisms that lives in or on a host, and obtain nourishment without benefiting or killing the host. They enter the body through the mouth when contaminated food or drink is swallowed. There are many different types and range in size from single-celled, microscopic organisms (protozoa) to larger, multi-cellular worms (helminths) that can be seen without a microscope. Parasites that contaminate food include:

- *Entamoeba histolytica*. Parasite that causes amoebic dysentery, characterized by severe diarrhea. It is transmitted by contaminated water, and is often called "traveler's dysentery" because of its prevalence in developing nations.
- *Giardia duodenalis*. Microscopic parasite that can live in the intestines of animals and people. It is found in every region of the world and is one of the most common causes of waterborne and foodborne) illness.
- *Cryptosporidium parvum*. Microscopic parasite, a significant cause of water contamination worldwide. It is found in the intestines of many herd animals including cows, sheep, goats, deer, and elk.
- *Cyclospora cayetanensis*. Single-celled, microscopic parasite. Little is known about this organism, although cases of infection are being reported from various countries with increasing frequency.
- *Toxoplasma gondii*. Single-celled, microscopic parasite found throughout the world. Found in foods such as raw or undercooked meats, especially pork, lamb, or wild game, and in drinking untreated water.
- *Trichinella spiralis*. Intestinal roundworm whose larvae may migrate from the digestive tract and form cysts in various muscles of the body. In the United States, infections are most prevalent where pork or wild game is consumed raw or undercooked.
- *Taenia saginata/solium*. *Taenia saginata* (beef tapeworm) and *Taenia solium* (pork tapeworm) are parasitic worms (helminths). They are now uncommon in the United States, although travelers and immigrants are occasionally infected.

## KEY TERMS

**Amoeba**—A single-celled organism, many species of which live in free in water.

**Amoebic dysentery**—Disease characterized by severe diarrhea, caused by infection of the gut by *Entamoeba histolytica*.

**Bacteria**—Microorganisms found in the environment. Bacteria can multiply quickly in food, and can cause foodborne illnesses. Not all bacteria are harmful: some are used to make yogurt and cheese.

**Contamination**—The undesired occurrence of harmful microorganisms or substances in food.

**Cross-contamination**—The transfer of harmful bacteria from one food to another, or also from hands to food.

**Feces**—Waste product of digestion formed in the large intestine. About 75% of its mass is water, the remainder is protein, fat, undigested roughage, dried digestive juices, dead cells, and bacteria.

**Foodborne illness**—Illness caused by pathogenic bacteria transmitted to humans by food.

**Microorganism**—A general term for bacteria, molds, fungus, or viruses, that can be seen only with a microscope.

**Parasite**—An organism that lives in or on a host; it obtains nourishment from the host without benefiting or killing the host. The parasites responsible for foodborne illnesses are mostly single-cell organisms such as amoeba, giardia, and trichomonas, while others have a worm-like appearance.

**Pathogen**—A disease-causing microorganism.

## Precautions

Simple precautions can reduce the risk of contamination. For instance, meat left at room temperature promotes bacterial growth and refrigeration helps to suppress it. One can also be careful about eating certain foods. Eating raw meats and fish should be avoided as well as salads prepared in restaurants where meats and vegetables share a common surface during preparation.

Most food-related illnesses can be avoided by washing fresh fruits and vegetables, cooking meat thoroughly, drinking only pasteurized milk, and common-sense hygiene. Heating food to an internal temperature above 160 °F, or 78 °C, is usually sufficient to kill

parasites, viruses or bacteria, except for the Clostridium bacteria, which produce heat-resistant spores. These can only be killed at temperatures above boiling.

The Mayo Clinic offers the following advice to prevent food contamination at home:

- Wash hands, utensils and food surfaces often. Keeping hands, utensils and food preparation surfaces clean can prevent cross-contamination, i.e. the transfer of harmful bacteria from one surface to another.
- Keep raw foods separate from ready-to-eat foods. When shopping, preparing food or storing food, keep raw meat, poultry, fish and shellfish away from other foods. This also prevents cross-contamination.
- Cook foods to a safe temperature. You can kill harmful organisms in most foods by cooking them to temperatures between 140°F and 180°F.
- Refrigerate or freeze perishable foods. Harmful bacteria can reproduce rapidly if foods are not properly cooled. Refrigerate or freeze perishable foods within two hours of purchasing or preparing them.
- Defrost food safely. Bacteria can reproduce rapidly on meat, poultry and fish at room temperature. To defrost food safely, tightly wrap meat, poultry and fish so that the juices do not drip on other food as they thaw in the refrigerator. Another method is to put the frozen food in a plastic bag and immerse it in cold water, changing the water every 30 minutes. The sealed food package can also be placed under cold, running water. Cook food immediately after defrosting.
- Use caution when serving food. Throw out any leftovers that have been at room temperature for more than two hours or in hot weather for more than an hour. If cold food needs to sit out for longer than two hours, use a tray of ice under the food to keep it cold. If hot food must sit out for longer than two hours, use warming trays to keep the food hot.
- Throw it out when in doubt. If you are not sure if a food has been prepared, served or stored safely, throw it away.
- Know when to avoid certain foods altogether.

## Interactions

Food contamination usually causes abdominal discomfort and pain, and diarrhea, but symptoms vary depending on the type of infection. Transmission usually occurs via the fecal/oral route with the ingestion of the pathogen present in the contaminated food. After they are ingested, there is a delay, (incubation period) before symptoms appear, that may range from hours to days, depending on the organism. During this period, the microbes pass through the stomach into the intestine, where they start to multiply. Some types stay in the intestine, others produce a toxin that is absorbed into the bloodstream, and others can directly invade the deeper body tissues. The symptoms depend on the type of infection. Numerous pathogens cause similar symptoms, for instance diarrhea, abdominal cramps, and nausea.

## Aftercare

There are many different kinds of foodborne diseases and they may require different treatments, depending on the symptoms they cause. Illnesses that cause diarrhea or vomiting lead to dehydration if the person loses more body fluids and salts (electrolytes) than they take in. Replacing the lost fluids and electrolytes is therefore important. If diarrhea is severe, oral medication such as Ceralyte, Pedialyte or Oralyte, can be taken to replace the fluid losses. Preparations of bismuth subsalicylate, such as Pepto-Bismol, can help reduce the duration and severity of the diarrhea.

## Complications

Food poisoning is especially serious and potentially life-threatening for young children, pregnant women and their fetuses, older adults, and people with weakened immune systems.

Data from the Centers for Disease Control and Prevention's (CDC) FoodNet surveillance system suggests that although younger individuals usually face far higher rates of infection from foodborne pathogens, older adults, along with the very young are more likely to have severe complications from these infections. In particular, research has shown that the elderly are more vulnerable to gastroenteritis-induced deaths. It is also estimated that 2–3% of all acute foodborne illnesses develop secondary long-term illnesses and complications called chronic sequellae. These can occur in any part of the body, such as the joints, nervous system, kidneys, or heart.

## Parental concerns

A bottle-fed infant is at higher risk for severe infections with bacteria that can grow in a bottle of warm formula if it is left at room temperature for many hours. Particular care is needed to keep baby bottles clean and disinfected. Leftover milk formula or juice should also not be kept in the bottle for many hours.

### Resources

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#### ORGANIZATIONS

Centers for Disease Control and Prevention. 1600 Clifton Road, NE, Atlanta, GA 30333. 1-800-CDC-INFO (1-800-232-4636) or 404-639-3534.<www.cdc.gov>.

Food and Drug Administration, Center for Food Safety and Applied Nutrition. 5100 Paint Branch Parkway, College Park, MD 20740-3835. 1-888-SAFEFOOD (1-888-723-3663). <vm.cfsan.fda.gov>.

U.S. Department of Agriculture, Food Safety and Inspection Service. Meat and Poultry Hotline: 1-888-MPHotline (1-888-674-6854). <www.fsis.usda.gov>.

U.S. Environmental Protection Agency. 1200 Pennsylvania Avenue, NW, Washington, DC 20460. 202-272-0167. <www.epa.gov>.

Monique Laberge, Ph.D.

# Food labeling

## Definition

Food labeling tells consumers about the, ingredients, and nutritional composition of packaged food for sale. Labels may also contain information about the conditions under which the food was produced. In the United States, food labeling is regulated by several federal agencies. Some labeling information is mandatory, while others is voluntary.

## Purpose

Food labeling is designed to protect the health and well being of consumers. It allows them to:

- know what ingredients are in the food
- determine the relative amounts of each ingredient
- determine how much of selected vitamins, minerals, and other nutrients a food contains. This information may be given either by weight OR as a percentage of a daily requirement value.
- examine foods for potential allergens, additives, or ingredients that they wish to avoid
- learn about the conditions under which certain ingredients were produced (e.g. organic, free-range)
- compare the price per unit volume or weight of similar products
- determine if nutrients have been added or removed from the base food (e.g. enriched, reduced fat)

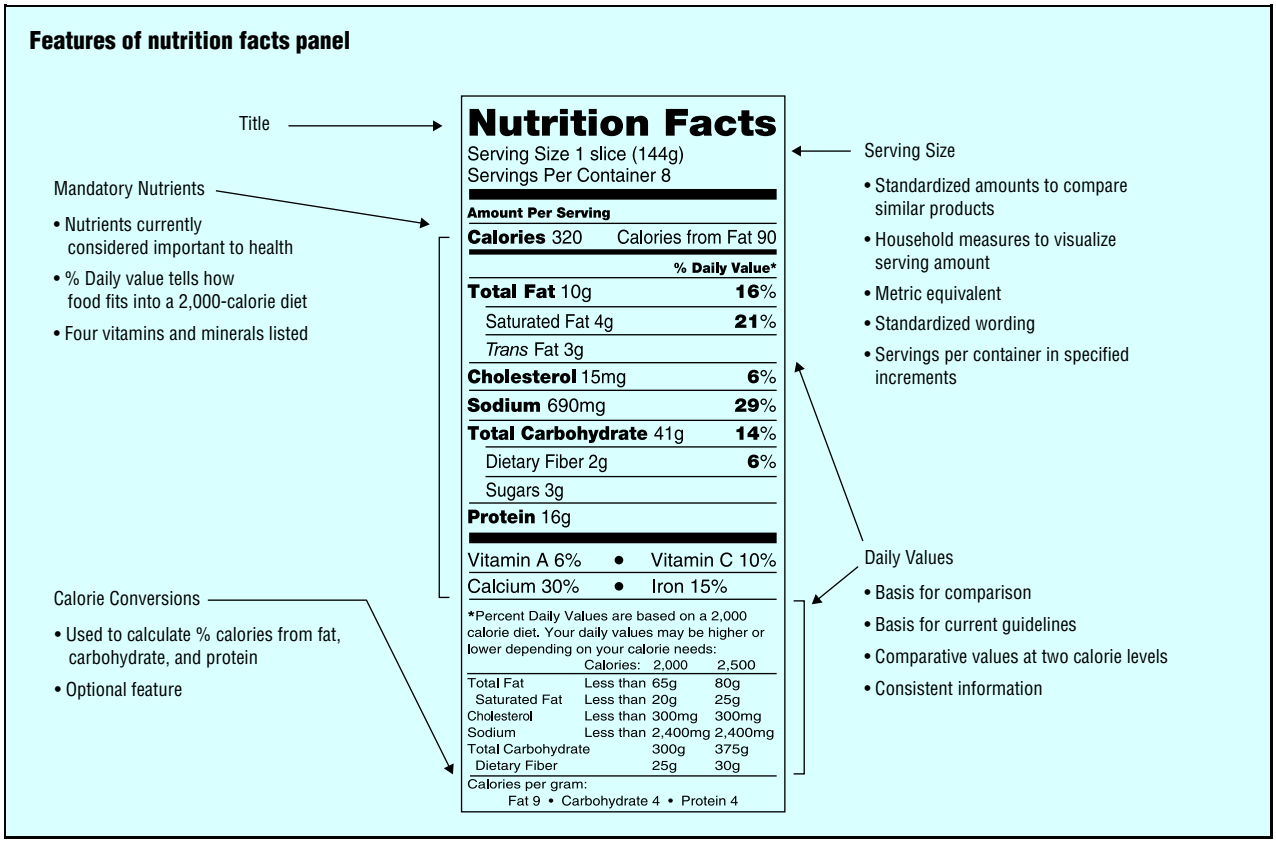
## Description

In the United States, food labeling is regulated by a great deal of very specific, complex, ever-evolving legislation. The United States Department of Agriculture (USDA) and the United States Food and Drug Administration (FDA) are the federal agencies most involved with food labeling issues and enforcement of food labeling laws. The USDA is responsible for the labeling of meat, poultry, and egg products. The FDA regulates the labeling most other foods, including seafood and **bioengineered foods**. The FDA also regulates **dietary supplements** and nutraceuticals. States also may regulate food labeling. For example, some states require sell-by or use-by information of food labels. When state and federal laws conflict, federal laws must be followed.

Different types of food have different labeling requirements. For example, canned or frozen foods are required to have different information on their labels than fresh meat, poultry, and fish. Fresh vegetables are usually subject to voluntary labeling unless they are being sold as "organic" produce. Legislation covers things as specific as the definitions of certain words used on the label (e.g. low fat), to the size of the print used on the label, to where certain information must be placed on the package. Milk and milk products are often subject to additional regulation by state dairy boards. The federal Bureau of Alcohol, Tobacco, Firearms, and Explosives regulates alcoholic beverages. The United States Customs Service requires certain information on processed foods that are imported into the U.S. This entry discusses general aspects of food labeling, with the understanding that there are complications and exceptions to almost every aspect of food labeling requirements.

### *Basic mandatory information*

Both the FDA and the USDA require certain information to be listed in English on the label of




*(Illustration by GGS Information Services/Thomson Gale.)*

packaged food available for sale. This information includes:

- Name of the product. Laws regulating what some products may be called based on their content and processing. This explains why some substances that look like cheese are called "cheese food" or "processed cheese product," and some juice-like products are called "fruit drinks" or "fruit beverages" and not juice.
- Net quantity. This is the amount of food by weight in the package. It does not include the weight of the packaging. Meat and poultry labels are required to give the weight in Imperial(avoirdupois) measures such as pounds or ounces. Other foods are required to give the weight in both English and metric (grams, kilograms) units.
- serving size and number of servings the package contains, except for single-serving packages.
- Nutrition facts. Calories, calories from fat, total fat, saturated fat, *trans* fat, cholesterol, sodium, total carbohydrates, dietary fiber, sugars, protein, vitamin A, vitamin C, calcium, and iron must be listed for a single serving of the food. This information is not required on fresh meat, fresh poultry, fresh seafood, or fresh fruit and vegetables.
- ingredient list. Every ingredient must be listed in order from the greatest to least by weight. There are exceptions for certain artificial colors and flavorings which may be listed generically by terms like "artificial coloring."
- Name of manufacturer or distributor. In some cases a full street address also is required.

### *Supplemental required information*

Certain foods are required to have additional information on the label. Some of these requirements are listed below.

- Foods containing the fat replacer olestra must state this on the label. See the entry on fat replacers for additional information.
- Foods containing sorbital or mannitol, both artificial sweeteners must list the amount.
- Foods packaged under pressure must indicate the contents are under pressure.
- Juices that have not been completely pasteurized must state they have not been completely processed.

## KEY TERMS

**Allergen**—something that causes an allergic reaction

**Dietary supplement**—a product, such as a vitamin, mineral, herb, amino acid, or enzyme, that is intended to be consumed in addition to an individual's diet with the expectation that it will improve health

**Mineral**—an inorganic substance found in the earth that is necessary in small quantities for the body to maintain a health. Examples: zinc, copper, iron.

**Nutraceuticals**—also called functional foods, these products are marketed as having health benefits or disease-preventing qualities beyond their basic supply of energy and nutrients. Often these health benefits come in the form of added herbs, minerals, vitamins, etc.

**Vitamin**—a nutrient that the body needs in small amounts to remain healthy but that the body cannot manufacture for itself and must acquire through diet

- Foods containing raw or not ready-to-eat meat or poultry products must be labeled as such.
- Juices must show the percent real juice the product contains (e. g. 100% grapefruit juice."
- Imported foods must list their country of origin
- Foods to which vitamins and minerals have been added must be labeled as enriched with the appropriate nutrient(s).

### *Optional label information*

Certain information on food labels is optional. However, any optional information on the label must follow set guidelines and not be misleading. Foods that are labeled as "low fat," ":reduced calorie," "sugar free," or that make similar claims must meet the official FDA definition of these words (see below). Foods may list a specific amount of a particular nutrient, such as ":3 grams of carbohydrates," so long as it is not done in a misleading way. The FDA must approve any health claims the label makes that relate a specific ingredient to a specific disease (such as **calcium** helping to prevent **osteoporosis**).

Plant foods labeled "organic" are made from crops raised without synthetic fertilizers or sewage sludge fertilizer, and they have not been treated with most conventional pesticides or are not genetically engineered (see bioengineered food). Animal products that are labeled "organic" come from livestock that has been fed 100% organic feed and raised without growth hormones or antibiotics in an environment where they have access to the outdoors. There continues to be debate about the exact requirements to label animal products "cage-free," "free-range," or "grass-fed."

### *Reading a food label*

The many descriptive words on a food label cannot be used unless they meet very specific legal requirements. Some of the common descriptions found on FDA-regulated foods are listed below.

- Fat-free: less than 0.5 grams of fat per serving.
- Low fat: no more than 3 grams or less of fat per serving.
- Less fat: A minimum of 25% less fat than the comparison food.
- Light (fat) A minimum of 50% less fat than the comparison food.
- Cholesterol-free: Less than 2 mg of cholesterol and 2 g of saturated fat per serving.
- Low cholesterol: no more than 20 mg of cholesterol and 2 grams of saturated fat per serving.
- Reduced calorie: A minimum of 25% fewer calories than the comparison food.
- Low calorie: No more than 40 calories per serving.
- Light (calories): A minimum of one-third fewer calories than the comparison food.
- Sugar-free: Less than 0.5 grams of sugar per serving.
- Low sodium: No more than 140 mg of sodium per serving.
- Very low sodium: No more than 35 mg of sodium per serving.
- High fiber: 5 or more grams of fiber per serving.
- High, rich in, excellent source of: 20% or more of the Daily Value of the nutrient.
- Good source of: 10% or more of the Daily Value of the nutrient than the comparison food.
- Less, fewer, reduced: 25% or less of the named nutrient than the comparison food.

The USDA also has specific requirements for words used in labeling meat and poultry. Some of these include:

- Certified: inspected, evaluated, graded, and approved the USDA Food Safety and Inspection Service.
- Free-range or free-roaming: indicates that the animals have access to the outdoors.

- Fresh (poultry): A complicated regulation that in general says that the raw meat has never been held at a temperature below 26 °F, although there are some adjustments to this that allow a temperature fluctuation of up to 2 degrees while poultry is in stores.
- Frozen (poultry): The temperature of the raw meat is 0 °F or lower.
- Halal: prepared at a federally inspected meat-packing plant that also is overseen by an Islamic authority and meets the requirements of Islamic dietary law.
- Kosher: prepared at a federally inspected meat-packing plant that also is overseen by an Rabbi and meets the requirements of Jewish dietary law.
- Natural: containing no artificial ingredients or added color and processed in a way that does not alter the raw product.
- oven prepared: the item is cooked and ready to eat without additional cooking.
- oven ready: the item is uncooked, but is ready to cook without additional preparation.

Consumers may also see a USDA grade on the label of cuts of beef and lamb. Pork, veal, and mutton are also graded, but the grades are not usually shown on store packaging. All USDA graded meat is inspected and wholesome, but some grades are more tender and better suit to certain cooking methods than others.

- Prime: the highest quality and most tender and juicy cuts, but also the most expensive. Prime cuts contain the most fat. They make excellent steaks and roasts.
- Choice: very tender, juicy, and flavorful. This is the most popular grade of meat sold in the United States.
- Select: very lean with less fat. These cuts are best suited to long, moist cooking methods such as soups and stews.

Two other lower grades of beef, standard and commercial, are sometimes sold as ungraded "store brand" meats. These cuts are wholesome and nutritious, but tend to be tougher and dryer than the higher grades. Utility, cutter, and canner beef, the lowest of the eight grades, are almost never seen in stores. These cuts of meat are used to make ground beef, hot dogs, and other processed meat products.

### *Understanding the nutrition facts panel*

The Nutrition Labeling and Education Act of 1990 and subsequent revisions require certain nutritional information be clearly displayed on many foods. It does not apply to meat and poultry, raw fruits and vegetables, ready-to-eat food such as cookies or cakes sold at a bakery, food sold by sidewalk vendors, and a few other exceptions. Counter cards instead of packaging labels provide voluntary nutrition information for many common fruits, vegetables, raw seafood, and wild game or exotic meats (e.g. ostrich). The nutrition facts panel is designed to encourage health eating. It gives consumers a way to compare the nutritional value of products and to see how specific products can meet their dietary needs.

The nutrition facts panel consists of several sections. The serving size is given in both a familiar units such as cups or ounces and in metric units. Serving sizes are standardized for similar foods, so that consumers can make easy comparisons. If the package contains a single serving, the serving size is not required. Under the serving size the servings per container lists the total number of servings contained in the package.

All information listed below the servings per container is given per single serving. People who eat more than one serving will take in more calories and nutrients than the amount listed on the label. Calories and calories from fat, the first nutrient listed, give the consumer a quick idea of how much energy the food provides and how healthful it is (or isn't).

The next section of the nutrient facts panel deals with specific nutrients. The information is given by weight in metric units (grams or mg) and as a percent daily value. The percent daily value shows how much of each nutrient the food contributes toward meeting the daily recommended amount of each specific nutrient. Percent daily values are based on the recommended dietary allowances (RDAs) of the nutrient for a person who is eating a 2,000-calorie diet. Percent daily values of 5% or less are considered low and values of 20% or greater are considered high.

The nutrients listed next on the panel are ones that Americans generally eat enough or too much of and that they should try to limit. The first of these are total fat, saturated fat and *trans* fat. High consumption of saturated fat and *trans* fat are linked to the development of cardiovascular disease. People should try to consume as little of these **fats** as possible. *Trans* was not part of the original nutrient facts panel, but was added beginning January 1, 2006. Not enough information is available to calculate a percent daily value for *trans* fat. Cholesterol and **sodium** complete the list of nutrients that Americans consume in large amounts and should try to consume less of.

The nutrient panel also lists total **carbohydrates**, dietary **fiber**, sugars, and proteins. Americans should try to increase the amount of dietary fiber they consume. A percent daily value for **protein** is not required unless the food makes the claim "high in protein." In

that case, the daily value must be 20% or greater. No recommendations have been made about how much sugar should be consumed in a day, so no percent daily value can be calculated.

At the bottom of the label, percent daily values, but no weights, are listed for four nutrients: **vitamin A**, **Vitamin C**, calcium, and **iron**. These percentages give consumes an idea how low or high the food is in these particular nutrients.

Larger labels have a footnote at the very bottom. The information in this footnote is the always same regardless of the type of food in the package. The footnote explains that the percent daily values are calculated based on a 2,000 calorie diet, and that an individual's needs may be greater or less than the listed percent daily value depending on the individual's energy (calorie) needs. The footnote then gives dietary guidance by showing the maximum recommended grams of fat, saturated fat, cholesterol, and sodium, and the minimum grams of carbohydrates and dietary fibers a person on a 2,000 or 2,500-calorie diet should consume. This guidance is based on the Dietary Guidelines for Americans 2005. Whether this footnote is included in the label depends on the space is available. By using all the information available on food labels, consumers can make informed decision about the nutritional content of what they eat and maintain a healthy diet.

## Precautions

Labeling requirements change occasionally as more research becomes available, There is a two-year phase-in period whenever labeling requirements are changed. This eases the financial impact on companies whose products require new labels. Occasionally labels will not reflect all the most recent regulations. In 2007, regulations that would require soluble dietary fiber to be listed on food labels were under consideration.

## Parental concerns

Special labeling requirements are in effect for foods designed to consumed mainly by children age four and younger. See the entry on **infant nutrition** for additional details.

## Resources

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United States Food and Drug Administration (FDA), Center for Food Safety and Applied Nutrition, Office of Nutritional Products, Labeling, and Dietary Supplements. 5100 Paint Branch Parkway, College Park, Maryland 20740. Fax: 301-436-2639. Website: <http://www.cfsan.fda.gov/>

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# Food poisoning

## Definition

Food poisoning comes from eating food or drinking **water** that is the contaminated with a virus, bacterium, parasite, or chemical that causes illness. It is also called gastroenteritis.

## Description

Foodborne illness is a serious public health concern in the United States and around the world. More than 250 foodborne diseases have been identified. Most food poisoning is unpleasant but not severe enough to require professional medical treatment. However, the economic impact of food poisoning is substantial. The United States Centers for Disease Control (CDC) estimates that food poisoning costs the United States between 5 and 6 billion dollars annually in direct medical care and lost productivity.

The organisms and chemicals that cause food poisoning can contaminate food at any point during the production process. Animal products cause the majority of food poisonings. They can become contaminated during slaughter, processing, transport, storage, or preparation. A vegetarian diet, however, does not protect a person from food poisoning. Fruits and vegetables can be contaminated in the fields from animal feces or pesticides, as well as during harvesting, processing, distribution, and storage. The CDC estimates that about 97% of all food poisoning comes from improper food handling. Of that, 80% occurs from food prepared in businesses (e.g. restaurants or work cafeterias) or institutions (e.g. schools or jails). The remaining 20% occurs from food prepared at home. In the twenty-first century, American bioterrorism experts have become increasingly concerned that a disease-causing organism could intentionally be introduced into the food or water supply to cause a mass outbreak of food poisoning illness.

## Demographics

The CDC estimates that about 76 million cases of food poisoning occur in the United States each year. The specific organism causing the disease is identified in only about 14 million cases. Most cases of food poisoning are mild, but about 325,000 individuals are hospitalized for food poisoning each year in the United States, and about 5,000 die. Internationally, food poisoning is about five times more common in developing countries than in the United States and Europe. In underdeveloped countries where contaminated water supplies are common and refrigeration is rare, foodborne illnesses may cause a billion illnesses and 4–6 million deaths each year.

Food poisoning is an equal opportunity illness. It affects people independent of race, age, or gender. However, the very young, the elderly, pregnant women, and people with weakened immune systems (e.g. people with HIV/AIDS, leukemia, transplant patients) are more likely to have severe cases that result hospitalization and life-threatening complications.

## Causes and symptoms

Food poisoning can be divided into two basic types: illness caused by infectious organisms and illness caused by chemicals. The infectious organisms (pathogens) that cause food poisoning are bacteria, viruses, and parasites. Chemicals can be either natural toxins (poisons) found in plants (e.g. poisonous mushrooms) and animals (Japanese puffer fish) or they can be man-made chemicals such as pesticides or herbicides.

Symptoms of food poisoning usually develop anywhere within 1–48 hours after eating contaminated food. Symptoms of chemical food poisoning often appear very quickly. The type of symptoms and their severity depend on the cause of the food poisoning, the amount of contaminated food eaten, and the health of the individual. Symptoms usually develop suddenly. Some common symptoms of food poisoning include:

- nausea followed by forceful vomiting
- frequent diarrhea. Stools can be extremely watery and may or may not contain blood.
- painful stomach cramps
- fever
- headache
- dizziness
- blurred vision, difficulty breathing, tingling in hands and feet (chemical food poisoning)

**Microorganisms responsible for common food-borne illness**

| Microorganism | Food-borne illness | Symptoms | Common food sources | Incubation |
|---|---|---|---|---|
| Bacillus cereus | Intoxication | Watery diarrhea and cramps, or nausea and vomiting | Cooked product that is left uncovered —milk, meats, vegetables, fish, rice, and starchy foods | 0.5–15 hours |
| Campylobacter jejuni | Infection | Diarrhea, perhaps accompanied by fever, abdominal pain, nausea, headache, and muscle pain | Raw chicken, other foods contaminated by raw chicken, unpasteurized milk, untreated water | 2–5 days |
| Clostridium botulinum | Intoxication | Lethargy, weakness, dizziness, double vision, difficulty speaking, swallowing, and/or breathing; paralysis; possible death | Inadequately processed, home-canned foods; sausages; seafood products; chopped bottled garlic; honey | 18–36 hours |
| Clostridium perfringens | Infection | Intense abdominal cramps, diarrhea | Meats, meat products, gravy, Tex-Mex type foods, other protein-rich foods | 8–24 hours |
| Escherichia coli group | Infection | Watery diarrhea, abdominal cramps, low-grade fever, nausea, malaise | Contaminated water, undercooked ground beef, unpasteurized apple juice and cider, raw milk, alfalfa sprouts, cut melons | 12–72 hours |
| Listeria Monocytogenes | Infection | Nausea, vomiting, diarrhea; may progress to headache, confusion, loss of balance and convulsions; may cause spontaneous abortion | Ready-to-eat foods contaminated with bacteria, including raw milk, cheeses, ice cream, raw vegetables, fermented raw sausages, raw and cooked poultry, raw meats, and raw and smoked fish | Unknown; may range from a few days to 3 weeks |
| Salmonella species | Infection | Abdominal cramps, diarrhea, fever, headache | Foods of animal origin; other foods contaminated through contact with feces, raw animal products, or infected food handlers. Poultry, eggs, raw milk, meats are frequently contaminated. | 12–72 hours |
| Shigella | Infection | Fever, abdominal pain and cramps, diarrhea | Fecally contaminated foods | 12–48 hours |
| Staphylococcus aureus | Intoxication | Nausea, vomiting, abdominal cramping | Foods contaminated by improper handling and holding temperatures—meats and meat products, poultry and egg products, protein-based salads, sandwich fillings, cream-based bakery products | 1–12 hours |
| Hepatitis A | Infection | Jaundice, fatigue, abdominal pain, anorexia, intermittent nausea, diarrhea | Raw or undercooked molluscan shellfish or foods prepared by infected handlers | 15–50 days |
| Norwalk-type viruses | Infection | Nausea, vomiting, diarrhea, abdominal cramps | Shellfish grown in fecally contaminated water; water and foods that have come into contact with contaminated water | 12–48 hours |
| Giardia lamblia | Infection | Diarrhea, abdominal cramps, nausea | Water and foods that have come into contact with contaminated water | 1–2 weeks |
| Trichinella spiralis | Infection | Nausea, diarrhea, vomiting, fatigue, fever, abdominal cramps | Raw and undercooked pork and wild game products | 1–2 days |

*(Illustration by GGS Information Services/Thomson Gale.)*

Contamination that causes food poisoning can occur at every level of the food production process Some examples follow.

- Growers: application of illegal pesticides and herbicides or their application higher than approved concentrations. In the United States, pesticides use is regulated by the United States Department of Agriculture (USDA) and the Environmental Protection Agency (EPA).
- Processors: use of contaminated water in processing, inadequate disinfecting of processing equipment, inadequate time and temperature in processing canned or cooked foods, contamination with poisons used to control factory pests, and improper handling of raw materials. In the United States, meatpacking plants are inspected by the USDA, and other food processing plants are inspected by the United States Food and Drug Administration (FDA).
- Storage and transportation: holding fresh or frozen foods at improper temperatures, inappropriate use of fumigants in warehouses or trucks, inadequate sanitizing of food-carrying tanker trucks (e.g. milk, corn syrup), and contamination by insects or rodent droppings in storage areas
- Retail outlets and restaurants: food kept at improper temperatures, cross-contamination between raw and cooked food, improper disinfecting of food preparation surfaces, transmission by infected food handlers,

## KEY TERMS

**Pathogen**—An organism that causes a disease.

**Toxin**—A general term for something that harms or poisons the body.

and failure of food handlers to wash their hands. Restaurants are inspected by local health authorities.

- Home preparation: letting food sit out too long at room temperature, inadequate cooking, cross-contamination between cooked and raw food, failure to properly reheat leftovers

### *Bacteria*

Bacterial contamination is the leading cause of food poisoning. At room temperature, bacteria reproduce at astounding rates. A single bacterium that divides every half hour can produce 17 million offspring in 12 hours. Bacteria fall into two general categories. One group causes symptoms of food poisoning by directly infecting the intestines causing irritation and diarrhea. The other group release toxins (poisons) as they grow and reproduce. These toxins affect the digestive system and often cause vomiting first followed by diarrhea. Many bacteria cause food poisoning. A few of the more common ones are described below.

Bacteria of the genus *Salmonella* are common in reptiles, birds, and mammals. They are found most often in eggs, poultry, dairy products, and beef. Infection with *Salmonella* causes nausea, vomiting, stomach cramps, headache, and low-grade fever. Symptoms begin anywhere from 6 to 48 hours after exposure and may last for 7 days. In people with weakened immune systems, *Salmonella*

Bacteria of the genus *Campylobacter* cause more diarrhea illnesses worldwide than any other group of bacteria. They produce fairly mild diarrhea, fever, and stomach cramps. *Campylobacter* bacteria are found in almost all raw chicken and turkey. Cross-contamination, that is putting cooked food down where raw food had been, is a leading cause of food poisoning from *Campylobacter*. These bacteria are also transmitted by water contaminated with animal feces.

*Escherichia coli* are a large group of bacteria, only some of which cause food poisoning. *E. coli* food poisoning usually begins with watery diarrhea that later turns bloody. One strain of *E. coli* known as 0157:H7 is most often found in undercooked hamburger, but has also been found in ready-to-eat raw spinach. This particular strain can cause kidney failure and death, especially in children and the elderly.

*Clostridium botulinium* is a bacteria that causes the disease botulism. *C. botulinium* produces a toxin that affects the nervous system and can cause difficulty breathing and paralysis. Symptoms do not appear until 1 to 4 days after exposure. Botulism is associated with improperly canned food, smoked fish, and honey. Infection with *C. botulinium* is serious and often fatal.

### *Viruses*

A large group of viruses called Norwalk or Norwalk-like viruses are an extremely common cause of foodborne illness. In the mid-2000s, Norwalk viruses were often in the news for causing outbreaks of gastrointestinal disease on cruise ships and in nursing homes. They cause more vomiting than diarrhea than any other viruses. Unlike many of the other causes of food poisoning, these viruses are not usually naturally present in food. They are usually transferred from the hands of infected food handlers to the food that they are preparing, especially to foods such as salads and sandwiches.

### *Parasites*

Parasites that cause food poisoning usually come from contaminated water. They often cause mild symptoms that are slow to develop but last for several weeks. *Giardia* causes watery diarrhea and is often acquired by drinking untreated water from lakes or streams. *Cyrptosporidium* is a parasite that causes large amounts of watery diarrhea for 3–4 days. Healthy people usually recover quickly, but in people with weakened immune systems, symptoms can persist for a long time.

### *Natural toxins*

Natural poisons found in some wild mushrooms can cause anything from nausea and vomiting to hallucinations, coma, and death, depending on the amount and species of mushroom eaten. Mushroom poisoning is a medical emergency. People who believe they have eaten a poisonous mushroom should, if possible, take a sample of the mushroom or their vomit to the emergency room with them. Identifying the type of mushroom causing the illness can help determine the most effective treatment.

Oysters, clams, mollusks, and scallops can contain toxins that affect the nervous system. Symptoms usually begin with a tingling in the mouth, then the arms and legs. Individuals may become dizzy and may have difficulty breathing. Shellfish poisoning is a medical emergency because the muscles needed for breathing

may become paralyzed. Similar symptoms result from eating the Japanese puffer fish which contains a natural poison that in its skin and digestive system that affects the nervous system.

### *Manmade toxins*

Manmade toxins include all pesticides, fertilizers, disinfectants, and any other chemicals remaining in food when it is eaten that can cause illness. Contamination is accidental, and often the result of ignorance or a misunderstanding of how to apply the chemical. Symptoms may develop rapidly or slowly depending on the type of chemical and the amount of exposure. Chemical poisoning requires prompt medical evaluation.

## Diagnosis

Food poisoning is caused by many different organisms, but identifying the exact organism is not usually necessary. Most mild food poisoning is diagnosed by the symptoms of vomiting, diarrhea, and stomach cramps coupled with information about that the individual has recently eaten. The length of time between eating the suspect food and the start of symptoms gives physicians a clue about what particular organism may be causing the food poisoning. Blood and urine tests may be ordered to determine the individual's degree of **dehydration** and electrolyte (chemical) imbalances. In most cases, determining the exact pathogen that is causing the food poisoning is relatively unimportant, as treatment tends to be the similar for most causes. However, if diarrhea is persistent, a stool culture may be done to provide more specific information.

When chemical or natural toxin poisoning is suspected, determining the exact cause is more important, and treatment is specific to the cause. The stomach may be pumped and the contents tested. Extensive blood tests are usually needed. Sometimes activated charcoal is used to help absorb the poison in the stomach.

## Treatment

The main goal of treatment for food poisoning is to keep the individual from becoming dehydrated. A loss of 20% of a person's body fluid is fatal, and 10-15% is serious. In food poisoning, huge amounts of both water and **electrolytes** can be lost quite rapidly. Vomiting and diarrhea in infants and young children require especially prompt professional treatment because small children can become dehydrated within hours.

Mild cases of food poisoning can usually be treated at home, especially if they are not accompanied by a fever. Dehydration in infants and children can be prevented or treated by giving them oral rehydration solutions such as Pedialyte, Infalyte, Naturalyte, Oralyte, or Rehydralyte. These are available in supermarkets and pharmacies without a prescription. Oral rehydration solutions have the proper balance of salts and sugars to restore fluid and electrolyte balance. They can be given to young children in small sips as soon as vomiting and diarrhea start. Children may continue to vomit and have diarrhea, but some of the fluid will be absorbed. In the past, parents were told to withhold solid food from children who had diarrhea. New research indicates that it is better for children should to be allowed to eat solid food should they want it, even though diarrhea continues.

Older children and adults who are dehydrated can be given oral rehydration solutions or sports drinks such as Gatorade. Adults and older children with food poisoning should avoid drinking coffee, tea, and soft drinks, especially soft drinks that contain **caffeine**, as these liquids promote dehydration. Over-the counter medications to stop or slow diarrhea such as Kaopectate, Pepto-Bismol, or Imodium will not shorten the duration of the disease, but may give the individual some control over his or her bowels. Consult a physician before giving these over-the-counter medicines to children.

Individuals of all ages who are seriously dehydrated need to be treated promptly by a medical professional. In the case of severe dehydration, the individual may be hospitalized and fluids given intravenously (IV; directly into the vein). Drugs may also be prescribed to stop persistent vomiting. Although bacteria cause many cases of food poisoning, antibiotics are not routinely used in treatment. Some studies have shown that antibiotics are necessary only in about 10% of cases.

Individuals who think their food poisoning symptoms are caused by chemicals or natural toxins should seek emergency medical care immediately. These types of food poisoning are too serious to try to treat at home.

## Nutrition/Dietetic concerns

Certain foods are more commonly associated with food poisoning than others. These include:

- raw and undercooked meat, especially ground meat
- raw or undercooked poultry
- raw or undercooked eggs and egg products such as mayonnaise or raw cookie dough. Estimates are that 1 of every 20,000 eggs is contaminated with *Salmonella*.
- unpasteurized milk products or unpasteurized fruit juice
- raw shellfish, especially oysters, clams, scallops, and mussels
- ready-to-eat raw fruits and vegetables

- alfalfa and bean sprouts
- wild mushrooms. Note: many mushrooms that are poisonous in North America look almost identical to safe-to-eat mushrooms found in Europe.
- improperly prepared fish such as barracuda or Japanese puffer fish.
- improperly canned foods (homemade or commercial). Note: any can that is leaking or bulging should be discarded.
- soft cheeses such as brie or feta
- lunch meats or deli meats

Although the food in the United States is very safe, occasionally major outbreaks of food poisoning occur that can be traced to a breakdown in the food handling system. Larger outbreaks can be identified and traced to their source because each state has a list of diseases that health professionals are required to report to the county public health service once positive diagnosis is made. Most states require that doctors and hospitals report confirmed cases of disease caused by *Salmonella* and *E. coli* 0157:H7 and several other food poisoning pathogens. This information is then passed on to the CDC.

Most food poisoning occurs to single individual or to a small group of people, such as a family at a picnic. A major food poisoning outbreak is suspected when many people develop the same symptoms of food poisoning within a short time or within the same geographic area. A major outbreak sets off a full investigation by a team of microbiologists, food scientists, process engineers, specialists in food sanitation, and others. In a larger outbreak, the CDC usually coordinates the investigation. The CDC has established a special system called FoodNet to monitor food poisoning reports and look for patterns that suggest an outbreak. Information on chemical and natural toxin poisonings is also collected by the American Association of Poison Control Centers.

## Prognosis

Most people have unpleasant gastrointestinal symptoms—vomiting and diarrhea—for a few days and then recover fully from food poisoning. In young children, dehydration is always a cause for concern. Worldwide, dehydration from diarrhea is the biggest killer of children under age 5. If dehydration can be controlled in young children with food poisoning, most recover with few complications. However, E. coli 0157:H7 can cause fatal renal failure in 3–5% of children. This bacteria is most often acquired by eating unpasteurized apple cider or apple juice, alfalfa or bean sprouts.

More serious long-term health problems often result from chemical poisonings. Toxins found in some wild mushrooms and some fish can cause permanent liver damage requiring a liver transplant or death. Pesticides and other chemical contamination can cause liver damage, kidney failure, and nervous system complications. In 2007, apparent chemical contamination of pet food caused the death of hundreds of dogs and cats in the United States.

## Prevention

Appropriate food handling procedures at every level of the production process can go a long way in preventing food poisoning. Growers should apply only approved pesticides and herbicides at levels recommended by the Environmental Protection Agency and the Department of Agriculture. Processors must use clean sources of water to wash produce. Processing machinery must be disinfected regularly, and pesticides used in processing plants must be safe for use around food. In restaurants, food must not be held under warming lights of on buffet tables for long periods.

At home, individuals can help prevent food poison by following these guidelines.

- Wash hands, food preparation surfaces, and utensils often when handling food.
- Prevent cross-contamination of raw and cooked food. Do not put cooked food back on the same plate or surface that held it when it was raw.
- Cook foods to internal temperatures between 140°F and 180°F (60–83° C).
- Refrigerate or freeze fresh foods and leftovers promptly
- Defrost food in the refrigerator or microwave and not on the counter at room temperature. Cook promptly when defrosted.
- Keep food at temperatures above 140°F (60°C) or below 40°F (4° C).
- Throw out food that has sat at room temperature for 2 hours or more.

### Resources

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#### ORGANIZATIONS

Centers for Disease Control and Prevention. 1600 Clifton Road, Atlanta, GA. 30333. Telephone: (800) 311-3435 or (404) 639-3534. Website: <http://www.cdc.gov>

National Digestive Diseases Information Clearinghouse (NDDIC). 2 Information Way Bethesda, MD 20892-3570. Telephone: (800) 891-5389. Fax: (703) 738-4929. Website: <http://digestive.niddk.nih.gov>

United States Food and Drug Administration (FDA), Center for Food Safety and Applied Nutrition, Office of Nutritional Products, Labeling, and Dietary Supplements. 5100 Paint Branch Parkway, College Park, Maryland 20740. Fax: 301-436-2639. Website: <http://www.cfsan.fda.gov/~dms/onplds.html>
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Food pyramid *see* **USDA Food Guide Pyramid (MyPyramid)**

# Food safety

## Definition

Food safety involves the safe handling of food from the time it is grown, packaged, distributed, and prepared to prevent foodborne illnesses. Food safety is the responsibility of those who handle and prepare food commercially for delivery to consumers and of consumers who prepare and eat food in their homes.

Foodborne illness, or **food poisoning**, may be caused by bacteria that grow on food or by viruses that are spread because food is not cleaned, stored, or handled properly. These illnesses may cause minor symptoms or serious symptoms and even death in some people. Contaminated foods also can carry harmful parasites, toxins, chemicals, and physical contaminants. It is estimated that about 76 million people in the United States become ill from foodborne pathogens each year and that about 5,000 of these people die.

**Safe cooking temperatures**

| Food | Internal temperature Fahrenheit | Celsius |
|---|---|---|
| **Ground meats** | | |
| Beef, veal, pork, lamb | 160° | 71° |
| Turkey, chicken | 165° | 74° |
| **Fresh beef, veal, lamb** | | |
| Medium rare | 145° | 63° |
| Medium | 160° | 71° |
| Well done | 170° | 77° |
| **Poultry** | | |
| Chicken, turkey, whole | 165° | 74° |
| Poultry breasts | 165° | 74° |
| Poultry thighs, wings | 165° | 74° |
| Duck, goose | 165° | 74° |
| Stuffing (cooked alone or in bird) | 165° | 74° |
| **Fresh pork** | | |
| Medium | 160° | 71° |
| Well done | 170° | 77° |
| **Ham** | | |
| Fresh (raw) | 160° | 71° |
| Pre-cooked (reheated) | 140° | 60° |
| **Seafood** | | |
| Fish | 145° | 63° |
| Shellfish | Shells red and flesh opaque | |
| Clams, oysters, mussels | Shells open | |
| Scallops | Milky white or opaque and firm | |
| **Eggs and egg dishes** | | |
| Eggs | Yolk and white firm | |
| Egg dishes | 160° | 71° |
| **Leftovers and casseroles** | 165° | 74° |

*(Illustration by GGS Information Services/Thomson Gale.)*

## Purpose

Avoiding foods that that are contaminated can help prevent illness, especially in certain people. Consumers can take simple steps to reduce the risk of foodborne illness in their homes. Government and the food and restaurant industries can work together to prevent foodborne illness from occurring in the American population.

### *Foodborne illnesses*

The following are some of the foodborne illnesses that can occur as a result of food contamination:

- Campylobacter, which is the most common bacterial cause of diarrhea, and can be caused by undercooked

chicken or other foods contaminated with juices that drip from raw chicken.

- Salmonella, a bacterium that can spread from food of animal origin. Symptoms include fever, diarrhea, and abdominal cramps and can become serious in some individuals.
- *E. coli* 0157:H7 is a bacteria that resides in cattle and similar animals. Humans usually get the illness from consuming food or water that has been contaminated with small amounts of cow feces.
- Calcivirus, or Norwalk-like virus, is common but rarely diagnosed because no laboratory test can diagnose it. It causes more vomiting than diarrhea.

The farmer who grows produce, the packager, the produce department employee, the fast food worker, and the parent in the kitchen preparing a family's meal, each have to work to keep food as safe as possible. Although there are several measures to take, they are not complicated or time-consuming. Yet food safety came into increasing public light in 2006 and 2007.

In September, 2006, Natural Selection Foods of San Juan Bautista, California, issued a nationwide recall of all of its fresh spinach and ready-made salads with spinach. Sold under 31 brand names, the company's product was found to be source of E. coli contamination. E. coli is a rare but dangerous organism usually found in undercooked meat products. But in this case, the organism had gotten into packages of the fresh spinach and sickened more than 200 people in 26 states and Canada, resulting in three deaths. Within months, news spread of E.coli from lettuce at Taco Bell restaurants in the Northeastern United States. In early 2007, several peanut butter brands were recalled after salmonella was found in a manufacturer's batch of peanut butter. These cases brought renewed attention to food safety.

In light of these outbreaks, the food and restaurant industries were working with United States government agencies to improve oversight and inspection of food sources in the country. Increased federal regulation may produce safety standards that are consistent and that apply to all produce grown in the United States or imported into the United States from other countries. New standards may be specific to particular foods. Many public education programs aim to keep the general public informed about home food safety, which is the part of food safety that individuals can monitor and control.

Families should take particular note of food safety for certain family members. Babies and young children are particularly vulnerable to food poisoning.

## KEY TERMS

**Immunocompromised**—Having an impaired or weakened immune system. The immune system protects the body from foreign substances, cells, and tissues.

Summer picnics and cookouts, including barbecues and outdoor buffets, can create opportunities for food poisoning in young children and is a key source of food poisoning for others. And parents need to be particularly careful in handling breast milk and infant formulas, which can harbor bacteria. Pregnant women, older family members, and anyone who is immunocompromised also may be more susceptible to food poisoning.

## Description

Most home food safety focuses on four key areas: proper cleaning of food, of hands, and of food preparation areas, keeping raw foods such as meats and poultry separated from ready-to-eat foods, keeping food properly chilled, and cooking food to the proper temperature.

### *Cleaning food and surfaces*

When it comes to handling food, consumers can't be too clean. Many food safety experts recommend that when preparing and eating food, people should wash their hands often. This is even more important after handling raw meat, poultry, eggs, or seafood. Thoroughly washing hands means applying soap and rubbing the hands together under warm, running **water** for at least 20 seconds. The American Dietetic Association says that singing two choruses of "Happy Birthday" while lathering up helps keep hand-washing time at 20 seconds. It's also important to rub soap between fingers, down to the wrists and into fingernails to ensure a thorough cleansing. Hands should be dried on paper towels rather than teatowels, which can easily spread bateria.

Cleaning some foods is recommended too. Fresh fruits and vegetables should be washed after discarding outside leaves and just before cooking or eating. They should be washed under clean running water and scrubbed with a clean brush or with both hands. Drying the fruits and vegetables after washing with a clean cloth or disposable towel also is important if they won't be eaten right away, since free moisture on the surface can

promote growth of microbial populations. Even fresh fruits and vegetables with skins and rinds that won't be eaten should be cleaned. Raw meat and poultry should not be washed, because it only adds to the possibility of cross-contamination between surfaces.

Food preparation tools and surfaces should be carefully and regularly cleaned. This includes cutting boards, kitchen utensils, dishes, appliances, kitchen bins and counter tops. Hot, soapy water can be used for cleaning surfaces. Dish cloths and dish towels should only be washed in the hot water cycle. Sponges should be disinfected in a chlorine bleach solution and replaced frequently. In 2007, research showed that placing a wet kitchen sponge in the microwave for two minutes would clean it, removing dangerous bacteria. The sponge should not be touched immediately after the two minutes are up, as it will be hot. And the sponge must be wet before being placed in the microwave. Any sponge, dish cloth, dish towel, or other food preparation item or surface that is smelly is a sign of bacteria build-up. It should be properly cleaned as described above or discarded. Bacteria thrive in damp conditions.

### *Separating foods*

The juices from raw meat, poultry, seafood, and eggs should never touch uncooked, ready-to-eat foods, such as fruits and vegetables. This is one reason why it is so important to thoroughly wash hands after each time raw meats and other raw foods are touched. Even when storing foods from shopping and in the refrigerator, care should be taken to contain juices. Fresh meats, poultry, and seafood can be sealed in plastic bags to prevent juices leaking onto refrigerator surfaces.

The cutting board is an opportune location for cross-contamination. It is best not to use a wooden board with cracks, crevices and knife scars. In fact, old cutting boards such as these should be discarded. Food safety experts say the safest way to avoid cross-contamination is to assign one cutting board strictly for cutting raw meat, poultry, and seafood, and another board for cutting vegetables, breads, and other ready-to-eat foods. Labeling the boards or using colors (green for vegetables) can help keep family members from confusing them. After using a board to cut raw meats, it should be thoroughly cleaned with hot, soapy water or in the dishwasher.

Care also must be taken when cooking foods not to re-use a plate that has contained raw meat, poultry, or seafood. For instance, when grilling, the cooked meats should be placed on a clean plate, not on the one that the meats were brought to the grill on, that contains remnants of juices from the raw food.

### *Properly chilling foods*

Bacteria growth is slowed by colder temperatures. Refrigerators should be kept at a temperature no higher than 40°F and the freezer at 0°F. It is recommended to keep a refrigerator thermometer in the refrigerator at all times to monitor the temperature. It's important to refrigerate foods promptly after bringing them home from the store, particularly during warmer summer months.

The length of time foods can be safely stored in the refrigerator varies. Foods usually are marked by manufacturers and grocery stores. Raw meat, poultry, eggs, seafood, and cut fruit and vegetables should never sit out of the refrigerator or freezer for more than two hours (one hour if the temperature is above 90°F. Leftovers should be refrigerated promptly. Most will last three to four days in the refrigerator but exceptions are stuffing and some cooked patties and gravies or broths, which only should be kept one to two days. Bacterial growth may not cause any sort of smell or discoloration, so there may be no way to tell by looking or smelling. It is better to be safe than sorry, or as food safety experts recommend, "If in doubt, throw it out." Plus, overstuffing the refrigerator keeps cold air from circulating properly, so cleaning it out often serves two purposes.

Foods such as raw meats should be marinated in the refrigerator, not on a kitchen counter. Food never should be defrosted at room temperature, but in a refrigerator. If food is defrosted more rapidly by submerging in warm water or by using a microwave, it should be cooked immediately.

### *Cooking to proper temperature*

Too often, consumers rely on the look of foods to determine if they are cooked. But trying to judge doneness by color of meat or juices does not accurately determine safe temperature. It is important to invest in a good meat thermometer and to use it appropriately because uncooked or undercooked meat, poultry, and eggs, as well as egg products, are potentially unsafe.

Accurate temperature readings on a thermometer require placing it in the thickest portion of meats and poultry pieces, away from bone, fat, and gristle. The thermometer should be placed in the center of casseroles and egg dishes. The following minimum temperatures are advised for some common foods:

- hamburger (patties, meatballs) 160°F (71°C)
- roasts and steaks 165°F (74°C)
- whole chicken, turkey 180°F (82°C)
- chicken drumstick (thighs, wings, dark meat) 180°F (82°C)

- fish 140°F (60° C)
- egg dishes, casseroles 160°F (71°C)

When cooking food in the microwave, it is important to avoid cold spots. This is why microwave heating directions often include instructions to stir food halfway through cooking; stirring helps to eliminate cold spots and evenly distribute heat. Reheated leftovers should reach a minimum temperature of 165°F (74°C). It is best to cook leftover sauces, soups, and gravy to a boil.

### Precautions

New information on food safety constantly is developed and released, so consumers should watch for updated information. This is particularly true of product recalls, such as those that occurred in late 2006.

### Complications

By not following food safety guidelines, consumers run the risk of developing food poisoning or causing it in a family member or other person served food. There have been reports of food poisoning at family and community events because a preparer or those gathered did not follow food safety precautions. Eating or drinking contaminated food almost always causes diarrhea, which can be a serious health risk for infants and other people at risk of complications. Depending on the cause and type of foodborne illness, a person also might experience fever, nausea, vomiting, and abdominal cramps. Many people mistakenly believe that symptoms of food poisoning must appear within hours of eating the contaminated food. But symptoms can appear in 30 minutes, 12 hours or up to one week later. The safety of the American food supply may improve as greater scrutiny, coordination, and possibly regulations are applied to the production, packaging, and preparation of food in the country. This concern for better scrutiny also applies in other countries.

### Parental concerns

Pregnant women need to pay particular attention to food hygiene and avoidance of some high risk foods is recommended.

Although potentially fatal cases of diarrhea from e. coli in young children have declined in recent years, it is important to remember that infants and young children are very vulnerable to food poisoning. It is important to carefully store breast milk and infant formula, keeping mixed formula no longer than 24 hours in the refrigerator. Any formula that is past the expiration date listed on the container should be discarded and when feeding an infant, parents and caregivers should throw away the formula or breast milk that is left in a bottle after feeding. Bottles should not sit around, but should be refrigerated. After two hours of sitting out, a bottle can be contaminated with salmonella. Babies under age one should never receive any food containing honey, even if it is cooked, as honey can contains botulism spores. Botulism can be deadly for babies.

When babies and toddlers start eating solid foods, it is important to check the expiration date and seal on the baby food jar. Dipping the spoon into the jar after using it to feed the baby and then refrigerating the jar with leftovers inside is not recommended. Germs from the baby's mouth can contaminate the food. Instead, the food should be poured from the jar into a dish and the baby should be fed from the dish.

#### Resources

**ORGANIZATIONS**

American Dietetic Association. 120 South Riverside Plaza, Suite 2000. Chicago, IL 60605. (800) 877-1600. <http://www.homefoodsafety.org >

Food Standards Agency. <http://www.eatwell.gov.uk>

Partnership for Food Safety Education. 50 F Street NW, 6th Floor, Washington, DC 20001. (202) 220-0651. <http://www.fightbac.org >

U.S. Department of Agriculture. 1400 Independence Ave. SW, Washington, D.C. 20250. (800) 687-2258. <http://www.cnpp.usda.gov >

Teresa G. Odle

## Food sensitivities

### Definition

Food sensitivity, also known as food intolerance, can be defined as a reproducible, adverse reaction to a food, or food ingredient, at a dose tolerated by most people. It is technically described as non-allergenic food hypersensitivity as it does not involve the immune system, unlike in cases of food allergy where an immune response is involved. Typically the features of food sensitivity are less severe and take a longer time to manifest, compared with food allergy where symptoms can be potentially life-threatening and occur soon after ingestion.

**Common food sensitivities**

- Eggs
- Milk and dairy
- Peanuts and other nuts
- Shellfish
- Soy
- Strawberries
- Wheat

**Possible symptoms**

- Abdominal pain and bloating
- Constipation
- Diarrhea
- Excess coughing
- Hyperactivity
- Infantile colic
- Irritable bowel syndrome
- Itchy skin
- Migraine
- Skin rash
- Sneezing
- Unexplained joint and muscle pain
- Vomiting
- Wheezing

*(Illustration by GGS Information Services/Thomson Gale.)*

## Origins

Food sensitivity is often misdiagnosed due to the lack of well-controlled clinical trials proving its existence. However, it is very difficult to investigate food sensitivity in the same way as you would a particular medical intervention because of the number of variable factors involved, such as the type, amount and frequency of foods consumed in a typical diet as well as other environmental factors that could provoke similar symptoms.

Food sensitivities that involve particular food additives are more easy to study and have indeed shown that certain individuals can be sensitive to synthetic colourings, such as azo dyes, as well as the preservatives, **sodium** benzoate, benzoic acid, sulphur dioxide and sulphites.

Other studies have excluded gluten (a **protein** found in wheat, barley and rye) and casein (a protein found in milk and dairy products ) in children with autistic spectrum disorder (ASD) and attention deficit **hyperactivity** disorder (ADHD) and have noted improvements in behaviour and communication. It is important to note that these trials did not take any baseline dietary measurements and so the 'exclusion' diet, whilst excluding certain food groups are highly likely to increase intakes of fruits, vegetables, fish, seafood, nuts, brown rice and soya-based foods ( eg. tofu and soya milk ), all of which are rich sources of key nutrients known to be vital for good physical and **mental health**. The positive outcomes highlighted from these studies may have more to do with which foods were included, rather than excluded, or even a combination of both.

## Description

Food sensitivity can occur for a variety of reasons, outlined in detail below:

- Enzyme -Deficiency: The classic example would be the loss of the lactase enzyme needed to breakdown lactose found in milk and dairy foods. The undigested lactose is fermented by gut bacteria that produce large amounts of organic acids and gases, resulting in abdominal pain, distension and diarrhoea.
- Pharmacological: Some foods contain pharmacologically active substances that can cause adverse effects in some people. Good examples include caffeine, found in in coffee and cola drinks, and monosodium glutamate, often used in manufactured foods and some Chinese meals.
- Histamine-Release: Foods, such as shellfish and strawberries, contain histamine-releasing agents which can cause adverse reactions in sensitive individuals.
- Irritant: Excessive consumption of foods such as onions, nuts and prunes can act as an irritant to the gastrointestinal tract (gut) and result in unpleasant symptoms.
- Toxic: A small number of foods contain naturally occurring toxic compounds, such as lectins found in under-cooked kidney beans, which can be lethal.

Depending on the actual cause, food sensitivity can cause adverse effects throughout the body. If the gut is involved, symptoms can include vomiting, diarrhoea, **constipation**, **irritable bowel syndrome**, infantile colic, abdominal pain and bloating. However, these symptoms may also be a consequence of poor nutrition and dysbiosis, which is when the beneficial bacteria that live in the gut are out of balance with more harmful varieties. This can often occur following a period of gastroenteritis or after taking broad-spectrum antibiotics. Including probiotic-enriched food and drinks in your diet and eating foods that contain prebiotics, which help feed the probiotic bacteria, can help redress the balance in favour of beneficial bacteria and consequently improve gut function. Prebiotic-rich foods include oats, bananas, onion, garlic, leeks, artichokes and asparagus.

If the gut is not working properly then potentially any food could exacerbate the situation and cause symptoms to worsen. In these situations it is difficult to differentiate between food sensitivity and compromised gut function.

## KEY TERMS

**Aetiology**—This refers to the cause of a disease.

**ADHD**—The combination of inattentive, hyperactive and impulsive behaviour which are severe, developmentally inappropriate and impair function at home and in school. Common features include mood swings, anxiety, impulsivity, hostility, poor concentration and sleep problems as well as physical complaints such as stomach aches, headaches and migraines.

**Antibodies**—A protein produced by certain cells in the body in the presence of a specific antigen, which bind with it to neutralize, inhibit or destroy it.

**Antigens**—Any substance that when introduced into the tissues or blood induces the formation of antigen-specific antibodies.

**ASD**—Autistic Spectrum Disorder (ASD) refers to the features of individuals who have a degree of the condition known as autism. Autism is a serious developmental disorder characterised by profound deficits in language, communication, socialisation and resistance to learning.

**Benzoic Acid**—A type of preservative used in processed foods known to cause food sensitivity in some individuals when consumed in the diet.

**Cardiovascular Disease**—This describes medical conditions that relate to disease of the heart and circulatory system ( blood vessels) such as angina, heart attacks and strokes.

**Dietitian**—A Healthcare Professional, qualified to degree or post-graduate level, who advises individuals on diet and nutrition as part of a treatment strategy for particular medical conditions or for disease prevention.

**Dysbiosis**—The general term to describe the overgrowth of undesirable microflora in the intestines.

**Food Allergy**—A hypersensitivity reaction to particular food proteins involving the immune system.

**Immune System**—The defence system of the body that responds when challenged by antigens.

**Microflora**—This term describes the collection of small micro-organisms, such as bacteria, that colonise the gastrointestinal tract (gut).

**Sodium Benzoate**—A type of preservative used in processed foods known to cause food sensitivity in some individuals when consumed in the diet.

**Sulphites**—A type of preservative used in processed foods known to cause food sensitivity in some individuals when consumed in the diet.

**Sulphur Dioxide**—A type of preservative used in processed foods known to cause food sensitivity in some individuals when consumed in the diet.

Other features of food sensitivity can include skin rash, itchy skin, excessive coughing , sneezing, wheezing as well as migraine, hyperactivity and unexplained joint and muscle pain.

### Function

The diet suitable for people with food sensitivity will depend on which food, or food ingredient, is causing the problem. If a particular food, or food ingredient, is suspected then the tried and tested method for diagnosis is a period of dietary exclusion followed by re-introduction of the food without the sufferer knowing to see if it has any effect and then a second exclusion. If the presence and absence of the food correlates with the presence and absence of symptoms then a positive diagnosis can be made.This should only be the case if the testing is blinded. If a reaction is severe re-introduction should be carried out with medical supervision.

In cases where multiple foods are suspected, a *few foods* diet, which consists of foods highly unlikely to cause a reaction ( eg. rice, lamb, pears ), is followed until symptoms disappear. This is then followed by a systematic blinded re-introduction of single foods, one at a time, allowing the identification of any *problem* foods to be easily identified whilst avoiding unnecessary restrictions.

Individuals with suspected or proven food sensitivity, who are excluding major food groups, should seek the advice of a qualified Dietitian to avoid compromising nutrient intakes and consequently their physical and mental health.

### Benefits

The diet suitable for food sensitivity benefits the individual by removal of the offending food, or food ingredient, leading to an improvement in symptoms. It is also worth noting that some types of food sensitivity can be transitory and so re-introduction of the

*offending* food, or food ingredient, is recommended every 3-6 months to test whether the sensitivity still persists.

Many people who have been motivated to change their diet in an attempt to relieve the effects of food sensitivity will remain interested in maintaining good nutritional health and continue to eat well. A well-balanced food sensitivity diet can still be rich in fibre, **vitamins** and **minerals**, all of which are vital for good brain and body functioning as well as reducing the risk of developing certain cancers and cardiovascular disease.

## Precautions

Very young children and babies should not have any dietary restrictions imposed upon them unless they are clinically indicated and are supervised by a Doctor and Dietitian. The restricted nutrient intake that might result can significantly compromise children's growth and development.

The same risk applies to older children and adolescents because of their high requirements needed to sustain good physical growth and mental development

Women planning a pregnancy, are already pregnant or are breast feeding should also avoid any dietary restrictions, unless recommended by a Doctor or Dietitian, as they can compromise nutrient intakes and ultimately the health of both mother and baby.

Individuals suffering from any chronic medical condition or recovering from surgery should not follow a restricted diet without medical supervision as this can exacerbate symptoms and slow down recovery and wound healing.

## Risks

The most nutritionally balanced diet is one that includes a wide range of different foods and so the main risk attached to the food sensitivity diet depends on the particular restrictions involved. In some cases, avoidance of the offending foods is nutritionally insignificant and can be easily excluded eg. **caffeine** drinks and strawberries.

The greatest nutritional risk is associated with the exclusion of entire food groups, such as dairy foods and gluten-containing cereals. Gluten-free diets can be low in fibre, which is needed for good bowel function and helps to protect against cardiovascular disease, and cows milk-free diets can be low in **calcium** and **iodine**, which are important for bone strength and brain function.

Advice from a Dietitian should ideally be sought to ensure nutritional adequacy and allow discussion of suitable substitute foods and **dietary supplements**, where appropriate.

A final point worth mentioning is that substitute foods are not always available, are usually more expensive and following these diets can make eating out and social occasions more difficult.

### QUESTIONS TO ASK YOUR DOCTOR

- How do I know if I have a food sensitivity ?
- How do you test for food sensitivity ?
- Could probiotics help ?
- Do I need to take calcium supplements if I follow a dairy-free diet ?
- What are the best sources of fibre in a gluten-free diet ?

## Research and general acceptance

The subject of food sensitivity remains contentious, with many healthcare professionals debating its prevalence. The lack of well designed clinical trials and the huge increase in self-diagnosis has certainly made it difficult to establish the true incidence and aetiology of food sensitivity. Another problem is that conditions can go undiagnosed if individuals self-diagnose food intolerances or rely on dubious tests.

Research findings support the view that some sensitive individuals can react badly to certain food additives but intolerance to major food groups has been difficult to evaluate. Those trials that have demonstrated improvements on a gluten-free and casein-free diets have not taken into account the other changes that have occurred in the diet and are often assessed by parents and carers, making their findings subjective.

Fundamentally in cases of food sensitivity the diet needs to be fully assessed to see what is missing, in terms of foods that provide key nutrients, as well as what is being included that could be triggering an intolerance.

### Resources

#### PERIODICALS

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Picado. "Classification of severe asthma exacerbations: a proposal Classification of severe asthma exacerbations: a proposal." *European Respiratory Journal 1996 (9) p1775-1778.*

**ORGANIZATIONS**

The British Dietetic Association. 5th Floor Charles House 148/9 Great Charles Street Queensway Birmingham B3 3HT.www.bda.uk.com.
The British Nutrition Foundation 52-54 High Holborn, London WC1V 6RQ. www.nutrition.org.uk.
The Food Standards Agency.www.food.gov.uk.

Emma Mills, RD

French diet *see* **Northern European diet**

# French paradox

## Definition

The French Paradox refers to the low rate of **coronary heart disease** (CHD) in France despite the diet being rich in saturated fat.

## Origins

2002 data from the Food and Agriculture Organization of the United Nations (FAO), showed that although the intake of saturated fat in France was higher than in the United States (US), 108 grams (g) compared to 72g per day, France had a 30–40% lower risk of CHD. Over the years, studies suggest that one of the reasons the French have a lower rate of CHD, despite higher saturated fat intakes, may be related to their regular consumption of red wine.

Links to alcohol and heart disease were first observed in 1976. English Physician William Heberden's classic descrition of angina pectoris, included "wines and liquors . . . afford considerable relief". This led to the assumption that alcohol was a coronary vasodilator.

The French Paradox was first noted by Irish cardiologist Samuel Black in 1819. He found that the French had lower heart rate deaths compared to the Irish and attributed this to "the French habits and modes of living, coinciding with benignity of their climate and the peculiar character of their moral affections". This was the beginning of more current thinking that other dietary and lifestyle factors may play a part in the risk for heart disease.

In the 1970s, epidemiological studies began to show that moderate intakes of alcohol were associated with a low rate of CHD. In 1997, a large American study by Thun et al., demonstrated that at least one drink a day reduced death risk from CHD, but more than three drinks daily was associated with an increased death rate. McElduff et al. followed this up in the same year and found that frequency was as important as quantity in risk for heart disease. Lowest risk was among those who drank moderate of alcohol amounts 4–6 days a week. At the time there were issues with defining heavy and moderate drinking and as of 2007 there is still some debate. However, there is a general agreement that 3 unit of alcohol a day for men and 2 or more a day for women is considered unhealthy.

It was not until the 1990s that the French Paradox was looked at again. Dr. Serge Renaud, a scientist from Bordeaux University in France, coined the term "French Paradox" after his 1992 study. This was a large study of middle age French men. He found they have a long life expectancy despite a diet high in saturated fat. Although the diet included butter, cheese, eggs and cream, contributing to 15% of calories from saturated **fats**, the incidence of CHD was only 40% of the American incidence of CHD. He concluded that two to three glasses of wine a day wine reduced death rates from all disease by up to 30%, but four glasses a day were found to have an adverse effect on health. He suggested that the combined effect of the alcohol and **antioxidants** in wine played a role in reducing CHD. The French Paradox became internationally recognized when in 1991 he, together with another French Paradox supporter Dr. R. Curtis Ellison of Boston University School of Medicine, outlined the research on the "60 minutes" documentary in the USA. Interestingly,soon after this, red wine sales in the United States increased by 40%.

Further studies have supported this hypothesis, including the 1995 Copenhagen Heart Study that ran from 1976 to 1988 and confirmed the health benefits of

## KEY TERMS

**Angina**—Pain that comes from the heart, caused by the narrowing of the coronary arteries.

**Binge drinking**—British Medical Association states there is no consensus on the definition of binge drinking, but is usually used to refer to heavy drinking over an evening or similar time span. Sometimes also referred to as heavy episodic drinking.

**Epidemiological studies**—These studies look at factors affecting the health and illness of populations.

**Foie Gras**—Liver of a duck or goose that has been specially fattened. It can be sold whole or prepared as pate or mousse.

**High-density lipoprotein (HDL)**—Often referred to as good cholesterol. This takes cholesterol away from the cells and back to the liver, where it's broken down or excreted.

**Homocysteine**—This is an amino acid. High blood levels are now considered a risk factor for several diseases, including CHD.

**Low-density lipoprotein (LDL)**—Often referred to as bad cholesterol. It carries cholesterol from the liver to the cells and can cause harmful build-up of cholesterol.

**Procyanidin**—These are associated with flavanoid antioxidants derived from grape seed extract, grape skin and red wine. Like Quercetin and Resveratrol they have many health-promoting benefits.

**Quercetin**—A natural compound which belongs to a group of plant pigments called flavonoids that are largely responsible for the colours of many fruits, flowers, and vegetables. They have many health-promoting benefits that may protect against cancer and cardiovascular disease.

**Resveratrol**—A natural compound found in grapes, mulberries, peanuts and red wine that may protect against cancer and cardiovascular disease.

**Vasodilator**—A substance that causes blood vessels the body to become wider allowing the blood to flow more easily.

regular, moderate wine consumption. Those who drank wine daily had half the risk of dying compared with non-drinkers or consumers of other alcoholic beverages. The researchers suggested the antioxidants in red wine, such as tannins and flavonoids, were key factors in its protective effects. The 1980 Seven Countries Study (Yugoslavia, Italy, Greece, Finland, Netherlands, United States and Japan) compared the relationship between diet and other risk factors to the occurrence of CHD. High intakes of animal foods, with the exception of fish, were associated with higher CHD death rates. With its reliance on meat and butter fat and less on fruits, vegetables, legumes and grains, the 40-year Zutphen study, the Dutch arm of the Seven Countries Study, looked independently at the effect of wine consumption. Their conclusion, reported at the 2007 American Heart Association's 47th Annual Conference on Cardiovascular Disease Epidemiology and Prevention, was "Drinking a little alcohol every day, especially wine, may be associated with an increase in life expectancy".

More recent studies have also found that any alcohol is responsible for most of the cardio protective effects previously seen with wine. A 1994 study of British doctors and 2002 study of U. S. male doctors indicated that the lowest risk of death was associated with one to two alcoholic drinks of any type per day, but there was no benefit from additional drinks.

However, 20 years on, there is still no conclusive evidence as to why with a diet high in saturate fat the French live longer. The World Health Organization (WHO) states "There is convincing evidence that low to moderate alcohol intake reduces the risk of coronary heart disease", but as of 2007, the French Paradox has not been tested by the gold standard of research, a controlled clinical study. Until then moderate alcohol intakes with food may be the key to the French Paradox.

## Description

While the French diet includes high fat foods such as cheese, croissants, pastries, butter, sausages and cold cuts, it also contains other heart healthy foods, which have a beneficial effect.

### *Alcohol*

Although the French drink more alcohol a year than the British, it is generally with a meal. Unlike the UK, binge drinking is a rarity. The French have a moderate consumption of 1–2 glasses of wine a day, which has shown to help reduce the risk of heart disease.

### *Fiber*

The French eat two to three times more soluble **fiber** from pulses, such as beans and chickpeas, fruit and vegetables, whole grains and grain products than the English and Americans. Soluble fiber helps to lower cholesterol levels. In addition these foods are a good source of antioxidants, such as Quercetin also found in red wine, which may reduce oxidation of harmful low-density lipoproteins (LDL) that can cause atherosclerosis (hardening of the arteries).

### *Vegetable sources of protein*

A diet rich in animal meat may result in high levels of homocysteine in the blood, which can lead to atherosclerosis. Low levels of **folate** are associated with high homocysteine levels—an independent risk factor for CHD especially in men. The French diet is high in legumes, fresh fruits and vegetables, especially dark-green leafy vegetables that are a rich source of folate or folic acid, a B vitamin. Their animal **protein** dishes are generally accompanied by generous salads and pulses are a large part of typical winter foods, such as soups and stews, which may help to control levels of homocysteine.

### *Unsaturate fat*

Although the French diet is high in fat, it includes plenty of unsaturated fat like olive oil, olives and nuts, which help lower the level of harmful LDL cholesterol. Like red wine, peanuts also contain significant amounts of the heart healthy antioxidant Resveratrol. One ounce of peanuts contains approximately 73 micrograms of Resveratrol, while a glass of red wine contains 160 micrograms per 30 millilitres (ml).

### *Goose and duck fat*

These fats are commonly used for cooking and to make pate or mousse,such as foie gras (goose or duck liver). Although high in fat, these fats have a nutritional composition closer to that of olive oil than butter or lard. Olive oil has about 76% monounsaturated fat and 15% saturated fat. Goose fat is 56% monounsaturated fat and 27% saturated fat while butter is only 33% monounsaturated fat and a huge 63% saturated fat. The benefit of monounsaturated fats is they lower total and LDL cholesterol without affecting beneficial high-density lipoprotein (HDL) cholesterol.

### *Portion sizes*

The French may have a diet high in fat, but they eat fewer calories consequently are slimmer than Americans. 11% of the French are obese compared with 30% in the United States. Fat stimulates the release of cholecystokinin, a hormone that acts as a hunger suppressant and prevents over eating and snacking. In addition, portion sizes in France tend to be a third to a half of American portions. For example, in Paris a croissant weighs in at 30g, while in Philadelphia it is 60g

### *Lifestyle*

A 2004 survey completed by the French government's Committee for Health Education (CFES) on French food and health showed that French eating habits have not really changed in the last 10 years. Most people in France still eat home-prepared meals, take their time eating and generally do not snack. Whereas in America snacking is a $30 billion industry.

However, the only justification for the lower CHD rates that has been most scientifically proven is the moderate consumption of wine with meals.

## Function

There are several potential benefits of red wine in lowering CHD risk.

Red wine contains flavanoid antioxidants, Resveratrol and Quercetin, which help prevent the build-up of fatty deposits within the wall of the arteries. Both are found in the skin of red grapes. A 2006 study indicates that antioxidant, procyanidin, found in red wines from the South West of France, which has the lowest incidence of CHD in France, helps lower blood pressure and may account for the lower rates of heart disease.

Alcohol itself has been shown to raise good HDL cholesterol levels, but as of 2007, the exact mechanism is still unknown. HDL cholesterol helps to carry LDL cholesterol away from the walls of the arteries and back to the liver for reprocessing or excretion. This prevents build-up of cholesterol in the artery walls and protects against heart disease.

Alcohol also has the effect of decreasing thrombosis or blood-clotting .It decreases fibrinogen production, a blood-clotting enzyme, which reduces the stickiness of platelets. This reduces the incidence of clots, which may lead to a heart attack or stroke.

## Benefits

Moderate consumption of alcohol can have health benefits other than reducing the risk for CHD.

In 1997, a study by the American Cancer Society found the risk of death of any cause was lower for those who had moderate intakes of alcohol compare

to non-drinkers. It is thought that the amount of Resveratrol in 2-3 glasses of red wine helps to starve cancer cells by blocking a key protein that feeds them. France has relatively low rates of stomach and colon cancer and the second-lowest world incidence of heart disease after Japan. However, drinking more can lead to a greater risk of cancer.

Data from the third National Health and Nutrition Examination Survey Study (NHANES III) in 1999 showed that regular alcohol intakes lowered the risk for **gallstones** by 25% in both men and women.

## Precautions

Individuals involved with activities that require attention, skill, or coordination, such as driving or operating machinery, should avoid alcoholic beverages. Alcohol has a depressant effect on the central nervous system and slows down brain function, which can affect judgment and emotions as well as behaviour.

The 2005 Centers for Disease Control and Prevention (CDC) guidelines advise women who may become pregnant or are pregnant not to drink. Moderate drinking during pregnancy may result in behavioural or neuro-cognitive problems in children.

There is conflicting advise on moderate alcohol or no alcohol with breast feeding. The American Academy of Paediatricians still recommends avoiding alcohol while breast-feeding. Alcohol can be passed on to the baby through the milk, which can affect the baby's feeding, sleeping or digestion. Heavy alcohol intakes have also been shown to reduce lactation. The National Childbirth Trust and the Association of Breastfeeding Mothers in UK advocate similar advice. The recommendation is to allow sufficient time between drinking and breast-feeding so the mother can fully metabolise the alcohol.

Individuals taking prescription and over the counter medications also need to be aware of the potential interactions any of their medications may have with alcohol and should consult a doctor.

## Risks

Higher intakes of alcohol drinking levels seem to offset the benefits of moderate drinking on CHD, by increasing risk of death from many other diseases.

Excessive intake of any kind of alcohol increases the risk of cancer of the mouth, oesophagus, stomach, liver, breast and colon. The Cancer Prevention Study in 2002 found that one drink or less in postmenopausal women increased the risk of death from breast cancer by 30%. They did not find an increased risk in premenopausal women.

Excessive alcohol can increase blood pressure, which increases the risk for CHD. Cutting back to moderate drinking can lower systolic blood pressure by up to 10mmHg.

According to a US study published in 2005, older men who drink more than the daily recommendations of alcohol may be more likely to suffer from a stroke.

**Triglycerides** are a type of fat found in food. High levels in the blood are associated with an increased risk if CHD and the liver make more triglycerides with excess alcohol, sugar and calories.

The risk of cirrhosis seems connected more with alcohol abuse than moderate use. Excessive drinkers will develop fatty liver, the first stage of alcoholic liver disease, but this can disappear when alcohol is reduced to moderate levels. Continued excessive alcohol can lead to alcoholic hepatitis or cirrhosis and liver failure.

Heavy alcohol use for 10 years or more is the usual cause of Chronic Pancreatitis. Acute pancreatitis with severe abdominal pain can occur before this and will settle if drinking is discontinued.

## Research and general acceptance

There has never been a controlled clinical trial testing the effect of alcohol, but there is agreement that while drinking too much of any kind of alcohol is not healthy, moderate alcohol intakes may have some health benefits. As such, a number of medical associations including the European Society of Cardiology, The National Institute on Alcohol Abuse and Alcoholism, American Dietetic Association, American Heart Association, Royal College of Physicians, and British Heart Foundation have the recommendation for alcohol as "If you use alcohol, do so in moderation". Recommendation on how many drinks per day equate moderation differs from country to country. In the United States, moderation is defined as up to one drink per day for women and up to two drinks per day for men. In the United Kingdom, moderation is defined as not exceeding 2–3 units for women and 3–4 units for men. There is also agreement that the evidence is not convincing enough to make a recommendation to start drinking alcohol if teetotal.

However, Dr Malcolm law and Nicholas Wald, British specialists in preventive medicine at St. Bartholomew's and the Royal London School of Medicine and Dentistry and Dr. Marion Nestle, chairwoman of the department of nutrition at New York University, have put forward another explanation for the French

## QUESTIONS TO ASK YOUR DOCTOR

- What does moderate drinking mean?
- How much red wine should I be drinking?
- What health problems are associated with drinking?
- Can I drink when I am pregnant?
- What does one unit of alcohol include?
- Can I save all my daily alcohol units for the weekend?

diet and health. They argue that it is related to France's history of lower animal fat intakes rather then their consumption of red wine. Up to 1970, the French ate less animal fat and had significantly lower blood cholesterol levels than the British. Now French habits are changing, they are eating more meat and fast foods and their consumption of animal fat is similar to those in Britain. The 1999 National Survey on Individual Food in France by the Research Center for the Study and Monitoring of Living Standards shows that between 1950 and 1980 the consumption of meat fat and oils doubled and alcohol intake halved. The rate of **obesity** in France has also increased from 8% in 1997 to 12% (The 2003 National Health and Wellness Survey by Consumer Health Sciences) and over 40% of the French are now considered overweight, not far off the 50% figure for the British and Americans. They say it takes 25-35 years for increased fat intakes to translate into heart disease and it is only a matter of time before France faces the obesity epidemics and CHD rates that began in America and Britain nearly 20 years ago.

### Resources

#### BOOKS


Guiliano, Mireille. *French Women Don't Get Fat: The Secret of Eating for Pleasure*Knopf, 2004. A non-diet book on how to eat with balance, control and pleasure, including recipes.

Lewis, Perdue. *The French Paradox and Beyond: Living Longer with Wine and the Mediterranean Lifestyle* Renaissance Publishing, 1992.Backed by Dr. Curtis Ellison, Chief, Department of Preventive Medicine and Epidemiology, Boston University School of Medicine a supporter of the French Paradox, this book describes the benefits of the Mediterranean lifestyle.

Mayle, Peter. *A Year in Provence*Vintage Reprint edition, 1991 A light-hearted autobiography as well as a travel/restaurant guide and cultural study of the south of France by a British businessman who gives Britain up it and buys a house in Provence with his wife and two dogs


#### PERIODICALS


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#### ORGANIZATIONS


American Heart Association (AHA). National Center, 7272 Greenville Avenue, Dallas, TX 7523 USA. Website: <http://www.americanheart.org/>>

American Dietetic Association (ADA). 120 South Riverside Plaza, Suite 2000, Chicago, Illinois 60606-6995 USA. Website: <http://www.eatright.org/>

British Heart Foundation (BHF).14 Fitzhardinge Street, London W1H 6DH, UK. Website: <http://www.bhf.org.uk/>

European Society of Cardiology. The European Heart House, 2035 Route des Colles 2035 Route des Colles, B.P. 179 - Les Templiers, F-06903 Sophia Antipolis, France. Website:<http://www.escardio.org/>

Food Standards Agency UK (FSA). Eat well Be well, Healthy Heart Aviation House, 125 Kingsway, London WC2B 6NH UK. Website: <http://www.eatwell.gov.uk/>

National Institute on Alcohol Abuse and Alcoholism (NIAAA). 5635 Fishers Lane, MSC 9304, Bethesda, MD 20892-9304 USA. Website: <http://www.niaaa.nih.gov/>

The Royal College of Physicians. 11 St Andrews Place, Regent's Park, London, NW1 4LE uk. Website: <http://www.rcplondon.ac.uk/>

Tracy J Parker, RD

# Frozen-food diet

## Definition

Frozen-food diets rely on packaged frozen foods for weight loss and weight control that are based on standardized portions, as well as for convenience and saving time.

## Origins

A frozen-food diet was first introduced in *Good Housekeeping* magazine in September of 1998. In October of 2005 *Good Housekeeping* debuted a new frozen-food diet that consisted entirely of microwaveable meals. The new plan, based on research performed at the Department of Food Science and Human Nutrition at the University of Illinois at Champaign-Urbana, promised slightly increased weight loss and even less preparation time than the original diet.

Other frozen-food diets have also been developed. Nutrition expert Joy Bauer prepared a nine-day meal plan for the American Frozen Food Institute (AFFI) that consists entirely of frozen foods. Commercial frozen-food diets that are home-delivered weekly are also available. One such diet was devised by Dr. Caroline J. Cederquist, a board-certified physician in bariatrics, the medical specialty of weight management.

## Description

### *The original Good Housekeeping* diet

The original *Good Housekeeping* frozen-food diet consists of seven days of menus. However any meal can be switched for the same meal on a different day. It is a 1,400-calorie per day diet and the plan calls for 45 minutes of exercise four–five days per week. Brand-name products may be substituted with similar foods having the same number of calories. Spices, garlic, lemon, **soy** sauce, and vinegar are permitted.

**BREAKFASTS.** The day 1 breakfast consists of:

- one-half cup of Post 100% Bran or Kellogg's Bran Buds or three-quarters cup Kellogg's All Bran Original or Complete Bran Flakes
- one cup of fat-free milk
- 100 calories of fruit.

The day 2 breakfast is:

- three frozen low-fat Aunt Jemima pancakes (150 calories) or two frozen low-fat Eggo Homestyle waffles (180 calories), with one-third cup of frozen unsweetened berries
- one cup of fat-free milk.

The day 3 breakfast is:

- one frozen single-serving Weight Watchers Smart Ones English muffin sandwich with ham and cheese (210 calories) or one frozen Swift Premium Morning Maker ham, egg, and cheese sandwich (250 calories)
- one 50-calorie fruit or 4 oz (118 ml) of calcium-fortified orange juice.

The day 4 breakfast consists of:

- one-half of a 3-oz (85-g) frozen Lender's Big'n Crusty bagel (230 calories) with 1 oz (28 g) of light Jarlsberg or reduced-fat cheddar cheese, broiled, or one Thomas's English muffin (110 calories)
- one cup of calcium-fortified orange juice.

The day 5 breakfast is the same as day 2 except that 6 oz (177 ml) of calcium-fortified orange juice may be substituted for the milk. The day 6 breakfast is the same as day 1. The day 7 breakfast is:

- one-half of a frozen Lender's Big'n Crusty toasted bagel with one teaspoon of light butter or margarine or one Thomas's English muffin (110 calories)
- one cup of fat-free Dannon yogurt
- one 50-calorie fruit.

**LUNCHES.** The day 1 lunch is:

- one frozen Celentano Great Choice Low Fat Stuffed Shells, Manicotti, or Lasagna (250 calories) or one Healthy Choice Manicotti with Three Cheeses frozen entree (260 calories)
- two cups of loosely-packed ready-to-eat salad greens with two tablespoons of fat-free Italian dressing or balsamic, rice, or raspberry vinegar
- two breadsticks
- one cup of fat-free milk.

The day 2 lunch consists of:

- one frozen Old El Paso Bean & Cheese Burrito with two tablespoons of salsa or one Weight Watchers Smart Ones Santa Fe Style Rice & Beans frozen entree (290 calories)

## KEY TERMS

**Bariatrics**—A medical specialty that deals with weight management and the treatment of obesity.

**Complex carbohydrates**—Starches; polysaccharides that are made up of hundreds or thousands of monosaccharides or single sugar units; found in foods such as rice and pasta.

**Couscous**—A North African food consisting of steamed semolina—milled durum wheat—that is also used to make pasta.

**Diuretic**—A substance that increases the excretion of urine.

**Lactose**—Milk sugar; a disaccharide in milk that consists of one glucose molecule and one galactose molecule.

**Monosodium glutamate**—MSG; sodium glutamate; a salt derived from glutamic acid that is used to enhance the flavor of foods.

**Pita**—Pitta; pita bread; a round, double-layered or pocket flatbread made from wheat and yeast.

**Simple carbohydrates**—Simple sugars; monosaccharides, such as fructose found in fruit, and disaccharides made up of two sugar units, such as lactose and sucrose or table sugar.

- one 50-calorie fruit
- one cup of fat-free milk.

The day 3 lunch is:

- a chicken sandwich made with three one-quarter-inch-thick slices of leftover chicken breast from the day 1 dinner or 10 deli-thin slices of chicken breast, lettuce, sliced tomato, and one tablespoon of light mayonnaise or honey mustard, on two slices of whole-wheat bread
- one 50-calorie fruit
- one cup of fat-free milk.

The day 4 lunch consists of:

- one frozen Lean Pockets Chicken Parmesan, Turkey, or Ham with Cheddar stuffed sandwich (280 calories) or one Ken & Robert's Truly Amazing Veggie Pocket, Oriental or Broccoli & Cheddar (250 calories)
- two cups of salad as for day 1
- one 50-calorie fruit
- one cup of fat-free milk.

The day 5 lunch is:

- a tuna and bean salad made from three cups of ready-to-eat, loosely packed salad greens, 1 oz (28 g) of crumbled reduced-fat feta cheese, one-third cup of canned drained red kidney beans, 2 oz (56 g) of water-packed canned tuna, drained and flaked, and 2 tablespoons of fat-free Italian dressing or flavored vinegar
- three breadsticks
- a 100-calorie fruit.

The day 6 lunch is:

- one frozen Stouffer's Lean Cuisine Swedish Meatballs with Pasta or Three Bean Chili with Rice (250–280 calories) or one frozen Lean Pockets stuffed sandwich (250 calories) or one Healthy Choice Chicken Enchilada Suiza frozen entree (270 calories)
- one small sliced tomato with two teaspoons of flavored vinegar
- one cup of fat-free milk.

The day 7 lunch consists of:

- one whole-wheat mini pita stuffed with one frozen Tyson or Banquet fat-free chicken-breast pattie (80–100 calories), diced tomatoes, 1 oz (28 g) of crumbled reduced-fat feta cheese, and a splash of red-wine vinegar
- a 100-calorie fruit
- one cup of fat-free milk.

**DINNERS.** Several of the dinner selections make three–four servings and the serving sizes can be increased for other family members. The day 1 dinner is:

- one-half of a fully cooked rotisserie chicken breast without the skin, about 4.5 oz (130 g)
- two-thirds of a cup of Ore-Ida mashed potatoes cooked with one-third cup of low-fat milk
- one-third cup of heated fat-free chicken gravy from a jar
- one cup of steamed chopped frozen broccoli
- one 50-calorie fruit.

The day 2 dinner consists of:

- frozen Master Choice Four Cheeses Gourmet pizza or Tombstone Oven Rising Crust Three Cheese pizza, topped with a single layer of two cups of frozen chopped broccoli or spinach; makes four–six servings of 320 calories each; for one person, one-half cup of Stouffer's Lean Cuisine Cheese French Bread Pizza and one-half cup of vegetables
- two cups of the day 1 lunch salad
- one 50-calorie fruit.

The day 3 dinner is:

- shrimp and couscous: one-half cup of frozen peas and carrots and 3 oz. (85 g) of peeled, raw, frozen shrimp (about eight medium shrimp) and one-half cup of chicken broth, heated to boiling, and one-third cup of couscous and some hot pepper sauce;

or for one person, frozen Healthy Choice Herb Baked Fish (340 calories) or Chicken Francesca frozen meal (330 calories)
- a 100-calorie fruit.

The day 4 dinner is:

- one 9-oz (250-g) package of frozen Tyson Chicken Breast Strips with Rib Meat (90 calories per serving) and the frozen sauce from one Green Giant Create a Meal! Sweet & Sour Stir Fry (130 calories per serving), stir-fried with rice, and the frozen vegetables and pineapple, for three one-quarter-cup servings, with three-quarters cup of cooked rice per serving; for 1 person, frozen Healthy Choice Sweet and Sour Chicken (360 calories)
- two breadsticks
- one 50-calorie fruit.

The day 5 dinner consists of:

- five Mrs. T's Pierogies Potato and Cheddar Pasta Pockets (300 calories), with one-third cup of salsa and two tablespoons of fat-free sour cream, or three Golden Potato Blintzes (270 calories)
- one cup of cooked frozen green beans
- one 50-calorie fruit.

The day 6 dinner is:

- one whole-wheat mini pita pocket stuffed with one frozen Boca Burger—Chef Max's Favorite (110 calories), lettuce, tomato, onion, and one tablespoon of ketchup, or 1 frozen low-fat Gardenburger, hamburger style (110 calories), or one frozen Morningstar Farms Garden Veggie Pattie (150 calories)
- 4 oz (110 g) of baked frozen French fries (20–23 fries)
- one 100-calorie fruit.

The day 7 dinner is:

- one 6-oz (170-g) individually frozen fish fillet, not breaded or flavored, sprinkled with one tablespoon of grated Parmesan cheese, two teaspoons of dried bread crumbs, paprika, salt, pepper, and two teaspoons of olive oil, and baked at 500°F (260°C) for about seven minutes
- two cups of frozen Ore-Ida country-style hash browns, cooked by the fat-free method (128 calories)
- one cup of cooked sliced zucchini.

**SNACKS.** Snacks can be eaten at any time of day. The day 1 snacks are:

- one Dole Fruit Juice Bar (45 calories) or one 50-calorie fruit
- four reduced-fat Triscuits (65 calories) with 1 oz (28 g) of light Jarlsberg or reduced-fat cheddar cheese
- one dill pickle.

The day 2 snacks are:

- one Starbucks Ice Cream Mocca Frappuccino blended coffee bar (120 calories) or a Quaker Chewy granola bar (about 110 calories)
- one 50-calorie fruit.
- eight raw baby carrots.

The day 3 snacks include:

- one cup of fat-free Dannon yogurt (110 calories)
- one Dole fruit juice bar or one 50-calorie fruit
- 15 raw baby carrots.

The day 4 snacks are:

- one Dole Fruit Juice Bar or one 50-calorie fruit
- one-half of a 3-oz (85-g) frozen Lender's Big'n Crusty toasted bagel with one teaspoon of jam or preserves
- one dill pickle.

The day 5 snacks include:

- four reduced-fat Triscuits (65 calories) with 1 oz (28 g) of light Jarlsberg or reduced-fat cheddar cheese
- one frozen Haagen-Dazs sorbet bar (80 calories) or Betty Crocker Healthy Temptations ice-cream sandwich (80 calories)
- one dill pickle.

The day 6 snacks are the same as for day 2. The day 7 snacks are:

- one-half of a 3-oz (85-g) frozen Lender's Big'n Crusty toasted bagel with one teaspoon of jam or preserves
- one frozen Haagen-Dazs sorbet bar or Betty Crocker Healthy Temptations ice-cream sandwich
- one dill pickle.

**FRUITS.** The 50-calorie fruit choices are:

- one-half cup of unsweetened applesauce
- three apricots
- one cup of blackberries
- one-quarter of a medium cantaloupe or one-half cup of cubes
- one-half of a medium grapefruit
- one cup of honeydew melon cubes
- one medium nectarine
- one large peach or two-thirds cup of frozen, unsweetened peaches
- one-half cup of juice-packed canned peaches, pears, or fruit cocktail
- two one-half-inch-thick slices of fresh pineapple or three-quarters cup of cubes
- one large plum
- two tablespoons of raisins

- one cup of fresh raspberries or two-thirds cup of frozen, unsweetened raspberries
- eight medium strawberries or two-thirds cup of frozen, unsweetened strawberries
- one medium tangerine.

The 100-calorie fruits are:

- one large apple
- three dried apricot halves
- one cup blueberries
- one medium banana
- 1 cup (21) cherries
- three-quarters cup (28) grapes
- two medium kiwifruit
- one large orange
- three dried peach halves
- one medium pear
- two-thirds cup of juice-packed canned pineapple
- two and one-half cups of watermelon cubes.

### *The new Good Housekeeping* diet

The more recent *Good Housekeeping* frozen-food diet relies on strict portion control for weight loss. The diet consists of 28 microwaveable frozen meals and supplemental foods that follow strict nutritional criteria. It includes calorie-free beverages and a daily multivitamin/multimineral supplement.

**BREAKFAST.** The frozen-food diet breakfast consists of:

- one cup of fat-free milk or 6 oz (170 g) of light yogurt
- three-quarters cup of Kashi GoLean or three-quarters cup of Cheerios or Wheaties mixed with one-quarter cup All-Bran Extra Fiber
- one serving of fruit.

One serving of fruit is about 60 calories and is equivalent to:

- one small apple
- one-half of a banana
- three-quarters cup of blueberries
- one cup of cubed cantaloupe or honeydew melon
- one-half of a large grapefruit
- 17 grapes
- one kiwi
- one-half of a small mango
- one nectarine
- one small orange
- one large peach
- one-half of a large pear
- three-quarters cup of fresh pineapple
- one-half cup of canned pineapple packed in juice
- one cup of raspberries
- one and one-quarter cup of whole strawberries
- two small tangerines.

**LUNCH.** Lunch consists of:

- a frozen meal
- two cups of salad greens of alternating varieties with one-half cup of bite-sized steamed or raw vegetables
- two tablespoons of reduced-calorie salad dressing, maximum 50 calories, or one teaspoon of olive oil mixed with flavored vinegar.

The frozen lunches are:

- Ethnic Gourmet Chicken Korma
- Ethnic Gourmet Tandoori with Spinach
- Ethnic Gourmet Kung Pao Chicken
- Healthy Choice Apple Glazed Pork Medallions
- Healthy Choice Princess Chicken
- Lean Cuisine Dinnertime Select Steak Tips Dijon
- Lean Cuisine Spa Cuisine Salmon with Basil and one extra serving of fruit
- Smart Ones Chicken Parmesan
- Smart Ones Chicken Tenderloins with Barbecue Sauce
- Smart Ones Lasagna Florentine
- South Beach Mediterranean Style Chicken with Couscous
- Stouffer's Chicken Teriyaki
- Uncle Ben's Roasted Chicken & Vegetable
- Uncle Ben's Savory Beef Portabello.

Allowable salad vegetables are:

- bell pepper
- broccoli
- cauliflower
- celery
- cucumber
- mushrooms
- onions
- radishes
- tomatoes.

**DINNER.** The dinner menu consists of:

- one frozen meal
- salad as with lunch
- salad dressing as with lunch.

The frozen dinners are:

- Amy's brand Cheese Ravioli with Sauce

- Amy's brand Santa Fe Enchilada
- Ethnic Gourmet brand Chicken Biryani over Rice
- Healthy Choice brand Salisbury Steak
- Lean Cuisine brand Dinnertime Selects Chicken Fettucini
- Lean Cuisine brand Dinnertime Selects Chicken Portabello
- Organic Classics Cajun Style Chicken Tettrazini with Penne Pasta
- Organic Classics Chicken Cacciatore with Penne Pasta
- Organic Classics Penne Pasta with Sauce & Meatballs
- South Beach Cashew Chicken with Sugar Snap Peas
- Stouffer's Rigatoni Pasta with Roasted White Meat Chicken
- Stouffer's Tuna Noodle Casserole
- Uncle Ben's Sweet and Sour Chicken
- Uncle Ben's Thai-Style Chicken.

**ADDITIONAL FOODS.** The following foods may be eaten once a day with meals or as a snack:

- one cup of fat-free milk or 6 oz (170 g) of light yogurt
- one serving of fruit
- one serving of whole grain, about 80 calories.

The 80-calorie whole grains may be:

- 1 oz (28 g) of mini wholegrain pita bread
- a 1-oz (28-g) slice of 100% whole-wheat bread
- four pieces of thin whole-wheat crispbread
- four Triscuits
- one mini bag of low-fat popcorn.

One treat of about 100 calories is permitted twice per week:

- one-half cup of light ice cream
- one Nabisco 100-calorie pack, any variety
- 13 roasted almonds
- four Hershey's Kisses
- 4 oz (118 ml) of red or white wine
- one light beer.

### *The AFFI diet*

All of the meals in the AFFI diet include at least one serving of frozen fruits or vegetables. Daily meal plans are for 1,600-, 2,200-, and 2,800-calorie diets. A sample daily menu for a 1,580-calorie diet consists of 58 g of **protein**, 38 g of **fiber**, and 28 g of fat.

A typical breakfast consists of:

- two calcium-fortified, wholegrain frozen waffles
- one cup of thawed frozen blueberries
- 8 oz (237 ml) of calcium-fortified orange juice from frozen concentrate
- one multivitamin and mineral supplement.

A sample lunch consists of:

- 2.5 oz (70 g) of frozen vegetable burger
- one cup of frozen mixed vegetables
- one cup of cooked frozen long-grain brown rice.

A typical dinner is:

- 4 oz (110 g) of frozen breaded baked fish filet (170 calories or less)
- one cup of boiled frozen artichokes, drained
- one cup of boiled frozen Brussels sprouts, drained
- one cup of boiled frozen asparagus tips, drained
- two-thirds cup of frozen whipped sweet potato.

The afternoon and evening snacks consist of:

- one small frozen oat-bran muffin (200 calories or less)
- one slice of low-fat frozen cheesecake (150 calories or less).

### *Commercial diets*

Like the other frozen-food diets, commercial frozen-food diets are designed for nutritional balance and portion control. Cederquist's diet delivers an average 1,200 calories, with a range of 1,100–1,400 calories, in three daily meals and two snacks. The calories come from lean protein and complex **carbohydrates** rather than from simple carbohydrates and **fats**. The diet avoids foods such as white bread, potatoes, and pasta that contain simple sugars. The program accommodates one dinner outside of the diet per week.

Cederquist's diet recommends:

- drinking a minimum of 64 oz (2 l) or eight glasses of water daily, as regular water, flavored water, decaffeinated diet soda, or diet fruit juices, to keep the body hydrated and 'flushed'
- limiting caffeinated drinks, such as coffee, tea, or diet soda, to two per day, since caffeine is a diuretic and will cause body cells to retain water, thereby slowing weight loss.
- drinking coffee black or with a low-fat creamer and/or a sugar substitute
- avoiding fruit juices because they are high in sugar
- drinking low-fat (1%) or skim milk for protein, limited to 8 oz (237 ml) per day because of the lactose.

## Function

Frozen-food diets are used for weight-loss and weight-control, for convenience, and to save time.

These diets are especially useful for people who are unable to cook or prefer not to cook. Since the ingredients and portions of the meals are predetermined, the diets are much easier to follow than those that require counting calories or weighing ingredients. The *Good Housekeeping* frozen-food diet is aimed especially at people who feel that they don't have time to diet, particularly if they have to prepare a different meal for the rest of the family. Some frozen-food diets are designed for diabetics, without simple sugars that could rapidly increase blood-sugar levels. Frozen-food diets may be difficult for vegetarians to follow.

## Benefits

In addition to being quick and convenient, frozen-food diets are designed by nutritionists to be well-balanced, low in fat and calories, and to provide the necessary **vitamins** and **minerals**. They supply a variety of different foods. The meals in the original *Good Housekeeping* frozen-food diet take less than 10 minutes to prepare and enables the dieter to lose 1 lb (0.45 kg) per week. The meals in the newer *Good Housekeeping* frozen-food diet take 9 minutes or less to prepare and enable the dieter to lose about 1.5 lb (0.7 kg) per week or 20 lb (9 kg) in just over three months. Commercial frozen-food diets make weight-loss claims of an average of 2–3 lb (0.9–1.4 kg) per week.

Frozen foods avoid spoilage problems associated with fresh foods, particularly those that are harvested, transported long distances, and stored before they reach the consumer. Frozen foods also require fewer trips to the grocery store.

## Precautions

Frozen food, particularly frozen meals and entrées, can be very expensive compared to buying fresh or canned food and preparing meals, although frozen fruits and vegetables may be less expensive than fresh produce. Frozen-food diets also require a significant amount of frozen storage capacity. Recommended choices, such as those in the *Good Housekeeping* frozen-food diets, may be biased toward advertisers or corporate sponsors.

Like many processed foods, frozen foods—especially frozen diet foods—contain various chemicals that some believe may be harmful. Frozen diet foods often contain monosodium glutamate (MSG), flavorings, and hydrolyzed vegetable protein. In large quantities glutamate may be damaging to the brain and nervous system.

## Risks

Frozen food is considered to be safe. Freezing inhibits the growth of some pathogens and reduces the risk of food contamination. However the thawing and refreezing of frozen foods may pose a risk. Frozen foods can remain too long in the freezer and can suffer from freezer burn and the formation of ice crystals.

## Research and general acceptance

### *Research*

In the 1990s the U.S. Food and Drug Administration declared frozen fruits and vegetables to be as nutritious as fresh produce and, in some cases, more nutritious.

The 2003 University of Illinois research study found that women who ate frozen main courses for lunch and dinner for an eight-week period lost an average of 12 lb (5.4 kg). In contrast the women who followed a diet that was equivalent in calories to the frozen-food diet, but which required them to plan and cook meals, lost an average of only 8 lb (3.6 kg). According to LeaAnn Carson, a research dietician and one of the study's authors, the results suggest that women who prepare their own food actually consume more calories because they do not accurately measure the ingredients, whereas the portion sizes of the frozen-food entrees are strictly controlled.

According to Cederquist, medical research has shown that a diet that varies the number of daily calories slightly is preferable to one that strictly adheres to a set number of calories. Varying the caloric intake prevents the body's **metabolism** from adjusting to the set point and making it progressively harder to lose more weight and maintain the weight loss.

### *General acceptance*

Frozen foods are a huge industry and frozen dinners and entrees constitute the largest category of frozen foods. Consumer demand for frozen meals grew steadily in the first years of the twenty-first century. The average American eats six frozen meals per month. In a survey reported by the AFFI, frozen-food products were among the top three food items that Americans did not want to live without. A poll conducted by the Tupperware Corporation found that on an average trip to the supermarket 94% of American shoppers sometimes purchase frozen food and 30% always buy some frozen food.

Surveys conducted in 2006 under the auspices of the AFFI found that the majority of American shoppers believe that frozen foods have many of the same

## QUESTIONS TO ASK YOUR DOCTOR

- How much weight do I need to lose?
- Would I be expected to lose weight on a frozen-food diet?
- What factors should I take into consideration in choosing a frozen-food diet?
- Should I be concerned about MSG or other additives in the frozen food?
- Should I take vitamin and/or mineral supplements while following a frozen food diet?

good qualities as fresh foods and retain the same or more nutrients as foods that have not been frozen. Consumers generally believe that in recent years frozen foods have significantly improved in taste, variety, and ease of preparation. In general they also believe that frozen foods are safer than prepared refrigerated foods.

### Resources

#### BOOKS

Blaylock, Russell L. *Excitotoxins: The Taste That Kills*. Santa Fe, NM: Health Press, 1998.

Fogle, Jared and Anthony Bruno. *Jared the Subway Guy: Winning Through Losing: 13 Lessons for Turning Your Life Around*. New York: St. Martin's Press, 2006.

#### PERIODICALS

Hammock, Delia A. 'The Frozen-Food Diet: Quick Meals, Quick Results—Lose Six Pounds This Month With Our Yummy (Microwavable) Meals.' *Good Housekeeping* 241 (October 2005): 231-235.

Mermelstein, Shari and Carol Wapner. 'The Frozen Food Diet.' *Good Housekeeping* 237 (September 1998): 119-121. Includes menus.

#### OTHER

'AFFI Invites a Fresh Perspective on Frozen Foods.' *AFFI* February 2006. <http://www.affi.com/Fresh_Look_Initiative_White_Paper_AFFI.pdf> (April 12, 2007).

Category Promotion Committee, Western Frozen Food Convention. 'Telling the Story that Sells.' *AFFI* February 27, 2006. <http://www.affi.com/PDFS/_KRESE.pdf> (April 12, 2007).

'Cutting Calories—and Cooking Time.' *AFFI*. <http://www.affi.org/PDFS/NAPS-Bauer.pdf> (April 12, 2007).

'FAQS.' *Diet To Your Door*. <http://www.diettoyourdoor.com/faqs.asp> (April 12, 2007).

'Frozen Food Trends.' *AFFI*. <http://www.affi.com/factstat-trends.asp> (April 12, 2007.

'A Long Life or a Quality Life?' *Capital Connection*. <http://www.affi.com/PDFS/LongLife-QualityLife.pdf> (April 12, 2007).

U.S. Department of Agriculture. *Dietary Guidelines for Americans* 2000. <http://www.affi.com/images/usdadietaryguide.pdf> (April 12, 2007).

#### ORGANIZATIONS

American Frozen Food Institute. Food Industry Environmental Council. 2000 Corporate Ridge, Suite 1000, McLean, VA 22102. (703) 821-0770. <http://www.affi.com>.

American Society of Bariatric Physicians. 2821 S. Parker Rd., Suite 625, Aurora, CO 80014. (877) 266-6834. <http://www.asbp.org>.

The Center for Food Safety. 660 Pennsylvania Ave, SE, ndash302, Washington, DC 20003. (202) 547-9359. <http://www.centerforfoodsafety.org>.

National Uniformity for Food Coalition. (202) 295-3946. <http://www.uniformityforfood.org>.

Margaret Alic, PhD

# Fructose intolerance

## Definition

Fructose intolerance is a condition where the body has difficult digesting and using fructose and fructose-containing foods. It is treated by complete elimination of fructose and sucrose from the diet.

## Origins

There are two types of fructose intolerances. The first, hereditary fructose intolerance (HFI), also known as fructosemia or fructose aldolase B-deficiency, is a rare genetic disease of the **metabolism** of fructose due to the absence of the enzyme that breaks it down (aldolase B). As a result, fructose accumulates in the liver, kidney, and small intestine and the body is unable to convert its energy storage material (glycogen) into glucose. If untreated, the blood sugar level falls (hypoglycemia) and there is formation of harmful substances that damage the liver. HFI is difficult to diagnose so its incidence rate is not known, but it is believed to be quite rare (between 1 in 12,000 to 1 in 58,000). Since it is inherited, it lasts for life.

The second type of fructose intolerance is dietary fructose intolerance (DFI), also called fructose malabsorption. DFI is quite common, affecting up to 30% of people in the United States. Its incidence is also difficult to evaluate since many people show no symptoms at all and its cause is not precisely known. It

**Sugars and sweeteners**

| Tolerated | Not tolerated |
|---|---|
| Aspartame | Agave syrup |
| Barley malt syrup | Baker's sugar |
| Birch sugar (if pure) | Beet sugar |
| Corn starch | Brown rice syrup |
| Corn sugar | Brown sugar |
| Dextrin | Cane sugar |
| Erythitol (if pure) | Carob powder |
| Glucose | Corn syrup |
| Glucose polymers | Date sugar |
| Neotame | Dulcitol |
| Saccharin | Fruit juice sweeteners |
| | Grape syrup |
| | Gur |
| | Honey |
| | Maple syrup |
| | Molasses |
| | Polydextrose |
| | Sorbitol |
| | Stevia |
| | Turbinado |
| | Wasanbon |

**This list of sugars and sweeteners for fruitose intolerant individuals was prepared by the HFI Laboratory at Boston University.** *(Illustration by GGS Information Services/Thomson Gale.)*

seems to be caused by the lack of special cells (epithelial cells) on the surface of the intestine that are not available to help digestion. As a result, the body is not able to absorb fructose efficiently.

Although having different causes, both HFI and DFI are treated by dietary adjustments. Complete elimination of fructose and sucrose from the diet is the only effective treatment for HFI. As for DFI, treatment also involves a fructose-free diet, with the treating physician allowing some concessions in mild cases. Some patients may find a threshold level where they can eat some fructose without getting symptoms. Close dietary monitoring is important for good outcome and should include at least semiannual visits to a biochemical geneticist (for HFI) and monthly meetings with a nutritionist.

## Description

A strict fructose-free diet involves exclusion of any beverage or food containing fructose, sucrose, or sorbitol. Fructose is a monosaccharide, or simple sugar, that has the same chemical formula as glucose, the main source of energy for the body, but a different molecular structure. It is found in all fruits, in some vegetables and in honey. Fructose and other sugars are **carbohydrates**, which are important sources of energy for the body. The main types of sugars found in beverages and foods are:

- Lactose: Disaccharide containing glucose and galactose. It occurs naturally in milk.
- Maltose: Disaccharide containing two glucoses. It is obtained from starch.
- Dextrose: Other name for glucose, it is obtained from sugar cane, sugar beets and starches.
- Corn syrup: Sugar that consists chiefly of single glucose molecules. It is produced from corn starch.
- High fructose corn syrup (HFCS): A mixture of glucose and fructose sugars, also produced from corn starch.

The HFI Laboratory at Boston University has prepared a list of sugars and their tolerance for patients. Some of the most common food sweeteners listed include:

- Agave syrup: Commonly used in Texan-Mexican foods, tequila, margaritas, soft drinks. High in fructose and not tolerated.
- Aspartame: FDA-approved sugar substitute sold as Equal, NutraSweet, NutraTase. Tolerated.
- Baker's sugar: Another name for sucrose, the finest of all granulated sugars. Not tolerated.
- Barley malt syrup: Obtained from sprouted grains of barley, kiln dried and cooked with water. Tolerated.
- Beet sugar: Sucrose. Not tolerated.
- Birch sugar: A sugar alcohol, xylitol. Trade name: The Ultimate Sweetener. Tolerated if pure.
- Brown rice syrup: Obtained from brown rice. Possibly contains sucrose. Not tolerated.
- Brown sugar: Sucrose coated with molasses. Not tolerated.
- Cane sugar: Sucrose, table sugar. Not tolerated.
- Carob powder: Obtained from the carob tree, it is 75% sucrose, plus glucose and fructose. Not tolerated.
- Corn starch: Derived from corn, consists of straight or branched chains of glucose. Tolerated.
- Corn sugar: Obtained from corn starch, contains glucose and maltose. Tolerated.
- Corn syrup: Also obtained from corn starch, but in making the syrup, it usually has either maltose or fructose or both added. Not tolerated.
- Date sugar: Made from dried, pulverized dates and likely to contain sucrose. Not tolerated.
- Dextrin: Glucose molecules linked together in chains that do not break down to pure glucose. Tolerated.
- Dulcitol: Naturally occurring sugar alcohol. Not tolerated.
- Erythitol: Sugar alcohol. Tolerated if pure.

## KEY TERMS

**Acidosis**—Excessive acidity of body fluids due to accumulation of acids.

**Carbohydrate**—Any of a group of substances that includes sugars, starches, celluloses, and gums and serves as a major calorie source in food.

**Digestion**—The process by which food is chemically converted into nutrients that can be absorbed and used by the body.

**Disaccharide**—Any of a class of sugars, including lactose and sucrose, that are composed of two monosaccharides.

**Enzyme**—A protein that accelerates the rate of specific chemical reactions.

**FDA**—The Food and Drug Administration is the United States Department of Health and Human Services agency responsible for ensuring the safety and effectiveness of all drugs, biologics, vaccines, and medical devices.

**Fructose**—Sugar found in fruits.

**Galactose**—A sugar contained in milk. Galactose makes up half of the sugar called lactose that is found in milk.

**Glucose**—A monosaccharide sugar occurring widely in most plant and animal tissue. In humans, it is the main source of energy for the body.

**Glycogen**—The storage form of glucose found in the liver and muscles.

**Hypoglycemia**—A deficiency of sugar in the blood caused by too much insulin or too little glucose.

**Malabsorption**—Poor absorption of nutrients by the small intestine, difficulty in the digestion of nutrients.

**Monosaccharide**—Any of several carbohydrates, such as glucose, fructose, galactose, that cannot be broken down to simpler sugars.

**Nutrient**—A source of nourishment, especially a nourishing ingredient in a food.

**Sorbitol**—Sugar alcohol food additive used as a sweetener in commercially prepared low sugar foods and gum.

**Starch**—A naturally abundant nutrient carbohydrate found in seeds, fruits, tubers, and roots.

- Fruit juice sweeteners: Derived from grapes, apples or pears, heated to reduce water, leaving a sweeter more concentrated juice. Not tolerated.
- Grape syrup: Pure fructose. Not tolerated.
- Glucose: Simple sugar. Tolerated.
- Glucose polymers: Chains of glucose. Tolerated.
- Gur: Consists of 35% sucrose, and 15% mixture of glucose plus fructose, made from palm dates or sugar cane juice. Used in Thai cooking. Not tolerated.
- Honey: Natural syrup containing about 35% glucose, 40% fructose, 25 % water. Not tolerated.
- Maple syrup: From maple trees, mostly sucrose. Not tolerated.
- Molasses: By-product of sugar cane with 24% water. Fructose level varies. Not tolerated.
- Neotame: Sugar substitute. Tolerated.
- Polydextrose: Food additive synthesized from dextrose, plus about 10% sorbitol and 1% citric acid. It is commonly used as a replacement for sugar, starch, and fat in commercial cakes, candies, dessert mixes, gelatins, frozen desserts, puddings, and salad dressings. Not tolerated.
- Saccharin: FDA-approved sugar substitute. No longer commonly used. Known as Sweet N' Low, Sugar Twin, Sucryl, Featherweight. More than 6 servings per day may increase bladder cancer risk and it is no longer approved for use in Canada. Tolerated.
- Sorbitol: Sugar alcohol common in fruits, particularly skin of ripe berries, cherries and plums. Not tolerated.
- Stevia: Natural sweetener from a South American plant. Not tolerated.
- Turbinado: Another name for raw sugar. Not tolerated.
- Wasanbon: Grown on an island in the area of Japan from a special variety of sugar cane. Not tolerated.

Foods not allowed in a fructose and sucrose-free diet include:

- Meats: Cold cuts, hot dogs, sausages, any meat products that contain sugar.
- Cereals: Any cereal sweetened with sugar, fructose, or sorbitol.
- Sweeteners: Sugar, sucrose, fructose, sorbitol, brown sugar, molasses, honey.
- Fruits: All fruits, fruit juices, fruit extracts, dehydrated fruits, and products that contain fruit or are sweetened with fruit juice or concentrate.

- Fats: Mayonnaise, mustards and dressings with sugar.
- Milk: Milk and dairy products with added sugar.
- Nuts: Candy-covered nuts or nuts prepared with sugar, fructose or sorbitol.
- Breads: Any type of sweet bread, or any that may contain sugar, fructose or sorbitol.
- Potatoes: Sweet potatoes.
- Fish: Processed fish with sugar.
- Desserts: Any dessert that contains sugar, fructose or sorbitol.
- Vegetables: Carrot, tomato, corn, canned vegetables with sugar.
- Other foods: Catsup, sauces that contain sugar, chile piquin with lemon, all regular soft drinks and sodas, jams, jellies, marmalades, maple syrup, canned or bottled fruits, corn syrup.

All types of fruits must be eliminated from fructose and sucrose-free diet. Examples of foods that are allowed include:

- Meats: Red meat, pork, chicken and turkey.
- Cereals: Any that do not contain sugar, fructose or sorbitol.
- Sweeteners: Aspartame, dextrine, no-calorie sweeteners.
- Fats: Butter, margarine, oil, salad dressings without sugar.
- Eggs: Any type.
- Milk: Any type.
- Nuts: Any type that has no sugar.
- Breads: Any type that does not contain sugar, fructose or sorbitol as ingredient.
- Potatoes: White potatoes.
- Pasta and soups: Macaroni, spaghetti, rice, soup pasta.
- Fish: Any fresh fish.
- Desserts: Natural yogurt, cakes and ice-cream made without sugar.
- Cheese: Any type.
- Vegetables: Asparagus, cauliflower, peppers, lettuce, spinach, celery, root vegetables except carrots.
- Other foods: Coffee, tea, diet soft drinks that contain artificial sweeteners, cocoa, salt, pepper and other spices.

Additional guidelines for a fructose-free diet include:

- Fructose, sucrose and sorbitol are used in many manufactured foods to such an extent that very few processed foods are allowed in the diet. Sugar is used in many other less obvious products such as canned food, bottled sauces
- Flavorings is another possible trace source of these sugars as they are sometimes used to carry flavoring compounds into foods.
- Only vegetables that contain predominantly starch are allowed in the diet. Cooked vegetables have a lower fructose content and should be selected rather than raw vegetables as the cooking process results in a loss of free sugars.
- New potatoes have a higher fructose content than old potatoes.
- Wholemeal flour contains more fructose than white flour because both germ and bran contain sucrose. Other wholegrain foods (brown rice and wholemeal pasta) also contain more sucrose than the refined products.
- Sorbitol is very often used as an artificial sweetener, especially in diabetic foods and drinks which should accordingly be avoided. Isomalt and lycasin, alternative sweeteners that are predominantly used in confectionary, also contain sorbitol. Glucose can be used as an alternative sweetener and as a source of energy.
- Sucrose and sorbitol are also often used in medications as bulking agents or to improve the taste.

## Function

The symptoms of both types of fructose intolerance are gastrointestinal distress, flatulence, bloating, diarrhea, fatigue, vomiting, low **iron** and other nutrient deficiency. For dietary fructose intolerance, there is clinical evidence also associating it with mood disturbances and depression. The function of a fructose-free diet is to eliminate dietary sugar intake so as to alleviate these symptoms.

## Benefits

Absolute elimination of fructose and glucose from the diet produces good outcomes in most people with fructose intolerance. For the rapidly diagnosed and treated infant, the outcome for a normal state of health is excellent. In the absence of substantial liver damage, life expectancy is normal.

## Precautions

Eating out is one of the most challenging parts of maintaining a fructose-free diet. This is because restaurant employees have little time to check food contents from the labels of the ingredients used by the kitchen to prepare menus. Some guidelines in dealing with restaurant staff include:

- Be as clear and explicit as possible when talking with the waiting staff. Explain your fructose intolerance in brief terms and order only foods that you know cannot have sugars and how they should be prepared. For example, order a steak, broiled on a piece of aluminum foil with no seasonings at all, a baked potato with butter, a lettuce-only salad with a small slice of lemon and oil on the side, plain steamed spinach and coffee/tea/milk.
- The person who knows the ingredients in the food is the person who prepares it. Ask to speak to that person. It can be the chef, or the cook, rarely the restaurant manager.
- Be careful of soups. Except for upscale restaurants, most soups are canned. Ask to read the label. If the soup is made at the restaurant it may also contain ingredients not compatible with a fructose-free diet.
- Whether grilled or broiled, seasoning is routinely used in meat preparation, so specify no seasonings in your order. The chef will know if a sauce has fructose-containing ingredients. Canned sauces are also used in many restaurants. Request to check the ingredient list.
- Non-dairy products are often used in restaurants, and may contain untolerated ingredients. Three frequently used non-dairy products in restaurants are non-dairy creamer, non-dairy potato topping, and non-dairy whipped topping. Also ask to read their labels.

With the increasing popularity of processed foods, sugar is often an ingredient about which the consumer is not aware, and not only in restaurants. For example, high fructose corn syrup (HFCS) is present and unsuspected in numerous products including soft drinks, fruit drinks, sports drinks, baked goods, candies, jams, yogurts, condiments, canned and packaged foods, and other prepared and sweetened foods. Also, potatoes, when prepared a certain way, may provide a significant amount of fructose. For this reason, the advice of a highly trained nutritionist is required in the treatment of fructose intolerance.

## Risks

After ingesting fructose, infants and children may become sufficiently ill to require hospitalization. If untreated, fructose intolerance leads to hypoglycemia and acidosis that may act together to cause organ shock and coma. Ongoing liver damage may result in cirrhosis and eventual liver failure. Death may result from any or all of the above. Hereditary fructose intolerance may be relatively mild or a very severe disease. In the severe form, even eliminating fructose and sucrose from the diet may not prevent progressive liver disease.

## QUESTIONS TO ASK YOUR DOCTOR

- What is the difference between dietary fructose intolerance and hereditary fructose intolerance ?
- How common are dietary fructose intolerance and hereditary fructose intolerance ?
- Do I have dietary fructose intolerance and hereditary fructose intolerance ?
- How did I get it ?
- What are the complications ?
- Can I be cured ?
- How is fructose intolerance identified ?
- What are the symptoms of dietary fructose intolerance and hereditary fructose intolerance ?
- How is fructose intolerance treated ?
- Which foods and beverages contain fructose ?
- Which foods and beverages contain high fructose corn syrup ?
- Can I consume any fructose at all ?
- Can I consume artificial sweeteners ?

## Research and general acceptance

Clinical intolerance to fructose was initially described in 1956. Some 4-5 years later, the defect in aldolase B enzyme in the liver was demonstrated, and hereditary fructose intolerance (HFI) became clinically recognized. The rapid early progress in the understanding of this disorder may be due to the fairly clear symptoms associated with ingestion of fructose, which are difficult to miss. In many young infants, the age of onset of symptoms leads to the diagnosis. Genetic counseling may be of value to prospective parents with a family history of fructose intolerance. Medical experts agree that definitive treatment simply consists of eliminating fructose from the diet. By doing so early in the course, the affected child's health is usually fully restored within days.

Recent research performed at the University of Innsbruck in Austria shows that fructose and sorbitol-reduced diet in subjects with fructose malabsorption does not only reduce gastrointestinal symptoms but also improves mood and early signs of depression. Improvement of the signs of depression was also more pronounced in females than in males

Medical researchers unanimously agree that symptoms can improve in dietary fructose intolerance patients willing to adhere to a low fructose diet.

## Resources

### BOOKS

Smith, J. *Living With Dietary Fructose Intolerance: A Guide to Managing your Life With this New Diagnosis*. Charleston, SC: BookSurge Publishing, 2006.
Gazzola, A. *Living with Food Intolerance*. London, UK: Sheldon Press, 2006.
Saville, A., Haynes, A. *Food Intolerance Bible*. New York, NY: ThorsonsElement (Harpercollins), 2005.
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Frieri, M, Kettelhut, B. (eds). *Food Hypersensitivity and Adverse Reactions*. Boca Raton, FL: S. CRC Press, 1999.
Cornblath, M., Schwartz, R. *Disorders of Carbohydrate Metabolism in Infancy*. Cambridge, MA: Blackwell Scientific Publications, 1991.

### ORGANIZATIONS

National Institute of Diabetes and Digestive and Kidney Diseases (NIDDK), National Institutes of Health. 31 Center Drive, MSC 2560, Bethesda, MD 20892-2560. 1-800-891-5389. <digestive.niddk.nih.gov/ddiseases/pubs/facts/index.htm>.
American Gastroenterological Association. 930 Del Ray Avenue, Bethesda, MD 20814. (301)654-2055. <www.gastro.org>.
International Foundation for Functional Gastrointestinal Disorders Inc. P.O. Box 170864, Milwaukee, WI 53217-8076. 1-888-964-2001. <www.iffgd.org>.
United States Food and Drug Administration (FDA). 5600 Fishers Lane, Rockville, MD 20857-0001. 1-888-INFO-FDA (1-888-463-6332). <www.fda.gov>.
Genetic and Rare Diseases (GARD) Information Center, PO Box 8126, Gaithersburg, MD 20898-8126. 1-301-519-3194.< rarediseases.info.nih.gov/html/resources/info_cntr.html>.

Monique Laberge, Ph.D.

# Fruitarian diet

## Definition

A fruitarian diet is a strict form of a vegetarian diet that is generally limited to eating fresh fruits.

## Origins

The fruitarian diet has been around for hundreds of years and probably longer. In his writings, artist, scientist, and inventor Leonardo da Vinci (1452–1519) indicated he was a fruitarian. Despite the popular view that early man was primarily meat-eaters, there is some scientific evidence to indicate that they ate a diet composed primarily of fruits, nuts, and berries. Some religious scholars argue that the original fruitarians were Adam and Eve in the Garden of Eden. There are a number of historical references to a fruitarian diet in the 1800s and 1900s. In much of the historical documentation, people who became fruitarians switched to a more accepted diet after a few months or years, often renouncing the diet. Indian spiritual and political leader Mahatma Gandhi (1869–1948) was a fruitarian for six months in the early 1900s before going back to a vegetarian diet.

**U.S. Centers for Disease Control and Prevention recommended amount of fruit per day**

| Age | Less active (cup) | Moderately active (cup) | Active (cup) |
|---|---|---|---|
| Children 2–3 yrs. | 1 | 1 | 1 |
| Boys 4–8 yrs. | 1½ | 1½ | 1½ |
| Girls 4–8 yrs. | 1 | 1½ | 1½ |
| Boys 9–13 yrs. | 1½ | 1½ | 2 |
| Girls 9–13 yrs. | 1½ | 1½ | 1½ |
| Boys 14–18 yrs. | 2 | 2 | 2½ |
| Girls 14–18 yrs. | 1½ | 2 | 2 |
| Men 19–30 yrs. | 2 | 2 | 2½ |
| Women 19–30 yrs. | 2 | 2 | 2 |
| Men 31–50 yrs. | 2 | 2 | 2½ |
| Women 31–50 yrs. | 1½ | 2 | 2 |
| Men 51≥ yrs. | 2 | 2 | 2 |
| Women 51≥ yrs. | 1½ | 1½ | 2 |

SOURCE: Centers for Disease Control and Prevention, U.S. Department of Health and Human Services

*(Illustration by GGS Information Services/Thomson Gale.)*

## Description

A fruitarian diet, also called a fructarian diet, is a form of vegan diet that is generally limited to eating fruits. The definition of what is a fruit often varies among fruitarians (also called fructarians or frugivores). Some adhere to a strict interpretation, consuming only fruits from plants and trees. Some fruitarians include berries in their diet, others broaden the definition to include nuts and seeds, while yet others include some food that is commonly thought of as vegetables, including peppers, tomatoes, cucumbers, and avocados. A fourth type of fruitarian includes grains in the diet. One definition of a fruitarian is someone who has a diet composed of more than 50% fruit. The Website Beyond **Vegetarianism** (http://www.beyondveg.com) defines a fruitarian diet as one containing at least 75% fruit (which includes grains and nuts) and the remainder

of the diet being raw vegan foods other than fruits. Most fruitarians consume raw, fresh fruit over canned, frozen, or processed fruit. A few fruitarians also consume green leafy vegetables, root vegetables, or both in their diet.

Fruitarians can choose from seven basic fruit groups:

- Acid fruits: Citrus, pineapples, strawberries, pomegranates, kiwi, cranberries, and sour apples.
- Subacid fruits: Sweet apples, sweet cherries, raspberries, blackberries, blueberries, peaches, pears, cherimoyas, papayas, figs, apricots, and mangos.
- Sweet fruits: Bananas, grapes, melons, and persimmons.
- Nuts: Pecans, almonds, Brazil, cashews, walnuts, macadamias, pistachios, pine nuts, hazelnuts, beechnuts, and hickory.
- Seeds: Sunflower, sesame, squash, and pumpkin.
- Dried fruits: Dates, figs, apricots, apples, raisins, cherries, prunes, bananas, and cranberries.

Oily fruits: Avocados, coconuts, and olives.

Many fruitarians believe the quality of fruit available in most commercial supermarkets is poor. This is due to hybridization, chemical fertilization, chemical pesticides, and harvesting before the fruit is at the peak of ripeness. They suggest buying certified organic fruit, preferably heirloom, often found at farmers' markets and health food stores.

Fruitarian and author David Wolfe says it is best to eat one type of fruit at a time and wait 45 minutes before another type of fruit is eaten. The Fruitarian Foundation recommends waiting at least 90 minutes between fruit types. If a person still is hungry after eating one type of fruit, they should eat more of the same type of fruit until their hunger is satisfied. People on the diet should eat only when hungry and then eat as much as they want until their hunger is satisfied. Those on a diet where only one type of fruit is eaten at a time will know when they have eaten enough, according to Wolfe. Their appetite will turn off and they will suddenly feel like they have eaten too much. Once satiated they will not gain the same satisfaction from the fruit. This is a signal from the body to stop eating, Wolfe states. The signal to stop eating is not as strong in people who eat more than one type of fruit at the same time. For a person who eats only fruit, there is no need to drink **water**. All the water the body needs is contained in the fruits. People whose diet is less than 100% fruit should supplement it with water. Some fruitarians fast one day a week. People fasting must drink a normal amount of water, usually eight to 10 glasses a day.

## KEY TERMS

**Anorexia**—The abbreviated term for anorexia nervosa, an eating disorder.

**Carbohydrates**—An organic compound that is an important source of food and energy.

**Cholesterol**—A solid compound found in blood and a number of foods, including eggs and fats.

**Diabetes**—A disease in which the blood glucose (sugar) levels are too high and the body does not make insulin (which helps regulate blood sugar) or does not make or use insulin well.

**HDL**—High-density lipoprotein, the so-called good cholesterol, found in the blood.

**Hybridization**—Relating to a plant produced from a cross between two genetically different plants.

**Insulin resistance syndrome**—A medical condition in which insulin fails to function normally in regulating blood glucose (sugar) levels.

**LDL**—Low-density lipoprotein, the so-called bad cholesterol, found in the blood.

**Triglyceride**—A natural fat found in body tissue.

### *One-day meal plan*

The following is a typical one-day meal plan from the Fruitarian Foundation for a fruitarian diet:

- Early morning (6–9 a.m.): The juice of three to five lemons immediately upon waking, raisins, and an unlimited amount of melon or melon juice.
- Midmorning (9 a.m. to 12 p.m.): An unlimited amount of apples, pineapple, figs, pears, grapes, yellow plums, lima beans, kiwi, and cucumber.
- Noon (12–3 p.m.): Oranges or tangerines, peaches, apricots, and papayas in any amount desired.
- Midafternoon (3–6 p.m.): Mango, cherries, strawberries, red plums, persimmons, pomegranates, watermelon, and tomatoes.
- Evening 6–9 p.m.): Grapes, blackberries, and raspberries.
- Late evening (9 p.m. to 12 a.m.): Mango, cherries, strawberries, red plums, persimmons, pomegranates, watermelon, and tomatoes.

Items that can be eaten at anytime are bananas, coconut, organic olives, ripe avocados, any type of raw nuts, and lemon juice. The only items that should be consumed from midnight to 3 a.m., if desired, are

four to six passion fruit, a small amount of water (if needed), and lemon juice.

Many people on a fruitarian diet give up the diet after a few months or several years because they find it too difficult to maintain. The problems include intense obsessions with food, social isolation, psychological problems, and frequent hunger. Because of these reasons and others, many people adopt a high-fruit diet composed of 50–75% fruit. The rest of the diet contains vegetables, including beans for **protein**. In some cases, the diet is still one of only raw (uncooked and unprocessed) foods while in other cases, it may include some cooked foods, such as potatoes.

### *Social implications*

Most Websites about fruitarianism emphasize that there are social concerns associated with a fruitarian diet. Much of this is because many fruitarians adopt the diet as part of a larger philosophical shift that is outside the mainstream of Western society. This includes animal rights and environmental activism, New Age spiritualism, meditation, and pacifism. In the United States, becoming or being a fruitarian or vegetarian is often seen as both a social and political statement. This can sometimes lead to conflict with family, friends, and even society at large.

"Those who live on their own and don't have any friends will have no problem changing their diet, though they may lead a bit of a lonely life," write fruitarians Lawrence and Michael Sartorius on the Website The New Earth (http://www.thenewearth.org). "For most of us, however, eating with families and friends is a daily experience and we need to consider how best to interact with them so that at the very least we do not cause a lot of inconvenience or appear cranky and antisocial with others. Younger readers especially may find themselves in conflict with their families and friends, putting them under severe pressure to 'give up this nonsense and eat sensibly like everybody else' "

For people facing these problems, the Sartorius' recommend explaining a decision to become a fruitarian with clear facts and strongly expressing personal views. This includes explaining that there is a growing trend towards healthier foods. Also, point out the growing health problems in the United States, including **obesity**, heart disease, **cancer**, diabetes, high blood pressure, and high cholesterol, which are often related to a bad diet and bad eating habits. Explain to friends the specific benefits of being a fruitarian or vegetarian, which includes living a longer, healthier life.

## Function

There are as many reasons for being a fruitarian as there are variations of the fruitarian diet. One reason is the opposition to killing animals for food, another is opposition to consuming any products that come from animals. Other reasons include opposition to killing any plant for food, health benefits, environmental concerns, and spiritual beliefs. The primary function of a fruitarian diet is to promote health and energy. Once someone adopts a fruit diet, they become physically, mentally, emotionally, and spiritually healthier, according to the Fruitarian Foundation (http://www.fruitarian.com). The foundation's philosophy states that fruitarians develop a fine-tuned body and experience few or no headaches, develop a greater resistance to illness, pain, and aging, and need less sleep. "The proper application of fruitarian dietary and lifestyle is calculated to allow the human to produce healthy offspring, live more than 100 years of age, be free of all disease, and only Lsquo;mature' while not aging, as most people think of it, and die a natural death in their sleep," according to a statement on the foundation's Website. "Man cannot eat of everything and maintain his good health. Man was created to eat of the fruits of the trees."

## Benefits

The benefits of a fruitarian diet are mostly promoted by people on the diet, rather than scientific research. These benefits include increased mental power and clarity, creativity, happiness, energy, confidence, self-esteem, and concentration. Physical health benefits, according to the Fruitarian Foundation, include preventing and curing cancer, **constipation**, insomnia, depression, and digestive problems, weight loss, wound healing, strengthening the immune system, reducing or eliminating menstruation, increasing sexual vitality, improvements in the health and appearance of skin, hair, eyes, and nails, improving muscle coordination, and the ability to control addictions to alcohol, drugs, and tobacco. The United States Department of Agriculture recommends fruit be included in daily meal planning, although the amount depends on age, gender, weight, height, level of physical activity, and weight loss goals. It must be noted that there is no scientific evidence that eating a fruit-only diet can cure any disease.

Eating a fruit or mostly fruit diet can improve cholesterol levels: raising the "good" cholesterol (high-density lipoprotein or HDL) and reducing the "bad" cholesterol (low-density lipoprotein or LDL). It can also reduce high triglyceride levels. Most of the cholesterol that contributes to clogged arteries and heart

disease comes from animal products and certain non-animal processed **fats**. Fruits, grains, and nuts contain little or no cholesterol and can help reduce cholesterol in the blood, according to the Website The New Earth.

Tom Billings, a writer and long-time vegetarian, was a self-described fruitarian for about 10 years. His experiences as both a vegetarian and fruitarian are chronicled on the Website Beyond Vegetarianism. He lists the benefits of a fruitarian diet as including:

- Fruit is the best tasting raw food and eating fruit is a pleasant experience.
- It helps cleanse the body of toxins.
- Fruit grown and sold locally is environmentally friendly.
- It promotes weight loss.
- It can improve the function of the respiratory system.
- It sharpens the senses, especially those of taste and smell.
- It reduces the amount of water a person needs to drink since most fruit has a high water content.

## Precautions

To get all of the **vitamins**, **minerals**, and nutrients that a body needs, a fruitarian must eat a wide variety of fruit and in many cases, large quantities. Very little protein can be obtained from fruit. To obtain the necessary amounts, fruitarians must include in their diet fruits and nuts that are highest in protein, including avocados, nuts, and dates. Still, it will be difficult to get the amount of protein the body needs on a daily basis. Vitamin, mineral, and other nutritional supplements can be taken to insure that a person is getting the recommended amounts. However, this does not fit into the nature-only philosophy of many fruitarians. Doctors strongly recommend that women who are pregnant or nursing not be on a fruitarian diet. Doctors also say children should not be on a fruitarian diet because their bodies require extra nutrients to sustain normal growth along with mental and physical development.

## Risks

There are many risks associated with a fruitarian diet and the risks grow as the degree of fruitarianism increases. That is, a person whose diet is 75% fruit is likely to have more health issues that a person on a diet consisting of 50% fruit. There are serious risks associated with the diet for diabetics, since fruit has a high sugar content. People with diabetes and insulin resistance syndrome should not go on an all-fruit diet. There are also the risks of serious nutritional deficiencies, including vitamin $B_{12}$, **calcium**, **iron**, **zinc**, omega-3 and omega-6 amino acids, and protein. There is also the risk of severe weight loss, which can lead to anorexia and other health problems.

### QUESTIONS TO ASK YOUR DOCTOR

- Do you see any health risks for me in a fruitarian diet?
- If there are health concerns, how can they be addressed within my diet guidelines?
- Have you treated other patients who were on a fruitarian diet?
- Can you recommend a dietician or nutritionist that is familiar with a fruitarian (or vegan) diet?

In 2001, a husband and wife from Surrey, England, were convicted of child cruelty in the death of their nine-year-old daughter. A pediatrician had testified in court that the infant, who died from a chest infection caused by malnutrition, was not developing properly because the mother's breast milk was nutritionally deficient. The couple ate a diet of only raw vegetables, fruits, and nuts.

## Research and general acceptance

There is little, if any, scientific research that supports fruitarianism as a healthy lifestyle, especially over the long-term, unless foods such as beans, green vegetables, **soy**, and whole grains are included in the diet. However, there is much scientific documentation on the benefits of a vegetarian diet. There is general and widespread disapproval of an all-fruit diet by the medical, scientific, fitness, and vegetarian communities. Many people experience positive results after initially going on a fruitarian diet but over time develop health problems, including emaciation, constant hunger, weakness, and fatigue.

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Walker, Vrinda. "Attitudes, Practices, and Beliefs of Individuals Consuming a Raw Foods Diet" *Vegetarian Journal* (July-August 2006): 27–29.

**ORGANIZATIONS**

American Dietetic Association. 120 South Riverside Plaza, Suite 2000, Chicago, IL 60606-6995. Telephone: (800) 877-1600. Website: http://www.eatright.org.

Calorie Restriction Society. 187 Ocean Drive, Newport, NC 28570. Telephone: (800) 929-6511. Website: http://www.calorierestriction.org.

North American Vegetarian Society. P.O. Box 72, Dolgeville, NY 13329. Telephone: (518) 568-7970. Website: http://www.navs-online.org.

Vegetarian Union of North America. P.O. Box 9710, Washington, DC 20016. Website: http://www.ivu.org/vuna.

**OTHER**

Beyond Vegetarianism. http://www.beyondveg.com

Fruitarian Foundation. http://www.fruitarian.com

The New Earth. http://www.thenewearth.org

Ken R. Wells

# G

## Gallstones

### Definition

Gallstones are solid material that forms in the gallbladder or bile ducts. They are made of cholesterol, bilirubin, and **calcium** and range in size from a grain of sand to a golf ball. A single stone may be present, or they may exist in large numbers. Gallstones are also called choleliths.

### Description

The gallbladder is a sac-like organ that lies on the right side of the abdomen underneath the liver. The liver makes bile that is then stored in the gallbladder. Bile is a yellowish-green fluid that helps digest **fats** and dissolve cholesterol. It contains bile salts, fats, proteins, cholesterol, and bilirubin. When a person eats a meal containing fat, the gallbladder contracts, and bile flows along the common bile duct, past the pancreatic duct that leads to the pancreas, and into the upper part of the small intestine (the duodenum) where it helps break down fat.

Gallstones form when some of the material in bile solidifies. At first the solid particles are small and may form a semi-solid sludge in the gallbladder. Gradually particles come together to form larger solid masses. As many as 20% of Americans have gallstones, and most do not know it. These are called asymptomatic gallstones, and they do not need treatment. Sometimes the stones are incidentally discovered during imaging tests (e.g. x rays, CT scan) being done for other purposes. Whether gallstones cause symptoms or not depends on their size and number and whether they move out of the gallbladder and block the common bile duct or the pancreatic duct.

Gallstones are categorized by their composition, not their shape or size. Cholesterol gallstones are the most common type of gallstone found in people in Western industrialized countries. In the United States, about 80% of gallstones are of this type. They are made of hardened cholesterol with small amounts of other substances. Pigment gallstones are black or dark brown stones made primarily of calcium and bilirubin. About 15–20% of gallstones are pigment stones. Primary bile duct stones are a third type of stone. These form directly in the bile duct instead of in the gallbladder and are rare.

### Demographics

Whites, Mexican Americans, and Native American are more likely to develop gallstone disease than blacks or Asians. Women are two to three times more likely than men to develop gallstones. The lifetime risk of a woman developing gallstones is 50% but only 30% for a man. This difference is thought to be related to the effect of estrogen, a female hormone, on increasing the production of cholesterol.

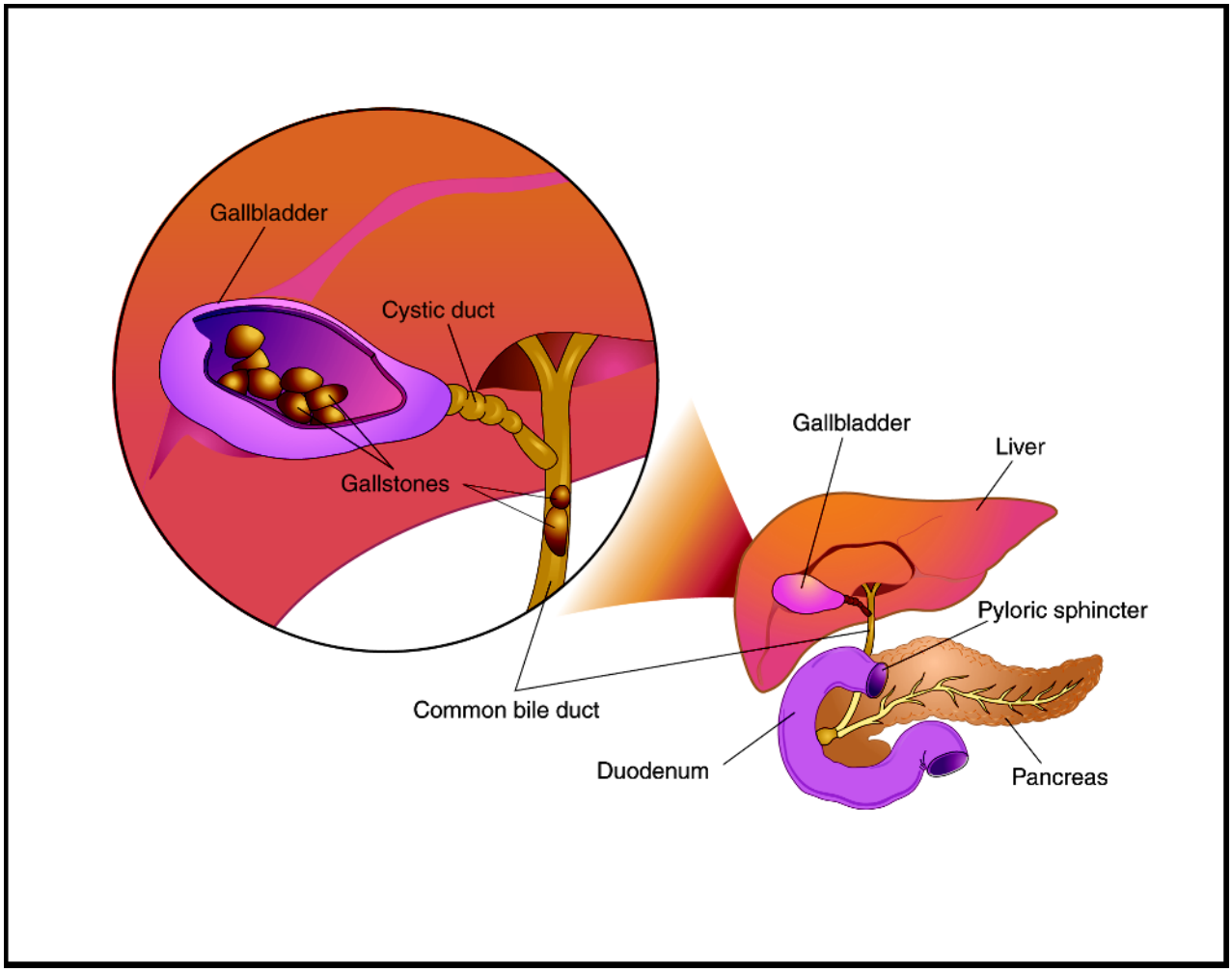
Each year 1–3% of Americans develop symptoms of gallstone disease. Gallbladder surgery is the most commonly performed abdominal surgery in the United States. About half a million gallbladder operations are done each year. Gallstones are uncommon in children, and when present are usually related to disorders orders present at birth (congenital disorders).

### Causes and symptoms

Researchers are not exactly sure why some people develop gallstones and others do not. One thought is that gallstones are more likely to develop when the gallbladder contracts infrequently or sluggishly and does not empty completely. Twin studies also suggest that heredity plays a moderate role in who develops gallstones.

What researches do know is that certain factors increase the risk of developing cholesterol gallstones. These include:

- overweight or obesity. The rate of gallstone formation increases with increasing weight. A body mass index




**Gallstones in the gallbladder and the common bile duct.** *(Illustration by Electronic Illustrators Group/Thomson Gale.)*

(BMI) of 18.5–24.9 is considered normal weight and a BMI of 25.0–29.9 is overweight. A BMI of 30 and above is obese. A woman with a BMI of 32 has about a three times greater risk of developing gallstones than a woman with a BMI of 25.

- too much cholesterol. If the liver makes too much cholesterol, it may not stay dissolved in bile, but may crystallize out and form a solid. The amount of cholesterol in bile is not related to the amount of cholesterol in blood, and lowering-lowering drugs do not affect the amount of cholesterol the liver makes.
- female gender, pregnancy, and estrogen drugs. The female hormone estrogen causes the liver to make more cholesterol. Women of reproductive age have higher levels of estrogen, which may explain why more women develop gallstones than men. In addition oral contraceptives (birth control pills) contain estrogen, and until recently, many women took drugs containing estrogen to combat hot flashes and other symptoms of menopause. Gallstone formation also increases during pregnancy, a time of increased estrogen levels.
- severe dieting. Losing weight rapidly—3 or more pounds a week— increases the likelihood of developing gallstones. About one-quarter of people who go on very low calorie diets (800 calories daily under medical supervision) and stay on them for several months develop gallstones. One-third of these people have symptoms severe enough to need gallbladder surgery. About one-third of people who have weight-loss surgery (bariatric surgery) also develop gallstones, usually in the first few months after surgery. Experts believe that somehow that triggers gallstone formation.

The chance of developing pigment gallstones is increased in individuals who have diseases such as sickle-cell anemia where there is an unusually high

## KEY TERMS

**Bile**—a greenish-yellow digestive fluid produced by the liver and stored in the gallbladder. It is released into the small intestine where it helps digest fat, and then is removed from the body in feces.

**Bilirubin**—a yellowish pigment found in bile that is produced through the normal breakdown of red blood cells

**Cholesterol**—a waxy substance made by the liver and also acquired through diet. High levels in the blood may increase the risk of cardiovascular disease.

**Pancreas**—a gland near the liver and stomach that secretes digestive fluid into the intestine and the hormone insulin into the bloodstream.

**Perforation**—a whole in the wall of an organ in the body

rate of red blood cell turnover. Bilirubin is the main component of pigment gallstones, and these diseases increase amounts of bilirubin formed in the liver.

Many people with gallstones and never have any symptoms. Symptoms tend to occur when a gallstone moves out of the gallbladder and irritates or blocks the common bile duct or the entrance to the pancreatic duct. Sometimes symptoms come and go, as when stones irritating bile duct move into the much larger small intestine.

Symptoms can include the following:

- sudden pain in the upper right part of the abdomen that lasts anywhere from 15 minutes to several hours and does not go away with changes in position.
- pain radiating up into the back or right shoulder blade
- nausea and vomiting
- fever
- jaundice, a yellowing of the skin and whites of the eyes

Pain can occur frequently or at long intervals. Jaundice and fever are signs of advanced gallstone disease and infection. Sudden intense pain, especially if accompanied by high fever, nausea, vomiting, jaundice, and dark urine are signs of a medical emergency. Medical care should be sought immediately. Untreated bile duct blockages can lead to perforation of the bile duct, infection, and death.

### Diagnosis

Diagnosis is made on the basis of a physical examination and imaging studies. Ultrasound is the least invasive and often the most effective way to locate gallstones. Other imaging studies, such as plain x rays and computed tomography (CT) scans, may also be used. These diagnostic tools may fail to located gallstones in the bile duct.

Other diagnostic tests can be used to better locate gallstones in the bile duct. A radionuclide scan, also called cholescintigraphy or HIDA scan, uses a small amount of radioactive tracer material that is injected into a vein. A machine locates the radioactive tracer as it moves through the body and in this way can tell if a stone is blocking the entrance or exit to the gallbladder or the common bile duct. Endoscopic retrograde cholangiopancreatography (ERCP) is an endoscopic procedure use to locate, and sometimes remove, gallstones from the bile and pancreatic ducts. In this procedure, a thin tube called an endoscope is passed down the throat, through the stomach, and into the first part of the small intestine. Air and dye are then injected that allows the physician to see the place where the bile duct empties into the small intestine. If stones are present, a special tool may be inserted through the endoscope to remove them.

### Treatment

By far, the most common and most successful treatment for gallstone disease is surgical removal of the gallbladder, an operation called a cholecystectomy. Removing the gallbladder has little effect on digestion. Bile simply goes directly from the liver to the small intestine instead of being stored. The difference is that the intestine receives a continuous flow of bile rather than receiving it only when it is needed. In about 1% of people, this continuous flow of bile causes mild diarrhea.

Most gallbladder surgery can be done laparoscopically. This means that surgery is done through a small cut in the abdomen instead of opening the entire abdominal cavity. A thin instrument called a laparoscope that contains a miniature video camera and a light is inserted through the cut. The surgeon uses the image from the video camera to insert small instruments through the incision and remove the gallbladder. Recovery from laparoscopic gallbladder surgery often takes only a few days.

If the gallbladder or pancreas is infected, a serious complication, or if there is scarring from previous surgeries, open gallbladder surgery is necessary. This involves making a large incision in the abdomen.

Recovery time usually involves 5–7 days in the hospital and several weeks at home.

Some people are not healthy enough to undergo surgery. In this case, treatment options include a medication called ursodiol (Actigall) that helps dissolve cholesterol stones. However, the dissolving process can take 6ndash;18 months. Sometimes this drug is given to people going on medically supervised very-low-calorie diets for fast weight loss to help prevent them from developing gallstones. The other nonsurgical treatment option is sound wave therapy (extracorporeal shock wave lithotripsy). High-frequency sound waves are aimed at the gallstones to shatter them into smaller pieces. The pieces are then dissolved using the ursodiol. With nonsurgical treatment gallstones often reoccur. When the patient is healthy enough for surgery, gallbladder removal is usually the preferred option.

### Nutrition/Dietetic concerns

Once recovery from surgery is complete, individuals who have had their gallbladder removed can return to a normal healthy diet.

### Prognosis

Gallbladder surgery is quite safe, although all surgery carries risk of infection, reaction to anesthesia, and unintentional damage to other tissue. Once the gallbladder is removed, no more gallstones can form. Most complications from gallstones arise when treatment is delayed and the pancreas or gallbladder becomes infected. This is a serious, potentially fatal, complication because infection can spread rapidly and overwhelm the body. Gallstone disease is responsible for about 10,000 deaths in the United States each year, of which only a few hundred are caused by surgical complications. The vast majority are caused by gallstone disease that has caused infection.

### Prevention

The formation of gallstones cannot be prevented. However maintaining a healthy weight, exercising regularly, and eating a diet high in whole grains and fresh fruit and vegetables and low in fat and cholesterol decrease the chance that gallstones will develop.

#### Resources


**ORGANIZATIONS**

American College of Gastroenterology. P.O. Box 342260 Bethesda, MD 20827-2260. Telephone: (301) 263-9000. Website: <http://www.acg.gi.org>

American Gastroenterological Association. 4930 Del Ray Avenue, Bethesda, MD 20814, Telephone: (301) 654-2089. Website: <:http://www.gastro.org>

Weight-control Information Network (WIN). 1 WIN Way, Bethesda, MD 20892-3665. Telephone: (877)946-4627 or (202) 828-1025. Fax: (202) 828-1028. Website: <http://win.niddk.nih.gov>

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Tish Davidson, A.M.

## Gastroesophageal reflux disease

### Definition

GERD, or gastroesophageal reflux disease, occurs when gastric juice from the stomach backs up into the bottom of the esophagus and causes irritation, inflammation or erosion of the cells lining the esophagus. GERD is sometimes called acid reflux disease.

### Description

The esophagus carries food from the mouth to the stomach. A ring of strong muscle called the lower esophageal sphincter (LES) is located at the spot where the esophagus enters the stomach. The LES relaxes and opens when a person swallows, allowing food to enter the stomach. The LES stays closed in healthy people the rest of the time, preventing the contents of the stomach from backing up into the esophagus. In people with GERD, the LES is weak and opens at inappropriate times, allowing a backwash of stomach contents into the bottom part of the esophagus.

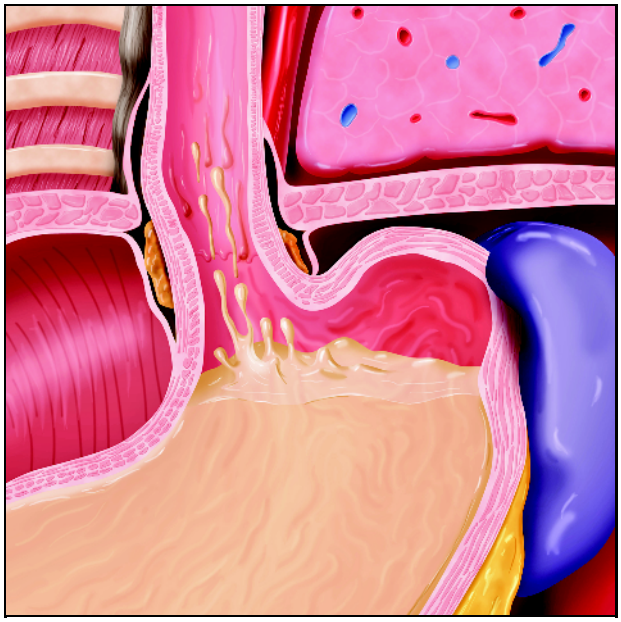

**Illustration of acidic stomach contents moving up into the esophagus.** *(Copyright Hector Aiza/Phototake. Reproduced by permission.)*

The stomach makes hydrochloric acid that is needed to digest food and help kill bacteria and other foreign organisms that are accidentally consumed with food. The cells lining the stomach secrete a thick layer of mucus that protects them from damage by stomach acid. The cells lining the esophagus do not secrete mucus, so when the LES opens and the acid mixture from the stomach come into contact with them, they become first irritated, then later inflamed, and finally eroded. The individual often feels this damage as heartburn. Heartburn is a pain or burning behind the breastbone. GERD is diagnosed when the stomach acid comes in contact with the esophagus twice or more in a week on a regular basis.

## Demographics

Acid reflux or heartburn is extremely common. About 7% of Americans, or more than 15 million people, have heartburn every day. About 60 million Americans have heartburn at least once a month, although not everyone who has heartburn has GERD, and not everyone who has GERD has heartburn. The exact number of people with GERD is difficult to determine, as many people self-treat symptoms with over-the-counter medications.

People of any race or age can develop GERD, including infants and children, but the disease is most common among people over age 50, pregnant women, and people who are overweight or obese. The condition is often overlooked in infants and children and is likely to be underdiagnosed in this group.

## Causes and symptoms

GERD is caused by stomach acid coming in contact with cells of the esophagus. The most common cause for this is weakening of the LES. Hiatal hernia is thought to increase the likelihood of developing GERD. The diaphragm is a sheet of muscle that divides the chest cavity from the abdominal cavity. With a hiatal hernia, a tear develops in the diaphragm and a portion of the stomach protrudes through the hole and up into the chest cavity. Hiatal hernias are very common, especially in people over age 50, and usually do not cause health problems or need treatment. However, the diaphragm gives support to the LES. When it is torn, this support is weakened, and the LES closes less tightly. The relationship between hiatal hernia and GERD is somewhat controversial. Many people with a hiatal hernia do not have heartburn, and some people who do not have a hiatal hernia do have heartburn.

Certain lifestyle choices increase the likelihood of developing GERD. These include:

- smoking
- alcohol consumption
- obesity
- pregnancy
- poor posture
- eating large meals shortly before bedtime

Certain foods also increase the likelihood of developing GERD. These foods include:

- greasy or fried foods
- citrus fruits or juices (e.g. orange, grapefruit)
- caffeinated beverages (e.g. coffee, colas)
- garlic and onions
- tomato-based foods (e.g. spaghetti sauce, chili)
- chocolate
- foods flavored with mint
- garlic and onions
- spicy foods
- wine, beer, and distilled spirits

## Symptoms

The most common symptom of GERD is heartburn. Heartburn is a sharp pain in the center of the chest that can spread to the neck and last for up to 2 hours. The pain can be substantial enough to be confused with angina or a heart attack. Note that if there is any question about whether the pain is caused by a

heart attack, the individual should seek medical attention immediately. Heartburn pain does not get worse with physical activity, but often worsens when bending over or lying down. As noted above, heartburn is extremely common. Almost everyone experiences it at some time, usually after eating an unusually large or spicy meal.

GERD also has less typical symptoms. Some people regurgitate or involuntarily bring up the contents of the stomach into the mouth. This causes a bitter taste, and if it occurs often enough can erode tooth enamel.

Other less typical symptoms are wheezing, shortness of breath, increased incidence of asthma, and a persistent dry cough. GERD can also cause the person's voice to sound hoarse. Hoarseness is usually worse in the morning. These symptoms are caused by contents of the stomach approaching or enter the airways.

Some people have difficulty swallowing or feel as if the food they have eaten is stuck behind their breastbone. This symptom can also be caused by a narrowing of the esophagus where it enters the stomach.

The most common symptoms of GERD in infants and children are repeated non-projectile vomiting (spitting up), persistent coughing, and wheezing.

## Diagnosis

Often GERD is tentatively diagnosed on the basis of the patient reporting heartburn twice or more a week on a regular basis. Normally the physician will suggest lifestyle changes (see treatment below), and if there is no improvement will order more extensive tests.

An upper GI series, sometimes called a barium swallow, includes x rays of the esophagus, stomach, and upper part of the intestine. Often the patient drinks a solution of barium to improve contrast on the x rays. These x rays help rule out abnormalities such as a narrowing of the esophagus (esophageal stricture) and **ulcers**.

An upper endoscopy is a diagnostic procedure that allows the physician to see the lining of the esophagus and stomach. It is performed in a doctor's office or an outpatient clinic under light sedation. A tube called an endoscope is inserted down the throat. At the end of the endoscope is a tiny camera that allows the doctor to see if there is damage to the cells lining the esophagus. During this procedure, the doctor may use also remove small tissue samples (a biopsy) from the esophagus in order to look for abnormal cells under the microscope.

Occasionally 24-hour pH monitoring is necessary. The pH scale measures the strength of acids. In this test, a tube put down the esophagus measures how much stomach acid back up into the esophagus. Monitoring usually for continues for 24 hours.

GERD is categorized according to the degree of damage to the esophagus.

- Grade I: redness and irritation of the esophagus
- Grade II: some non-adjacent spots of erosion of esophageal cells
- Grade III: increased and continuous patches of erosion
- Grade IV: Barrett's esophagus, a precancerous condition in which normal cells are replaced by abnormal ones.

## Treatment

The goals of treating GERD are to eliminate heartburn and other symptoms, heal damage to the esophagus, and prevent return of symptoms. Treatment proceeds in four stages: lifestyle changes, over-the-counter remedies, prescription drug therapy, and surgery.

Lifestyle changes are the easiest and least expensive approach to treating GERD. They bring relief to many people. Recommended lifestyle changes include:

- Quitting smoking
- If overweight, losing weight
- Stopping drinking alcoholic beverages
- Avoiding foods likely to cause heartburn
- Avoiding eating at least 3 hours before going to bed
- Elevating the head of the bed about 4 inches on blocks or using a sloped piece of foam under the mattress to raise the head 6 or more inches.

When lifestyle changes are not enough to relieve symptoms within a few weeks, the next step is to use over-the-counter medications. Antacids, such as Alka-Seltzer, Maalox, Rolaids, or Tums, reduce the acidity of liquid already in the stomach. Many antacids contain aluminum and **magnesium**. They should not be taken regularly for long periods because these **minerals** may disrupt the chemical balance in the body.

Drugs known as H2 blockers help reduce the production of acid in the stomach. H2 blockers that are available without a prescription include cimetidine (Tagamet), ranitidine (Zantac), ranitidine (Zantac), and nizatidine (Axid). Some of these are also available in higher strengths with a doctor's prescription.

H2 blockers are most effective when taken about an hour before meals. They do not affect acid already in the stomach.

Proton pump inhibitors use a different chemical mechanism to block acid production by the stomach. They are more effective than H2 blockers and are used when H2 blockers fail. Some are available in over-the-counter strengths, while others require a prescription. Common proton pump inhibitors include omeprazole (Prilosec), lansoprazole (Prevacid), rabeprazole (Aciphex), esomeprazole (Nexium), and metoclopramide (Reglan).

Surgery is the most drastic treatment for GERD. It is used when all other treatments fail and symptoms remain. The most common surgical operation to correct GERD is called fundoplication. This surgery is done laparoscopically; the entire abdomen does not need to be opened. A small slit is made in the abdomen and a camera guides the surgeon who manipulates small instruments through this slit to wrap the top of the stomach (the fundus) like a cuff around the bottom of the esophagus. This provides additional support for the LES, and is initially successful in stopping GERD about 92% of the time. Long-term success rates are variable. Laparoscopic fundoplication usually requires a hospital stay of 1–3 days and takes about 2–3 weeks for complete recovery.

In 2000, the United States Food and Drug Administration (FDA) approved two other procedures to treat chronic acid reflux. On involves putting stitches in the LES to create small pleats that make the muscle stronger. The other involves making small cuts in the LES. The scar tissue that forms when the muscle heals makes the LES stronger. There is little data on the long-term success of these procedures. More recently, the FDA has approved an implant that does not require surgery. The implant reinforces and strengthens the LES reinforces. This procedure is too new to have any data concerning long-term success.

## Nutrition/Dietetic concerns

Nutritional concerns related to GERD involve lifestyle changes designed to reduce or eliminate heartburn. These dietary changes are likely to have other beneficial health effects as well. Foods to avoid include:

- alcoholic beverages
- coffee, tea, and caffeinated soft drinks
- fatty or fired foods
- acidic foods such as citrus fruit or juice and tomato-based foods
- chocolate or foods with mint flavorings
- highly spiced foods

## Prognosis

About 80% of people get relief from GERD through lifestyle changes and medication, although relapses are common. H2-blockers successfully treat 50 to 60% of people with grade I or grade II GERD. Most people not helped by H2 blockers can be healed by 6–8 weeks of treatment with proton pump inhibitor drugs. Of the 20% of people not helped by medication, 92% improve with fundoplication surgery.

The most serious complication of GERD is Barrett's esophagus. In this disease, normal cells lining the esophagus are replaced with abnormal cells. About 30% of people with Barrett's esophagus go on to develop **cancer** of the esophagus. Those at highest risk are white men.

Other long-term complications of GERD include narrowing or scarring of the base of the esophagus, a condition called peptic stricture. This can cause difficulty swallowing. Also, people with GERD may have more ear infections and laryngitis. GERD may worsen asthma.

## Prevention

Prevention of GERD is very similar to the lifestyle changes suggested in the initial stage of treatment—stop smoking, lose weight, reduce or eliminate **alcohol consumption**, and avoid foods likely to cause heartburn.

### Resources

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American College of Gastroenterology. P.O. Box 342260 Bethesda, MD 20827-2260. Telephone: (301) 263-9000. Website: <http://www.acg.gi.org>

American Gastroenterological Association. 4930 Del Ray Avenue, Bethesda, MD 20814, Telephone: (301) 654-2089. Website: <:http://www.gastro.org>

National Digestive Diseases Information Clearinghouse (NDDIC). 2 Information Way, Bethesda, MD 20892-3570. Telephone: (800) 891-5389. Fax: (703) 738-4929. Website: <http://digestive.niddk.nih.gov>

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Tish Davidson, A.M.

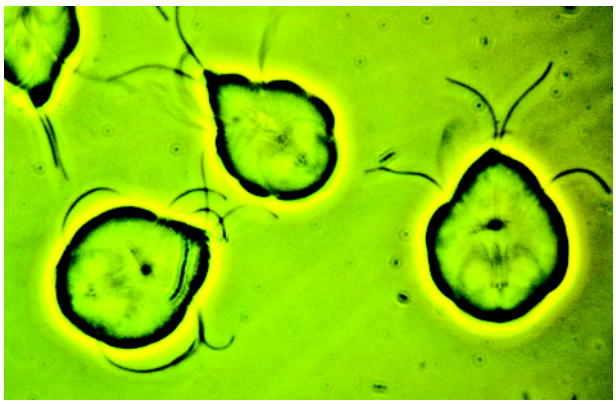
GERD *see* **Gastroesophageal reflux disease**

# Giardiasis

## Definition

Giardiasis is a communicable gastrointestinal disease characterized by acute diarrhea. It is caused by a parasite, *Giardia lamblia*, also known as *Giardia intestinalis*. Giardiasis is the most common water-borne infection of the human intestine worldwide, affecting as many as 200 million people each year. According to the Centers for Disease Control and Prevention (CDC), there were 90 major community outbreaks of giardiasis in the United States between 1964 and 1984, and 34 major outbreaks since 1985.

The organism that causes giardiasis, *G. lamblia*, is a protozoan, a single-celled organism formerly classified as a member of the animal kingdom. It is a pear-shaped parasite with four flagella, which are long whip-like extensions of the cell that allow the organism to move. It was first seen under a microscope by the Dutch lens maker Antony van Leeuwenhoek in the 17th century. *G. lamblia* was found in human stool samples in 1859 by a Czech physician named Lambl, but was not identified as the cause of giardiasis until the 1970s. It was given its present name in 1915 to honor Alfred Giard, a French biologist, as well as Dr. Lambl.



**Giardiasis is a diarrheal illness caused by a one-celled, microscopic parasite, Giardia intestinalis (also known as Giardia lamblia).** *(Dr. George Wilder/Visuals Unlimited/Getty Images. Reproduced by permission.)*

## Origins

Dietary treatment of patients with giardiasis has been a gradual process, dependent on better understanding of the causes of the disease as well as the development of nutritionally adequate rehydration solutions and anti-infective medications. A large part of dietary therapy for giardiasis, in fact, consists of measures to prevent the spread of the disease, not just to treat the symptoms after they appear.

## Description

### *Life cycle of G. lamblia*

In order to understand the symptoms, treatment, and prevention of giardiasis, it is helpful to understand the life cycle of *G. lamblia*. The parasite that causes giardiasis has a simple two-stage life cycle that does not require an intermediate host; it can be spread directly among human beings. The cycle begins when a person swallows as few as 10 to 15 cysts of *G. lamblia*. The cyst is a protective shell that the organism forms around itself that enables it to survive outside a human or animal host. The cysts of *G. lamblia* are smooth-

## KEY TERMS

**Barberry**—A shrub native to southern Europe and western Asia that produces oblong red berries that have a sour taste. Barberry has been used as a natural treatment for giardiasis.

**Beaver fever**—An informal name for giardiasis, so called because beavers are a common animal reservoir of the parasite that causes giardiasis.

**Carrier**—A person who bears or carries a disease agent in or on their body and can transmit the disease to others, but is immune to the disease or has no symptoms of it. Some people can be carriers of the organism that causes giardiasis without developing diarrhea.

**Cyst**—The protective shell formed by *G. lamblia* that keeps the organism alive after it has been expelled from the host's body.

**Endoscope**—A special tube-shaped instrument that allows a doctor to examine the interior of or perform surgery inside the stomach or intestines.

**Flatulence**—The passage of intestinal gas. Flatulence is a common symptom of giardiasis.

**Gastroenterologist**—A doctor who specializes in the diagnosis and treatment of diseases of the stomach and intestines.

**Lactose**—A sugar found in milk and milk products that requires an enzyme called lactase to digest it. Some people with giardiasis must avoid foods containing lactose for several weeks or months after they are treated for the disease because their bodies are temporarily unable to produce enough lactase to digest the milk sugar.

**Malabsorption syndrome**—A condition characterized by indigestion, bloating, diarrhea, loss of appetite, and weakness, caused by poor absorption of nutrients from food as a result of giardiasis, other bowel disorders, or certain surgical procedures involving the digestive tract.

**Protozoan**—Any member of a phylum of one-celled eukaryotes (organisms with nuclei) that are able to move but are not animals in the strict sense. The organism that causes giardiasis is a protozoan.

**Reservoir**—A term used for animals that can carry parasites that cause disease in humans without falling ill themselves. Beavers, dogs, cats, cattle, and horses are common reservoirs of *G. lamblia*.

**Steatorrhea**—The passage of large amounts of fat or grease in the stool, caused by failure to absorb it during digestion. Steatorrhea is often associated with chronic giardiasis.

**Traveler's diarrhea (TD)**—A nonspecific term for a form of diarrhea that frequently affects tourists abroad. TD is the most common illness affecting visitors to other countries. Some cases of TD are caused by *G. lamblia*, but others result from infection with various bacteria, rotaviruses, and other intestinal parasites.

**Trophozoite**—The active feeding stage in the life cycle of *G. lamblia*. It is the trophozoites that multiply within the small intestine and cause the diarrhea and other symptoms of giardiasis.

walled and oval in shape, about 8–12 micrometers long and 5–15 micrometers wide. They are hardy and can survive for several months in cold **water**. They usually enter the human body through the mouth. The cysts may be transferred to the mouth directly from unwashed hands that have touched fecal matter containing cysts, or through having oral sex with an infected person. They may also enter the mouth through eating food or swallowing liquids contaminated by fecal matter containing *G. lamblia* cysts. *G. lamblia* is not, however, transmitted through blood.

Once inside the body, the cysts pass through the digestive tract until they reach the small intestine. Each cyst then opens—often within 5 minutes after arrival—and releases two trophozoites, which are the active feeding stage of the parasite. The trophozoites multiply rapidly, reproducing every 9 to 12 hours. They may remain free within the central cavity (lumen) of the small intestine or attach themselves to the mucous tissue lining the intestine by a sucking disk located on their ventral surface. It is the trophozoites that cause the violent diarrhea, nausea, intestinal gas, and cramping associated with giardiasis. As of 2007, however, researchers do not know the exact reason for the symptoms; some think that the parasites compete with the host for nutrients, while others think that they affect the host's immune system, cause damage to the tissues lining the intestine, or block the functioning of the intestinal mucosa by their sheer numbers.

As the trophozoites are carried toward the colon, they begin to secrete proteins to form the walls of a new cyst. Within the next 24 hours, the trophozoite

completes the construction of its cyst and is shed into the outside environment through the person's feces.

### *Symptoms*

About 15% of people who swallow cysts are asymptomatic. These cases are usually detected only if the person's stool is tested during a community outbreak. They are significant, however, because persons carrying the cysts in their digestive tract, known as carriers, can still transmit giardiasis to others even if they do not develop the symptoms of the illness. It is estimated that between 30 and 60% of children in daycare centers and adults on Native American reservations are carriers of *G. lamblia*. Some domestic and wild animals can also be carriers of *G. lamblia*, dogs and beavers being the most common animal reservoirs.

Of the patients who have symptoms, 90% develop acute diarrhea within 7 to 10 days of ingesting the cysts; and 70–75% have abdominal cramps, bloating, vomiting, and flatulence (the passage of intestinal gas). A small percentage of patients develop symptoms within 3 days of swallowing the cysts, including violent diarrhea, extremely foul-smelling intestinal gas, severe vomiting, fever, and headache. Most patients lose their appetite, and 50% lose weight—an average of 10 pounds in adults. Without treatment, these symptoms can last for as long as 7 weeks or even longer.

Between 20 and 40% of adults with giardiasis develop a temporary difficulty with digesting lactose, a sugar found in milk or milk products. This condition is called lactose intolerance and may last for a month or so after treatment with anti-parasite medications for giardiasis. Having lactose intolerance does not mean that the person has become reinfected.

There is no universal pattern to recovery from giardiasis. It is rarely fatal except in severely dehydrated and malnourished children, but may develop into chronic forms—malabsorption syndrome in adults and failure to thrive in children. Chronic giardiasis in adults is characterized by episodes of diarrhea that come and go, alternating with periods of **constipation** and normal bowel movements. Other symptoms of chronic giardiasis in adults include:

- Ongoing weight loss apart from intentional weight reduction.
- Steatorrhea. Steatorrhea is the medical term for the passage of large amounts of fat or greasy-looking material in the stool.
- Discomfort in the stomach or abdomen that is worse after a meal.
- Persistent bad breath or burping that smells like sulfur.
- Ongoing bloating, flatulence, or abdominal cramping.
- Recurrent headaches.
- Malaise (general feeling of sickness), fatigue, or weakness.

The symptoms of chronic giardiasis in children include:

- Failure to grow and gain weight at a normal rate for the child's age and sex.
- Recurrent episodes of pale, frothy, foul-smelling diarrhea.
- Loss of appetite.
- Abdominal pain and vomiting.
- Nutritional deficiencies caused by the inability to absorb nutrients in food.

### *Demographics*

In the United States and other developed countries, giardiasis is most likely to affect children, particularly children in daycare centers. About 20 to 25% of the children in daycare centers are infected with giardiasis even though they may not be symptomatic. Most of the community outbreaks in the United States since the 1980s, in fact, began in daycare centers.

Older adolescents and adults are more likely to be infected with giardiasis while hiking or traveling abroad. *G. lamblia* is a common cause of so-called **traveler's diarrhea**, although it is not the only organism that causes it. Giardiasis acquired its nickname of "beaver fever" because backpackers and hikers who drink water from or swim in streams close to beaver colonies are likely to ingest *G. lamblia* cysts shed into the water by infected animals. The CDC reports that as many as 80% of water samples from lakes, streams, and ponds in the United States contain *G. lamblia* cysts.

Outbreaks of giardiasis are most likely to occur in Canada and the United States during warmer weather, particularly in summer and fall. Race does not appear to be a factor in contracting giardiasis; however, males in all age groups are about 1.2 times more likely than females to develop the disease.

### *Risk factors*

Some people are at increased risk of contracting giardiasis because of their location or lifestyle:

- Parents of infected small children.
- Employees (and their family members) of daycare centers in which some of the children are not yet toilet-trained.
- Employees (and their family members) of nursing homes or other custodial facilities.

- Male homosexuals, particularly those with several or many partners.
- People who swim in or boat on rivers, lakes, streams, or other bodies of water liable to contamination by fecal matter. The greatest risk of infection comes from accidentally swallowing a mouthful of water while swimming, diving, rafting, or water skiing.
- People who depend on well water for their household drinking supply.

Some people are at increased risk of a severe case of giardiasis because they have other health problems:

- An impaired immune system.
- Crohn's disease, cystic fibrosis, or other diseases that weaken the intestines.
- Malnutrition.
- Recent surgery on the stomach or taking medications to lower stomach acid secretion (stomach acid kills *G. lamblia*).

## Treatment

Most people with giardiasis can be diagnosed and treated by their primary care physician. Diagnosis is usually done by examining stool samples under a microscope for the characteristic cysts and trophozoites of *G. lamblia* (both forms of the organism may appear in the stool); by enzyme-linked immunosorbent assay (ELISA) tests; or by an Entero-test. The Entero-test, also called the string test, consists of a gelatin capsule containing a nylon string attached to a weight. The patient tapes one end of the string to the inside of the cheek and swallows the capsule. The string is left in place for 4 to 6 hours or overnight while the patient is fasting; it is then removed and the mucus on the string is examined for trophozoites.

Patients suspected of having chronic giardiasis may be referred to a gastroenterologist, who is a doctor with special training in digestive disorders. In some cases, the doctor may need to examine the patient's small intestine through an endoscope or remove a sample of tissue from the lining of the patient's intestine to make sure that the patient's symptoms are caused by a parasite and not by some other disorder.

### *Medications*

Giardiasis is most commonly treated with one of the following drugs, which cause the death of the disease organisms:

- Metronidazole (Flagyl). The most common drug given to treat giardiasis. Adults are usually given three doses per day over a 5-day period, while children are usually given a 10-day course.
- Furazolidone (Furoxone). Some doctors prefer to treat children with this drug because it is available in a liquid form.
- Nitazoxanide (Alinia). This drug is also preferred for treating children because it causes fewer adverse effects in younger patients.
- Tinidazole (Tindamax). Tinidazole is a relatively new anti-infective drug; it was approved by the Food and Drug Administration (FDA) only in 2004. It has the advantage of requiring only one dose of 2000 mg for treatment of giardiasis rather than several days of repeated doses.
- Paramomycin (Humatin). Paramomycin is the only drug effective against *G. lamblia* that is considered safe to give pregnant women.

Some herbalists and naturopaths recommend barberry (*Berberis vulgaris*) as an anti-infective agent in treating giardiasis.

Children or adults who are carrying cysts are sometimes given anti-infective drugs even if they are not symptomatic, in order to lower the risk of transmission to other children in a daycare center or other family members.

### *Dietary treatment*

People with mild cases of giardiasis may not need any special dietary therapy after they have started taking medications to kill the parasites.

Children and adults who have become dehydrated because of severe diarrhea may be given a rehydration drink (Lytren, Rehydralyte, or Pedialyte) to sip. Adults should drink 1 cup of water or rehydration drink for each large passage of watery stool. Children should be given 1/2 to 1 cup of rehydration fluid (or Pedialyte frozen pops) per hour, as **dehydration** is more dangerous to them than to adults. Children should not be given undiluted sports drinks, soda pop, or fruit juice, as these contain too much sugar and not enough **electrolytes**. If a commercial rehydration drink is not available and the diarrhea does not stop within 24 hours, the World Health Organization (WHO) formula for oral rehydration can be used. To make the WHO formula at home, combine 1 quart of boiled or purified water with 2 teaspoons table sugar, 1/2 teaspoon salt, and 1/2 teaspoon of baking soda (**sodium** bicarbonate).

Dietary therapy for adults recovering from giardiasis includes the following:

- Take clear liquids only (beef broth, soda, vegetable or chicken bouillon, etc.) for the first 24 hours of acute symptoms; do not try to eat solid foods.

- Begin eating mild foods without spices on the second day. These foods include plain boiled rice, dry toast, saltines, applesauce, and bananas.
- Avoid spicy foods, citrus fruits, caffeinated beverages, and alcohol until two days after the last symptoms of giardiasis have disappeared.
- Avoid milk and other dairy products for three days after the last symptoms of giardiasis.

Patients who have developed lactose intolerance as a result of giardiasis can usually treat the problem themselves by avoiding milk and dairy products for a full month (or longer) after the end of symptoms, and then add them to the diet in small amounts on a gradual basis. They may also wish to consider some alternative products such as **soy** milk, almond milk, oat milk, or rice milk, or try some of the lactose-free milk and cheese products that are now available.

## Benefits

### *Medications*

Anti-infective medications benefit the patient by killing the parasites responsible for giardiasis, thereby lowering the risk of developing chronic giardiasis and malabsorption syndrome.

### *Dietary treatment*

Dietary treatment for giardiasis benefits the patient by giving the digestive tract a rest and by replacing nutrients and electrolytes lost by acute diarrhea or vomiting.

## Precautions

### *Medications*

Patients taking anti-infective drugs should tell their doctor about any other medications they may be taking, including over-the-counter drugs, to lower the risk of drug interactions.

Pregnant women should not take any anti-infective medication for giardiasis except paramomycin, and then only if they are severely ill.

Anti-infective medications should be taken with food to lower the risk of nausea or heartburn. They should, however, *never* be taken with alcohol, as they will interact to cause severe nausea and vomiting. Alcoholic beverages should be avoided for at least 48 hours after the last dose of the medication.

### *Preventive dietary and public health measures*

The risk of contracting giardiasis can be lowered by simple dietary and personal cleanliness measures:

## QUESTIONS TO ASK YOUR DOCTOR

- What can I do to prevent giardiasis in my household?
- What precautions would you advise before a family vacation trip?

- Avoid drinking untreated or unpurified water when hiking or camping. Boil the water for at least 1 full minute or add commercial purification tablets before drinking.
- When traveling in other countries known to have high rates of giardiasis, drink only bottled water and do not eat raw fruits or vegetables or drink beverages containing ice made from untreated water. The CDC maintains a frequently updated list of travelers' advisories on its website.
- Wash hands often, particularly after using the toilet, changing diapers, helping someone else use the toilet, or before food preparation.
- Avoid swallowing water when swimming in lakes, rivers, or streams.
- Protect others by avoiding swimming pools, hot tubs, the ocean, or lakes and streams while infected with *G. lamblia*, and for at least 2 weeks after the diarrhea stops. It is possible to pass the organism in stool and contaminate water for several weeks after the symptoms have ended.
- Avoid exposure to fecal material during sexual activity.

## Risks

### *Medications*

The anti-infective drugs listed above cause some adverse effects in some patients, including nausea, constipation, headache, temporary discoloration of the urine, a metallic taste in the mouth, drowsiness, skin rashes or itching, dry mouth, or depression.

Anti-infective medications interact with such other drugs as cimetidine, praziquantel, tricyclic antidepressants, selective serotonin reuptake inhibitors (SSRIs), lithium, phenytoin, and others. They counteract the effects of some of these medications and intensify the effects of others.

### *Dietary treatment*

There are no risks associated with modifying the patient's normal diet as part of recovery from giardiasis.

No adverse effects have been reported from the use of rehydration solutions in treating patients with giardiasis.

### Research and general acceptance

Anti-infective medications for the treatment for giardiasis have been tested and used for several decades as of 2007. The WHO formula for oral rehydration has been used in developing nations since the 1960s in treating people dehydrated by diarrhea resulting from cholera, giardiasis, and other intestinal disorders.

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American College of Gastroenterology (ACG). 6400 Goldsboro Road, Suite 450, Bethesda, MD 20817. Telephone: (301) 263-9000. Website: http://www.acg.gi.org.

Centers for Disease Control and Prevention (CDC). 1600 Clifton Road, Atlanta, GA 30333. Telephone: (404) 639-3311. Website: http://www.cdc.gov/.

North American Society for Pediatric Gastroenterology, Hepatology and Nutrition (NASPGHAN). P. O. Box 6, Flourtown, PA 19031. Telephone: (215) 233-0808. Website: http://www.naspghan.org.

U. S. Food and Drug Administration (FDA). 5600 Fishers Lane, Rockville, MD 20857-0001. Telephone: (888) INFO-FDA. Website: http://www.fda.gov/.

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## Ginseng

### Definition

Ginseng refers to two closely related herbs of the genus *Panax*. Asian ginseng (*P. ginseng*) and American ginseng (*P. quinquefolius*) have traditionally been used for healing. Asian ginseng is also known as Korean red ginseng, Chinese ginseng, Japanese ginseng, ginseng radix, ninjin, sang, and ren shen. American ginseng is also known as Canadian ginseng, North American ginseng, Ontario ginseng, Wisconsin ginseng, red berry, sang, and ren shen. Siberian ginseng (*Eleutherococcus senticosus*) is a plant with different properties that belongs to a completely different genus. Ginseng in this entry refers only to Asian and American ginseng of the genus *Panax*.

### Purpose

Ginseng has been used for about 2,000 years in Traditional Chinese Medicine (TCM) to boost energy, hasten recovery from illness or injury, reduce stress, improve mental and physical performance (including sexual performance) and to treat a several dozen different infections, gastrointestinal disorders, circulatory problems, and conditions as diverse as burns, cancers, diabetes, migraine headaches, and weight loss. The genus name *Panax* means "heal all," and ginseng is considered by herbalists to be an almost universal remedy. Most of these traditional uses of ginseng have not yet been substantiated by conventional medicine, however encouraging results from some well-designed, controlled human studies strongly suggest that ginseng may improve mental performance and have other health benefits.

### Description

Ginseng is a perennial herb that grows in cool, damp, shady forests. Asian ginseng is native to

**Cultivated American gingseng.** *(JLM Visuals. Reproduced by permission.)*

Northern China and today is grown as a cash crop in China, Korea, Japan, and Russia. American ginseng once grew wild from the Appalachian Mountains to Minnesota. Today it is cultivated mainly in Wisconsin and in the Canadian provinces of Ontario and British Columbia. Most cultivated ginseng from North America is exported to Asia. In both Asia and North America, wild ginseng is threatened with extinction from over harvesting. In the United States, a government permit is usually required to export wild ginseng. High-quality wild ginseng is very expensive. Illegal harvesting of wild ginseng from public lands is an ongoing law enforcement problem for the United States Fish and Wildlife Service.

Ginseng is a slow-growing plant that reaches a height of 12–30 inches and produces red berries. Only the root used for medicinal purposes. Ginseng is difficult to cultivate. Plants must grow 4–6 years before the roots can be harvested. Ginseng roots are forked and twisted, looking somewhat like a miniature human body. They are occasionally used fresh but more often are dried and ground or powdered. The root can be soaked to make an extract or tincture. Ground ginseng can be added to tea and powered ginseng put into capsules. Ginseng extract can be added to products as diverse as chewing gum and soft drinks. Ginseng is sold under dozens of different brand names. It is often found in multi-herb remedies sold under a huge variety of names. The active ingredients of ginseng are thought to be more than twenty compounds called ginsenosides. Some manufacturers standardize the amount of ginsengosides in their product while others do not. Standardized products usually contain 4–% ginsenosides.

### *Regulation of ginseng sales*

In the United States, ginseng is regulated by the Food and Drug Administration (FDA) as a dietary supplement under the 1994 Dietary Supplement Health and Education Act (DSHEA). At the time the act was passed, legislators felt because many **dietary supplements** such as ginseng come from natural sources and have been used for hundreds of years by practitioners of complementary and alternative medicine (CAM), these supplements did not need to be regulated as rigorously as prescription and over-the-counter drugs used in conventional medicine.

The DSHEA regulates ginseng in the same way that food is regulated. Like food manufacturers, manufacturers of herbal products containing ginseng do not have to prove that they are either safe or effective before they can be sold to the public. This differs from conventional pharmaceutical drugs, which must undergo extensive human testing to prove their safety and effectiveness before they can be marketed. Also unlike conventional drugs, the label for a dietary supplement such as ginseng does not have to contain any statements about possible side effects. All herbal supplements sold in the United States must show the scientific name of the herb on the label. Consumers should look for ginseng of the *Panax* variety. Sometimes less expensive herbs such as Siberian "ginseng" are substituted for true ginseng.

### *Health claims*

Dozens of health claims are made for ginseng, many based on traditional or folk use of the herb. These claims are difficult to substantiate in ways that satisfy conventional medicine for several reasons including:

- The amount and strength of ginseng in dietary supplements is not standardized and a wide range of doses are used in different studies.
- Ginseng is often one of several herbs contained in herbal remedies, making it difficult to tell if the effects are due to ginseng or another herb.
- Many studies done on ginseng are poorly designed so that it is impossible to show a direct link between cause and effect, or they poorly reported, making analysis of the results difficult.
- Many rigorous and well-designed human studies have a small sample size.

## KEY TERMS

**Alternative medicine**—A system of healing that rejects conventional, pharmaceutical-based medicine and replaces it with the use of dietary supplements and therapies such as herbs, vitamins, minerals, massage, and cleansing diets. Alternative medicine includes well-established treatment systems such as homeopathy, Traditional Chinese Medicine, and Ayurvedic medicine, as well as more-recent, fad-driven treatments.

**Alzheimer's disease**—An incurable disease of older individuals that results in the destruction of nerve cells in the brain and causes gradual loss of mental and physical functions.

**Conventional medicine**—Mainstream or Western pharmaceutical-based medicine practiced by medical doctors, doctors of osteopathy, and other licensed health care professionals.

**Dietary supplement**—A product, such as a vitamin, mineral, herb, amino acid, or enzyme, that is intended to be consumed in addition to an individual's diet with the expectation that it will improve health.

**Traditional Chinese Medicine (TCM)**—An ancient system of medicine based on maintaining a balance in vital energy or *qi* that controls emotions, spiritual, and physical well being. Diseases and disorders result from imbalances in qi, and treatments such as massage, exercise, acupuncture, nutritional and herbal therapy is designed to restore balance and harmony to the body.

- Many studies are sponsored by ginseng growers, manufacturers, or importers who have a financial interest in obtaining positive results.

Despite these drawbacks, there is enough evidence that ginseng provides health benefits that the National Center for Complementary and Alternative Medicine (NCCAM), a government organization within the National Institutes of Health, is sponsoring clinical trials to determine safety and effectiveness ginseng as a treatment for several diseases and disorders. Individuals interested in participating in a clinical trial at no charge can find a list of open trials at <http://www.clinicaltrials.gov>.

Some health claims for ginseng appear more promising than others. There is good evidence that ginseng can cause short-term improvement in mental performance in both healthy young adults and elderly ill adults. Not enough information is available to determine if long-term gains also occur, but the results have been promising enough that ginseng is being studied in patients with Alzheimer's disease and other dementias. Along with improved mental performance, some studies have shown that ginseng improves the sense of well being and quality of life. Results of these studies are mixed, with some finding improvements and others finding no change. The situation is complicated by the fact that different studies define and measure "well being" and "quality of life" in different ways. In general, people with the worst quality of life report the most improvement.

Many claims are made that ginseng boosts the immune system, thus helping to prevent disease and promote a more rapid recovery from illness and injury. Some studies also claim that ginseng boosts the effect of antibiotics and improves the body's response to influenza vaccines. Some studies of patients with diseases that cause a low white cell count (white cells are a part of the immune system) show that white cell count increases with high doses of ginsenosides. Better studies are needed before the effect of ginseng on the immune system can be determined.

There is good evidence that ginseng lowers blood sugar in people with type 2 (non-insulin dependent) diabetes. The effect of ginseng on blood sugar in people with type 1 (insulin dependent) diabetes has not been studied enough to produce any definite findings.

Ginseng has been promoted as a preventative and/or cure for **cancer**. According the American Cancer Society in 2007, "There is no reliable scientific evidence that ginseng is effective in preventing or treating cancer in humans." However, controversial evidence from some studies done in Asia suggests the possibility that ginseng powder or extract may prevent some cancers. More and better studies are needed to clarify these results.

Some studies have reported that ginseng improves stamina and athletic performance and decreases fatigue, while other studies find no effect. There are so many other lifestyle variables in most of these studies that it is difficult to separate the effect of ginseng from other factors.

Studies of the effect of ginseng on the circulatory system are mixed. Some studies find that ginseng lowers blood pressure and in combination with other herbs prevents coronary artery disease and possibly congestive heart failure. Other studies find no effect, or that the effect is apparent only at very high, and possibly unsafe, doses. The effect of ginseng on the circulatory system continues to be investigated.

Many other health claims are made for herbal mixtures that contain ginseng. These claims are extremely difficult to evaluate because of the number of variables, including the strength of the mixture, the effects of the different herbs, and potential interactions among other herbs. Until much more is known about the chemical properties and active ingredients of common medicinal herbs, it is almost impossible to evaluate these mixtures in a way that satisfies the demands of conventional medicine.

## Precautions

Ginseng is generally safe and causes few side effects when taken at recommended doses. The generally recommended dose is 100–200 mg of standardized ginseng extract containing 4% ginsenosides once or twice daily. The safety of ginseng in children and pregnant and **breastfeeding** women has not been studied. Pregnant and breastfeeding women should be aware that some tinctures of ginseng contain high levels of alcohol. Some herbalists recommend that individuals take ginseng for 2–3 weeks and then take a break of 1–2 weeks before beginning the herb again.

Independent laboratory analyses have repeatedly found that many products labeled as ginseng contain little or none of the herb. True ginseng is expensive, and unscrupulous manufacturers often substitute low-cost herbs for ginseng. Another problem is that some ginseng products have been found to be contaminated with pesticides and other chemicals that can cause serious side effects.

## Interactions

Ginseng appears to interact with blood-thinning and anti-coagulant medicines such as warfarin (Coumadin), clopidogrel (Plavix), aspirin, and nonsteroidal anti-inflammatory drugs (e.g. Advil, Motrin). Individuals taking these drugs should not begin taking ginseng without consulting their health care provider.

Because ginseng lowers blood sugar levels, individuals who are taking insulin or other medications that also lower blood sugar, and those with type 2 diabetes, should be monitored for low blood sugar if they begin taking ginseng. Adjustments are needed in their other medications.

Ginseng may also interact with monoamine-oxidase (MAO) inhibitors used to treat certain kinds of depression and mental illness. Examples of MAOs include isocarboxazid (Marplan), phenelzine (Nardil) and tranylcypromine (Parnate). Individuals taking MAOs with ginseng may develop headache, tremors, increased anxiety, restlessness, sleeplessness, and mania.

Preliminary evidence suggests that ginseng may interact with certain blood pressure and heart medications. The herb may also interfere with the way the liver processes other drugs and herbs. Before beginning to take a supplement containing ginseng, individuals should review their current medications with their health care provider to determine any possible interactions.

## Complications

Serious side effects of ginseng are rare. The most common side effects are increased restlessness, insomnia, nausea, diarrhea, and rash. Allergic reactions are possible, but uncommon. Some of the more serious side effects reported are thought to be the result of contamiNation with pesticides, heavy metals, or other chemicals rather than a side effect caused by ginseng.

## Parental concerns

Parents should be aware that the safe dose of many herbal supplements has not been establsihed for children. Accidental overdose may occur if children are give adult herbal supplements.

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**ORGANIZATIONS**

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# Ginkgo biloba

## Definition

Ginkgo biloba is an herbal dietary supplement made from the leaves of the tree *Gingko biloba*.

**Various forms of ginko biloba.** *(Photograph by Robert J. Huffman. Field Mark Publications. Reproduced by permission.)*

## Purpose

Ginkgo biloba, sometimes called *bai guo*, has been used in Traditional Chinese Medicine (TCM) for about 5,000 years to treat memory loss, mood, nerve, circulatory and many other health problems. Ginkgo biloba often is combined with **ginseng** to boost memory, improve the quality of life, and increase a sense of well being. The effectiveness of some TCM uses of gingko, such as relieving pain caused by clogged arteries in the leg (claudication), treating Alzheimer's disease, and improving blood flow to the brain have been evaluated in well-designed studies and are generally accepted by practitioners of conventional medicine. Many other TCM uses of gingko biloba are currently being investigated.

## Description

*Gingko biloba* is the last existing member of an ancient family of trees. The fossil record shows that gingko trees existed 200 million years ago. *Gingko biloba* is native to China, Japan, and Korea. The tree was introduced to North America in the 1700s. Ginkgo trees grow to a height of 65–115 ft (20–35 m). They are extremely resistant to disease and insect damage and can live for several hundred years. Female trees produce bad-smelling fruit-like bodies the size of an apricot that contains seeds. Herbal practitioners sometimes use the seeds in treatment. The much cleaner male ginkgo is a popular tree for urban landscaping.

The fan-shaped leaves of the ginkgo are used for medicinal purposes. About twenty different compounds have been identified in ginkgo leaves, but the medically active ingredients appear to be flavenoids and terpenoids. Flavenoids are **antioxidants** that help lower the level of free radicals in the body. Terpenoids are thought

## KEY TERMS

**Alternative medicine**—A system of healing that rejects conventional, pharmaceutical-based medicine and replaces it with the use of dietary supplements and therapies such as herbs, vitamins, minerals, massage, and cleansing diets. Alternative medicine includes well-established treatment systems such as homeopathy, Traditional Chinese Medicine, and Ayurvedic medicine, as well as more-recent, fad-driven treatments.

**Alzheimer's disease**—An incurable disease of older individuals that results in the destruction of nerve cells in the brain and causes gradual loss of mental and physical functions.

**Antioxidant**—A molecule that prevents oxidation. In the body antioxidants attach to other molecules called free radicals and prevent the free radicals from causing damage to cell walls, DNA, and other parts of the cell.

**Claudication**—Tiredness and pain in the leg muscles that occur when walking and disappear with rest. The cause is inadequate supply of oxygen to the muscle usually caused by clogged blood vessels.

**Complementary medicine**—Includes many of the same treatments used in alternative medicine, but uses them to supplement conventional drug and therapy treatments, rather than to replace conventional medicine.

**Conventional medicine**—Mainstream or Western pharmaceutical-based medicine practiced by medical doctors, doctors of osteopathy, and other licensed health care professionals.

**Dietary supplement**—A product, such as a vitamin, mineral, herb, amino acid, or enzyme, that is intended to be consumed in addition to an individual's diet with the expectation that it will improve health.

**Free radical**—An unstable, highly reactive molecule that occurs naturally as a result of cellular metabolism, but can be increased by environmental toxins, ultraviolet and nuclear radiation. Free radicals damage cellular DNA and are thought to play a role in aging, cancer, and other diseases. Free radicals can be neutralized by antioxidants.

**Traditional Chinese Medicine (TCM)**—An ancient system of medicine based on maintaining a balance in vital energy or qi that controls emotions, spiritual, and physical well being. Diseases and disorders result from imbalances in qi, and treatments such as massage, exercise, acupuncture, nutritional and herbal therapy is designed to restore balance and harmony to the body.

to protect nerves from damage, reduce inflammation, and decrease blood clotting.

In the United States, *Gingko biloba* is cultivated and the leaves are harvested and dried, then often used to make a standardized extract that contains 24–25% flavenoids and 6% terpenoids. U. S. law does not require the standardization of **dietary supplements**, so consumers should read all labels carefully. Ginkgo biloba is often sold as capsules and tablets. Dry and liquid ginkgo extract is added to other herbal remedies as well as teas, energy or health bars, and similar products. An injectable form of ginkgo biloba extract that was available in Europe has been withdrawn from the market because of adverse side effects. Most well-designed studies have been done using a total of 80–240 mg of 50:1 standardized extract divided into 2 or 3 doses daily and taken by mouth.

### *Regulation of ginkgo biloba sales*

Ginkgo biloba is one of the top selling herbal remedies in the United States and is even more popular in Europe. Under the 1994 Dietary Supplement Health and Education Act (DSHEA), the sale of ginkgo biloba is regulated by the U.S. Food and Drug Administration (FDA) as a dietary supplement. At the time the act was passed, legislators felt because many dietary supplements such as ginkgo biloba come from natural sources and have been used for hundreds of years by practitioners of complementary and alternative medicine (CAM), supplements did not need to be regulated as rigorously as prescription and over-the-counter drugs used in conventional medicine.

The DSHEA regulates gingko biloba in the same way that food is regulated. Like food manufacturers, manufacturers of herbal products containing gingko biloba do not have to prove that they are either safe or effective before they can be sold to the public. This differs from conventional pharmaceutical drugs, which must undergo extensive human testing to prove their safety and effectiveness before they can be marketed. Also unlike conventional drugs, the label for a dietary supplement such as gingko biloba does not have to

contain any statements about possible side effects. All herbal supplements sold in the United States must show the scientific name of the herb on the label.

### *Health claims*

Gingko biloba is one of the most promising traditional herbs investigated by Western medicine. The National Center for Complementary and Alternative Medicine (NCCAM), a government organization within the National Institutes of Health, is sponsoring clinical trials to determine safety and effectiveness of gingko biloba as a treatment for more than a dozen diseases and disorders. Individuals interested in participating in a clinical trial at no charge can find a list of open trials at <//www.clinicaltrials.gov>.

Some health claims for gingko biloba have already been evaluated in large, well-controlled studies that satisfy the proof of safety and effectiveness demanded by conventional medicine. There is good evidence that gingko biloba can cause short-term improvement in mental function in people with Alzheimer's disease. In a well-designed study, ginkgo biloba was as effective as the prescription drug donepezil (Aricept) in slowing the development of dementia in people with mild to moderate Alzheimer's. Ginkgo biloba has also been shown to be effective in improving blood flow to the brain and in treating certain other dementias. The effect of ginkgo biloba on memory in healthy young adults and in people with age-related memory impairment is inconsistent, but strong enough to continue to study the effects of the herb in these populations.

In other rigorous studies, ginkgo biloba has improved symptoms of claudication. Claudication is leg pain that occurs during walking when insufficient oxygen reaches the leg muscles. It is usually caused by blocked arteries in the leg. Ginkgo biloba's ability to reduce blood clotting ("thin the blood") is thought to account for improving symptoms in people with claudication. However, exercise and prescription medication were more effective in reducing leg pain due to claudication than ginkgo biloba alone. Ginkgo biloba has also been used, especially in Europe, to treat Raynaud's disease. Raynaud's disease causes the extremities of the body to feel cold in response to stress or cool temperatures. During an attack of Raynaud's disease, the blood vessels to the affected area narrow and blood flow is reduced.

Several health claims for ginkgo biloba center on treating disorders of the eye, including glaucoma, age-related macular degeneration, and type 2 diabetes-related retinopathy. Ginkgo appears to increase blood flow to the eye, but additional studies need to be done to evaluate its effectiveness in helping to treat these disorders.

The terpenoids in ginkgo biloba are thought to help prevent nerve damage. Because of this, ginkgo has been suggested as a treatment for tinnitus (ringing of the ears), multiple sclerosis, cochlear deafness, and Huntingdon's disease. Results of studies so far are inconsistent, and additional research is needed to determine the usefulness of ginkgo in nerve disorders.

Some researchers have suggested that ginkgo biloba is useful in treating depression, seasonal affective disorder, premenstrual syndrome, altitude sickness, vertigo (dizziness), premenstrual syndrome (PMS), gastric **cancer**, side effects of anti-cancer drugs, and pulmonary interstitial fibrosis, as well as generally improving quality of live and sense of well being. Further studies need to be done to evaluate these health claims.

## Precautions

Ginkgo biloba seeds contain toxins that can cause vomiting, seizures, loss of consciousness, and death, especially in young children. Ginkgo biloba seeds are not safe and should be avoided.

Extracts of the leaf of *Gingko biloba* are generally safe and cause few side effects when taken at recommended doses for up to six months. People who are planning to have surgery should stop taking ginkgo biloba at least two days before their operation because of the risk of increased bleeding. The safety of gingko biloba in children and pregnant and **breastfeeding** women is still being studied.

## Interactions

Ginkgo biloba has blood-thinning properties and is likely to increase the blood-thinning and anticoagulant effects of medicines such as warfarin (Coumadin), clopidogrel (Plavix), aspirin, and nonsteroidal anti-inflammatory drugs (e.g. Advil, Motrin). Individuals taking these drugs should not begin taking ginkgo biloba without consulting their health care provider.

Ginkgo biloba may also interact with monoamine-oxidase (MAO) inhibitors used to treat certain kinds of depression and mental illness. Examples of MAOs include isocarboxazid (Marplan), phenelzine (Nardil) and tranylcypromine (Parnate). Individuals taking MAOs along with ginkgo biloba may experience increased effects from the MAO.

Some reports suggest that ginkgo biloba lowers blood sugar levels. Individuals who are taking insulin or other medications that also lower blood sugar, and those with type 2 diabetes, should consult their health care provider before starting to take ginkgo biloba.

## Complications

Serious side effects of ginkgo biloba are rare. The most common mild side effects are headache, dizziness, nausea, diarrhea, increased restlessness, and racing heart. Increased bleeding may occur. Allergic reactions to gingko are possible, but uncommon. In severe rare cases, the skin blisters and sloughs off, a condition called Stevens-Johnson syndrome. People who are allergic to sumac, mango rind, cashews, poison oak, and poison ivy are at slightly higher risk to have an allergic reaction to ginkgo biloba.

## Parental concerns

Parents should be aware that the safe dose of many herbal supplements has not been establsihed for children. Accidental overdose may occur if children are give adult herbal supplements.

### Resources

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#### ORGANIZATIONS


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# Glucosamine

## Definition

Glucosamine is a natural compound found in the human body, specifically an amino monosaccharide (a nitrogen-containing sugar). It is thought to possibly play a role in cartilage formation and repair and to perhaps have an anti-inflammatory affect within humans.

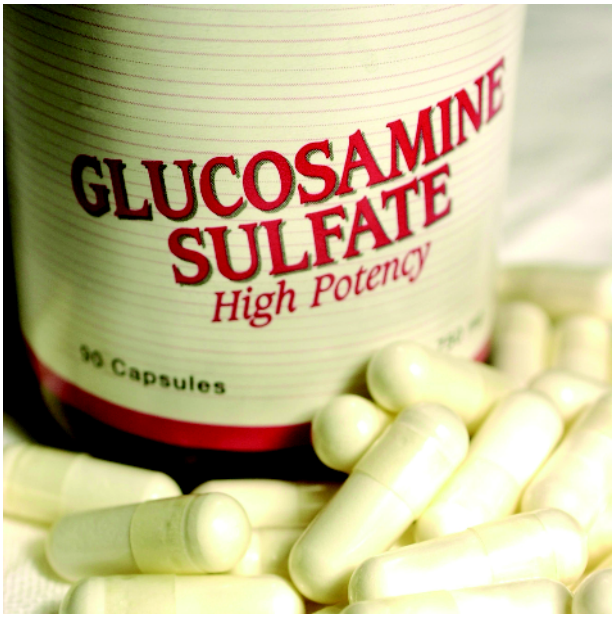
Glucosamine is also known as 2-amino-2-deoxy-glucose; 2-amino-2-deoxy-beta-D-glucopyranose; and chitosamine. The chemical symbol for glucosamine is $C_6H_{13}NO_5$. It is sold as a nutritional or dietary supplement in three forms: glucosamine hydrochloride (glucosamine HCl), glucosamine sulfate, and N-acetyl-glucosamine (NAG). Within scientific studies, there appears to be no difference between the three forms with regards to their effectiveness.

Glucosamine is found is various forms when it is sold commercially. Some of these forms include capsules (500 milligrams [mg], 550 mg, 750 mg, and 1,000 mg), liquid (500 mg per five milliliters), tablets (340 mg, 500 mg, and 1,000 mg), and powder.

## Purpose

When taken as an oral supplement, glucosamine is sometimes used in the treatment of a type of arthritis called osteoarthritis. Osteoarthritis is considered the largest and most widely occurring type of arthritis. Osteoarthritis, also called degenerative joint disease, is caused by deterioration or loss of cartilage at one or more joints of the body. The symptoms range from mild pain and stiffness to complete loss of use of the joint, and may or may not have an identifiable cause. Unlike the less common rheumatoid arthritis, osteoarthritis is not marked by inflammation. While osteoarthritis is commonly associated with overweight, cartilage deterioration can be caused by excessive wear and tear on the joints, which may be due to excessive physical exercise or exertion. People aged 60 years or older often have osteoarthritis. According to the U.S. Centers for Disease Control and Prevention (CDC), over 21 million people in the United States annually suffer with osteoarthritis.

The use of glucosamine in osteoarthritis therapy seems to be considered generally safe among medical professionals. However, it is not completely accepted within the medical community as being effective for osteoarthritis treatment. In the United States, the Food and Drug Administration (FDA) has not approved the use of glucosamine for medical use within humans. It is classified as a dietary supplement




**Glucosamine sulfate capsules.** *(© Envision/Corbis. Reproduced by permission.)*

so FDA approval is not needed as long as companies do not advertise it as a treatment for a medical condition. Instead, in the United States, glucosamine is a widely popular alternative medicine for the relief of joint pain. In Europe, however, the glucosamine-form glucosamine sulfate is approved as a medical drug.

Besides osteoarthritis, glucosamine is also used to relieve symptoms of leg pain, rheumatoid arthritis, **inflammatory bowel disease** (such as ulcerative colitis and **Crohn's disease**), and temporomandibular joint (TMJ) disorders. Scientific results show some positive evidence for the effective use of glucosamine with osteoarthritis; however, the scientific evidence is much more unclear for the other diseases.

## Description

Glucosamine is taken from animal tissue, specifically from the shells of crabs, lobsters, and shrimp. Within these shellfish, glucosamine is made naturally in the form of glucosamine-6-phosphate, which eventually makes glycosaminoglycans, among other substances. Since glucosamine-6-phosphate helps to regulate the production of joint cartilage and glycosaminoglycans are a major component of cartilage, glucosamine may help to rebuild cartilage and treat arthritis. Whether these glucosamine processes could be involved in human arthritis remains undecided in the medical community. Not all medical professional believe glucosamine is effective

## KEY TERMS

**Antihistamine**—Drugs that treat allergies.

**Autism**—Condition that causes disturbances in psychological development within children such as problems in relationships; perceiving, interpreting, and reacting to stimuli, and using language.

**Diabetes**—Medical problem that affects blood sugar levels and causes the body to produce urine in excessive amounts.

**Fetus**—Unborn offspring.

**Gastrointestinal**—Relating to the stomach and intestines.

**Sedative**—Medicines that increase drowsiness and calmness.

**Tranquilizer**—Medicines that reduce anxiety and tension.

A typical dosage of glucosamine is 1,500 milligrams per day. The two most commonly sold forms are glucosamine sulfate and glucosamine hydrochloride. Glucosamine is often sold in combination with other supplements such as chondroitin sulfate (a sulfated glycosaminoglycan composed of a chain of alternating sugars) and methylsulfonylmethane (MSM, an organic sulfur compound within the chemical class of sulfones).

When glucosamine is taken orally into the body (as a pill), according to conclusions from scientifically based animal studies, it is absorbed into the small intestine. It then travels into the liver where most of it is metabolized. Based on these studies, some of it does apparently go to cartilage; however, it is not known how much is actually transmitted to joints. It is primarily removed from the body through urine.

### Precautions

Clinical studies have consistently showed that glucosamine is safe when used as directed. However, according to the National Institutes of Health (NIH), side effects may include drowsiness, headache, upset stomach, insomnia, skin reactions, light sensitivity, and nail toughening. Rare symptoms include abdominal pain, appetite loss, vomiting, nausea, intestinal gas, heartburn, and diarrhea.

The National Institutes of Health recently sponsored a large, multi-institutional clinical trial to test the effects of chondroitin sulfate, glucosamine, and the combination of the two on knee osteoarthritis. (Chondroitin is a carbohydrate that is a component of cartilage. It is thought to help promote **water** retention and elasticity in cartilage and help prevent enzymes from destroying cartilage.) The study is the largest of its kind to date with respect to research into the two substances.

The four-year study, known as Glucosamine/chondroitin Arthritis Intervention Trial (GAIT), involved almost 1,600 participants and 16 research facilities. It was funded by the National Center for Complementary and Alternative Medicine and the National Institute of Arthritis and Musculoskeletal and Skin Diseases. The lead researcher in the study was Daniel O. Clegg from the University of Utah, School of Medicine (Salt Lake City). Five different treatments were given daily for 24 weeks: glucosamine alone (1,500 mg), chondroitin sulfate alone (1,200 mg), glucosamine and chondroitin sulfate combined (same doses), a placebo, or celecoxib (200 mg) (a FDA-approved drug for osteoarthritis pain, and branded in the United States as Celebrex®).

According to the resulting 2006 article "Glucosamine, chondroitin sulfate, and the two in combination for painful knee osteoarthritis" in the *New England Journal of Medicine*, the six-month trial found that patients taking glucosamine, chondroitin sulfate, or a combination of the two had no significant decrease in their major osteoarthritis symptoms compared to patients taking a placebo. Patients who took celecoxib had a significant decrease in the severity of their symptoms. However, glucosamine and chondroitin sulfate together seemed to help people with pain classified as moderate-to-severe. With people in the mild pain group, glucosamine and chondroitin sulfate together or alone did not provide substantial relief.

### Interactions

For the most part, glucosamine does not show any contraindications with other drugs; that is, medical studies have not shown that it is harmful to users. Scientific studies have shown that the use of glucosamine (as directed) does not produce any serious, permanent problems.

Glucosamine is derived from the shells of shellfish. People with shellfish allergies or **iodine** hypersensitivity may not want to take it. It is important to note that people with shellfish allergies are usually allergic to the skin (**protein**) of shellfish, and not to the actual shells (chitin). According to a 2004 article from the *Journal of Allergy and Clinical Immunology*, most people with shellfish allergies can safely take glucosamine. However, it is always wise to ask a

physician before taking any new medicines. According to the NIH, throat swelling may occur if glucosamine reacts negatively in people with shellfish allergies.

Glucosamine taken above the recommended dosages could decrease the effectiveness of insulin or other such drugs that control blood sugar levels in diabetes. According to the NIH, some studies show a connection while other studies do not; however, the connection has been suggested as possible by the medical community.

Reports from the NIH suggest that glucosamine may also increase the risk of bleeding especially when taking aspirin, blood thinners, anti-platelet drugs, and non-steroidal anti-inflammatory drugs. The use of glucosamine has also been possibly linked to the increase in the frequency and severity of asthma.

Since glucosamine is not approved by the FDA, its safety and formulation is determined solely by the manufacturer. Thus, quality and content may vary among manufacturers. Tests have been performed by ConsumerLab.com, a leading provider of independent tests for nutritional and health products and services. Technicians at the laboratory report that the majority of companies manufacturing glucosamine for consumer use provide at least 90% of the amount of glucosamine stated on the label.

The Arthritis Foundation recommends that, if using glucosamine, consumers should buy from established companies (because they can more easily be held accountable for their products); read the product label carefully (if need be, ask the pharmacist questions); consult with the family doctor before trying new medicines; verify the source of the medical problem before beginning glucosamine; make sure the physician is aware of any future plans to take glucosamine; and do not reduce or eliminate prescription medicines one is already taking.

If deciding to take glucosamine, try it between six to eight weeks. It generally takes this amount of time before any noticeable effects are felt. Sometimes, no effects are felt. If a reduction of symptoms is not noticed at the end of this period of time, the Arthritis Foundation states that glucosamine will probably not help.

## Complications

The use of alcohol, tranquilizers, sedatives, anti-seizure drugs, anti-anxiety drugs, muscle relaxants, and antihistamine medicines may intensify the drowsiness side effect that is possible with glucosamine. Thus, if taking glucosamine and any of these drugs together, users should be aware (and warned) that it may adversely affect one's concentration. Consumers should talk with a medical professional before taking glucosamine.

People who are overweight, have diabetes, or liver disease should check their blood sugar levels more frequently when taking glucosamine because it is an amino sugar. If taking blood-thinning medication or daily aspirin therapy, blood clotting time should be tested more frequently.

A person can overdose on glucosamine. The amount of glucosamine varies with the supplemental form. Pure glucosamine hydrochloride is at a concentration of about 83% in the glucosamine base; pure glucosamine sulfate is approximately 65%, and pure N-acetyl glucosamine is around 75%.

## Parental concerns

According to the NIH, there is no scientific evidence to show that glucosamine should be given to children. Methylsulfonylmethane (MSM), which is sometimes packaged with glucosamine, has been shown to have a relationship with autism, but whether that association is good or bad is not currently known.

Osteoarthritis does affect children. Clinical studies have not proven whether or not glocosamine—either in children or adults—should be recommended as a medical therapy for osteoarthritis. Some studies show that glucosamine can help people with mild to moderate osteoarthritis and prevent the deterioration of cartilage. However, other studies do not show these benefits. The majority of studies have been performed with glucosamine hydrochloride and glucosamine sulfate; but not with N-acetyl-glucosamine.

In any case, the effects of these glucosamine supplements on a growing child or developing baby are not yet known. For that reason, glucosamine is not recommended for, and should not be taken by, children. Because of the lack of long-term effects on a developing fetus and child, women who are pregnant and women who could become pregnant are advised by the Arthritis Foundation not to take glucosamine.

### Resources

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William Arthur Atkins

# Gluten-free diet

## Definition

A gluten-free diet is a diet that is completely free of gluten, which is a generic term for storage proteins found in grains. In **celiac disease** (also referred to as celiac sprue), persons develop an inflammatory immune system response to gluten that results in damage to the small intestine, which inhibits absorption of nutrients. Some persons also develop dermatitis herpetiformis, an itchy and blistering skin condition. Because of gluten intolerance, affected persons must completely avoid foods that contain gluten.

## Origins

Guidelines for this diet have been developed by dietitians for several organizations associated with celiac disease and dermatitis herpetiformis, including the Gluten Intolerance Group, the Celiac Sprue Association, and the Celiac Disease Foundation. The American Dietetic Association also sponsored the development of a gluten-free diet through a cooperative effort of dietitian experts in celiac disease in Canada and the United States, which was published in October, 2000.

## Description

The gluten-free diet is the prescribed medical treatment for gluten intolerance diseases, including celiac disease and dermatitis herpetiformis. Celiac disease is a genetically inherited, chronic digestive disease that results in damage to parts of the small intestine that are responsible for absorption of nutrients. Celiac disease affects almost three million people in the United States, about one percent of the population. Celiac disease is found among North American and European populations, where wheat is a staple food, but is found infrequently among descendants of China and Japan and persons with an African-Caribbean background, where wheat is not as widely consumed.

In addition, dermatitis herpetiformis is an important disorder or complication of gluten-sensitive enteropathy, which is manifested in the form of a skin rash. Approximately 10% of persons with celiac disease have dermatitis herpetiformis, but about 85% of persons with dermatitis herpetiformis also have celiac disease.

When a person with celiac disease consumes gluten, the villi of the small intestine, where absorption of key nutrients takes place, become damaged, resulting in nutrients passing through the digestive system without being absorbed. The person exhibits gastrointestinal distress and eventually malnutrition. In infancy, celiac disease manifests itself as failure to thrive, diarrhea, abdominal distention, developmental delay, and in some infants, as severe malnutrition.

After infancy, the symptoms of celiac disease are less dramatic. Older children may be short or exhibit dental enamel defects. Women comprise about 75% of newly diagnosed adult cases of celiac disease. Symptoms of celiac disease include diarrhea, **constipation** alternating with diarrhea, intestinal gas, fatty, greasy, foul-smelling stools, bloating, nausea, vomiting, skin irritation, weight loss, anemia, neurological effects (including seizures, and possibly migraine headaches), fatigue, concentration and memory problems. In some cases, there may be intestinal damage without significant gastrointestinal symptoms. Celiac disease is diagnosed by blood tests for certain antibodies and small intestine biopsy. A positive small intestine biopsy, followed by an improvement in health after following a gluten-free diet, is confirmation of celiac disease. A gluten-free diet should not be started before diagnosis is confirmed.

Some individuals may exhibit gluten intolerance, with gastrointestinal symptoms similar to those seen with celiac disease, but without its resulting intestinal damage. Gluten intolerance is diagnosed by following

**Gluten-free diet**

| Ingredients/foods to avoid | May contain gluten | Foods allowed |
|---|---|---|
| Barley | Baking powder | Amaranth |
| Bran (wheat or oat) | Beans, baked | Beans, dried, unprocessed |
| Bulgur | Bouillon cubes | Buckwheat |
| Cake meal | Candy | Cassava |
| Couscous | Cheese sauces and spreads | Cheese, aged |
| Emulsifier | Chips, potato and tortilla | Corn |
| Farina | Chocolate drinks and mixes | Eggs, unprocessed |
| Flavoring | Coffee substitutes | Fish, unprocessed |
| Flour, enriched, durum, graham, semolina | Cold cuts | Flax |
| Gluten | Communion wafers | Fruits and juices, fresh, frozen or canned |
| Hydrolyzed plant protein | Corn cakes, popped | Herbs and spices, pure |
| Kamut | Egg substitutes, dried eggs | Ketchup |
| Malt and malt flavoring | French fries | Legumes |
| Matzo meal | Fruits, dried | Meats, unprocessed |
| Oatmeal and oat bran | Fruit-flavored drinks | Milk |
| Oats, rolled | Fruit pie fillings | Millet |
| Rye | Gravy | Mustard |
| Semolina | Hot dogs and other processed meats | Nuts, unprocessed, and nut flours |
| Seitan | Matzo | Olives |
| Soy sauce or soy sauce solids | Mayonnaise | Pickles, plain |
| Soy | Milk drinks | Potatoes and sweet potatoes |
| Spelt | Nuts, dry roasted | Quinoa |
| Stablizer | Peanut butter | Rice, wild rice, Indian rice |
| Starch, modified, or modified food starch | Pudding mixes | Sago |
| Triticale | Rice, brown | Seeds, unprocessed |
| Vegetable gum | Rice crackers and cakes | Soy flour |
| Vegetable protein | Rice mixes | Soy sauce, gluten-free |
| Vinegar, malt | Salad dressings | Sorghum |
| Wheat | Sauces | Tapioca |
| Wheat berries | Seasoning mixes | Tomato paste |
| Wheat bran | Sour cream | Vegetables without gluten-containing additives |
| Wheat, cracked | Soy nuts | Vinegar, apple, cider, and distilled white |
| Wheat germ | Syrup | Yucca |
| Wheat protein and hydrolyzed wheat protein | Teas, flavored and herbal | |
| Wheat starch | Turkey, self-basting | |
| Whole wheat | Vegetables in sauces | |
| | Yogurt, flavored or frozen | |

*(Illustration by GGS Information Services/Thomson Gale.)*

a gluten-free diet, followed by reintroduction of gluten- containing foods, to evaluate health improvement associated with elimination or reduction of gluten from the diet. Some individuals with gluten intolerance maybe be able to tolerate a low-gluten diet under the supervision of a physician or dietitian.

A gluten-free diet may also be helpful for persons with multiple sclerosis and other autoimmune disorders, as well as for persons with autism spectrum disorders, Attention Deficit **Hyperactivity** Disorder (ADHD), and some behavioral problems.

The foods of concern for individuals with, or susceptible to, celiac disease are the cereal grains that contain the storage proteins prolamin and glutelin (commonly referred to as glutens in wheat), including all varieties of wheat (e.g., durum, spelt, kamut), barley (where the storage proteins are called hordiens), rye (where the storage proteins are called secalins), and their cross-bred hybrids (such as triticale).

Grains and starches that are allowed in a gluten-free diet include: rice, corn, **soy**, potato, sweet potato, tapioca, beans, garfava, sorghum, quinoa, millet, arrowroot, amaranth, tef, nut flours, and buckwheat. However, some commercial buckwheat products are mixtures of wheat and buckwheat flours and should be avoided. Other foods that are allowed (only a partial list) include fresh, canned, and frozen fruit or fruit juices, fresh vegetables, canned and frozen vegetables without gluten-containing additives, milk, aged cheese, all unprocessed meats, poultry, fish, eggs, dried beans, nuts, and seeds. A dietitian should be consulted to develop and monitor a gluten-free diet.

Gluten-free foods can be found in health food stores, through mail order sources, and in some supermarkets. Cookbooks are available to help in food preparation. Many food manufacturers maintain lists of gluten-free products. The Gluten-Free Certification Organization (GFCO) of the Gluten Intolerance

## KEY TERMS

**Antibodies**—Any of numerous protein molecules produced by the immune system as a primary immune defense to destroy or neutralize foreign objects. Each antibody recognizes a specific target, referred to as the antigen. These antigens may include foreign proteins, microorganisms, or toxins. Some antibodies attack the body's own tissues.

**Autoimmune Disease** —An illness that occurs when the body tissues are attacked by its own immune system.

**Enteropathy**—A disease of the intestinal tract

**Lymphoma**—Any of various usually malignant tumors that arise in the lymph nodes or in other lymphoid tissue.

**Osteomalacia**—Softening of bone, particularly bone weakened by demineralization (loss of mineral) and most notably by the depletion of calcium from bone. Osteomalacia may be caused by poor dietary intake or poor absorption of calcium and other minerals needed to harden bones. Osteomalacia is a characteristic feature of vitamin D deficiency in adults.

**Osteopenia**—Mild thinning of the bone mass, but not as severe as osteoporosis. Osteopenia results when the formation of bone is not enough to offset normal bone loss. Osteopenia is generally considered the first step to osteoporosis.

**Osteoporosis**—A decrease in bone mass and bone density and an increased risk and/or incidence of fracture.

**Tropical sprue**—A condition of unknown cause whereby abnormalities in the lining of the small intestine prevent the body from absorbing food normally. This disease is not associated with gluten enteropathy. It has been associated with travel and residence in tropical areas.

**Villi**—The tiny, finger-like projections on the surface of the small intestine that help absorb nutrients.

Group, in cooperation with the Food Services, Inc., a subsidiary of the Orthodox Union, a kosher certification agency, has developed a gluten-free certification program. This program benefits consumers by giving them confidence that a product is gluten-free through a process whereby products have been tested and the manufacturing site inspected. The program also saves the consumer time that would have been spent calling the manufacturer for the gluten-free status of the product. Certification is a yearly process based on ingredient review, on-site inspection and product testing. The Celiac Sprue Association (CSA) also has the CSA Recognition Seal Program that certifies gluten-free products. Requirements for obtaining the CSA Seal for products include:

- Ingredient review and verification by testing to assure products are free of wheat, barley, rye and oats
- Provision of written facility procedures and on-site facility audits to assure that procedures are in place to control any cross or outside contamination in processing and packaging

Foods may contain gluten, although gluten will not be indicated on the ingredient list, because it was not included in the formulation of the product. For example, a conveyer belt may be dusted with a gluten-containing material to prevent foods from sticking and may contaminate the finished food product.

### Function

The gluten-free diet is used by persons who are gluten-sensitive to prevent damage to their small intestines and to prevent serious complications such as gastrointestinal cancers, iron-deficiency anemia, and decreased bone mineral density.

### Benefits

A gluten-free diet has been shown to greatly reduce the risk for **cancer** and overall mortality for individuals with symptomatic celiac disease.

For many people with celiac disease, following a gluten-free diet will stop the symptoms of the disease and result in improved health, usually within several months (for some persons, recovery may take up to one year) However, the health of some people with extensive damage to their small intestines may not improve. Refractory coeliac disease (RCD) is a rare syndrome with a poor prognosis, defined by malabsorption due to gluten-related enteropathy after initial or subsequent failure of a strict gluten-free diet and after exclusion of any other disease or disorder mimicking celiac disease. Other treatments may be necessary to treat the RCD, such as the use of corticosteroids and immunosuppressant drugs, but data on their effectiveness is lacking.

## Precautions

In addition to gluten-containing grains, gluten can be found in a large variety of foods including soups, salad dressings, processed foods, candy, imitation bacon and seafood, marinades, processed luncheon meats, sauces and gravies, self-basting poultry, soy sauce or soy sauce solids, thickeners, communion wafers, and natural flavorings. Unidentified starch, binders and fillers in medications. supplements, or **vitamins** and adhesives in stamps and stickers can also be unsuspected sources of gluten. Playdough, which contains wheat, can be harmful if hands are put on or in the mouth after contact or hands are not washed after play.

An individual following a gluten-free diet must read labels every time a food item purchased or consumed. Ingredients that may contain hidden sources of gluten include unidentified starch, modified food starch, hydrolyzed vegetable or plant **protein** (HVP or HPP), texturized vegetable protein (TVP), and binders, fillers, and extenders. In addition, manufacturers can change ingredients at any time, and a product may no longer be gluten-free. Ingredients may be verified by contacting a manufacturer and specifying the ingredient and lot number of a food item. If a person cannot verify ingredients in a food product or if the ingredient list is unavailable, the food should not be eaten, to avoid damage to the small intestine that occurs every time gluten is consumed.

Gluten-free recommendations can be difficult to follow. It is recommended that an affected person keeps the diet simple at the beginning by eating fresh fruits and vegetables, milk, unprocessed protein foods such as fresh beef, pork, poultry, fish, and eggs, natural nuts, seeds, and vegetable oils without additives.

Pure, uncontaminated oats eaten in moderation (one cup cooked daily) may be safe for persons with celiac disease. However, in many cases oats can become cross-contaminated with grains containing gluten during growth, harvest, transport, storage, or processing. Some persons with celiac disease who introduce oats to their diet may experience abdominal discomfort, gas, and stool changes until they become accustomed to the increased **fiber** levels from the oats. Others with celiac disease may exhibit a hypersensitivity to oats and should avoid their consumption. Recent research published in the last few years (2000 to 2004) has indicated that oats may contain a protein similar to gluten that has caused intestinal inflammation in many persons with celiac disease. At this time, because of conflicting information on the effects of oats on persons with celiac disease, excluding oats from the diet may be the best and most risk-free choice. In all cases, persons with celiac disease should consult their health care provider or dietitian before including oats in their diet and should have their antibody levels monitored regularly.

Almost all beers are brewed with barley (some are brewed with wheat) and should not be consumed by a person following a gluten-free diet. Sorghum and buckwheat beers are available but are a specialty product. Most distilled forms of alcohol are gluten-free, unless additives and colorings have been added, which may contain glutens. Wines are also usually gluten-free.

Since celiac disease is an inherited autoimmune disease, screening of family members is recommended. The chances of developing gluten-sensitive enteropathy increases to 10 to 20% in persons who have a first-degree relative with celiac disease. Celiac disease is also associated with other autoimmune syndromes such as Type 1 diabetes.

## Risks

A gluten-free diet is difficult to follow, and continued health problems are usually associated with problems with adhering to the gluten-free diet. A person can exhibit celiac-related symptoms for months after a single gluten intake. Persons with gluten-sensitivity who do not treat their disease are at a higher risk for enteropathy-associated T-cell lymphoma and other gastrointestinal cancers. However, the maintenance of a long-term gluten-free state reduces the risk of lymphoma to the level seen in the general population. Other complications of gluten-sensitivity include decreased mineral bone density and iron-deficiency. Persons with celiac disease and dermatitis herpetiformis must maintain a gluten-free diet for the rest of their lives, for these diseases cannot be cured.

Persons are more likely to adhere to the diet if a dietitian and support group are involved. If a person is not responding well to a gluten-free diet, the doctor should:

- Investigate whether the initial diagnosis of celiac disease was correct
- Check for other conditions that can be causing symptoms, such as pancreatic insufficiency, irritable bowel syndrome, bacterial overgrowth, lymphocytic colitis, T-cell lymphoma, fructose intolerance, or tropical sprue
- Refer the person to a dietician to check for errors in the diet or for compliance with the diet

To monitor dietary adherence to the gluten-free diet, the dietitian will examine the person's dietary history and habits. Blood tests will be conducted to see is gluten antibody levels have returned to normal levels. If there is clinical concern that a person is not adhering to the gluten-free diet or that the diet is not effective, a biopsy of the small intestine may be conducted.

The gluten-free diet is complex and it cannot be assumed that chefs in restaurants or others who prepare food (including friends and family) are aware of potential sources of gluten contamination. Education of family and friends is important in accomplishing a life-style change. In restaurants simple dishes without sauces should be ordered, and the person should inquire whether grain products are prepared with the same equipment or utensils used to prepare other foods. Although a food may be considered to be gluten-free by the ingredients it contains, it may be gluten-contaminated by the way in which it is prepared or stored. Other difficulties associated with following a gluten-free diet include lifestyle changes such as avoiding travel, finding gluten-free foods, especially those of good quality, determining whether foods are gluten-free, not being invited out because of the diet, with resulting social isolation, and maintaining a gluten-free diet when in the hospital.

As with any restrictive diet, the gluten-free diet has potential for nutritional inadequacy. Persons who are sensitive to gluten are at increased risk for **osteoporosis** and osteomalacia, due to malabsorption of **calcium** and **vitamin D**. Most persons with celiac disease have some degree of osteopenia or osteoporosis. Calcium and vitamin D supplementation along with strict adherence to a gluten-free diet usually results in remineralization of the skeleton. **Iron** or other vitamin deficiencies may also be present and must be treated appropriately. The consumption of gluten-free fiber-rich foods (for example, brown rice, fruits, and vegetables) and adequate fluid intake is recommended to assist in the prevention of constipation.

Women with untreated celiac disease often exhibit a history of miscarriages, anaemia, low birth weight babies, and unfavorable outcome of pregnancy. It is suggested that testing for celiac disease be included in the battery of tests prescribed for pregnant women. Celiac disease is considerably more common than most of the diseases for which pregnant women are routinely screened. Unfavorable events associated with celiac disease may be prevented by a gluten-free diet.

## QUESTIONS TO ASK YOUR DOCTOR

- Can oats be added to my gluten-free diet? What medical tests are necessary to monitor possible adverse effects due to oat consumption?
- What foods can I eat?
- What foods must I eliminate or reduce?
- How do I prepare gluten-free foods?
- What types of on-going monitoring should I undergo?
- How do I ensure that I am getting the nutrients and vitamins that I need?
- Where can I go to join a support group to help me to adhere to the gluten-free diet?
- Should I take a nutritional supplement?
- Will I have to avoid gluten for the rest of my life?
- How often should I follow up with the doctor? With the dietitican?

### Research and general acceptance

The gluten-free diet is recognized as the required treatment for persons exhibiting gluten-sensitivity.

The National Institutes of Health noted in 2004 that the strict definition of a gluten-free diet remains controversial due to the lack of an accurate method to detect gluten in food products and the lack of scientific evidence for what constitutes a safe amount of gluten ingestion. No international agreement has yet been developed on how much gluten a person with gluten-sensitivity can tolerate. Research is on-going to better identify levels that are acceptable, and health professionals involved in the therapy of celiac disease should keep up-to-date on the latest research. As of February, 2007, the United States Food and Drug Administration is proposing to set a standard of 20 part per million as the maximum acceptable level of gluten allowed for a product to be labeled as gluten-free.

Research continues on the benefits of a gluten-free diet for persons with multiple sclerosis and other autoimmune disorders, as well as for persons with autism spectrum disorders, ADHD, and some behavioral problems.

In addition, a new enzyme that was being developed for commercial food processing has been found to break down gluten molecules quickly and almost completely. The enzyme is made from Aspergillis niger, a common fungus that is the source of other food grade

enzymes already being manufactured for human consumption. Fritz Koning of Leiden University Medical Center in the Netherlands is leading the research. He stated that if the enzyme proves itself in clinical trials to eliminate the need for a gluten-free diet, it could be mass produced at a reasonable cost.

### Resources

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Celiac Disease Foundation, 13251 Ventura Boulevard, Suite 1, Studio City, CA 91604-1838; Telephone: (818) 990-2354; Website: [www.celiac.org]

Celiac Sprue Association, P.O. Box 3170, Omaha, NE 68131-0700. Telephone: (877) 272-4272; E-mail: [celiacs@csaceliacs.org]; Website: [www.csaceliacs.org]

Gluten Intolerance Group, 31214 124th Avenue SE, Auburn, WA 98092-3667. Telephone: (253) 883-6655; Website: [www.gluten.net]

Gluten-Free Living, [glutenfreeliving.com]

The University of Maryland Center for Celiac Research. 20 Penn Street, Room S303B Baltimore, MD 21201. Clinic: University of Maryland Medical Center 22 S. Greene Street (N5W40) Baltimore, MD 21201. Telephone: (410) 328-6749 or (800) 492-5538. Website: [www.celiaccenter.org/]


Judith L. Sims

# Glycemic index diets

## Definition

Glycemic index diets rank carbohydrates based on their ability to affect blood glucose (sugar) levels. These diets generally consider foods high in carbohydrates, such as bread, sugar, and pasta, as bad and low carbohydrate foods, such as meat, fish, and dairy products, as good.

## Origins

Low-glycemic diets concepts were first developed in the 1960s and were originally designed for individuals with diabetes. At that time, the prevailing medical attitude was that a diet emphasizing well-balanced foods while paying special attention to carbohydrates (carbs) and avoiding carbohydrate-rich foods, helped to control blood sugar and insulin levels. This came after a number of medical studies linked eating foods high in carbohydrates with elevated blood glucose levels in diabetics. In the 1980s, researchers developed the glycemic index (GI).

Before 1981, carbohydrates were classified as simple or complex. Simple carbohydrates included fructose (fruit sugar), sucrose (table sugar), and lactose (milk sugar). Complex carbohydrates are also composed of sugars but the sugar molecules are strung together to form longer and more complex chains. Foods high in complex carbohydrates include vegetables, whole grains, and beans. In 1981, researchers David Jenkins and Thomas Wolever of the University of Toronto Department of Nutritional Sciences developed the glycemic index (GI) and published a study suggesting that using the glycemic index of foods was a more accurate way of classifying carbohydrates than the simple and complex system.

Since 1981, dozens of low-carb diets and diet books have come out, using the glycemic index as the primary guiding principle. Among the more popular glycemic index-inspired diets are the Sugar Busters Diet, Zone Diet, Protein Power Diet, Suzanne Somers diet, and South Beach Diet. In general, these diets are similar. Their differences are in the zeal that they limit carbohydrate intake.

In 1997, epidemiologist and nutritionist Walter Willett of the Harvard School of Public Health developed the glycemic load as a more accurate way of rating carbohydrates compared to the glycemic index. This is because the glycemic load factors in the amount of a food eaten which the glycemic index does not. The glycemic load of a particular food is determined by

**Glycemic index of common foods**

| Food item | GI (Glucose = 100) | GI (Bread = 100) | Serving size (grams or milliliters) |
|---|---|---|---|
| **Beverages** | | | |
| Coca Cola, soft drink (Atlanta, GA, USA) | 63 | 90 | 250 ml |
| Apple juice, unsweetened | 40 | 57 | 250 ml |
| Orange juice (mean of Canada, Australia, & USA) | 52 | 74 | 250 ml |
| **Breads** | | | |
| Bagel, white, frozen (Lender's Bakery, Montreal Canada) | 72 | 103 | 70 g |
| Wonder, enriched white bread | 73 | 105 | 30 g |
| Healthy Choice Hearty 7 Grain Wheat bread (Con Agra Inc., USA) | 55 | 79 | 30 g |
| **Dairy products and alternatives** | | | |
| Ice cream, regular flavor, not specified (mean of Canada, Italy, & USA) | 61 | 87 | 50 g |
| Milk, full-fat (mean of Italy, Sweden, USA, Australia, and Canada) | 27 | 38 | 250 g |
| Milk, skim (Canada) | 32 | 46 | 250 g |
| **Fruit and fruit products** | | | |
| Apples, raw (mean of Denmark, New Zealand, Canada, USA, and Italy) | 38 | 52 | 120 g |
| Banana, raw (mean of Canada, USA, Italy, Denmark, and South Africa) | 52 | 74 | 120 g |
| Grapefruit, raw (Canada) | 25 | 36 | 120 g |
| **Pasta and noodles** | | | |
| Macaroni and cheese, boxed (Kraft General Foods Canada, Inc., Don Mills, Canada) | 64 | 92 | 180 g |
| Spaghetti, white or type not specified, boiled 10–15 min (mean of Italy, Sweden, and Canada) | 44 | 64 | 180 g |
| Ravioli, durum wheat flour, meat-filled, boiled (Australia) | 39 | 56 | 180 g |
| **Vegetables** | | | |
| Green peas, frozen, boiled (mean of Canada and India) | 48 | 68 | 80 g |
| Carrots, not specified (Canada) | 92 | 131 | 80 g |
| Baked potato, without fat (mean of Canada and USA) | 85 | 121 | 150 g |

SOURCE: Adapted from Foster-Powell et al.

*(Illustration by GGS Information Services/Thomson Gale.)*

multiplying the amount of net carbohydrates in a serving by the glycemic index and dividing that number by 100. Net carbohydrates are determined by taking the amount of total carbohydrates and subtracting the amount of dietary fiber. For example, popcorn has a glycemic index of 72, which is considered high, but a serving of two cups has 10 net carbs for a glycemic load of seven, which is considered low.

## Description

Glycemic index diets vary in the specifics but most have one simple rule: people can eat as much food as they want providing the foods have a low glycemic index (GI) ranking. Most foods that are rated high on the GI contain high levels of carbohydrates. Some people with diabetes (diabetics) use the GI as a guide in selecting foods and planning meals. The GI ranks foods based on their effects on elevating blood sugar (glucose) levels. Foods with a high GI tend to increase blood glucose levels higher and faster than foods with a low GI value. The GI is not a measure of a food's calorie content or nutritional value.

### *The Glycemic Index*

The glycemic index (GI) is a ranking of carbohydrate foods individuals with diabetes use to manage their disease. This ranking is based on the rate carbohydrates affect blood glucose levels relative to glucose or white bread. Generally, the glycemic index is calculated by measuring blood glucose levels following the ingestion of a carbohydrate. This blood glucose value is compared to the blood glucose value acquired following an equal carbohydrate dose of glucose or white bread. Glucose is absorbed into the bloodstream faster than any other carbohydrate, and is thus given the value of 100. Other carbohydrates are given a number

## KEY TERMS

**Cardiovascular**—Pertaining to the heart and blood vessels.

**Endocrinologist**—A medical specialist who treats diseases of the endocrine (glands) system, including diabetes.

**Insulin**—A hormone that regulates the level of glucose (sugar) in the blood.

relative to glucose. Foods with low GI indices are released into the bloodstream at a slower rate than high GI foods.

A number of factors influence the digestion and absorption rate of food, including ripeness, particle size, the nature of the starch, the degree of processing and preparation, the commercial brand, and the characteristics of the diabetic patient, and these factors naturally affect each food's glycemic index position or rank. In addition, differences exist in the glycemic indeces of foods due to the choice of reference food, the timing of blood sampling, or the computational method used to calculate the glycemic index.

The glycemic index measures the quality rather than the quantity of carbohydrates found in food. Quality refers to how quickly blood sugar levels are raised following eating. The GI is a standard— 10+ healthy people consume a digestible carb (usually white bread), and their blood glucose rise is followed for the next two hours—that is assigned an index value of 100. Other foods are compared to the standard in order to arrive at their ratings. The higher the GI number, the faster blood sugar increases when that particular food is consumed. A high GI is considered to be 70 and greater, a medium GI is 56–69, and a low GI value id 55 or less. In general, low-carb diets recommend a glycemic load (the total GI number in foods consumed per day) of 80 or less. A high glycemic load is considered to be 120 or more.

The following is the GI for a few foods:

- Cornflakes, 83
- Grapefruit, 25
- Watermelon, 72
- Sugar, 64
- Potato chips, 56
- White bread, 70
- Sourdough bread, 54
- Macaroni, 46
- Baked red potato, 93
- French fries, 75

But the GI in not a straightforward formula when it comes to reducing blood sugar levels. Various factors affect the GI value of a specific food, such as how the food is prepared (boiled, baked, sautéed, or fried, for example) and what other foods are consumed with it.

The following recommendations help achieve a daily diet based on low glycemic index foods.

- Cornflakes, 83
- Oats, barley, and bran cereals
- Citrus fruits to slow emptying of the stomach
- A variety of vegetables, especially salad vegetables
- Wild rice instead of white rice
- Whole seed breads
- Al dente whole grain pastas rather than white potatoes
- Less sugary desserts

### Function

Glycemic index diets have two separate functions. The first is to help individuals with diabetes or insulin resistance syndrome maintain normal and steady blood glucose levels. The second is to aid in weight loss.

The objectives of management in diabetic patients are to reduce hyperglycemia, prevent hypoglycemic episodes, and reduce the risk of complications. For people with diabetes, the glycemic index is a useful tool in planning meals to achieve and maintain glycemic control. Foods with a low glycemic index release sugar gradually into the bloodstream, producing minimal fluctuations in blood glucose. High GI foods, however, are absorbed quickly into the bloodstream causing an escalation in blood glucose levels and increasing the possibility of hyperglycemia. The body compensates for the rise in blood sugar levels with an accompanying increase in insulin, which within a few hours can cause hypoglycemia. As a result, awareness of the glycemic indices of food assists in preventing large variances in blood glucose levels.

### Benefits

There is conflicting scientific research on the benefits of a low glycemic index diet for both diabetics and as a weight loss tool. Glycemic index diets may help diabetics maintain constant levels of blood glucose. By consuming more fruits and vegetables and whole grains rather than processed foods, low glycemic diets encourage higher fiber consumption.

## QUESTIONS TO ASK YOUR DOCTOR

- What dietary supplements should I consider taking while following a GI diet?
- What are the health risks of this diet?
- What other diets would you recommend I consider to help me accomplish my weight loss goals?
- Have you treated other patients who are on a glycemic index diet? If so, what has their response to the diet been?

Experts disagree regarding the use of the glycemic index in athletes' diets and in exercise performance. Insufficient evidence exists supporting the benefit of low glycemic meals prior to prolonged exercise. Nonetheless, a low GI pre-event meal may be beneficial for athletes who respond negatively to carbohydrate-rich foods prior to exercise or who cannot consume carbohydrates during competition. Athletes are advised to consume carbohydrates of moderate to high GI during prolonged exercise to maximize performance, approximately 1 gram per minute of exercise. Following exercise, moderate to high GI foods enhance glycogen storage.

### Precautions

If an individual has health concerns, a low glycemic index diet should be undertaken with the supervision of a doctor. Doctor supervision of the GI diet is not necessary when the individual is healthy and disease-free. People with diabetes should consult an endocrinologist, who may recommend discussing the diet with a diabetes dietitian.

### Risks

Eating a diet based solely on the glycemic index of foods can lead to overeating and a weight gain rather than loss. No emphasis is placed on total calorie intake or on the amount of saturated fat content. By basing one's diet on glycemic index alone, it is still possible to eat excess calories and to, therefore, gain weight.

### Research and general acceptance

There is mixed acceptance of glycemic index diets by the medical community. Some studies have shown GI diets can be effective in controlling blood sugar levels in diabetics and in helping people lose weight. Other studies have contradicted these findings. No major studies or research has shown that GI diets are harmful to a person's health. The American Diabetes Association has adopted a position that there is not enough conclusive evidence to recommend the general use of a low-GI diet for diabetics. Not all physicians and endocrinologists (medical specialists who treat disorders of the glands, including diabetes) subscribe to the association's position.

In 2006, researchers at the University of Sydney (Australia) found that low-carb, low-GI diets decreased fat mass and reduced the risk of cardiovascular disease.

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**ORGANIZATIONS**

American College of Nutrition. 300 South Duncan Ave., Suite 225, Clearwater, FL 33755. Telephone: (727) 446-6086. Website: http://www.amcollnutr.org.

American Diabetes Association. 1701 N. Beauregard St., Alexandria, VA 22311. Telephone: (800) 342-2383. Website: http://www.diabetes.org.

American Dietetic Association. 120 South Riverside Plaza, Suite 2000, Chicago, IL 60606-6995. Telephone: (800) 877-1600. Website: http://www.eatright.org.

American Society for Nutrition. 9650 Rockville Pike, Bethesda, MD 20814. Telephone: (301) 634-7050. Website: http://www.nutrition.org.

Center for Nutrition Policy and Promotion. 3101 Park Center Drive, 10th Floor, Alexandria, VA 22302-1594. Telephone: (703) 305-7600. Website: http://www.cnpp.usda.gov.

Ken R. Wells

**Gout**

**Gout risk factors**

- Family history of the disease
- Male
- Overweight
- Excessive alcohol
- Purine-rich diet
- Enzyme defect that makes it difficult for the body to break down purines
- Exposure to lead in the environment
- Organ transplant recipient
- Use of medicines such as diuretics, aspirin, cyclosporine, or levodopa
- Take niacin (vitamin)

**Signs of gout**

- Hyperuricemia
- Presence of uric acid crystals in joint fluid
- More than one attack of acute arthritis
- Arthritis that develops in a day, producing a swollen, red, and warm joint
- Attack of arthritis in only one joint, often the toe, ankle, or knee

SOURCE: National Institute of Arthritis and Musculoskeletal and Skin Diseases, National Institutes of Health, U.S. Department of Health and Human Services

*(Illustration by GGS Information Services/Thomson Gale.)*

# Gout diet

## Definition

A gout diet is a nutritional routine that includes eating foods low in purines to help reduce the occurance and severity of gout attacks. Gout is a form of arthritis with symptoms of sudden and severe pain, redness, and tenderness in joints.

## Origins

There has been an association between gout and diet for at least two thousand years. It is the oldest known type of arthritis and was described by Greek physican Hippocrates 2,500 years ago. It subsequently became known as the disease of kings due to its association with eating rich foods and **alcohol consumption**, a lifestyle only the wealthy had access to. The association between gout and the production of uric acid has been known since the 1800s. In his 1861 medical book, *Gunn's New Domestic Physician: Home Book of Health,* American physician John Gunn describes gout as, "a peculiar disease, somewhat resembling rheumatism, affecting the joints, most generally those of the foot or toes." It states the cause of gout is excess uric acid in the blood. That description is generally accurate today, although much more is know about gout, including how it develops, what causes it, and how it can be treated.

It wasn't until the 1960s that researchers developed an accurate understanding of the biochemistry of uric acid production in the human body. With this understanding came effective medical and dietetic therapy for the condition. In the 1800s, a rudimentary gout diet was developed that recommended avoidance of "rich foods" generally defined as cream and other high-fat dairy products and alcoholic beverages. In the 1960s and 1970s, as more become known about gout and uric acid production, the diet was revised and refined. It encouraged avoiding high-fat and high-protein foods, alcohol, coffee, and soft drinks, along with anchovies, asparagus, legumes, mushrooms, meat, animal organ meat such as heart and liver, and shellfish.

## Description

A gout diet is low in purines (part of what makes up DNA), especially those from red meat and seafood. Traditionally, doctors have recommended people avoid or limit eating foods high in purines. Foods that are highest in purines include sardines, mackerel, organ meats (such as brains, kidneys, and liver), scallops, mussels, goose, caviar, and yeast extract. Foods that are high in purines that can be eaten in moderation include, crab, shrimp, red meat, poultry, trout, legumes, beans, lentils, peas, asparagus, cauliflower, mushrooms, spinach, wheat germ, and bran. There are no restrictions on eating foods low in purines, including dairy products, nuts, eggs, pasta, non-whole grain breads and cereals, chocolate, and **fats** (such as butter, margarine, and cooking oils). Medical research released in 2004–2006 suggest vegetarian diets that are high in purines from vegetables and **soy** products are less likely to lead to gout than diets containing meat and seafood.

## KEY TERMS

**Atherosclerosis**—Hardening of the arteries.

**Chronic renal disease**—The permanent loss of kidney function.

**DNA**—Deoxyribonucleic acid (DNA) is a nucleic acid molecule in a twisted double strand, called a double helix, that is the major component of chromosomes. DNA carries genetic information and is the basis of life.

**Hyperuricemia**—High levels of uric acid in the blood.

**Purines**—Substances in DNA that can be metabolized into uric acid.

**Rheumatism**—A painful condition of the joints or muscles.

**Uric acid**—An acid found in urine and blood that is produced by the body's breakdown of nitrogen wastes.

By eating less meat, poultry, and seafood while taking in more low-fat or non-fat dairy products, men can cut their chances of getting gout by 50 percent, according to the results of a 12-year study of nearly 50,000 men who had no history of gout. The study is the most definitive and comprehensive research done on gout. It was conducted by rheumatologist Hyon K. Choi and other researchers at Massachusetts General Hospital in Boston. The study followed men aged 40–75 years. During the study, the men, all health care professionals, were quizzed periodically on how much of 130 foods and beverages they had eaten along with questions on weight, medications they had taken, and their medical condition. At the end of the study, 730 (about 2 percent) of the men had developed the condition.

The study found that men with the highest consumption of seafood were 51% more likely to develop gout than those who consumed the least amount of seafood. It also found that men with the highest consumption of beef, pork, and lamb had a 41% higher incidence of gout than those who ate the least amount of these meats. Men who had the highest consumption of low-fat dairy products had a 42% lower rate of developing gout compared to those who consumed the least amount of dairy products. Vegetables that are high in purines that were previously associated with an increased risk for developing gout were found to not increase the risk of getting the disease. These vegetables include peas, beans, mushrooms, cauliflower, asparagus, and spinach.

The study also looked at the role alcohol consumption plays in gout. The risk of gout increased by 30% by consuming one drink a day, compared to people who did not drink alcohol at all. Two drinks a day increased the risk to 50% and three drinks a day increased the risk by 100 percent. There were some differences in the types of alcohol consumed. Two glasses of wine a day did not increase the risk of gout at all when compared to men who drank no wine. Alcohol other than beer or wine increased the risk by 15% per serving. Beer increased the risk by 49 % per serving. Researchers are uncertain why the risk of gout varies depending on the type of alcohol consumed. Some suggest that other non-alcoholic ingredients in beer that are not found in wine or spirits may be responsible for increased risk of gout.

### *What is gout?*

Gout, also called gouty arthritis, is a painful but treatable form of arthritis that affects up to five million Americans, primarily men over the age of forty. The disease is characterized by sudden and severe pain, redness, swelling, heat, stiffness, and inflammation in one or more joints. It most commonly affects the big toe first. Subsequent attacks of gout, usually limited to a single joint at a time, can occur in the instep, ankles, heels of the feet and hands, knees, wrists, fingers, and elbows.

Gout is caused by needle-like crystals of uric acid, a substance that results from the metabolic breakdown of purines, which are found in many foods and are part of normal human tissue.. Uric acid is normally dissolved in the blood and filtered through the kidneys into the urine. If uric acid production is increased by the body or it is not sufficiently eliminated from the kidneys, it can build up in the blood., resulting in a condition called hyperuricemia (high uric acid). This can lead to gout. High amounts of uric acid can also collect in the kidneys, causing kidney stones.

### *General dietary guidelines*

People with gout should consult their doctors about developing individualized meal plans. Diets should take into account all aspects of medical nutrition therapy, especially for people with heart disease, high blood pressure, or diabetes. General **dietary guidelines** for people with gout include:

- Limit protein consumption from meat and replace it with low-fat or non-fat dairy products and soy products, such as soybeans and tofu.
- Consume dairy products low in fat rather than those high in fat.

- Since carbohydrates help increase the excretion of uric acid, carbohydrates should be about 50% of total calories consumed. To accomplish this, persons should eat six to ten servings a day of breads, pasta, cereals, and other starchy foods, and five servings of fruits and vegetables daily.
- Fat consumption should be limited to 30% of total calories consumed.
- Cholesterol intake should be limited to 300 milligrams (mg) per day.
- Maintaining a healthy body weight is essential.
- Alcohol, especially beer, should be avoided.
- It is important to stay hydrated by drinking eight to ten eight-ounce glasses of fluids, preferably water, every day.

Dietary management of gout is centered around reducing uric acid in the body and managing conditions that often occur in people with gout, including diabetes, **obesity**, high cholesterol, high blood pressure, and atherosclerosis (hardening of the arteries). A diet of foods low in purines is recommended for most people with gout, although it is not possible to completely eliminate purines from the diet. The Arthritis Foundation recommends that people with gout learn by trial and error which foods cause problems and what their personal limits of these foods are.

Laura Rall, a nutrition researcher at Tufts University in Boston, advocates the trial and error method of developing a gout diet. "Begin by eliminating foods in the high-purine category, while reducing your intake of foods in the moderate-purine category, If you don't have gout attacks after trying this, you may add more foods from the moderate category, or occasionally try a food from the high category. Using these guidelines, you may be able to determine a safe level of purine consumption and enjoy some of your favorite foods without experiencing (gout) attacks."

## Function

The function of a gout diet is to lower uric acid levels in the blood by eating less meat that is high in purines, which increase uric acid levels in the blood. Uric acid is a waste product formed as purines breakdown in the body. By reducing uric acid levels in the blood, people with gout usually experience a decrease in pain and swelling in joints afflicted with the disease. Without treatment, gout can lead to joint damage and disability. Gout is also associated with an increased risk of heart disease and kidney disease., according to the American College of Rheumatology.

## QUESTIONS TO ASK YOUR DOCTOR

- Will I need to take any vitamin, mineral, or other nutritional supplements while on a gout diet?
- How do you feel about the trial and error approach to individualizing a gout diet as recommended by the Arthritis Foundation?
- Do I have any risk factors associated with gout, such as a high body mass index, high blood pressure, or chronic renal disease?
- Can I drink wine or other alcoholic beverages while on a gout diet?
- Will being on a gout diet effect my energy level?
- Will an exercise routine enhance my gout diet?

## Benefits

The main benefit of a gout diet is a decrease in the pain, tenderness, swelling, redness, warmth, and inflammation of joints associated with the condition, and prevention of joint damage and disability. It also improves the quality of life in gout sufferers by helping prevent repeat attacks.

## Precautions

The gout diet is designed for people who have gout or who may be prone to developing gout since it can be genetically inherited. People who do not have gout or have no predisposition to the condition do not need to be on the diet. There are no precautions associated with the diet. However, since the diet recommends a severe curtailment or elimination of meat and seafood from the diet, people on or planning to go on the diet should consult a dietician in addition to their physician or rheumatologist. People who eliminate meat and seafood from their diets should make sure they are getting adequate **protein** and other nutrients found in meat. This may include adding vitamin, mineral, and other nutritional supplements to the diet, similar to those taken by non-vegan vegetarians. These may include **iron**, **calcium**, **zinc**, **vitamin D**, **riboflavin**, vitamin B-12, **vitamin A**, **iodine**, and Omega-3 and Omega-6 amino acids derived from non-fish sources, such as **flaxseed** oil, evening primrose oil, and borage oil.

## Risks

There are no known risks associated with a gout diet.

## Research and general acceptance

There is general acceptance among health care professionals of the low-purine diet for people with gout or those who have a family history of the disease.

Diets that are high in purines and high in proteins had long been thought to cause an increased risk of gout. For that reason, a gout diet was more about what foods to avoid rather than what foods to eat. However, in the March 11, 2004 issue of *The New England Journal of Medicine,* gout researcher Hyon Choi reported on the results of a 12-year study of nearly 50,000 men comparing those who got gout with those who didn't. It confirmed conventional medical opinion that eating meat, especially red meat, significantly increased the risk of gout and that eating seafood carried the greatest risk for getting gout. However, the study disproved previously held assumptions that gout was also associated with eating vegetables high in purines, such as asparagus, having a high **body mass index**, or eating high-protein foods. The study also found that consuming beer poses a greater risk for gout that drinking wine or other types of alcohol.

A 2004 study by the Arthritis Foundation concluded that drinking alcohol and eating any food high in purines increases the risk of repeat gout attack. The study was conducted by Dr. Yuqing Zhand, professor of medicine and public health at Boston University School of Medicine and was reported at the American College of Rheumatology Annual Scientific Meeting on Oct. 17, 2004 in San Antonio.

Statistics show that African American men have twice the risk of getting gout compared to Caucasian men, according to the Arthritis Foundation.

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#### ORGANIZATIONS


American College of Rheumatology. 1800 Century Place, Suite 250, Atlanta, GA 30345-4300. Telephone: (404) 633-3777. Website: http://www.rheumatology.org.

American Dietetic Association. 120 South Riverside Plaza, Suite 2000, Chicago, IL 60606-6995. Telephone: (800) 877-1600. Website: http://www.eatright.org.

Arthritis Foundation. P.O. Box 7669, Atlanta, GA 30357-0669. Telephone: (800) 568-4045. Website: http://www.arthritis.org.

National Institute of Arthritis and Musculoskeletal and Skin Diseases, National Institutes of Health, Building 31, Room 4C02, 31 Center Drive, MSC 2350, Bethesda, MD 20892-2350. Telephone: (301) 496-8190. Website: http://www.niams.nih.gov.

The Arthritis Society. 393 University Ave., Suite 1700, Toronto, ON M5G 1E6, Canada. Telephone: (416) 979-7228. Website: http://www.arthritis.ca.


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# Grapefruit diet

## Definition

There are several diets or approaches to dieting that have been referred to as the "grapefruit diet." The first two are **fad diets** that have been circulating via chain letters, photocopies, faxes, and e-mail since the 1930s. The third form might be better described as the regular use of grapefruit or grapefruit juice as part of a general approach to weight reduction. It received considerable attention following the 2004 publication of a study conducted at the Scripps Clinic in California.

## Origins

According to the American Dietetic Association, the fad type of grapefruit diet began in the 1930s, when it was also known as the **Hollywood diet**. There were two regimens, a 7-day and a 21-day version, both of which were very low-calorie diets or VLCDs. The dieter consumed little except black coffee and half a grapefruit at each meal, with small amounts of salad and lean meat. This Depression-era version of the "Hollywood diet" was quite different from the Hollywood diet offered online as of 2007, which amounts to a 24- or 48-hour juice fast intended to detoxify the dieter's body as well as promote rapid weight loss.

In the 1940s, the VLCD grapefruit diet reappeared under the name of the Mayo Clinic Diet—a name that has also been attached to several other so-called mono diets, one based on eggs and the other on meat. The Mayo Clinic has issued a disclaimer regarding the use of its name in connection with the grapefruit diet as well as other fad diets that have used the clinic's name. It is also possible that the VLCD form of the grapefruit diet may have influenced Herman Tarnower's first version of the **Scarsdale diet** in the 1960s. The original mimeographed diet sheet that the doctor gave his overweight cardiology patients specified 18 servings of grapefruit—14 at breakfast and 4 for dessert in the evenings—over the two-week period of the diet, and some of his patients referred to the Scarsdale diet informally as a grapefruit diet.

The VLCD grapefruit diet has also been recommended since the 1970s as a detoxification diet. Some writers recommend taking apple cider vinegar along with the grapefruit in order to "flush the system of impurities." The fact that the **fiber** in grapefruit speeds up the passage of foods through the intestine and eases **constipation** is another reason why some advocates of **detoxification diets** design their regimens around grapefruit.

The high-protein version of the grapefruit diet began to circulate at some point during the 1970s and has reappeared at various intervals since then. It is the variation most commonly found on Internet sites that post fad diets. Some forms of this diet claim that it works because grapefruit supposedly contains special "fat-burning" enzymes.

The term grapefruit diet has also been used by journalists since 2004 to refer to the findings of a 12-week research study conducted at the Scripps Clinic in California in 2003. The term diet is a bit of a misnomer, because the study was designed to measure the effectiveness of grapefruit and grapefruit products in treating insulin resistance as well as lowering weight in 91 overweight subjects who were not otherwise trying to diet. The study received considerable publicity and revived interest in incorporating grapefruit into nutritionally sound weight reduction diets. Its use of grapefruit in capsule form as well as fresh grapefruit, however, also prompted the development of several new lines of over-the-counter "miracle diet aids."

## Description

### *Very low-calorie grapefruit diet plan*

The basic menu plan is the same for each day of the week:

- Breakfast: 1/2 grapefruit + 2 slices of bacon + 2 boiled eggs + black coffee (no sugar) or unsweetened tea.
- Lunch: 1/2 grapefruit + 1 cup of salad with low-calorie dressing + 8 ounces of lean chicken or water-packed tuna fish + black coffee (no sugar) or unsweetened tea.
- Dinner: 1/2 grapefruit + as much salad with low-calorie dressing as desired + 8 ounces of lean chicken, lean beef, or fish + black coffee (no sugar) or unsweetened tea
- No snacks are allowed, and the only seasonings permitted for the meat or fish are herbs; no soy sauce, mustard, catsup, or other condiments are allowed.

The dieter is supposed to follow this diet for 12 days, then take two days off, and repeat the two-week cycle indefinitely.

### *High-protein grapefruit diet plan*

This version of the grapefruit diet has been described as "just plain weird" because it comes with a curious set of rules as well as lists of foods that the dieter may or may not have. It also promises a weight loss of 52 pounds over 2-1/2 months.

"The Rules":

- You must drink eight 8-ounce glasses of water every day (64 ounces total).
- At any meal you may eat until you are full.
- You must eat the minimum of each food listed at each meal.
- You cannot eliminate any item from the diet, especially the bacon at breakfast and the salads. You MUST eat the bacon and the salads. These combinations of food burn the fat; omitting one part of the combination will cause the whole thing not to work.

## KEY TERMS

**Cytochromes**—Complex proteins within cell membranes that carry out electron transport. Grapefruit juice interferes with the functioning of an enzyme belonging to the cytochrome P-450 group.

**Glycemic index (GI)**—A system devised at the University of Toronto in 1981 that ranks carbohydrates in individual foods on a gram-for-gram basis in regard to their effect on blood glucose levels in the first two hours after a meal. There are two commonly used GIs, one based on pure glucose as the reference standard and the other based on white bread.

**Insulin resistance**—A condition in which normal amounts of insulin in a person's blood are not adequate to produce an insulin response from fat, muscle, and liver cells. Insulin resistance is often a precursor of type 2 (adult-onset) diabetes.

**Lycopene**—A plant pigment that appears red in natural light and is responsible for the red color of tomatoes. Grapefruit is rich in lycopene, which is a powerful antioxidant and is thought to retard skin aging and may help to protect against chronic diseases such as heart disease and cancer.

**Metabolic syndrome**—A group of risk factors related to insulin resistance and associated with an increased risk of heart disease. Patients with any three of the following five factors are defined as having metabolic syndrome: waist circumference over 102 cm (41 in) for men and 88 cm (34.6 in) for women; high triglyceride levels in the blood; low levels of HDL cholesterol; high blood pressure or the use of blood pressure medications; and impaired levels of fasting blood glucose (higher than 110 mg/dL).

**Mono diet**—A type of detoxification diet based on the use of only one food or beverage. Some versions of the grapefruit diet are essentially mono diets.

**Pectin**—A water-soluble heterosaccharide (complex molecule composed of a sugar molecule and a non-sugar component) found in the cell walls of higher plants. It is used primarily as a gelling agent in making jams and jellies, but can also be taken by mouth as a form of plant fiber to relieve constipation.

**Placebo**—An inert or medically inactive substance, often formulated to look like a pill or capsule, administered to subjects as part of clinical research trials to determine the effectiveness of a drug or treatment. Placebo comes from the Latin and means "I shall please," because the name was first given to sugar pills dispensed by some doctors to satisfy some patients' demands for drugs they didn't need.

**Pomelo**—A large pear-shaped citrus fruit with a thick rind that was crossed with the sweet orange in the West Indies to produce the modern grapefruit.

**Very low-calorie diet (VLCD)**—A term used by nutritionists to classify weight-reduction diets that allow around 800 or fewer calories a day. Some versions of the grapefruit diet are VLCDs.

- The grapefruit or fruit juice is important because it acts as a catalyst that starts the burning process. Don't add to or reduce the amount of grapefruit or juice.
- Cut down on coffee because it affects the insulin balance that hinders the burning process. Try to limit yourself to 1 cup of coffee at meal time.
- Don't eat between meals. If you eat the suggested foods, you will not get hungry.
- You can fry food in butter and use generous amounts of butter on the vegetables.
- Do not eat desserts, bread, or white vegetables or sweet potatoes.
- You may have double or triple helpings of meat, salad, or vegetables.
- Eat until you are stuffed. The more you eat, the more weight you will lose.
- Stay on the diet 12 days, then stop the diet for 2 days and repeat.

The daily diet plan:

- Breakfast: Either 1/2 grapefruit or 8 ounces of unsweetened fruit juice (any fruit) + 2 eggs any style + 2 slices of bacon.
- Lunch: Either 1/2 grapefruit or 8 ounces of unsweetened fruit juice (any fruit) + salad with any dressing + meat any style and any amount.
- Dinner: Either 1/2 grapefruit or 8 ounces of unsweetened fruit juice (any fruit) + salad with any dressing or a red or green vegetable cooked in butter or spices + meat or fish any style cooked any way + coffee or tea (1 cup).
- Bedtime snack: 8 ounces of tomato juice or skim milk.

Foods the dieter may eat: red onions, bell peppers, broccoli, radishes, cucumbers, carrots, green onions,

leaf spinach, cabbage, tomatoes, green beans, lettuce, chili (no beans), mayonnaise, any cheese, hot dogs, cole slaw, salad dressing, dried nuts, dill pickles.

Foods the dieter may *not* eat: white onions, potatoes, celery, peas, cereal, corn, starchy vegetables, potato chips, peanut butter, pasta, corn chips, jelly or jam, sweet pickles, pretzels, fruit, low-fat or diet salad dressings.

#### *2004 grapefruit research diet*

The 91 subjects in this 12-week study were randomly assigned to four groups: one group received a placebo capsule plus 7 ounces of apple juice before each meal, the second group received grapefruit capsules plus 7 ounces of apple juice, the third group received 8 ounces of grapefruit juice plus a placebo capsule, and the fourth group received 1/2 of a fresh grapefruit plus a placebo capsule. At the end of the 12 weeks, the subjects in the three groups that had received some form of grapefruit had lost significantly greater amounts of weight than those in the group that had received only the placebo, with those who received the fresh grapefruit losing the most weight. The patients were not asked to make any other changes in their food intake, but they were required to take 30-minute walks three times a week.

#### *Grapefruit diet capsules*

As of 2007 there are two types of grapefruit pills or capsules sold over the Internet, both claiming to help people lose weight. The "grapefruit pectin diet tablets" are said to "help release fat deposits" that the dieter already carries on the stomach and hips. "They can also prevent new fat from penetrating the cells by redirecting it to the muscles where it is burned off, thereby eliminating fat deposits." The pills contain 200 mg of grapefruit pectin, plus cellulose and fiber. Given the high fiber content of these pills, it is most likely that they simply speed up the dieter's digestion and elimination.

The Grapefruit Solution Natural Diet, based on a book published in 2004, makes use of capsules that contain "pure, organic whole grapefruit. . . . Five years of study and research has gone into developing and perfecting the technique of taking whole grapefruit and converting it into concentrated power while retaining all the benefits of the entire grapefruit." In addition to the capsules, however, this diet does emphasize the importance of exercise as well as a balanced diet of complex **carbohydrates** and **protein** foods.

## Function

The fad versions of the grapefruit diet are intended for rapid weight loss. They are usually recommended as a good way to lose weight after holiday-related overeating or to fit into a special outfit for an important occasion. Several of the versions available on the Internet, however, claim that the grapefruit diet can be used for weight maintenance or for long-term nutrition on a twelve-days-on, two-days-off schedule.

The 2004 research version of the diet is intended to assess the effectiveness of grapefruit in counteracting metabolic syndrome (a group of risk factors for heart disease related to insulin resistance) as well as its usefulness in weight reduction diets. Preliminary results indicate that regular inclusion of grapefruit in the diet is effective in helping patients lose weight at a moderate rate and in improving their response to insulin.

## Benefits

The fad versions of the grapefruit diet should be avoided in spite of their promises of rapid weight loss. The VLCD version does not allow enough calories to supply the daily energy needs of even a moderately active adult and is nutritionally unbalanced. The high-protein version is highly unlikely to help anyone lose weight, since its allowance of "meat any style and any amount" and "double or triple helpings" of meat and vegetables could easily encourage overeating.

Using grapefruit as an adjunct to a balanced weight-reduction diet by eating half a grapefruit before meals, however, appears to be helpful in reducing hunger **cravings**. It also contributes fiber and **vitamins** to the dieter's daily intake.

## Precautions

#### *General precautions*

A general precaution for anyone seeking to lose weight is to consult a physician before trying any specific diet. This precaution is particularly important for adolescents, women who are pregnant or nursing, people with kidney or liver disorders, people with **eating disorders**, anyone who has had recent surgery, and anyone who needs to lose more than 30 pounds.

#### *Drug interactions*

Grapefruit contains certain compounds that interact with various types of medications in the digestive tract (it does not, however, affect drugs taken by injection). Although apple juice and orange juice may also interact with some prescription drugs, grapefruit contains three compounds known as naringin, bergamottin,

and dihydroxybergamottin, which inhibit a family of enzymes in the intestine known as the cytochrome P450 system—in particular an enzyme called CYP3A4. CYP3A4 metabolizes many drugs; when it is inhibited by grapefruit juice, it increases the potency of a medicine by allowing more of it to enter the bloodstream. This effect of grapefruit juice was first discovered in 1989 by a group of researchers in Ontario who were studying the effects of alcohol on a blood pressure drug called Plendil. The scientists needed a liquid that would hide the taste of alcohol from their test subjects, and used grapefruit juice to do so. They were surprised to discover that the blood levels of the blood pressure drug went up in the subjects who received grapefruit juice alone as well as those who received a mixture of grapefruit juice and alcohol. Most interactions between grapefruit juice and prescription drugs do not have serious consequences, but others are potentially fatal.

Here is a list of families of medications known to interact with grapefruit juice. Readers should consult their doctor or a pharmacist if they are taking a specific medication that belongs to any of these groups:

- Calcium channel antagonists (given to treat high blood pressure).
- Immunosuppressants (given to control autoimmune diseases).
- Statins (given to reduce blood cholesterol levels).
- HIV protease inhibitors (given to treat HIV infection).
- Antihistamines (given to treat seasonal allergies).
- Antiarrhythmics (given to control irregular heartbeat).
- Sedatives, sleep medications, and benzodiazepine tranquilizers.
- Birth control pills.
- Selective serotonin reuptake inhibitors (given to treat depression).
- Drugs given for male impotence.
- Some anti-migraine drugs.

In addition, people who are using herbal teas, other Western herbal preparations, or herbal compounds associated with Ayurveda or traditional Chinese medicine should consult their doctor or a pharmacist before beginning a grapefruit diet, as the chemicals in herbs can interact with grapefruit as well as with prescription medications.

## Risks

The risks of using the fad versions of the grapefruit diet include nutritional imbalance (for both versions) and weight gain (for the high-protein version). The researcher who designed and conducted the Scripps Clinic trial has specifically warned people against the fad grapefruit diets, saying that both are unhealthy.

The risk of a severe interaction between grapefruit and prescription drugs can be minimized by checking with a physician or pharmacist before adding large amounts of grapefruit or grapefruit juice to the diet.

### QUESTIONS TO ASK YOUR DOCTOR

- Are any of my prescription medications known to interact with grapefruit?
- What is your opinion of the Scripps Clinic study?
- Are there any health risks that you know of related to adding grapefruit to a well-balanced weight reduction diet?

## Research and general acceptance

### *Basic nutritional information about grapefruit*

Unlike some other fruits, such as apples, grapes, and lemons, that have figured in mono diets, grapefruit is a relatively new addition to the human table. It was not known to the ancient world and was first encountered by Europeans in the 1750s on the island of Barbados in the West Indies. Grapefruit (*Citrus paradisi*) developed as a hybrid of the pomelo (*Citrus maxima*), a large citrus fruit with a sour taste, and the sweet orange (*Citrus sinensis*). It is not known whether the hybridization occurred spontaneously in the citrus groves on the island or was carried out by native fruit growers.

The grapefruit was originally called the *shattuck* or *shaddock* until the 1820s. The name came from a Captain Shaddock, a 17th-century Englishman who had brought the first pomelo seeds to Barbados in 1693. In 1823 the new hybrid was brought to Florida by a Frenchman named Odette Philippe; it was first cultivated only as an ornamental plant. By the 1880s, however, grapefruit were being shipped from Florida to New York and Philadelphia. It was not until the 1940s that improved methods of packaging and faster transportation made grapefruit a household favorite in the Northeast as well as in Florida and the Southwest. As of 2007, the United States produces 41% of the world's grapefruit.

According to the U.S. Department of Agriculture (USDA), half a standard grapefruit (4 inches in diameter) weighs 128 grams, 116 of which are **water**. It contains 41 calories, 10.3 grams of carbohydrates (1.4 grams of fiber and 8.93 grams of fruit sugars),

0.81 grams of protein, and less than 0.13 grams of total fat. Grapefruit are rich in **vitamin C** (44 mg), **vitamin A** (1187 IU), lycopene (1453 mcg in red and pink varieties), and potassium (178 mg). Apart from concern about drug interactions, nutritionists consider grapefruit a healthful fruit to include in a well-balanced diet. Its high vitamin C content helps to protect against scurvy, while the lycopene contained in red and pink varieties is an antioxidant thought to slow down the aging of skin and connective tissue. Lycopene may also be important in preventing chronic diseases such as heart disease and **prostatecancer**. In addition, the fiber content of grapefruit is helpful in preventing constipation.

### *Evaluations of grapefruit in weight reduction diets*

Grapefruit is considered a good food choice for people watching their weight because it is relatively filling thanks to its fiber content. It also has a low glycemic index (GI), which is a measurement of the rate at which carbohydrates in the food affect a person's blood glucose level within two hours after eating the food. Foods with low GI scores break down slowly in the digestive tract and thus prevent sudden changes in the blood sugar level—an important consideration for persons with metabolic syndrome or type 2 diabetes and possibly for those watching their weight for other reasons. Grapefruit has a GI of 25 (pure sugar is 100), which is lower than the GI scores of apples (40), oranges (51), and bananas (51).

According to the research team at Scripps Clinic, it is not yet known as of 2007 why grapefruit appears to improve insulin response in overweight people or why it assists weight loss. Ongoing research may help to answer this question, but one finding at least is clear: grapefruit does not contain any miracle fat-burning enzymes.

## Resources

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### ORGANIZATIONS


American Dietetic Association (ADA). 120 South Riverside Plaza, Suite 2000, Chicago, IL 60606-6995. Telephone: (800): 877-1600. Website: http://www.eatright.org.

Dietitians of Canada/Les diététistes du Canada (DC). 480 University Avenue, Suite 604, Toronto, Ontario, Canada M5G 1V2. Telephone: (416) 596-0857. Website: http://www.dietitians.ca.

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Scripps Clinic, Department of Nutrition and Metabolic Research. 12395 El Camino Real Street, 317, S95, San

Diego, CA 92130. Telephone: (858) 794-1250. Website: http://www.scrippshealth.org.

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# Greek and Middle Eastern diet

## Definition

The "Mediterranean diet" gained much recognition and worldwide interest in the 1990s as a model for healthful eating habits. The diet is based on the traditional dietary patterns of Crete, a Greek island, and other parts of Greece and southern Italy. The diet has become a popular area of study due to observations made in 1960 of low incidences of chronic disease and high life-expectancy rates attributed to the populations who consumed a traditional Mediterranean diet. This healthful diet model goes far beyond the use of particular ingredients and recipes. It attains its full meaning in the context of climate, geography, customs, and the way of life of Mediterranean peoples.

## Origins

### *The Mediterranean Basin*

In efforts to understand the **Mediterranean diet**, it is necessary to first learn about the many countries that border the Mediterranean Sea. The diet is closely tied geographically to areas of olive oil cultivation in the Mediterranean Basin. It can be defined by diets of the early 1960s in Greece, southern Italy and other Mediterranean regions in which olive oil was the principal source of dietary fat. The olive remains the most typical Mediterranean tree because it has adapted to the regional climate of long, very hot, dry summers and mild, damp winters.

The lands surrounding the Mediterranean Sea contain some of the oldest cultures on Earth. Greece, as well as other countries of Europe, North Africa, and some Middle Eastern nations, played a central role in the expansion of empires and cross-cultural exchanges over the centuries. Over 2,000 years ago trade by means of sea routes allowed Greek, Roman, Phoenician, Carthaginian, Arab, and Oriental products and traditions to intermix, resulting in mutual enrichment and an evolution of what is now incorporated into the Mediterranean diet. However, many different diets exist throughout the Mediterranean region, and there is no such thing as just one Mediterranean diet. Variations of this diet have traditionally existed in the North African countries of Morocco and Tunisia, parts of Turkey, and other Middle Eastern countries such as Lebanon and Syria.

| Halal (Halaal) food products | Haram (Haraam) food products not halal |
|---|---|
| Milk (from cows, sheep, camels, and goats) | Pork and pork by-products |
| Honey | Animals improperly slaughtered or dead before slaughtering |
| Fish | Alcohol and intoxicants |
| Plants that are not an intoxicant | Carnivorous animals, birds of prey, and land animals without external ears |
| Fresh or naturally frozen vegetables | Blood and blood by-products |
| Fresh or dried fruits | Foods contaminated with any of the above products |
| Legumes and nuts such as peanuts, cashew nuts, pistachios, hazelnuts, and walnuts | |
| Grains such as wheat, rice, rye, barley, and oats | |

SOURCE: Adapted from <http://www.infanca.org>

*(Illustration by GGS Information Services/Thomson Gale.)*

### *Culture*

Mediterranean and Middle Eastern culture is centered on a strong patriarchal family. This has lessened in recent years, but family ties are still strong. Customs and family traditions influence nutrition greatly.

Food is an integral part of family celebrations, special days of honor, and festivals. In the Middle Eastern nation of Israel, kosher dietary laws concerning the selection, preparation, and eating of food remains influential in Jewish life. The Jewish laws of *kashrut*, or keeping kosher, determines which foods are kosher and which are non-kosher. Many ancient practices and rituals, handed down from generation to generation, are observed.

Many people from Mediterranean and Middle Eastern cultures observe Islam and Eastern Orthodox religions, which influence the kinds of food chosen and how the foods are combined. Fasting from sunrise to sunset is a Muslim religious obligation practiced during the sacred month of Ramadan. Muslims do not eat any form of pork, or any meat that has been slaughtered without mentioning God's name. Muslims cannot drink alcoholic beverages or foods flavored with alcohol—which differs from Greek and other Mediterranean cultures, where wine is a large part of the diet. Middle Easterners also have a high incidence of lactose intolerance, and therefore fresh milk is not widely consumed.

## Description

### *Traditional Eating Habits*

Traditional eating habits of Mediterranean countries, and those countries along the basin, include olives, fish, lamb, wheat, rice, chick peas and other legumes, pistachios, dates, cheese, and yogurt. Bread typically accompanies each meal.

Traditional food consumption includes the following:

*Dairy products*. Most dairy products are eaten in fermented forms, such as yogurt and cheese. Whole milk is used in desserts and puddings. Feta cheese, traditionally made of sheep or goat's milk, is the most commonly consumed cheese.

*Meats*. Lamb is the most widely eaten meat. Pork is eaten only by Christians, not by Muslims or Jews. Many Middle Easterners will not combine dairy products or shellfish with the meal. Kosher beef, kosher poultry, lox (brine-cured cold-smoked salmon, much of which is slightly saltier than other smoked salmon), and sardines are also common foods. Legumes such as black beans, chick peas (garbanzo beans), lentils, navy beans, fava beans, and red beans are used in many dishes.

*Breads and Cereals*. Some form of wheat or rice accompanies each meal. Pita and matzoh (unleavened bread) are common. Filo dough, which is used to make baklava, is also used in many dishes.

*Fruits*. Fruits tend to be eaten as dessert or as snacks. Fresh fruit is preferred. Fruits made into jams and compotes (a cooked preparation of fruit in syrup) are eaten if fresh fruit is not available. Lemons and concentrated lemon juice are commonly used for flavoring.

*Vegetables*. Potatoes and eggplant are the most commonly consumed vegetables. Fruit and vegetables are preferred raw or mixed in a salad. Vegetables are often stuffed with rice or meats. Green and black olives are present in many dishes, and olive oil is most frequently used in food preparation.

### *Food Preparation and Storage*

Grilling, frying, grinding, and stewing are the most common ways of preparing meats in countries bordering the Mediterranean Basin. A whole, roasted lamb or leg of lamb is a special dish prepared for festive gatherings. Spices and seasonings are essential in the preparation of Middle Eastern dishes. Common spices and herbs include dill, garlic, mint, cinnamon, oregano, parsley, leek, and pepper.

Many Middle Eastern nations, such as Turkey, Syria, and Lebanon, have predominantly Muslim populations. Eating *halal* is obligatory for every Muslim. *Halal* is an Arabic word meaning "lawful" or "permitted," and refers to Islamic law regarding the diet. Animals such as cows, sheep, goats, deer, moose, chickens, ducks, and game birds are *halal*, but they must be *zabihah* (slaughtered according to Islamic method) in order to be suitable for consumption. Halal foods are those that are:

Free from any component or ingredient taken or extracted from an unlawful animal or ingredient that Muslims are prohibited from consuming.

Processed, manufactured, prepared, or stored with apparatus, equipment and/or machinery that has been cleansed according to Islamic law.

Free from contamination when prepared or processed with anything considered unclean.

### *Present-Day Eating Habits*

Today, the Mediterranean region is characterized by a high increase in modernization. The traditional diet of the Mediterranean region has been affected by modernization, particularly in the area of agricultural production for trade. The countries of North Africa and the Middle East struggle the most with modernization problems. This has led to an increase in the dependence on costly food imports from outside the region. While the Greek economy remains rooted in agriculture and the government places a strong emphasis on agricultural reforms, Middle Eastern nations face constraints such as high rates of urbanization, leading to the loss of vital agricultural land.

Modernization has created significant changes in food consumption patterns in the countries of the Mediterranean region. The factors affecting the traditional dietary customs of the region are economy,

### KEY TERMS

**Antioxidant**—Substance that prevents oxidation, a damaging reaction with oxygen.

**Fatty acids**—Molecules rich in carbon and hydrogen; a component of fats.

**Lactose intolerance**—Inability to digest lactose, or milk sugar.

**Saturated fat**—A fat with the maximum possible number of hydrogens; more difficult to break down than unsaturated fats.

**Trans-fatty acids**—A type of fat thought to increase the risk of heart disease.

environment, society and culture, disasters (e.g., war, drought), the expansion of food industries, and advertising campaigns promoting certain foods (e.g., soda, candy bars). Fast-food restaurant chains are also altering traditional diets. The expansion of fast food has resulted in the population consuming processed foods such as sweets and snack foods, which were never a part of their nutritional sustenance.

## Benefits

### *Nutrition and Disease*

The wide use of olive oil in food preparation throughout the Mediterranean region contributes to a diet high in monounsaturated fatty acids and cultures commonly known for lower blood pressure among their populations. Recent research has produced scientific proof that a Mediterranean diet (which includes olive oil) is not only generally healthful, but that consuming olive oil can actually help lower harmful low density lipoprotein (LDL) cholesterol (often referred to as "bad" cholesterol). Olive oil contains antioxidants that discourage artery clogging and chronic diseases, including **cancer**.

The Mediterranean diet offers a practical and effective strategy that is relatively easy to adopt and more likely to be successful over the long term than most heart-healthy nutrition plans. In April 2001, the American Heart Association (AHA) published a science advisory stating that some components of the Mediterranean diet may be beneficial when used in conjunction with the association's traditional diets for the prevention and treatment of cardiovascular disease.

In the Mediterranean diet, not all fat is regarded as bad, however. In fact, the focus of the diet is not to limit total fat consumption, but rather to make wise choices about the type of fat in the diet. The Mediterranean diet is low in saturated fat, which is found mostly in meat and dairy products, vegetable oils such as coconut and palm oils (tropical oils), and butter. The diet views two types of protective fats, **omega-3 fatty acids** and monounsaturated **fats**, as healthful and places no restrictions on their consumption. Omega-3 fatty acids are found in fatty fish (e.g., sardines, salmon, tuna) and in some plant sources (e.g., pistachios, walnuts and other tree nuts, **flaxseed**, various vegetables). Monounsaturated fat is abundant in olive oil, nuts, and avocados.

Because the Mediterranean diet emphasizes eating whole, natural foods, it is extremely low in trans-fatty acids, which are increasingly recognized as important contributors to heart disease. These fats are found in hard margarine and deep-fried and processed snacks and food, including fast food and commercially baked products. They are similar to saturated fats and are known to raise levels of LDL cholesterol. Eating a diet incorporating the traditional foods of the Mediterranean, such as a variety of fruits and vegetables, has been shown to decrease the risk of heart disease. Five important dietary factors may contribute to the cardioprotective effect of this eating pattern. These are the inclusion of fish rich in omega-3 fatty acids, olive oil, nuts, and moderate amounts of alcohol, and the exclusion of transfatty acids.

Many common characteristics exist among the countries along the Mediterranean Basin, but each country has adapted to the geography and developed its own customs. The common core, however, can be seen in the diets of these countries. It is important to remember that the Mediterranean diet emphasizes eating whole, unprocessed foods that are extremely low in harmful LDL cholesterol. Recent studies indicate that the use of natural, monounsaturated oils such as olive oil, a balanced intake of vegetables and fish, and a low intake of red meats provides a natural defense against cardiovascular disease. Although more research is needed, the Mediterranean way of eating is potentially an ideal diet to improve the health of people by warding off illnesses.

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# Green tea

## Definition

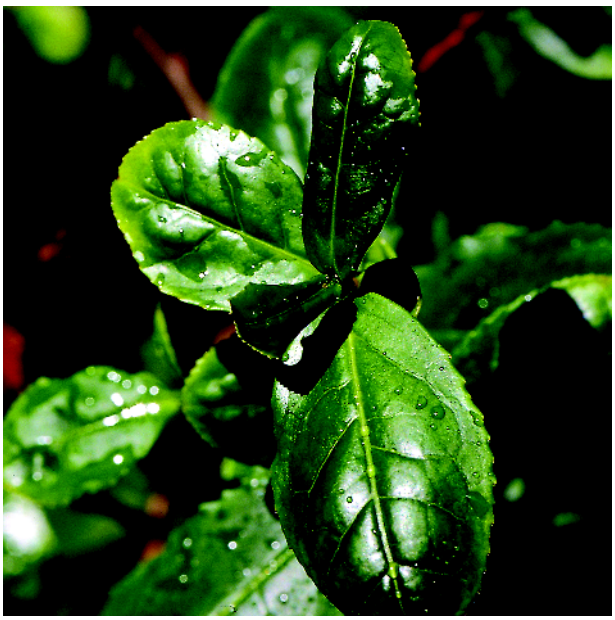
Green tea is made of the lightly steamed and then dried leaf of the shrub *Camilla sinensis*. When processed in this way, the leaves retain many of the chemical properties that are thought to provide health benefits. Green tea extract is a concentrated form of green tea that is sold as a dietary supplement. It usually comes in capsules, but sometimes is packaged as a liquid.

## Purpose

Green tea has been drunk for thousands of years, especially in Asia. Traditionally it has been used to treat colds, cough, asthma, nausea, vomiting, and diarrhea, as an astringent, and as a diuretic ("water pill"). Green tea or green tea extract has also been proposed as a treatment for reducing cholesterol, preventing heart attack, preventing **cancer**, increasing fertility, decreasing symptoms associated with menopause, increasing mental alertness, preventing tooth decay, relieving anxiety, protecting skin from sun damage, and aiding in weight loss. Few of these health claims have been studied in rigorous ways that satisfy the standards of conventional medicine, although many health care professionals feel that there is no harm and likely some health benefit in drinking green tea.

## Description

Green tea, oolong tea, and black tea all are made from leaves of the same shrub, *Camilla sinensis*. This plant is farmed in many temperate areas of China, India, Sri Lanka, Indonesia, Kenya, Malawi, Turkey, and Pakistan. The chemical content of the tea leaves varies slightly from location to location. However, the difference between green, oolong, and black tea is in the processing of the leaves. Green tea is the least processed. The leaves are picked, steamed lightly, and then dried. Oolong tea is made by allowing the leaves to ferment slightly before drying. With black tea, the leaves are more heavily fermented for longer periods. Because green tea is not fermented, it retains more of its nutrients than either oolong or black tea. Most green tea comes from India or Sri Lanka.



**Green tea leaves.** *(PlantaPhile Germany. Reproduced by permission.)*

Green tea has become increasingly popular in Europe and the United States. As more information about its potential health benefits has become available, capsules of green tea extract have been promoted as a dietary supplement that may help with weight loss, prevent cancer, and rid the body of free radicals. In the United States, the sale of green tea and green tea extract is regulated by the Food and Drug Administration (FDA). Green tea is treated as a food and is sold in supermarkets everywhere. Green tea extract is considered a dietary supplement under the 1994 Dietary Supplement Health and Education Act (DSHEA) and is available mainly in health food stores. Manufacturers of green tea extract do not have to prove that their products are either safe or effective before they can be sold to the public. This differs from conventional pharmaceutical drugs, which must undergo extensive human testing to prove their safety and effectiveness before they can be marketed. Also unlike conventional drugs, the label for a dietary supplement such as green tea extract does not have to contain any statements about possible side effects.

Under the DSHEA, **dietary supplements** such as green tea, are not legally allowed to claim that they will "cure," "treat," "mitigate," "prevent," or "diagnose" a

specific disease. Dietary supplements make the following claims:

- health claims. These statements indicate a relationship between an ingredient in the supplement and the reduction in the risk of developing a disease or condition. (e.g. Increased intake of folic acid by pregnant women helps reduce the risk of neural tube defects in their offspring.)
- nutrient content claims. These statements describe the amount of supplement in the product and may contain words such as "high in," "good source of," "fortified," "enriched," or "high potency."
- structure or function claims. These claims describe how the supplement may affect organs or systems in the body without mentioning a specific disease or condition. (e.g. Calcium builds strong bones.). Labels with structure or function claims must also contain the words "This statement has not been evaluated by the FDA. This product is not intended to diagnose, treat, cure, or prevent any disease."

### *Active ingredients in green tea*

Green tea contains a group of compounds called polyphenols. Polyphenols have strong antioxidant properties. **Antioxidants** help protect the body against damage caused by free radicals. Free radicals are formed during normal metabolic processes. The quantity of free radicals in the body may also be increased by exposure to environmental toxins, ultraviolet light, and radiation. Free radicals have a strong tendency to react with and damage other compounds, especially those in DNA (genetic material) and certain **fats** (lipids) in cell membranes. Antioxidants react with free radicals to neutralize them. The damage that free radicals cause to cells is believed to play a role in the development of certain diseases, especially cancer. Many of the health claims for green tea and green tea extract are based on the fact that green tea leaves contain 30–40% polyphenol antioxidants that are capable of neutralizing free radicals and, by extension, help prevent disease. In comparison, black tea contains only 3–10% polyphenols.

The six major polyphenols in green tea belong to a group called catechin compounds. The most active of these catechins is epigallocatechin gallate (EGCG). Some manufacturers of green tea extract standardize the amount of polyphenols and EGCG in each capsule. Standardization ranges from 50–90% polyphenols or 100–750 mg of polyphenols. By comparison, one brewed cup of green tea contains about 50–150 mg polyphenols. U. S. law does not require the standardization of dietary supplements, so consumers should read all labels carefully. Green tea also contains **caffeine** and caffeine-like compounds. Caffeine is a central nervous system stimulant. The average cup of green tea contains about 50 mg of caffeine. Decaffeinated green tea is available. It contains little or no caffeine but still contains polyphenols. All teas, including green tea, contain tannin. Tannin is an astringent that slows secretions and helps control bleeding.

## KEY TERMS

**Antioxidant**—A molecule that prevents oxidation. In the body antioxidants attach to other molecules called free radicals and prevent the free radicals from causing damage to cell walls, DNA, and other parts of the cell.

**Astringent**—A substance that reduces secretions, dries and shrinks tissue, and helps control bleeding.

**Dietary supplement**—A product, such as a vitamin, mineral, herb, amino acid, or enzyme, that is intended to be consumed in addition to an individual's diet with the expectation that it will improve health.

**Diuretic**—A substance that removes water from the body by increasing urine production

**Free radical**—An unstable, highly reactive molecule that occurs naturally as a result of cellular metabolism, but can be increased by environmental toxins, ultraviolet and nuclear radiation. Free radicals damage cellular DNA and are thought to play a role in aging, cancer, and other diseases. Free radicals can be neutralized by antioxidants.

**Traditional Chinese Medicine (TCM)**—An ancient system of medicine based on maintaining a balance in vital energy or qi that controls emotions, spiritual, and physical well being. Diseases and disorders result from imbalances in qi, and treatments such as massage, exercise, acupuncture, nutritional and herbal therapy is designed to restore balance and harmony to the body.

### *Health claims*

Health claims for green tea are based on the way the active ingredients act in laboratory (test tube) studies and in animal studies. The results of green tea studies in humans have been mixed, and the FDA's official position is that the evidence for health benefits of green tea is not strong enough to meet the requirements of conventional medicine. However, some studies are promising. The National Center for Complementary

and Alternative Medicine (NCCAM), a government organization within the National Institutes of Health, is sponsoring clinical trials to determine safety and effectiveness green tea as a treatment for more than a dozen diseases and disorders. Individuals interested in participating in a clinical trial at no charge can find a list of open trials at <http://www.clinicaltrials.gov>.

**CANCER.** Many claims have been made that regularly drinking green tea can help prevent skin, esophagus, stomach, colon, pancreas, lung, bladder, **prostate**, and breast cancer. The basis for these claims lies in laboratory experiments with EGCG. In cell cultures and in some animal studies, EGCG has been found to kill cancer cells and to shrink tumors, possibly by preventing blood vessels from growing into the tumor (a process called angiogenesis) and thus cutting off the tumor's supply of food and oxygen. Human studies have shown mixed results. For example, one study found that green tea protected against the development of esophageal cancer, while another found it had no effect. In a large study of more than 40,500 Japanese, researchers found that participants who drank green tea regularly were less likely to die of cardiovascular disease (e.g. heart attack, stroke) but just as likely to die of cancer as non-tea drinkers.

There are many difficulties associated with studying the role of green tea in the development of cancer in human populations. These include:

- The amount and strength of green tea and green tea extract are not standardized and a wide range of doses are used in different studies.
- Many studies done on green tea are poorly designed so that it is impossible to show a direct link between cause and effect, or they poorly reported, making analysis of the results difficult.
- Many human studies have a small sample size.
- Cancer takes a long time to develop, making it difficult to follow study participants and determine outcomes.
- Many studies are sponsored by tea growers, manufacturers, or importers who have a financial interest in obtaining positive results.

Despite these drawbacks, the possibility that EGCG and other antioxidants in green tea can slow or prevent cancer is strong enough that many research studies are being supported by government health agencies around the world. The official position of the American Cancer Society states, " While the results of lab studies have been promising, at this time there is no conclusive evidence that green tea can help prevent or treat any specific type of cancer in humans."

**WEIGHT LOSS.** Some studies in mice have shown that the polyphenols in green tea lower the level of blood glucose (sugar), lipids (fats), and cholesterol, and reduce the amount of body fat deposited under the skin. Other studies have shown that green tea increases body **metabolism**. However, these results have not been rigorously duplicated in humans. Although green tea may be good food for dieters when used in conjunction with a calorie-reduced diet and increased exercise, it is not a magic bullet that will cause weight loss by itself.

**MENTAL PERFORMANCE.** Any effects of green tea on mental alertness and performance are most likely due to the effects of caffeine and caffeine-like compounds found in green tea.

**CARDIOVASCULAR DISEASE.** Claims have been made green tea decreases cholesterol and fats in the blood. This is thought to reduce the risk of clogged arteries and thus help prevent heart attack and stoke. There is not enough reliable evidence to determine if these claims are true. One large study done in Japan did show improved cardiovascular health in individuals that used green tea, but these individuals tended to be thinner than the average American and have other dietary differences. It is not clear how the Japanese results might apply to other populations.

**OTHER HEALTH CLAIMS.** The tannins in green tea have an astringent or drying effect. One folk remedy to stop the bleeding where a tooth has been extracted is to bite down on a used tea bag. Tannins in green tea may also be responsible for helping to control diarrhea.

## Precautions

Green tea has been safely used for thousands of years. Most negative effects are attributable to the caffeine it contains. Children and pregnant and breast feeding women may want to avoid the effects of caffeine by choosing decaffeinated green tea.

## Interactions

There are no known drug or herbal interactions with green tea when used in moderate quantities.

## Complications

Green tea is generally safe and complications are few even when large amounts of tea are drunk. The safety of green tea extract has not been established. Individuals with hypersensitivity to caffeine or who use large amounts of green tea may develop caffeine-related insomnia or upset stomach. The tannin in green may contribute to **iron** deficiency in individuals

with low amounts of iron in their diet. For this reason tea should not be drunk with meals.

## Parental concerns

Parents should be aware that the safe dose of many herbal supplements has not been establsihed for children. Accidental overdose may occur if children are give adult herbal supplements.

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Alternative Medicine Foundation. P. O. Box 60016, Potomac, MD 20859. Telephone: (301) 340-1960. Fax: (301) 340-1936. Website: <http://www.amfoundation.org>

National Center for Complementary and Alternative Medicine Clearinghouse. P. O. Box 7923, Gathersburg, MD 20898. Telephone: (888) 644-6226. TTY: (866) 464-3615. Fax: (866) 464-3616. Website: <http://nccam.nih.gov>

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Tish Davidson, A.M.

Greenlane diet *see* **British Heart Foudation diet**

# H

## Hamptons diet

### Definition

The Hamptons diet is a low-carbohydrate, low-calorie diet that could be described as a cross between the **Atkins diet** and the **Mediterranean diet**. The originator of the Hamptons diet, Dr. Fred Pescatore, is the former associate medical director of the Atkins Center. He has himself described the Hamptons diet as "low-carb with a Mediterranean twist." The diet focuses on eating healthy monosaturated **fats**, especially **omega-3 fatty acids**, found in fish and vegetables.

### Origins

The Hamptons diet is a relatively recent addition to the list of popular diets. Its basic guide, *The Hamptons Diet: Lose Weight Quickly and Safely with the Doctor's Delicious Meal Plans*, was published in 2004, and the official cookbook of the diet appeared in print in 2006.

According to Fred Pescatore, the author of *The Hamptons Diet*, his interest in nutrition originated in his painful experiences as an overweight teenager "frustrated by his inability to get a date," as he told one Australian reporter. He went on a crash diet for 40 days during his sophomore year of college and resolved to "never allow myself to get that way again." After college, Pescatore went to medical school at the American University of the Caribbean.

Pescatore then returned to New York City, where he completed a residency in internal medicine and a master's degree in public health. Still concerned about his weight, he tried the Atkins diet and reportedly lost an additional 20 pounds. In 1994, a recruiter for the Atkins Center in Manhattan hired Pescatore, who had started a nutrition-based practice in East Hampton, to be the associate medical director of the center. Pescatore remained at the center until 1999, after the publication of his first diet book—on the importance of preventing **obesity** in children. A second low-carbohydrate diet book, *Thin for Good*, followed in 2000. This book was disting\uished by a comparatively extenstive treatment of the psychological issues involved in weight loss. It also contained a series of diet plans designed for men and women in different life stages.

After the Atkins Center closed in October 2003, Pescatore and four other former Atkins employees—an internest, an osteopath specializing in spinal manipulative treatment, a psychotherapist, and a physician's assistant—formed a practice called the Partners in Integrative Medicine (PIM). Pescatore describes PIM as creating five "amazing partnerships . . . at the center of low-carb medicine"—partnerships between traditional and alternative medicine, between the patient and PIM, between body, mind and spirit, between the staff at PIM, and between PIM and other professionals.

Pescatore's variation on the Atkins theme, which he says took him five years to develop, was to separate good dietary fats from bad fats, a step that Atkins had not taken. More specifically, Pescatore departed from the high levels of saturated fats recommended in the Atkins diet. He based the Hamptons diet on the use of more healthful food oils—monounsaturated fats, which are fats or fatty acids with only one double-bonded carbon atom in their molecules. Monounsaturated fats soften and liquefy at lower temperatures than saturated fats, and are thought to offer some protection against heart disease. They are found naturally in such foods as nuts and avocados. When Pescatore was asked in 2004 whether the changes he introduced in his diet plan means that Atkins was wrong, he said that Atkins "was starting to come around towards the end. . . . Dr. Atkins wasn't wrong at all. It's just times change and things evolve. And as the science evolves, so should the low-carb dieting world evolve, because it is not just a fad."

## KEY TERMS

**Macadamia nut**—A hard-shelled nut resembling a filbert, produced by an evergreen tree native to Australia and cultivated extensively in Hawaii. The nut is named for John Macadam, an Australian chemist.

**Monounsaturated fat**—A fat or fatty acid with only one double-bonded carbon atom in its molecule. The most common monounsaturated fats are palmitoleic acid and oleic acid. They are found naturally in such foods as nuts and avocados; oleic acid is the main component of olive oil.

**Trans-fatty acid**—A type of unsaturated fatty acid that occurs naturally in small quantities in meat and dairy products; however, the largest single source of trans-fatty acids in the modern diet is partially hydrogenated plant oils, used in the processing of fast foods and many snack foods.

## Description

Although there are a number of plant-based oils used in cooking that contain monounsaturated fats—olive oil, peanut oil, **flaxseed** oil, and sesame oil—the Hamptons diet claims to be based on a "secret ingredient"macadamia nut oil from Australia. Macadamia nuts are produced by an evergreen tree, *Macadamia integrifolia*, which is native to the rain forests of Queensland and New South Wales in Australia.

The Hamptons diet uses macadamia nut oil not only for cooking, but also in salad dressings and marinades. Pescatore claims that macadamia nut oil is "the most monounsaturated oil on the planet." Macadamia nut oil contains 84% monounsaturated fats, 3.5% polyunsaturated fats, 12.5% saturated fats, and no cholesterol. Pescatore presently sells MacNut Oil, a form of macadamia oil on his website; it can also be ordered directly from a distributor in Plano, Texas.

In addition to the "secret ingredient," the Hamptons diet is distinctive for the use of food lists defined by how much weight the dieter needs to lose. Calories and portion sizes are not emphasized; the dieter is expected to divide the recipes into portions according to the number of servings indicated by each recipe. The basic menu plans, however, provide between 1000 and 1200 calories per day. There are three food groups, labeled A, B, and C:

- A group: Foods on this list are for people who need to lose more than 10 pounds. These dieters are limited to between 23 and 26 grams of carbohydrates per day.
- B group: For dieters with less than 10 pounds to lose. They may select foods from both the A and B lists, which allow 40 to 43 grams of carbohydrates per day.
- C group: Foods on this list are slowly added to the meal plans as the dieter reaches his or her weight loss goal and begins a maintenance diet. Foods in this group provide up to 65 grams of carbohydrates per day.

## Function

The Hamptons diet is essentially a low-carbohydrate diet intended to promote a moderate rate of weight loss in otherwise healthy people. It is not intended to treat any chronic medical conditions or disorders.

## Benefits

The Hamptons diet promotes a gradual weight loss and encourages eating a balanced range of foods. It allows dieters complex **carbohydrates** (including whole-grain breads and fresh fruit); discourages the use of processed foods and distinguishes between healthy and unhealthy sources of fat in the diet. Its preference for such lean sources of **protein** as chicken and fish rather than the higher saturated fat items such as bacon and steaks is also in its favor. In addition, some people like the fact that the Hamptons diet allows moderate amounts of alcohol and the kinds of flavorful foods featured in the Mediterranean diet. The gourmet-quality recipes in this diet may also be useful to dieters who want to cook for a family or for guests without having to prepare two separate meals.

## Precautions

Although the Hamptons diet is not a very low-calorie diet (VLCD), it is always advisable for people who need to lose 30 pounds or more; are pregnant or nursing; are below the age of 18; or have such chronic disorders as diabetes, kidney disease, or liver disease to check with a physician before starting a weight-reduction diet.

The Hamptons diet has been criticized by nutritionists for its inadequate allowances of **fiber**, **vitamin C**, **calcium**, **folate**, **vitamin D**, and **vitamin E**. The diet is also high in fat, which provides as much as 70% of the calories in some menu plans, particularly those that call for cream cheese, bacon, and heavy whipping cream. The Hamptons diet does not focus on high sat fat items. Therefore, the cream cheese, bacon, and heavy whipping cream is generally only recommened

## QUESTIONS TO ASK YOUR DOCTOR

- What have your other patients liked and disliked about the Hamptons diet?
- What feedback have your patients given you regarding the recipes?
- What is your opinion of the author's emphasis on macadamia oil as the "secret ingredient" of the diet?
- What is your opinion of low-carbohydrate diets? what about diets that differentiate between types of fat?

in moderation. Very few dietitians have a problem with this.

A frequent criticism of the Hamptons diet from those who have tried it is that the recipe ingredients are often costly and hard to find. Many of the ingredients called for in the recipes would be unfamiliar to anyone except a professional chef, and some are quite costly. For example, the macadamia nut oil recommended by Dr. Pescatore costs about $10 (as of early 2007) for a bottle containing 8.5 ounces (slightly more than a cup), or $18 for a bottle containing 16.9 ounces (slightly more than a pint). In addition, the diet recommends organic, not just fresh, ingredients, which are almost always more expensive than nonorganic produce or meats. It is perhaps not surprising that the Hamptons diet has spawned a Hamptons Diet Market website, where the dieter may purchase the "uniquely healthy products from the Hamptons world of wellness" online.

Another potential drawback of the Hamptons diet for many people is that many of the recipes require advance preparation, as much as a day ahead of eating the dish. Others are time-consuming to cook or assemble apart from the time required for advance preparation.

### Risks

The relatively high fat content of some of the recipes formulated for the Hamptons diet may be worrisome for dieters; however, only saturated and trans-fat pose risks for heart health. Monosaturated and polyunsaturated fats, including omega-3 fatty acids, actually promote heart health.

### Research and general acceptance

The Hamptons diet have been featured primarily in celebrity, fashion, and homemaking magazines rather than in clinical studies. As of 2007, there have been no clinical trials of the Hamptons diet reported in mainstream research journals. Pescatore is involved in two groups listed on his website, presumably to establish his credentials as a researcher. He is the president of the AHCC Research Association. As of 2007 he is also the current president of the International and American Association of Clinical Nutritionists (IAACN).

Like the **Scarsdale diet**, the Hampton diet makes snob appeal an important part of its publicity material. A brief article about the Hamptons diet that appeared in *In Touch* magazine in July 2004 has prominent photographs of the celebrities, who are said to be current clients of Dr. Pescatore. The article trades on the reputation of the Hamptons as a summer playground for the wealthy. The official website of the Hamptons diet has the following description under the heading of "Hamptons How-To: Embrace the Hamptons Lifestyle: Rich, Indulgent, and Thin": "The Hamptons are a forty-mile stretch of land on the southern shore of Long Island in New York State. First settled in the mid-1600s, the area boasts 300-year-old trees, hundreds of acres of farmland, gorgeous dunes, sea cliffs, and stunning beaches. The Hamptons didn't really 'arrive' until the late 1800s, when the railroad was built from New York City. From that era up to the present, the eastern end of Long Island has been synonymous with the good life: sun, fun, glamour, and lots of money. The Hamptons Diet was formulated with the belief that millions of people want to be thin, rich, and famous—like many of [Dr. Pescatore's] clientele."

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Dietitians of Canada/Les diététistes du Canada (DC). 480 University Avenue, Suite 604, Toronto, Ontario, Canada M5G 1V2. Telephone: (416) 596-0857. Website: http://www.dietitians.ca.

Hamptons Diet website. URL: http://www.hamptonsdiet.com/index.asp. No other contact information given.

Hamptons Diet Market. Telephone: (877) 944-7325. Website: http://www.hamptonsdietmarket.com/.

International and American Association of Clinical Nutritionists (IAACN). 15280 Addison Road, Suite 130, Addison, TX 75001. Telephone: (972) 407-9089. Website: http://www.iaacn.org/index.htm.

MacNut Oil. P.O. Box 864066, Plano, TX 75086-4066. Telephone: (866) 4-MACNUT or (972) 516-1740. Website: http://www.macnutoil.com.

Partners in Integrative Medicine (PIM). 369 Lexington Avenue, New York, NY 10017. Telephone: (212) 779-2944. Website: http://www.piimdocs.com/


Rebecca J. Frey, Ph.D.

# Hay diet

## Definition

The Hay diet is named for the New York physician who created a plan that prohibited the consumption of starches and proteins during the same meal. William Howard Hay began developing the food-combining diet in 1904 to treat himself for medical conditions including a dilated heart. He lost 50 (22.7 kilograms) pounds in approximately three months and recovered from the conditions.

## Origins

When William Howard Hay (1866–1940) graduated from New York University Medical College in 1891, he practiced medicine and specialized in surgery. That changed 16 years later when his own medical troubles led him to research the connection between diet and health. Hay then weighed 225 pounds (102 kilograms) and had high blood pressure and Bright's Disease, a kidney condition. Hay discovered that his heart was dilated while running to catch a train.

The dilated heart caused by weakened heart muscles meant that his blood could not pump efficiently. Hay knew from treating patients that his future did not "look overlong or very bright," according to his 1929 book *Health via Food*. The title described Hay's health theories, his condition, and treatment.

Hay diagnosed the causes of his conditions as the "very familiar trinity of troubles" that then ranked as the primary cause of death: the combination of high blood pressure, kidney disease, and dilated heart.

Hay wrote that his legs had swelled; and he slept seated because he was afraid he would drown in his fluids if he slept lying down. He wasn't able to lose the weight through exercise and what he thought was a proper diet. Hay wrote that the dilated heart made his prospects were bleak. He knew from treating patients that there was no medical treatment for a dilated heart. He advised them to prepare for the "final hop-off" (death). With that diagnosis applied to himself, Hay looked at his life to evaluate his own situation. He described himself as a "strong man of splendid heredity," so Hay looked at his eating habits.

### *Plain food of the American table*

After graduating from medical school, Hay ate at hotels, boarding houses, and restaurants for 11 years. He then married, and his wife prepared meals for the following five years. As a married man, Hay wrote that

**Food combining guidelines**

| Food groups | Foods | Combine with | Do not combine | Exceptions |
|---|---|---|---|---|
| Acid fruits | Grapefruit, oranges, lemons, limes, pineapples, pomegranates, tomatoes | Sub-acid fruit and nuts and seeds | Sweet fruit and other food groups | Tomatoes can be eaten with low and non-starchy vegetables and avocado |
| Sub-acid fruits | Apples, apricots, berries, grapes, kiwi, mango, nectarines, papaya, peaches, pears, plums, strawberries | Acid or sweet fruits, not both, and nuts and seeds | Other food groups | |
| Sweet fruits | Bananas, coconut, dates, dried fruits, prunes, raisins | Sub-acid fruits, and nuts and seeds | Acid fruit and other food groups | |
| Melons | Cantaloupe, honeydew, watermelon | Eat alone | All groups | |
| Protein | Meat, poultry, fish, eggs, dairy, dry beans/peas, nuts & seeds, peanuts, soy beans, soy products, tofu | Low and non-starchy vegetables | Other proteins, fats, carbohydrates and starches, and fruits | Drink milk alone |
| Low and non-starchy vegetables | Asparagus, artichokes, green beans, beets, broccoli, cabbage, cauliflower, cucumber, eggplant, garlic, lettuce, celery, carrots, onions, parsley, peas, peppers, turnips, mushrooms, zucchini | Protein, fats, carbohydrates, and starches | Fruits | |
| Carbohydrates and starches | Bread, pasta, grains/cereals, potatoes, pumpkin, winter squashes, yams | Low and non-starchy vegetables and fats | Fruits and protein | |
| Fats | Avocado, olives, coconut, butter, cream, and olive, avocado, flax, sesame, and canola oils | Low and non-starchy vegetables, carbohydrates and starches, and protein | Protein, fruits | Avocado can be eaten with fruits |

*(Illustration by GGS Information Services/Thomson Gale.)*

he could control what he ate. However, his food preferences were formed during hid years of "public eating."

At home, each of Hay's meals consisted of meat or other concentrated **protein**. He usually combined this with white bread and generally ate a potato of some form. Hay described this meal as the "plain food of the American table." His meal ended with pastries and two to three cups of coffee that he sweetened with sugar and cream.

Hay's eating habits weren't unusual. Meat and potatoes were long part of a traditional American meal. In addition, Americans during the early 1800s tended to eat large meals. Excess weight was regarded as a sign of prosperity. That perspective began to change later in the century, with a range of weight-loss solutions proposed during the 1890s.

Dr. Edward Hooker Dewey's plan involved skipping breakfast. Horace Fletcher, a businessman, created a plan after he couldn't get life insurance because of his weight. He lost 40 pounds (18.1 kilograms) by slowly chewing his food until it liquefied. He then swallowed it. The slow-chewing technique became a popular weight-loss method known as "Fletcherism."

### *Developing a new diet*

Hay started his special diet by eliminating two meals and eating only vegetables for the third. He stopped drinking coffee, but continued to smoke cigarettes and drink alcohol. Hay wrote that his craving for coffee ended in two weeks. Several months later, he gave up smoking. By the third month, Hay weighed 175 pounds (79.4 kilograms).

Hay considered that a normal weight. He spent the next four years researching diet and exercise, examining those issues from the conventional and alternative perspectives. His research included studying the work of Ivan Petrovich Pavlov, the Russian physiologist known for his research involving dogs. Pavlov's studies of the digestion process of dogs indicated that it took about two hours to digest starches and four hours to digest proteins. However, it could take 13 hours to digest a mixture of protein and starch.

## KEY TERMS

**Body Mass Index**—Also known as BMI, the index rates a person's weight as healthy, underweight, overweight, or obese.

**Calorie**—The nutritional term for a kilocalorie, the unit of energy needed to raise the temperature of one liter of water by one degree centigrade at sea level. A nutritional calorie equals 1,000 calories.

**Carbohydrate**—A nutrient that the body uses as an energy source. A carbohydrate provide 4 calories of energy per gram.

**Edema**—Swelling caused by caused by the build-up of fluid in the body's tissues.

**Fat**—A nutrient that the body uses as an energy source. Fats produce 9 calories per gram.

**Fiber**—A complex carbohydrate not digested by the human body. Plants are the source of fiber.

**Morbidly obese**—Also known as extremely obese, the condition of someone with a BMI of more than 40.

**Obese**—A person with a high amount of body fat; someone with a Body Mass Index of 30 or higher.

**Overweight**—A person is too heavy for his or her height; someone with a Body Mass Index of from 25 to 30.

**Protein**—A nutrient that the body uses as an energy source. Proteins produce 4 calories per gram.

Hay's research led to a diet based on the theory that health was affected by the chemical process of digestion. The body uses an alkaline digestive process for **carbohydrates**, the group that Hay classified as consisting of starchy foods and sweet things. The digestion of proteins involved acid. If carbohydrates and proteins were consumed at the same time, the alkaline process was interrupted by the acid process. Combining incompatible foods caused acidosis, the accumulation of excess acid in body fluids. Hay linked the combination of foods to medical conditions like Bright's disease and diabetes. The wrong combinations "drained vitality" and caused people to gain weight.

Hay maintained that the solution was to eat proteins at one meal and carbohydrates at another. He classified fruits with acids. Hay labeled vegetables in the neutral category that could be consumed with either group. He also advocated the daily administration of an enema to cleanse the colon.

The Hay diet was credited with curing the doctor. He pointed out in *Health via Food* that the book was written 24 years after his bleak diagnosis. Hay said that after changing his eating habits that his blood pressure was lower, the swelling caused by fluid was gone, and he could run quickly and at a distance.

He gave up his traditional medical practice, surgery and administering drugs. He believed that his eating plan was more beneficial. Hay introduced his diet in 1911 and spent the rest of his life promoting it. He lectured in the United States and Canada and wrote books. *The Medical Millennium* was published in 1927, followed by *Health via Food* in 1929 and *A New Health Era* in 1939.

In addition to writing diet books, Hay used the diet to treats patients at sanatoriums. He worked as the medical director of the East Aurora Sun Diet and Health Sanatorium in New York state from 1927 through 1932. He then founded the Pocono Haven Sanatorium Hotel in Mount Pocono, Pa. He served as its director until he died in a traffic accident in 1940.

Hay's eating plan was the forerunner of late 20th century food-combining diet including Stephen's Twiggs' Kensington Diet and Judy Mazel's New **Beverly Hills Diet**.

## Description

William Howard Hay evaluated health theories and weight-loss methods while developing his plan. When he concluded that proper food combination was the solution to improved health, he saw some benefits in Fletcherism. The slow-chewing method could aid in the digestion of incompatible foods in some cases, Hay wrote in *Health via Food*. Bread could be chewed into a liquid, but the process wasn't effective with foods like cheese.

Exercise did not provide the answer, Hay said. He pointed out that farmers who were physically active were diagnosed with some of the same conditions that less sedentary people were. Hay concluded that the solution was a lifetime of his diet and a daily enema. Hay regarded the enema as vital to providing relief to the colon and eliminating the toxins produced by a poor diet. He pointed out that some patients were constipated for two weeks because of their poor eating habits.

Hay also maintained that fresh air provided a benefit, especially when people slept. However, the Hay diet was the foundation of his treatment. The

plan that scheduled when food was consumed generally consisted of one food group per meal. Foods were classified as Proteins, Starches, and Neutral Foods that could be combined with proteins or starches. *Health via Food* included a month-long schedule of suitable meals. It gave the public a guide to follow. For the contemporary reader, the diet plan offers a perspective on the Hay diet and the eating habits of those times. Although food items were limited, people could eat as much as they wanted.

The Hay diet menus for the summer included the following meal recommendations:

- A Friday plan began with a breakfast of orange juice and milk. Lunch was tomato bullion, a baked onion, a tomato-and-cucumber salad with mayonnaise dressing, and apricots for dessert. Dinner was broiled fish or steak, steamed chicory, steamed carrots, and a salad of shredded cabbage, onions, and radishes. Mayonnaise dressing was allowed, and dessert consisted of lemon ice.
- A Saturday plan started with a breakfast of whole-wheat muffins, honey, butter, and black coffee. Lunch was cream of carrot soup, steamed celery, and a salad of pineapples, pears, and grapes. Salad was served with mayonnaise dressing. Dessert was lemon fluff. Dinner was broiled lamb chops, steamed cauliflower, steamed kale, and a salad of grapefruit and sauerkraut with mayonnaise dressing. The dessert was fresh peaches with unsweetened cream.

### *The contemporary Hay diet*

Contemporary versions of the Hay diet no longer recommend a daily enema. The eating plan still follows Hay's classification of foods into three categories, along with the rules about how the foods are combined at mealtime. The diet consists primarily of fruits and vegetables, and dieters are advised to wait at least four hours before consuming a meal from an incompatible category.

Some versions of the Hay diet recommend eating small portions of proteins, starches, and **fats**. There is also an emphasis on eating whole-grain products and unprocessed starches. Some plans allow alcoholic beverages; others prohibit processed foods with ingredients such as refined sugar, margarine, and white flour.

The Hay diet meal plan is based on the categories of Proteins, Starches, and Neutral Foods. Proteins and Neutral Foods may be combined, and Neutral Foods may be combined with Starches. The combination of Proteins and Starches should be avoided.

The Protein category consists of:

- Meat, poultry, fish, eggs, and dairy products including milk, cheese, and yogurt. Milk should be avoided with meat, but combines well with fruit.
- Beans including lentils, pinto beans, kidney beans, soy beans, garbanzo beans (chickpeas), haricot beans, and lima beans.
- The majority of fruits. In this category are apples, apricots, berries, cherries, currants, gooseberries, grapefruit, grapes, guavas, kiwis, lemons, limes, lychees, mangoes, nectarines, oranges, passionfruit, pears pineapples, prunes, raspberries, strawberries, and tangerines. Melons are in this category but should be consumed separately.
- Beverages allowed are red wine, white wine, and cider.

In the Neutral Foods category are:

- All vegetables except those in the Starches category.
- All nuts except peanuts.
- Fats including butter, cream, egg yolks, and olive oil.
- Beverages in this category are whisky and gin.

In the "Starches category" are:

- Cereal, bread, rice, and products made from flour and whole-grains such as wheat, oats, corn, and barley.
- Starchy vegetables such as potatoes, sweet potatoes, pumpkins, and Jerusalem artichokes.
- Sweet fruits such as raisins, dates, figs, sweet grapes, and ripe bananas. Extremely ripe fruit is not allowed because the sugar content is higher.
- Beverages in this category are beer and ale.

## Function

Hay created his meal plan to treat medical problems associated with **obesity**. He claimed that a change in eating habits rather than medication was beneficial in the treatment of conditions such as cardiac disease, kidney disease, and kidney disorders.

In contemporary times, the Hay diet is used as a weight-loss plan by the general public and people interested in alternative treatments. Advocates of natural health maintain that the plan reverses conditions such as arthritis, indigestion, **constipation**, and flatulence. The Hay diet is also regarded as a natural method for providing relief to people diagnosed with asthma and allergies.

## Benefits

Hay wrote in *Health via Food* that he saw "the comeback of thousands of patients" who followed his regimen. The Hay diet features some nutritional principles endorsed by organizations including the United States Department of Agriculture (USDA), the American Dietetic Association, and the medical community. Their recommendations call for eating lean meat and poultry that is that is prepared by grilling and baking. Nutritional guidelines also advocate the consumption of a variety of fruits and vegetables.

Those recommendations are also found in the Hay diet. People who follow those recommendations and fill up on fruits and vegetables will lose weight. Those are low-calorie foods that are rich in **fiber**. Whole-grain products also contain fiber. Eating high-fiber food produces the sense of fullness more quickly than the consumption of foods with fat does.

## Precautions

Although there are some nutritional aspects of the Hay diet, there are some flaws. The diet does not include serving sizes and portion control is an important aspect of maintaining a healthy weight. In addition, people may miss out on **vitamins** and nutrients by restricting food groups to one meal per day.

## Risks

Although the consumption of fruits and vegetables will help to relieve constipation, people should not rely solely on the Hay diet to treat condition such as heart disease, arthritis, allergies, and asthma. People diagnosed with those conditions may need medication and should consult their physician before undertaking the Hay diet or any weight-loss plan.

## Research and general acceptance

The Hay diet as designed by the late doctor featured variety within all food groups. Eating an assortment of foods was also recommended in *Dietary Guidelines for Americans 2005*. The guidelines prepared by the USDA and the Department of Health and Human Services recommended the consumption of a variety of foods within each of the five food groups: fruits, vegetables, calcium-rich foods like milk and cheese, grains, and proteins.

Contemporary research also showed that eating high-fiber foods helps people to feel full, and eating less means that people will lose weight. While research proved that Hay was correct about those nutritional principles, his food-combining plan has been criticized over the years.

Critics countered that the human digestive system was able to process the proteins and starches from one meal. They also pointed out that some foods contained both carbohydrates and proteins.

### *General acceptance*

The Hay diet brought people to sanatorium hotels during the first three decades of the 20th century. It was modified into other food-combining diets towards the end of the century. However, Hay's diet remained popular with natural-health advocates. Information about the plan was posted on several websites in the United Kingdom in the spring of 2007.

### QUESTIONS TO ASK YOUR DOCTOR

- How much weight do I need to lose?
- Will the Hay diet's food-combining rules help me to lose weight more quickly?
- Does the Hay diet help to improve conditions like diabetes or indigestion?
- Would any health condition prevent me from starting the Hay diet?
- Should I avoid certain foods because of medications I'm taking or because of a health condition?
- What portion sizes do you recommend from each of the food groups?

## Resources


### BOOKS

Hay, William Howard. *Health via Food*. Sun-Diet Health Service, 1929. Public domain material, Soil and Health Library, <http://www.soilandhealth.org/02/0201hyglibcat/020165.hay.pdf< (April 20, 2007).

### PERIODICALS

Blonz, Ed. "Logic behind call to avoid certain food combinations is faulty." *The San Diego Union Tribune* (Sept. 14, 2005): <http://www.signonsandiego.com/uniontrib/20050914/news_lz1f14focus.html> (April 20, 2007).

### ORGANIZATIONS

American Dietetic Association, 120 South Riverside Plaza, Suite 2000, Chicago, IL 60606. (800) 877-1600. <http://eatright.org>.

### OTHER

Centers for Disease Control and Prevention National Center for Chronic Disease Prevention and Health Promotion. *Physical Activity and Good Nutrition: Essential Elements*

*to Prevent Chronic Diseases and Obesity At A Glance 2007*. <http://www.cdc.gov/nccdphp/publications /aag/dnpa.htm> (April 9, 2007).
Synergy UK Natural Health Directory: Hay Diet. <http://www.synergy-health.co.uk/healthnews/hay_diet19991130.html> (April 20, 2007).
U.S. Department of Agriculture and the Department of Health and Human Services. *Dietary Guidelines for Americans 2005,* <http://www.health.gov/dietaryguidelines/dga2005/document> (April 9, 2007).

Liz Swain

# Healthy heart diet

## Definition

A healthy heart diet is an eating plan designed to keep blood cholesterol low and prevent the risk of heart disease. This is usually achieved by eating foods that are low in saturated fat, total fat, cholesterol, and **sodium**. Some diets help people lower their cholesterol levels.

## Origins

The healthy heart diet is the result of ongoing nutrition research by organizations including the United States Department of Agriculture (USDA) and the American Heart Association (AHA). The department first issued dietary recommendations for Americans in an 1894 Farmer's Bulletin, according to the 1996 USDA report *Dietary Recommendations and How They Have Changed Over Time*.

The 1894 recommendations came from W.O. Atwater, first director of the USDA's Office of Experiment Stations. He proposed a diet for American men based on **protein**, carbohydrate, fat, and mineral matter. In a 1902 Farmer's Bulletin, he warned about the danger of a dieting consisting of too much protein or fuel ingredients (**carbohydrates** and fat). "The evils of overeating may not be felt at once, but sooner or later they are sure to appear—perhaps in an excessive amount of fatty tissue, perhaps in general debility, perhaps in actual disease," Atwater cautioned.

More was known about nutrients in 1941 when the USDA first issued the Recommended Dietary Allowances (RDAs). The allowance allowances covered areas like calorie intake and nine essential nutrients: protein, **iron**, **calcium**, **vitamins** A and D, **thiamin**, **riboflavin**, **niacin**, and ascorbic acid (**Vitamin C**). The USDA also released national food guides during the 1940s. The guides provided a foundation diet with recommendations for foods that contained the majority of nutrients. The guide was modified in 1956 with recommended minimum portions from food groups that the USDA called the "Big Four": milk, meats, fruits and vegetables, and grain products.

The guides remained in effect until the 1970s when an increasing amount of research showed a relationship between the over-consumption of fat, saturated fat, cholesterol, and sodium and the risk of chronic diseases such as heart disease and stroke. In 1979, the USDA guide included the Big Four and a fifth category that included **fats**, sweets, and alcoholic beverages.

The following year, the USDA and the Department of Health and Human Services (HHS) issued the first edition of *Nutrition and Your Health: Dietary Guidelines for Americans*. The recommendations for healthy Americans age 2 and older included consuming a variety of foods, avoiding too much fat, saturated fat, cholesterol, and sodium. Those guidelines were recommended for people older than age 2 because younger children need more calories and fat in their diet to aid in their growth and development.

The USDA and HHS update the federal guidelines every five years. The 1990 edition recommended a diet low in fat, saturated fat, and cholesterol. Salt and sugars were to be consumed in moderation. In *Dietary Guidelines for Americans 2005*, the federal departments featured more specific recommendations.

The recommendations for healthy Americans came from two departments that are part of the National Institutes of Health (NIH). Within NIH is the National Heart, Lung, and Blood Institute (NHLBI), which was formed by Congress in 1948. In the 21st Century, the institute's focus on heart disease included the creation of a Heart Healthy Diet to keep cholesterol low and the Therapeutic Lifestyles Changes (TLC) Diet to help people lower their blood cholesterol.

Furthermore, the American Heart Association (AHA)has long been concerned with educating the public about the relationship between diet and heart health. The association started in 1924 as an outgrowth of local organizations including the Association for the Prevention and Relief of Heart Disease in New York City. That group was founded in 1915 and consisted of physicians and social workers.

The national organization's public education activities include issuing nutritional guidelines that are periodically revised. The title of the association's "2006 Diet and Lifestyle Recommendations" reflected the importance of diet and physical activity on health,

**Heart healthy diets**

| | Heart Healthy diet guidelines | Therapeutic Lifestyle Changes diet guidelines | American Heart Association diet guidelines |
|---|---|---|---|
| Saturated fat | 8–10% of the day's total calories | Less than 7% of the day's total calories | Less than 7% of the day's total calories |
| Total fat | 30% or less of the day's total calories | 25–35% or less of the day's total calories from fat | 25–35% or less of the day's total calories from fat |
| Dietary cholesterol | Less than 300 milligrams a day | Less than 200 milligrams a day | Less than 300 milligrams a day |
| Sodium | Less than 2,400 milligrams a day | Less than 2,400 milligrams a day | Less than 2,400 milligrams a day |
| Calories | Enough calories to achieve or maintain a healthy weight and reduce blood cholesterol level | Enough calories to achieve or maintain a healthy weight and reduce blood cholesterol level | Number of calories based on age, gender, height, weight, and physical activity level, and whether trying to lose, gain or maintain weight |

**A comparison of the dietary guidelines of the Healthy Heart diet, the Therapeutic Lifestyle Changes diet, and the American Heart Association diet.** *(Illustration by GGS Information Services/Thomson Gale.)*

a combination endorsed by the medical community and public health organizations.

## Description

Healthy heart diets share fundamental elements about how to prevent heart disease. The process starts with an understanding of why some foods should be avoided and others are beneficial to the heart. The first step is for the person to be aware of how food affects heart health.

### *An internal delivery system*

The heart is a muscle, and the body's muscles require a steady supply of oxygen and nutrients. This supply is brought to the heart by blood in the coronary arteries. Healthy heart diets are designed to keep the coronary arteries open for the delivery of oxygen and nutrients. When the arteries become narrow or clogged, the heart will not receive enough blood. This blockage causes coronary heart diseases. If the heart doesn't receive enough of the blood containing oxygen, the person feels a chest pain, which is known as angina. If the coronary artery is totally blocked off and no blood reaches the heart, the person experiences a heart attack.

The narrowing or clogging of the arteries is designated as atherosclerosis when the blockage is caused by deposits of cholesterol and fat. Cholesterol is a soft, waxy substance that is similar to fats (lipids). Cholesterol occurs naturally and is found throughout the body in the bloodstream and cells.

### *Cholesterol's functions*

Cholesterol is used by the body to produce **Vitamin D**, hormones, and the bile acids that dissolve food, according to NHBLI. However, the body doesn't need much cholesterol to perform those functions, and the extra cholesterol is deposited in the arteries.

Cholesterol and fats don't dissolve in the bloodstream and are moved through the body by lipoproteins. These are a combination of a lipid (fat) surrounded by a protein, according to the American Heart Association. Total cholesterol consists of low-density lipoprotein (LDL), high-density lipoprotein (HDL), and very-low density lipoprotein (VLDL).

VLDL carries **triglycerides**, a form of blood fat that could affect the heart. LDL is known as "bad" cholesterol, and HDL is called "good" cholesterol. HDL may help the body by clearing fat from the blood and removing extra cholesterol, according to the AHA.

The body produces LDL and receives more of it from food. When foods rich in cholesterol and some fats are consumed, the body creates more LDL. The **dietary cholesterol** comes from animal products such as meat. Also contributing to the LDL build-up are foods that are high in trans fats and saturated fats.

### *Fat facts*

Food contains three types of fats that should be monitored on a healthy heart diet:

- Saturated fat is the popular term for saturated fatty acid. Saturated fat tends to raise cholesterol levels and is found in meat, poultry, whole-milk dairy products including cheese and butter, cocoa butter, lard, and tropical vegetable oils like coconut and palms oils. Saturated fat remains solid at room temperature.

## KEY TERMS

**Body Mass Index**—Also known as BMI, the index determines whether a person is at a healthy weight, underweight, overweight, or obese.

**Calorie**—The nutritional term for a kilocalorie, the unit of energy needed to raise the temperature of one liter of water by one degree centigrade at sea level. A nutritional calorie equals 1,000 calories.

**Carbohydrate**—A nutrient that the body uses as an energy source. A carbohydrate provide 4 calories of energy per gram.

**Fat**—A nutrient that the body uses as an energy source. Fats produce 9 calories per gram.

**Fiber**—A complex carbohydrate not digested by the human body. Plants are the source of fiber.

**Morbidly obese**—Also known as extremely obese, the condition of someone with a BMI of more than 40.

**Obese**—A person with a high amount of body fat; someone with a Body Mass Index of 30 or higher.

**Overweight**—A person is too heavy for his or her height; someone with a Body Mass Index of from 25 to 30.

**Protein**—A nutrient that the body uses as an energy source. Proteins produce 4 calories per gram.

- Trans fat is a type of vegetable oil that was processed to make the liquid more solid. The process called hydrogenation produces hydrogenated and partially hydrogenated vegetable oils. These oils are found in stick margarine, vegetable shortening, commercial fried food, and baked goods such as cookies and crackers.
- Unsaturated fats include polyunsaturated fats and monosaturated fats. Polyunsaturated fats are found in fish, walnuts, corn oil, and safflower oil. Monosaturated fats are found avocadoes, olives, olive oil, canola oil, and peanut oil.

### *Sodium*

Sodium and salt are sometimes used interchangeably in information about healthy heart diets. The AHA recommends that people consume less than 2,300 milligrams of salt per day. This amounts to about 1 teaspoon of salt. Some organizations recommend a slightly higher amount of less than 2,400 milligrams. The recommended amount is for healthy people and may be lower for people with some health conditions.

The diets of most Americans contain too much salt, and processed foods are generally the source of this sodium. A diet high in salt tends to raise blood pressure, and this could lead to heart disease, stroke, and kidney damage.

Reducing the amount of sodium in a diet will lower blood pressure, and aid in reaching healthy cholesterol levels. In addition, foods high in potassium counteract some of the effect of sodium on blood pressure, according to the USDA guidelines.

### *Creating a healthy heart diet*

The federal government and the American Heart Association are among the organizations that provide recommendations for a healthy lifestyle. The recommendations frequently parallel those of the healthy heart diet, a plan that emphasizes the consumption of less fat, less cholesterol, and less sodium. There is also agreement that diets should include fiber-rich foods like fruits, vegetables, and whole-grain products.

Guidelines also focus on the importance of regular physical activity to prevent or lower the risk of conditions like heart disease. Generally, people are advised to exercise at least 30 minutes most days of the week. While some recommendations are designed for healthy people, the guidelines also apply to a healthy heart diet. There may be more specific instructions in plans to lower cholesterol levels.

**DIETARY GUIDELINES FOR AMERICANS 2005.** *Nutrition and Your Health: Dietary Guidelines for Americans* defines a healthy eating plan as one that:

- Emphasizes fruits, vegetables, whole grains, and fat-free or low-fat milk and milk products.
- Includes lean meats, poultry, fish, beans, eggs, and nuts.
- Is low in saturated fats, trans fats, cholesterol, salt, and added sugars.
- The total fat intake should be between 20% to 35% of the daily calories consumed.

People can create a diet with those foods by using online tools like the USDA's MyPyramid Plan and calculators on the NHBLI pages for the Heart Healthy and TLC diets. Someone Internet sites produce an individualized plan with specific calorie amounts, recommended foods, serving portions, and a system to track physical activity.

**AMERICAN HEART ASSOCIATION 2006 DIET AND LIFESTYLE RECOMMENDATIONS.** The heart association's plan starts with the person determining how

many calories are needed to maintain a healthy weight. People are advised not to eat more calories then they burn through activity. They should create a meal plan that includes:

- A variety of vegetables and fruits and unrefined, whole-grain food.
- Fish at least twice a week. Oily fish such as salmon, trout, and herring contain omega-3 fatty acids. These acids may help reduce the risk of fatal coronary disease.
- Lean meats and poultry without skin. These proteins should be prepared them without added saturated and trans fat.
- Less than 300 milligrams of cholesterol each day.
- A moderate amount of alcohol, with one drink per day for women and two drinks per day for men.
- Dairy products that are fat-free, 1% fat, and low-fat dairy.
- Food containing little or no salt.

The association advises the public to cut back on:

- Foods containing partially hydrogenated vegetable oils to reduce trans fat in their diets.
- Foods high in dietary cholesterol.
- Beverages and foods with added sugars.

The association certifies grocery products that meet the organization's standards. Certification on packaging is indicated by a red heart with a white check mark inside. Products with that symbol meet association criteria for recommended amounts of saturated fat and cholesterol for healthy people above the age of 2. The standard-certification designation is based on one serving that contains 1 gram or less of saturated fat, 20 milligrams or less of cholesterol, and 480 milligrams or less of sodium. The whole-grains certification is issued to foods containing those quantities and an amount of whole-grain at a proportion of 51% by weight with reference to the amount customarily consumed.

**THE NHBLI HEART HEALTHY DIET.** The NHBLI website in the spring of 2007 featured heart healthy diet guidelines and an online tool to create a personal eating plan. The online activity starts with the person providing information about height, weight, gender, age, and level of physical activity. This action generates a recommendation for a daily calorie allowance. That allowance is used to determine the percentage of total fat and saturated fat permitted at that calorie level. The consumer then receives prompts to select food choices for three meals and a snack.

As information is received, the person sees the amounts of calories, fat, total fat, cholesterol, and sodium that would be consumed. After the final entry is made, the nutritional information is totaled. The total is compared with the recommended amounts. Along with that data are recommendations on how to modify the meal plan to lower fat and cholesterol consumption.

Meal planning on the heart healthy diet is based on these guidelines:

- A person should eat just enough calories to achieve or maintain a healthy weight and reduce blood cholesterol level. A doctor or registered dietitian can determine what a reasonable calorie level.
- Saturated fat should account for 8 to 10% of the day's total calories.
- Total fat should be 30% or less of the day's total calories.
- Dietary cholesterol should be limited to less than 300 milligrams per day.
- Sodium intake should be limited to 2,400 milligrams a day.

**THE TLC DIET.** The Therapeutic Lifestyles Changes (TLC) Diet helps to lower the cholesterol of people who have a heart disease or at risk of developing one. The TLC section of the NHLBI contains online tools similar to those for the Healthy Heart diet. The guidelines for the low-saturated fat, low-cholesterol **TLC diet** are:

- The person should eat just enough calories to achieve or maintain a healthy weight and reduce the blood cholesterol level.
- Saturated fat should account for less than 7% of the daily total calorie total.
- Fat consumed amounts to 25 to 35%% of the day's total calories.
- The person should eat less than 200 milligrams of dietary cholesterol per day.
- Sodium intake should be limited to 2,400 milligrams per day.

## Function

A healthy heart diet helps people age 2 and older reduce the risk of cardiac disease. This is achieved by the consumption of foods that keep total cholesterol and LDL cholesterol at healthy levels. A healthy heart diet may involve lowering cholesterol levels by reducing the amount of foods high in cholesterol, fat, and sodium. At the same time, people work to increase HDL levels through diet and exercise.

The healthy heart diet is a lifelong process that starts with education about the effects of food on the heart. People on this diet learn to make wise food choices, relying on information including the nutritional labels on processed food. The labels provide information about the calories, fats, sodium, and sugar in a single serving of the product.

## Benefits

The benefits of a healthy heart diet are that people lower their cholesterol levels and reduce their risks of cardiovascular disease. A healthy heart diet is a preventive plan for people age 2 and older since high cholesterol could become an issue in childhood. Parents who place their children on healthy heart diets not only help them with physical health, they give their children with the basics for a lifetime of healthy habits.

Diet and regular physical activity keep cholesterol at healthy levels. The healthy heart diet that is also a weight loss plan will help obese and overweight people shed excess pounds. Smoking is another risk factor that will be lowered when people stop smoking. Diabetes and high blood pressure also put people at risk for heart disease. Both may be treated with medication, and people diagnosed with those conditions will benefit from a healthy heart diet.

Factors like heredity can't be changed, so people with a family history of high cholesterol or early heart disease should prescribe to a heart healthy diet. The NHLBI defined the person at risk as someone with a father or brother diagnosed with this condition before the age 55. There is also a risk to someone with a mother or sister with this condition before age 65.

Furthermore, cholesterol levels rise as a person ages. The level rises in men at age 45 and older. For women, the increase is generally seen at age 55 and older, according to NHLBI.

## Precautions

A healthy heart diet is safe for people age 2 and older. However, some people may to consult with their doctor before eating some foods such as fish. The United States Food and Drug Administration and the Environmental Protection Agency in 2004 warned pregnant women and nursing mothers to limit their consumption of fish and shellfish to 12 ounces (340.2 grams) per week. The warning was issued because of the risk that toxins in seafood would cause developmental problems in babies and children. Furthermore, women who are pregnant or nursing should not eat shark, marlin, and swordfish because of the high mercury content in these fish.

### QUESTIONS TO ASK YOUR DOCTOR

- Should I be concerned about my cholesterol levels?
- What do I need to do to lower cholesterol levels?
- Do I need to lose weight? If so, what is a healthy goal weight?
- What healthy heart diet should I follow?
- Should I avoid certain foods because of medications I'm taking or because of a health condition?
- What is the minimum amount of calories that I should eat each day to lose weight?
- Am I physically able to begin an exercise program?
- What is the best type of exercise for me?
- How long should I do this exercise?
- How many times a week should I exercise?
- Are there any instructions I need to prevent injuries?

## Risks

When following a healthy heart diet, people need to be aware of the nutritional content of the foods they consume. They need to evaluate that information and make wise food choices. For example, the AHA points out that nuts and seeds are cholesterol-free sources of protein and a source of unsaturated fat. However, nuts and seeds are high in calories. Furthermore, frozen meals that are low in calories and fat should be examined for their sodium content.

Those foods can be part of a healthy heart diet. However, people need to observe nutritional recommendations for daily fat, sodium, and calorie allowances. Otherwise, their diet will aggravate a condition like high blood pressure or **obesity**.

## Research and general acceptance

More than a century ago, W.O. Atwater of the UDSA cautioned about the dangers of overeating. His warning proved accurate. Cardiovascular disease (CVD) was the leading cause of death in the United States in each year since 1900, with the exception of 1918, according to the American Heart Association's *Heart Disease and Stroke Statistics—2007 Update*. The heart association compiles that report in conjunction with government agencies.

According to the report, nearly 2,400 Americans die of CVD each day. That amounts to an average of one death every 36 seconds. In addition, an estimated 79,400,000 American adults (one in three) have one or more types of cardiovascular disease. Of those, 37,500,000 were estimated to be age 65 or older.

By the 1970s, research showed the link between chronic diseases like heart disease and stroke and a diet high in fat, saturated fat, cholesterol, and sodium. Research in the decades since then has affirmed the connection between poor diet and disease.

During those years, Americans ate more of the foods that put them at risk for heart disease. The average calorie consumption rose 16% between 1970 and 2003, according to USDA figures cited in the heart association report.

Information from the National Health and Nutrition Examination Survey for 1999-2000 indicated that Americans have not yet accepted the nutritional guidelines of a heart health diet. According to the report:

- The average daily intake of total fat in was 79 grams, with men averaging 91 grams and women averaging 67 grams.
- The average daily intake of saturated fat was 27 grams, with 31 grams for men and 23 grams for women.
- The average amount of dietary fiber consumed was 15.6 grams, below the recommended amount of 25 grams or more. Men ate 17.8 grams of fiber and women consumed 13.6 grams.

In the 21st century, obesity in the United States is considered an epidemic. Federal agencies and organizations are responding with a range of programs to promote the benefits of a healthy heart diet.

### Resources

#### BOOKS

American Heart Association. *The new American Heart Association Cookbook*. Clarkson Potter/Publishers, 2004.

#### ORGANIZATIONS

American Dietetic Association, 120 South Riverside Plaza, Suite 2000, Chicago, IL 60606. (800) 877-1600. <http://eatright.org>.

American Heart Association National Center, 7272 Greenville Ave., Dallas, TX 75231. (800) 242-8721. <http://www.americanheart.org.>.

#### WEBSITES

National Heart, Lung, and Blood Institute. *Choosing Foods on the Heart Healthy Diet* .<http://www.nhlbisupport.com/cgi-bin/chd1/diet1.cgi> (April 21, 2007).

National Heart, Lung, and Blood Institute. *Introduction to the TLC Diet*. <http://www.nhlbi.nih.gov/cgi-bin/chd/step2intro.cgi> (April 21, 2007).

United States Department of Agriculture. *MyPyramid Plan*. <http://www.mypyramid.gov/mypyramid/index.aspx> (April 21, 2007).

#### OTHER

American Heart Association. *American heart Association's Heart Disease and Stroke Statistics— 2007 Update* <http://www.americanheart.org/presenter.jhtml?identifier=1200026> (April 9, 2007).

Centers for Disease Control and Prevention National Center for Chronic Disease Prevention and Health Promotion. *Physical Activity and Good Nutrition: Essential Elements to Prevent Chronic Diseases and Obesity At A Glance 2007*. <http://www.cdc.gov/nccdphp/publications/aag/dnpa.htm> (April 9, 2007).

Davis, Carole and Sallo, Etta; U.S. Department of Agriculture *Dietary Recommendations and How They Have Changed Over Time*. <http://www.ers.usda.gov/publications/aib750/aib750b.pdf> (April 21, 2007).

U.S. Department of Agriculture and the Department of Health and Human Services. *Dietary Guidelines for Americans 2005*. <http://www.health.gov/dietaryguidelines/dga2005/document> (April 9, 2007).

Liz Swain

# Heartburn

## Definition

Heartburn is a burning sensation in the chest that can extend to the neck, throat, and face; it is worsened by bending or lying down. It is the primary symptom of gastroesophageal reflux, which is the movement of stomach acid into the esophagus. On rare occasions, it is due to gastritis (stomach lining inflammation).

## Description

More than one-third of the population is afflicted by heartburn, with about one-tenth afflicted daily. Infrequent heartburn is usually without serious consequences, but chronic or frequent heartburn (recurring more than twice per week) can have severe consequences. Accordingly, early management is important.

Understanding heartburn depends on understanding the structure and action of the esophagus. The esophagus is a tube connecting the throat to the stomach. It is about 10 in (25 cm) long in adults, lined with squamous (plate-like) epithelial cells, coated with

**An illustration of foaming antacid on top of the contents of a human stomach. Heartburn is caused by a backflow of the stomach's acidic contents into the esophagus, causing inflammation and a sense of pain that can rise to the throat.** *(Illustration by John Bavosi, Custom Medical Stock Photo, Inc. Reproduced by permission.)*

mucus, and surrounded by muscles that push food to the stomach by sequential waves of contraction (peristalsis). The lower esophageal sphincter (LES) is a thick band of muscles that encircles the esophagus just above the uppermost part of the stomach. This sphincter is usually tightly closed and normally opens only when food passes from the esophagus into the stomach. Thus, the contents of the stomach are normally kept from moving back into the esophagus.

The stomach has a thick mucous coating that protects it from the strong acid it secretes into its interior when food is present, but the much thinner esophageal coating doesn't provide protection against acid. Thus, if the LES opens inappropriately or fails to close completely, and stomach contents leak into the esophagus, the esophagus can be burned by acid. The resulting burning sensation is called heartburn.

Occasional heartburn has no serious long-lasting effects, but repeated episodes of gastroesophageal reflux can ultimately lead to esophageal inflammation (esophagitis) and other damage. If episodes occur more frequently than twice a week, and the esophagus is repeatedly subjected to acid and digestive enzymes from the stomach, ulcerations, scarring, and thickening of the esophagus walls can result. This thickening of the esophagus wall causes a narrowing of the interior of the esophagus. Such narrowing affects swallowing and peristaltic movements. Repeated irritation can also result in changes in the types of cells that line the esophagus. The condition associated with these changes is termed Barrett's syndrome and can lead to esophageal cancer.

## KEY TERMS

**Barrett's syndrome**—Also called Barrett's esophagus or Barrett's epithelia, this is a condition where the squamous epithelial cells that normally line the esophagus are replaced by thicker columnar epithelial cells.

**Digestive enzymes**—Molecules that catalyze the breakdown of large molecules (usually food) into smaller molecules.

**Esophagitis**—Inflammation of the esophagus.

**Fundoplication**—A surgical procedure that increases pressure on the LES by stretching and wrapping the upper part of the stomach around the sphincter.

**Gastroesophageal reflux**—The flow of stomach contents into the esophagus.

**Hiatus hernia**—A protrusion of part of the stomach through the diaphragm to a position next to the esophagus.

**Metabolic**—Refers to the chemical reactions in living things.

**Mucus**—Thick, viscous, gel-like material that functions to moisten and protect inner body surfaces.

**Peristalsis**—A sequence of muscle contractions that progressively squeeze one small section of the digestive tract and then the next to push food along the tract, something like pushing toothpaste out of its tube.

**Scleroderma**—An autoimmune disease with many consequences, including esophageal wall thickening.

**Squamous epithelial cells**—Thin, flat cells found in layers or sheets covering surfaces such as skin and the linings of blood vessels and esophagus.

**Ulceration**—An open break in surface tissue.

## Causes and symptoms

### *Causes*

A number of different factors may contribute to LES malfunction with its consequent gastroesophageal acid reflux:

- The eating of large meals that distend the stomach can cause the LES to open inappropriately.
- Lying down within two to three hours of eating can cause the LES to open.

- Obesity, pregnancy, and tight clothing can impair the ability of the LES to stay closed by putting pressure on the abdomen.
- Certain drugs, notably nicotine, alcohol, diazepam (Valium), meperidine (Demerol), theophylline, morphine, prostaglandins, calcium channel blockers, nitrate heart medications, anticholinergic and adrenergic drugs (drugs that limit nerve reactions), including dopamine, can relax the LES.
- Progesterone is thought to relax the LES.
- Greasy foods and some other foods such as chocolate, coffee, and peppermint can relax the LES.
- Paralysis and scleroderma can cause the LES to malfunction.
- Hiatus hernia may also cause heartburn according to some gastroenterologists. (Hiatus hernia is a protrusion of part of the stomach through the diaphragm to a position next to the esophagus.)

### *Symptoms*

Heartburn itself is a symptom. Other symptoms also caused by gastroesophageal reflux can be associated with heartburn. Often heartburn sufferers salivate excessively or regurgitate stomach contents into their mouths, leaving a sour or bitter taste. Frequent gastroesophageal reflux leads to additional complications including difficult or painful swallowing, sore throat, hoarseness, coughing, laryngitis, wheezing, asthma, pneumonia, gingivitis, bad breath, and earache.

## Diagnosis

Gastroenterologists and internists are best equipped to diagnose and treat gastroesophageal reflux. Diagnosis is usually based solely on patient histories that report heartburn and other related symptoms. Additional diagnostic procedures can confirm the diagnosis and assess damage to the esophagus, as well as monitor healing progress. The following diagnostic procedures are appropriate for anyone who has frequent, chronic, or difficult-to-treat heartburn or any of the complicating symptoms noted in the previous paragraph.

X rays taken after a patient swallows a barium suspension can reveal esophageal narrowing, ulcerations or a reflux episode as it occurs. However, this procedure cannot detect the structural changes associated with different degrees of esophagitis. This diagnostic procedure has traditionally been called the "upper GI series" or "barium swallow" and costs about $250.00.

Esophagoscopy is a newer procedure that uses a thin flexible tube to view the inside of the esophagus directly. It should be done by a gastroenterologist or gastrointestinal endoscopist and costs about $700. It gives an accurate picture of any damage present and gives the physician the ability to distinguish between different degrees of esophagitis.

Other tests may also be used. They include pressure measurements of the LES; measurements of esophageal acidity (pH), usually throughout a 24-hour period; and microscopic examination of biopsied tissue from the esophageal wall (to inspect esophageal cell structure for Barrett's syndrome and malignancies).

New technology introduced by 2003 allows for continuous monitoring of pH levels to help determine the cause. A tiny wireless capsule can be delivered to the lining of the esophagus through a catheter and data recorder on a device the size of a pager that is clipped to the patient's belt or purse for 48 hours. The capsule eventually sloughs off and passes harmlessly through the gastrointestinal tract in seven to 10 days.

*Note:* A burning sensation in the chest is usually heartburn and is not associated with the heart. However, chest pain that radiates into the arms and is not accompanied by regurgitation is a warning of a possible serious heart problem. Anyone with these symptoms should contact a doctor immediately.

## Treatment

### *Drugs*

Occasional heartburn is probably best treated with over-the-counter antacids. These products go straight to the esophagus and immediately begin to decrease acidity. However, they should not be used as the sole treatment for heartburn sufferers who either have two or more episodes per week or who suffer for periods of more than three weeks. There is a risk of kidney damage and other metabolic changes.

H2 blockers (histamine receptor blockers, such as Pepsid AC, Zantac, Tagamet) decrease stomach acid production and are effective against heartburn. H2 blocker treatment also allows healing of esophageal damage but is not very effective when there is a high degree of damage. It takes 30–45 minutes for these drugs to take effect, so they must be taken prior to an episode. Thus, they should be taken daily, usually two to four times per day for several weeks. Six to 12 weeks of standard-dose treatment relieves symptoms in about one-half the patients. Higher doses relieve symptoms in a greater fraction of the population, but

at least 25% of heartburn sufferers are not helped by H2 blockers.

Proton-pump inhibitors also inhibit acid production by the stomach, but are much more effective than H2 blockers for some people. They are also more effective in aiding the healing process. Esophagitis is healed in about 90% of the patients undergoing proton-pump inhibitor treatment.

The long-term effects of inhibiting stomach acid production are unknown. Without the antiseptic effects of a consistently very acidic stomach environment, users of H2 blockers or proton-pump inhibitors may become more susceptible to bacterial and viral infection. Absorption of some drugs is also lowered by this less-acidic environment.

Prokinetic agents (also known as motility drugs) act on the LES, stimulating it to close more tightly, thereby keeping stomach contents out of the esophagus. It is not known how effectively these drugs promote healing. Some of the early motility drugs had serious neurological side effects, but a newer drug, cisapride, seems to act only on digestive system nerve connections.

#### *Surgery*

Fundoplication, a surgical procedure to increase pressure on the LES by stretching and wrapping the upper part of the stomach around the sphincter, is a treatment of last resort. About 10% of heartburn sufferers undergo this procedure. It is not always effective and its effectiveness may decrease over time, especially several years after surgery. Dr. Robert Marks and his colleagues at the University of Alabama reported in 1997 on the long-term outcome of this procedure. They found that 64% of the patients in their study who had fundoplication between 1992 and 1995 still suffered from heartburn and reported an impaired quality of life after the surgery.

However, laparoscopy (an examination of the interior of the abdomen by means of the laparoscope) now provides hope for better outcomes. Fundoplication performed with a laparoscope is less invasive. Five small incisions are required instead of one large incision. Patients recover faster, and it is likely that studies will show they suffer from fewer surgical complications.

## Nutrition/Dietetic concerns

Prevention, as outlined below, is a primary feature for heartburn management in alternative medicine and traditional medicine. Dietary adjustments can eliminate many causes of heartburn.

Herbal remedies include bananas, aloe vera gel, chamomile (*Matricaria recutita*), ginger (*Zingiber officinale*), and citrus juices, but there is little agreement here. For example, ginger, which seems to help some people, is claimed by other practitioners to *cause* heartburn and is thought to relax the LES. There are also many recommendations to *avoid* citrus juices, which are themselves acidic. Licorice (*Glycyrrhiza uralensis*) can help relieve the symptoms of heartburn by reestablishing balance in the acid output of the stomach.

Several homeopathic remedies are useful in treating heartburn symptoms. Among those most often recommended are *Nux vomica, Carbo vegetabilis*, and *Arsenicum album*. Acupressure and acupuncture may also be helpful in treating heartburn.

Sodium bicarbonate (baking soda) is an inexpensive alternative to use as an antacid. It reduces esophageal acidity immediately, but its effect is not long-lasting and should not be used by people on sodium-restricted diets.

## Prognosis

The prognosis for people who get heartburn only occasionally or people without esophageal damage is excellent. The prognosis for people with esophageal damage who become involved in a treatment program that promotes healing is also excellent. The prognosis for anyone with esophageal cancer is very poor. There is a strong likelihood of a painful illness and a less than 5% chance of surviving more than five years.

## Prevention

Given the lack of completely satisfactory treatments for heartburn or its consequences and the lack of a cure for esophageal cancer, prevention is of the utmost importance. Proponents of traditional *and* alternative medicine agree that people disposed to heartburn should:

- avoid eating large meals
- avoid alcohol, caffeine, fatty foods, fried foods, hot or spicy foods, chocolate, peppermint, and nicotine
- avoid drugs known to contribute to heartburn, such as nitrates (heart medications such as Isonate and Nitrocap), calcium channel blockers (e.g., Cardizem and Procardia), and anticholinergic drugs (e.g., Probanthine and Bentyl), and check with their doctors about any drugs they are taking
- avoid clothing that fits tightly around the abdomen
- control body weight
- wait about three hours after eating before going to bed or lying down

- elevate the head of the bed 6–9 inches to alleviate heartburn at night. This can be done with bricks under the bed or with a wedge designed for this purpose.

Preventing heartburn's switch to cancer begins with preventing heartburn in the first place. A study in Great Britain in 2004 also looked at using a combination of aspirin and an anti-ulcer drug to try to prevent Barrett's esophagus from forming in patients with long-term heartburn. Aspirin has been found in previous studies to reduce cases of esophageal cancer. However, since one of its side effects is an increased risk of stomach ulcers, the researchers were including an effective anti-ulcer drug for participants.

### Resources

#### PERIODICALS

"Aspirin Trial Launched to Block Heartburn's Switch to Cancer." *Drug Week*. January 23, 2004:188.

Bealfsky, Peter C., and William Halsey. "An Endoscopic View of a Wireless pH–Monitoring Capsule." *Ear, Nose and Throat Journal*. April 2003: 254.

#### ORGANIZATIONS

The American College of Gastroenterology (ACG). PO Box 3099, Alexandria, VA 22302. (800) HRT-BURN. <http://www.healthtouch.com.>

The American Gastroenterological Association (AGA). 7910 Woodmont Ave., 7th Floor, Bethesda, MD 20814. (310) 654-2055. <http://www.gastro.org/index.html.>

American Society for Gastrointestinal Endoscopy. 13 Elm St., Manchester, MA 01944. (508) 526-8330. <http://www.asge.org/doc/201.>

National Digestive Diseases Information Clearinghouse. 2 Information Way, Bethesda, MD 20892-3570. (800) 891-5389. <http://www.niddk.nih.gov/health/digest/nddic.htm.>

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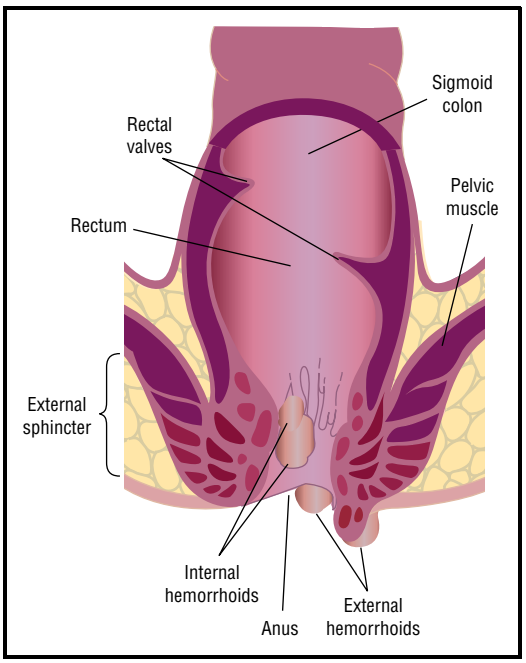
# Hemorrhoids

## Definition

Hemorrhoids, also called piles, refers to a condition in which the veins around the anus or rectum are swollen and inflamed. Dietary adjustments are known to help relieve hemorrhoids.

## Origins

Ten million people in the United States have hemorrhoids, leading to a prevalence greater than 4%. Up to a third of these people require medical treatment,




**Sitting for long periods, pregnancy, constipation, and straining to defecate all contribute to hemorrhoids, which are caused by congestion in the veins of the lower rectum or anus.** *(Illustration by Electronic Illustrators Group/Thomson Gale.)*

resulting in 1.5 million prescriptions per year. The peak age for hemorrhoids is 45–65 years. The term hemorrhoid is usually related to symptoms caused by hemorrhoids. Hemorrhoids occur in healthy individuals. It is when they become enlarged, inflamed, or prolapsed, that most people refer to the condition as hemorrhoids. They are rarely a serious risk to health, and result from too much pressure on the hemorrhoidal veins in the rectum. The strain of **constipation**, diarrhea and pregnancy can cause the veins to swell. Other factors such as **obesity** and liver disease can also increase pressure and cause hemorrhoids. There are three types of hemorrhoids:

- Internal hemorrhoids: Internal hemorrhoids can not be seen, they are inside the anus. Straining or irritation from passing stool can injure a hemorrhoid's delicate surface and cause bleeding. Because internal anal membranes lack pain-sensitive nerve endings, these hemorrhoids usually do not cause discomfort.
- External hemorrhoids: These hemorrhoids are under the skin around the anus and tend to be painful. Sometimes blood may collect in an external hemorrhoid and form a clot, causing severe pain, swelling and inflammation. When irritated, external hemorrhoids can itch or bleed.
- Prolapsed hemorrhoids: These are internal hemorrhoids that are so distended that they are pushed outside the anus.

In the absence of complications, treatment usually involves over-the-counter corticosteroid creams that can reduce the pain and swelling of hemorrhoids and bathing in tubs with warm **water** to ease painful perianal conditions. Another important step in treating hemorrhoids is to relieve anal pressure and straining. This can often be done by controlling constipation with a **high-fiber diet**.

## Description

Foods that are high in **fiber** have been shown to help in the treatment of constipation and hemorrhoids. The American Academy of Family Physicians recommends the following simple **dietary guidelines** to prevent or lower hemorrhoids symptoms:

- Eating at least 4.5 cups of fruits and vegetables each day.
- Replacing white bread with whole-grain breads and cereals.
- Eating bran cereal for breakfast.
- Adding 1/4 cup of wheat bran (Miller's bran) to foods such as cooked cereal or applesauce or meat loaf. (This advice is contrary to other experts and organisations who advise against this practice as it can make constipation worse.)
- Eating cooked beans each week.

In its most recent 2005 public health recommendations for dietary fiber, the National Academy of Sciences established an Adequate Intake (AI) level of 38g of total daily fiber for males 19–50 years of age and 25g for women in this same age range. The following foods are excellent sources of dietary fiber and can be included as part of a hemorrhoid diet:

- cinnamon, ground, 2 tsp (2.5g)
- turnip greens, cooked, 1 cup (5.0g)
- basil, dried, ground, 2 tsp (1.2g)
- coriander seeds, 2 tsp (1.4g)
- oregano, dried, ground, 2 tsp (1.3g)
- raspberries, 1 cup (8.3g)
- thyme, dried, ground, 2 tsp (1.1g)
- mustard greens, boiled, 1 cup (2.8g)
- rosemary, dried, 2 tsp (0.9g)
- romaine lettuce, 2 cups (1.9g)
- cauliflower, boiled, 1 cup (3.4g)
- collard greens, boiled, 1 cup (5.3g)
- broccoli, steamed, 1 cup (4.7g)
- cloves, dried, ground, 2 tsp (1.5g)
- celery, raw, 1 cup (2.0g)
- swiss chard, boiled, 1 cup (3.7g)
- cabbage, shredded, boiled, 1 cup (3.5g)
- spinach, boiled, 1 cup (4.3g)
- chili pepper, dried, 2 tsp (2.6g)
- black pepper, 2 tsp (1.1g)
- fennel, raw, sliced, 1 cup (2.7g)
- green beans, boiled, 1 cup (4.0g)
- eggplant, cooked, 1 cup (2.5g)
- cayenne pepper, dried, 2 tsp (1.0g)
- cranberries, 1/2 cup (2.0g)
- strawberries, 1 cup (3.3g)
- bell peppers, red, raw, 1 cup (1.8g)
- winter squash, baked, 1 cup (5.7g)
- kale, boiled, 1 cup (2.6g)
- split peas, cooked, 1 cup (16.3g)
- summer squash, cooked, 1 cup (2.5g)
- carrots, raw, 1 cup (3.7g)
- lentils, cooked, 1 cup (15.6g)
- brussel sprouts, boiled, 1 cup (4.1g)
- asparagus, boiled, 1 cup (2.9g)
- black beans, cooked, 1 cup (15.0g)
- green peas, boiled, 1 cup (8.8g)
- pinto beans, cooked, 1 cup (14.7g)
- cucumbers, slices, with peel, 1 cup (0.8g)
- lima beans, cooked, 1 cup (13.2g)
- turmeric, powder, 2 tsp (1.0g)
- flaxseeds, 2 tbs (5.4g)
- kiwifruit, 1 each (2.6g)
- wheat, bulgur, cooked, 1 cup (8.2g)
- tomato, ripe, 1 cup (2.0g)
- oranges, 1 each (3.1g)
- kidney beans, cooked, 1 cup (11.3g)
- barley, cooked, 1 cup (13.6g)
- apricots, 1 each (0.8g)
- blueberries, 1 cup (3.9g)
- onions, raw, 1 cup (2.9g)
- chickpeas, 1 cup (12.5g)
- papaya, 1 each (5.5g)
- apples, 1 each (3.7g)
- grapefruit, 1/2 (1.7g)
- beets, boiled, 1 cup (3.4g)
- navy beans, cooked, 1 cup (11.7g)
- rye, whole grain, uncooked, 1/3 cup (8.2g)
- pear, 1 each, (4.0g)
- soybeans, cooked, 1 cup (10.3g)
- yam, cubed, cooked, 1 cup (5.3g)
- sweet potato, baked, with skin, 1 each (3.1g)

## KEY TERMS

**Anus**—The terminal opening of the digestive tract.

**Colon**—Part of the large intestine, located in the abdominal cavity. It consists of the ascending colon, the transverse colon, the descending colon, and the sigmoid colon.

**Constipation**—The difficult passage of stools or the infrequent (less than three times a week) or incomplete passage of stools.

**Digestive system**—Organs and paths responsible for processing food in the body. These are the mouth, the esophagus, the stomach, the liver, the gallbladder, the pancreas, the small intestine, the large intestine, and the rectum.

**Feces**—Waste product of digestion formed in the large intestine. About 75% of its mass is water, the remainder is protein, fat, undigested roughage, dried digestive juices, dead cells, and bacteria.

**Perianal**—The area surrounding the anus.

**Prolapse**—The falling down or slipping out of place of an organ or part.

**Rectum**—Short, muscular tube that forms the lowest portion of the large intestine and connects it to the anus.

**Venous return**—The blood returning to the heart via the inferior and superior venae cavae.

- avocado, slices, 1 cup (7.3g)
- mustard seeds, 2 tsp (1.1g)
- prunes, 1.4 cup (3.0g)
- buckwheat, cooked, 1 cup (4.5g)
- olives, 1 cup (4.3g)
- oats, whole grain, cooked, 1 cup (4.0g)
- plum, 1 each (1.0g)
- miso, 1 oz (1.9g)
- banana, 1 each (2.8g)
- corn, yellow, cooked, 1 cup (4.6g)
- pineapple, 1 cup (1.9g)
- cantaloupe, cubes, 1 cup (1.3g)
- potato, baked, with skin, 1 cup (2.9g)

### Function

Eating more high-fiber foods such as fruits, vegetables and grains softens the stool and increases its bulk, which helps to reduce the straining that can cause hemorrhoids or worsen the symptoms of existing hemorrhoids.

### Benefits

Fiber helps to keep stool soft while lowering pressure inside the colon so that bowel contents can move through easily. Eating a high-fiber diet will not only relieve constipation and alleviate hemorrhoid symptoms, it is also beneficial in supporting bowel regularity, maintaining normal cholesterol and blood sugar levels, and keeping excess weight off. Additionally, a high-fiber diet is believed to play a role in the prevention and treatment of the following health conditions:

- Breast cancer
- Cardiovascular disease
- Colon cancer
- Diabetes
- Gallstones
- High cholesterol
- Irritable bowel syndrome
- Obesity
- Syndrome X

### Precautions

Intake of dietary fiber exceeding 50 grams per day may cause intestinal obstructions. Excessive intake of fiber can also result in body fluid imbalance and **dehydration**. This is why individuals who start increasing their fiber intake are often advised to also increase their water intake, up to 2 liters (8 cups) of fluid daily.

### Risks

When people increase the fiber content of their diet, they are usually advised to do so gradually, adding small amounts to start with so as to allow the intestinal tract to adjust. Otherwise, abdominal cramps, gas, bloating, and diarrhea or constipation may result. Excessive intake of dietary fiber has also been linked with reduced absorption of **vitamins**, **minerals**, proteins, and calories. However, it is unlikely that healthy adults who consume fiber in amounts within the recommended ranges will experience such problems.

### Research and general acceptance

Most medical experts agree that low-fiber diets result in small stools, that increase straining during defecation. This increased pressure causes congestion of the hemorrhoids. Pregnancy can also cause hemorrhoidal problems. A decreased venous return is

## QUESTIONS TO ASK YOUR DOCTOR

- How common are hemorrhoids?
- How did I get hemorrhoids?
- How are hemorrhoids treated?
- Are there foods that I should avoid?
- How are hemorrhoids prevented?
- Can hemorrhoids be cured?
- How can I tell if I am getting enough fiber in my diet?
- How will I know if I am getting too much fiber in my diet?
- Would seeing a dietician for an eating plan help?
- How effective is diet in controlling hemorrhoids?
- What is the function of dietary fiber?

believed to be the mechanism of action. Prolonged sitting on a toilet, for instance while reading, is also thought to cause a venous return problem in the perianal area, resulting in enlarged hemorrhoids. Aging also weakens the anal support structures, which facilitates prolapse. Weakening of support structures can occur as early as the third decade of life. There is agreement among health practitioners that the best way to prevent hemorrhoids is to keep stools soft so that they can pass easily, and to empty bowels as soon as there is an urge. Waiting to pass stool may cause it become dry and harder to pass.

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#### ORGANIZATIONS


American Dietetic Association. 216 W. Jackson Blvd, Chicago, IL 60606-6995. 1-800-877-1600 ext. 5000. <www.eatright.org>.

Food and Nutrition Information Center. 10301 Baltimore Avenue, Beltsville, MD 20705-2351. <http://www.nutrition.gov>.

American Gastroenterological Association. 930 Del Ray Avenue, Bethesda, MD 20814. (301)654-2055. <http://www.gastro.org>.

International Foundation for Functional Gastrointestinal Disorders Inc. P.O. Box 170864, Milwaukee, WI 53217-8076. 1-888-964-2001. <http://www.iffgd.org>.


Monique Laberge, Ph.D.

# Herbalife

## Definition

Herbalife is a U.S. company—formally named Herbalife International—which sells weight-loss, weight management, personal care, health, food/dietary, and nutritional supplement products. The company uses network marketing, also called multi-level marketing, which is a type of marketing plan that uses direct marketing along with franchisers and/or independent contractors to sell its products. According to the company's Website, "Herbalife's innovative products have been developed by scientists, doctors and nutritionists with your personal wellness goals in mind."

Herbalife is headquartered in Los Angeles, California, with about 3,500 employees worldwide, as of 2006. The company is part of the nutrition and skin care products industry. Its website is http://www.herbalife.com.

The company sells a wide range of herb-, botanical-, and other such health-based products including Male Factor 1000, 21-Day Herbal Cleansing, NiteWorks, HeartBar, Shapeworks, MentalBalance, Health & Fitness Bulk & Muscle Program, Dermojetics skin-care products, Cell-U-Loss supplement, and Nature's Raw Guyana. As of 2006, Herbalife sells products in 63 countries, and has annual retail sales of $3 billion. Over one million (qualified and unqualified) independent distributors are associated with the company.

## KEY TERMS

**Botanical**—Relating to plants.

**Doxepin**—A psychoactive drug characterized with helping treat depression and anxiety.

**Macronutrient**—Any carbohydrate, fat, or protein.

**Micronutrient**—Essential elements needed for human life such as minerals and vitamins.

**Pyramid scheme**—A fraudulent act in which perpetrator(s) recruit other people to pay money to those above them in a structured hierarchy with the expectation that they will get a portion of that money.

### Purpose

According to information contained in the Herbalife website, the company sells its products to consumers so they can manage and control their weight, add nutritional supplements to their diets, and provide personal care items to their daily body regimen. Weight management and weight-loss products include **protein** snacks, enhancers for energy support, enhancers for appetite support, and enhancers for digestive support. Nutritional supplements sold by the company include herbs, **minerals**, and **vitamins**. Some of its nutritional supplements are devoted to specific body parts such as the heart and digestive system, and on certain physical and mental conditions such as stress, energy/fitness, and aging. Its personal care products emphasize nutritional and herbal ingredients such as aloe vera and **vitamin C**, and deal with such matters as skin essentials and skin revitalizers, anti-aging, body essentials, hair essentials, and fragrances.

The Herbalife mission, according to its website, is to "change people's lives by providing the best business opportunity in direct selling and the best nutrition and weight management products in the world." The company states that it provides safe weight control products that supplement a balanced low-calorie diet and a regular exercise program. Its weight management and nutritional products use macronutrient and micronutrient food formulas. **Macronutrients** include **carbohydrates**, **fats**, and proteins, which together provide most of the energy needed by humans. Micronutrients are essential elements (minerals and vitamins) that are needed in minute quantities for a healthy body. Such essential elements include chromium, cobalt, copper, **iron**, **manganese**, **molybdenum**, **selenium**, and **zinc**.

As part of their advertising and marketing strategy, Herbalife relies on testimonials from health professionals. Customer testimonials also appear on the company's website.

### Description

The company was incorporated in 1979, but essentially started operations in February 1980 when its first distributor, Mark Hughes, began selling Herbalife products from the trunk of his automobile. As his customers tried and liked the products Hughes' business quickly grew. He rented an office and a warehouse in the Beverly Hills, California area, and soon developed a network of distributors.

Within two years, the company had grown to over two million dollars in sales through its distributorships in the United States and its sole distributor in Canada. Vehicles all over the United States were seen with the company's slogan: "Lose weight now, ask me how!". At this time, the Herbalife plan recommended only one meal each day, which was supplemented with protein powders and nutritional pills.

By 1985, Herbalife was listed on *INC*. magazine's fastest growing private companies. Its five-year profits from 1980 to 1985 went from $386,000 to $423 million. More than 700,000 distributors in the United States, Canada, the United Kingdom, and Australia had total gross sales of about $500 million.

In 1994, Hughes started the Herbalife Family Foundation in order to help children worldwide. In 1996, Herbalife reached one billion dollars in sales. However, four years later, Hughes died from an overdose of alcohol and doxepin (a psychoactive drug with antidepressant and anti-anxiety properties).

Today, signs posted on telephone poles, fences, mailboxes, newsstands, vehicle windshields, and other public structures and locations state such slogans as: "Lose Weight Now—Ask Me How", "Have a Computer?—Work from Home", and "Lose 30 lbs in 30 days!". These and other advertising means are often seen promoting a way for people to earn cash. When people call the toll-free number or browse the listed website they are directed to Herbalife.

### Precautions

Historically, there has been controversy with Herbalife due to the way the company operates its business. This controversy, specifically, has been directed to potentially dangerous ingredients in some

products, perceived inaccurate marketing claims, and unconventional distribution methods. Company supporters stress that Herbalife is a profitable and reputable business that is a member of the New York Stock Exchange (NYSE). Critics state that the company is run like a pyramid scheme, its independent distributors use improper customer methods, and the company has poor organization and management of distributors.

Some of the early products sold by Herbalife consisted of ma huang (*Ephedra sinica*). The herb contained ephedrine (EPH), which is one of the active ingredients in the plant genus *Ephedra*. Ephedrine was used widely as an appetite suppressant, asthma and hay fever aid, decongestant and cold reliever, and hypotension treatment. Eventually, Herbalife eliminated ephedrine after consumers complained of adverse reactions and its insurance premiums were increased. The U.S. Food and Drug Administration (FDA) banned the sale of all ephedra-contained supplements beginning on April 12, 2004.

In 1981, the FDA began receiving complaints from Herbalife consumers with symptoms of **constipation**, diarrhea, headaches, and nausea from various products. Initially, Herbalife officials informed distributors to tell customers that such symptoms were the result of the removal of poisons and toxins from the body by the use of such products. The FDA acted against Hebalife in 1982 for making claims that its Herbal-Aloe drink helped to treat bowel, kidney, and stomach **ulcers**, and that its Herbalife Formula ndash2 should be used to treat bursitis, **cancer**, herpes, and impotence. Consequently, the FDA required the company to eliminate the ingredients of mandrake and poke.

The Canadian Department of Justice filed numerous criminal charges against Herbalife for false medical claims and misleading advertising practices in 1984. The California Department of Health, California Attorney General, and FDA brought a civil lawsuit against the company in 1985. The company was charged with making misleading consumers, improper product claims, and operating an illegal 'endless-chain' scheme. Herbalife reached an out-of-court settlement by paying $850,000 in costs, fees, and penalties.

In 1986, Herbalife expanded into other countries, including Israel, Japan, Mexico, and New Zealand, after U.S. and Canadian sales declined due to negative news stories. In order to raise cash, the company merged with an Utah-based public company, and called itself Herbalife International.

In 2001, the U.S. Federal Trade Commission (FTC) provided to interested parties, in response to the Freedom of Information Act (FOIA), numerous customer complains against Herbalife International. The customer complaints are listed in the following FTC website: http://www.ftc.gov/foia/herbalife.pdf.

Still later, the company was cited by the U.S. Securities and Exchange Commission (SEC) for numerous violation involving is business practices. Herbalife officials promised to fix their managerial problems. In 2006, the company reported to the SEC that it now annually re-qualifies distributors as a way to better manage its independent contractors. As of the first-quarter of 2006, Herbalife stated that it has 240,000 qualified distributors worldwide, with about 80% outside of the United States and Canada.

## Complications

Information gleaned from various sources indicate that it is often difficult for Herbalife distributors to make a profit. Initially, they must pay large amounts of money to become a distributor. For example, according to interviews and research performed by Rob Cockerham (whose website is considered a well-known anti-scam site for Herbalife) between March and July 2002, potential distributors must purchase an informational packet for $36 and, later, an International Business Packet for $195. After completing a distributor's application, the new independent distributor receives a catalog, order forms, sales and marketing manuals, product samples, and other such literature.

The distributor then signs up for Herbalife Advantage Program, which costs $80 each month for informational brochures and Web pages that describe products. In addition, the company recommends that distributors buy a Herbalife diet and skin product website for $315 and a Herbalife business promotion website, each for $315. Furthermore, Gold and Platinum E-Commerce Business Packages cost between $952.90 and $1,994.22.

There are many websites on the Internet that advertise Herbalife products, both on the corporate and individual distributor levels. Distributors, according to Herbalife, can earn up to $250,000 annually. However, the average earning per distributor is estimated at only around $1,500. As independent contractors, distributors do not earn salaries nor benefits from the company.

## Parental concerns

Herbalife, as do many other companies, sells products that are not under FDA regulatory protection.

The FDA, under the Department of Health and Human Services, is responsible for the regulation of foods, drugs, **dietary supplements**, biological medical products, blood products, medical devices, radiation-emitting devices, veterinary products, and cosmetics. With respect to dietary supplements, the FDA, under the Dietary Supplement Health and Education Act of 1994, can only take action against manufacturers if their dietary supplements are proven unsafe. Manufacturers can legally claim their products have health benefits, however, they cannot claim these products diagnose, treat, cure, or prevent disease.

Cosmetics are regulated by the FDA's Center for Food Safety and Applied Nutrition. Cosmetics are generally not approved before they reach the marketplace. However, color added to cosmetics must be FDA approved before being sold. The FDA does regulate cosmetic labeling. According to the FDA, cosmetics that have not been thoroughly tested must advise so on its label.

Network marketing, or multi-level marketing, is legal in most U.S. states under the stipulation that a company's sales force receives earnings from customers other than relatives. In the Herbalife network marketing plan, new distributors buy products up front at 25% off the retail price. Once a distributor buys $2,000 to $4,000 of products, the distributor becomes a supervisor, at which time they get 50% off the retail price. Distributors also become supervisors by bringing other distributors into the network. Distributors then get a percentage of each recruit's sales, generally about 8%. As supervisors increase in rank, they gain the potential to earn more money. This pyramiding of earnings often is criticized as being a pyramid scheme.

In addition, Herbalife sponsors many sporting events that are especially attractive to children and young adults. For instance, the company is a regular sponsor of AVP Pro Beach Volleyball, at times being the event's Official Nutritional Advisor. It has also been the sponsor of the JPMorgan Chase Open WTA tennis tournament, the Los Angeles Galaxy, the Tour of California bicycle road race, the Michelob Ultra London Triathlon, the Nautica Malibu Triathlon, and the Thai Airways International Laguna Phuket Triathlon. Parents need to be especially concerned that children do not associate products with sporting, entertainment, or other such events, thus, thinking they are safe to use based solely on sponsorship in such events.

Before parents give children any unregulated FDA products such as nutritional supplements—whether it be from Herbalife or any other company—they should consult their family doctor. Any company or individual can make, market, and sell nutritional supplements, for instance, without adhering to quality control requirements from the FDA. They also are not required to perform research to prove the safety or effectiveness of such products. Only products under FDA regulation are required by their manufacturers to perform such activities.

In addition, parents need to be aware that some medical conditions that children may have (and which any human can have) may be adversely affected when used with unregulated products. Even though a product is advertised as being natural, this does not mean it is necessarily safe to use in all situations and with all people. Also, since nutritional supplements, for instance, are not regulated by the FDA, there is little way to determine if each dosage is identical in quantity and quality with the advertised labeling. In fact, in 2004, the Commission for Scientific Medicine and Mental Health (CSMMH) formally requested that the FDA require manufacturers of herbal remedies and dietary supplements to insert label warnings on products that have been associated with adverse health reactions in consumers.

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William Arthur Atkins

# High-fat/low-carb diets

## Definition

All food is comprised of three essential components or **macronutrients**: fat, **protein**, and carbohydrate. High-fat/low-carbohydrate or low-carb diets emphasize increased consumption of proteins and **fats** and a severe reduction of **carbohydrates**. These diets are based on research that indicates high carbohydrate consumption increases levels of insulin in the blood. Insulin is a hormone that helps the body covert food into energy in the form of glucose or sugar. High insulin levels have been linked to medical conditions such as **diabetes mellitus** type II, cardiovascular disease, and **obesity**. These diseases are all part of a syndrome called Insulin Resistance Syndrome or Syndrome X.

## Origins

The most popular and well-known of the current high fat/low carb diets is the **Atkins diet** first published in 1972 by cardiologist, Dr. Robert Atkins. However, some anthropologists believe this way of eating is as old as humanity and have called it the Paleolithic Diet.

The earliest recognized publication of a high-fat/low-carb diet was William Banting's *Letter on Corpulence*, published in 1863, in which Banting reported weight loss and improved health by following a low carbohydrate diet prescribed by his doctor, William Harvey. Banting suffered from obesity and hearing loss caused by fat compressing his inner ear. After following a low carb diet, he lost weight and his hearing improved.

In the 1920s the Epilepsy Center at Johns Hopkins Hospital began to use a high fat/low carbohydrate diet called the Ketogenic Diet to treat children with intractable, or hard to control, seizures. Johns Hopkins Epilepsy Center continues to use this diet program today. Also in the 1920s explorers Vilhjalmur Stefansson lived for many years with the Inuit people of artic Canada. His diet consisted exclusively of meat and fish. Since it was a virtually carbohydrate-free diet and high in fat, it was expected that his health would suffer. Once Stefansson returned home, Dr. Clarence Lieb of Bellevue Hospital in New York, examined him and found, to his surprise, that Stefansson was in perfect health. Dr. Lieb was able to duplicate these results later in a year long controlled study.

**High fat/low carb diets**

- Atkins Diet
- Carbohydrate Addict's Diet
- Caveman Diet (Stone Age Diet, Paleolithic Diet)
- Diet Cure
- Eat Fat Get Thin Diet
- Ketogenic Diet
- Life Without Bread
- Neanderthin
- Protein Power Diet
- Schwarzbein Principle

*(Illustration by GGS Information Services/Thomson Gale.)*

## Description

High-fat/low-carb diets vary in the number of grams of carbohydrates to be consumed each day. Most plans include three or more phases or stages. The earliest stages allow the fewest grams of carbohydrate to be eaten per day and typically last for two weeks. The middle stage is the weight loss stage and the carbohydrate grams may be slightly increased and then maintained at that level until the desired weight loss has been achieved. During the final phases, carbohydrates are gradually increased until weight loss stops or weight gain begins. At this point, the dieter reduces the amount of carbohydrate consumed until weight has stabilized.

The number of carbs allowed varies according the plan, but most plans consider the range of carbohydrates that will allow an individual to lose weight to be between 25 and 45 grams per day. The daily number of grams of carbohydrate consumed after ideal weight has been achieved will depend on the age, gender, and size of the individual, but Dr. Atkins reports that an individual of healthy weight who exercises should be able to eat between 45 and 100 grams of carbohydrate a day and still maintain a healthy weight and enjoy the health benefits of a low carb lifestyle.

Most high fat/low carb diets include counting grams of carbohydrate consumed each day or at each meal. The term Net Carb is also used. The net carbs a serving of food has is the total number of carbohydrates in the food minus the number of grams of **fiber** and the number of grams of sugar alcohol in the food. While fiber is technically a form of carbohydrate, it is not absorbed by the body and does not raise blood insulin levels. Sugar alcohol is a neither sugar nor alcohol. It is a chemically altered carbohydrate that adds sweetness to foods but is metabolized more slowly than sugar and is not as readily absorbed.

These sugar alcohols do not significantly impact insulin levels. The Atkins program calls net carbs impact carbs because these are the carbohydrates that actually impact or affect insulin levels.

Many high-fat/low-carb diets recognize that not all carbohydrates are bad. Some carbohydrates digest more slowly than others, causing a gradual rise in blood sugar after eating. Researchers have developed a glycemic index to rank carbohydrates and other foods according to the effect they have on blood sugar. It is called the glycemic index because the term "glycemia" refers to the presence of glucose or sugar in the blood.

The glycemic index is a scale of 0-100. Foods with higher glycemic index ratings break down quickly and cause a sharp spike in blood sugar. When blood sugar rises quickly, the body produces a surge of insulin to lower the amount of glucose in the blood. Insulin is a hormone that helps the body take sugar (glucose) out of the bloodstream and put it into cells, where it can be used for energy or stored in fat. Foods with lower glycemic index ratings break down more slowly. They cause a more gradual rise in blood sugar, which means less insulin will be needed. Lower blood sugar and insulin levels have been shown to prevent or treat type II diabetes and heart disease. They have also been shown to improve weight loss.

Foods that have a high glycemic index rating include: white bread, white rice, white potatoes, beer, corn products and products containing refined sugars. Foods with moderate glycemic index ratings include: whole grain breads and pastas, brown rice, sweet potatotes, green peas, many fruits (especially when eaten alone) and yogurt. Low glycemic index foods include: rye grain, nuts, legumes such as black beans and lentils, green vegetables, apricots and cherries.

Foods that are high in fiber tend to have lower glycemic index numbers, because fiber takes longer to digest. Studies have shown that fats like olive oil and acidic products like vinegar, can also slow digestion and keep blood sugar from rising too quickly. The glycemic index can be used along with a high fat/low carb diet, to help choose which carbohydrates can be eaten with the least effect on blood sugar.

Other high fat/low carb diets include:

- Protein Power (Michael Eades, MD and Mary Dan Eades, MD.)—This diet plan emphasizes adequate protein consumption and limiting carbs to between 20 to 40 grams per day in the initial phase, increasing carb consumption to 50 grams per day during the middle phase, and once ideal weight is achieved, maintaining carb consumption at between 70 to 130 grams per day afterwards. Fat is considered neutral, but the authors admit that accessive fat consumption will make weight loss difficult.
- Eat Fat Get Thin diet (Barry Groves, MD)—This plan allows up to 60 grams of carbohydrate per day until ideal weight is reached and then the dieter is advised to gradually increase the grams of carbohydrates until weight loss stops. Unlimited amounts of meat, fish, poultry, cheese and eggs are allowed. Sugar, most grains, and breads are eliminated. Fruits are allowed, but not extremely sweet fruits. All vegetables are allowed except starchy vegetable, and green leafy vegetables are encouraged.
- The Schwarzbein Principle (Diana Schwarzbein, M.D. and Nancy Deville)—Life Without Bread (Wolfgang Lutz, MD)— Dr. Lutz is an early proponent of high fat/low carb eating. His plan deals primarily with the heath benefits of the diet. He recommends a carbohydrate limit of no more than 72 grams per day and encourages unlimited meat, non–starchy vegetables, cheese and natural fats. He advices moderation when eating nuts and whole dairy products.
- The Diet Cure (Julia Ross, MD)—This plan advises eating 20 grams of protein at each meal and limiting carbohydrates to 20 grams per meal. The plan is called "undieting" and stresses the importance of breakfast, avoiding hunger, and avoiding white flour, sugar, and refined products.
- Neanderthin (Ray Audette)—Nutritionist, Ray Audette advises that it is modern technology and overly processed food that make people ill and fat. His plan advises to eat as close to natural as possible asking the simple question, "Could I eat this if I were naked with a sharp stick on the savanna?" It is a Spartan plan that forbids all grains, all beans, all dairy products, and sugar. It has been called low carb dieting in its purest form.
- The Stone Age diet (Richard Mackarness, MB, BS, DPM)—One of the earliest books espousing the benefits of high fat/low carb diets. The author suggests that refined sugar should come with a warning label, encourages high fat and high protein consumption, and restricing carbohydrates to 60 or fewer grams per day.
- The Carbohydrate Addict's diet (Richard F. Heller, MD and Rachel F. Heller, MD)—This plan suggests that people who crave carbohydrates and consume too many have a metabolic disorder that causes them to produce too much insulin in response to carbohydrates. The diet includes two low carb meals a day and one reward meal that allows more carbohydrates. This reward meal must include a large salad to start, equal portions of protein, vegetable, and

carbohydrate, and it must be eaten within a hour period. The plan does not count carbohydrate grams. It has a list of foods called "Craving–Reducing Foodsrdquo; that are allowed through out the day.

## Function

The macronutrients in foods, fat, protein, and carbohydrate are converted to energy during digestion in a process called **metabolism**. The human body needs fat and protein to survive. Both fats and proteins are converted into energy as they are digested. Carbohydrate is converted to glucose as the body produces the hormone insulin. Insulin stimulates the body to store excess energy as fat. Unless the energy generated by these carbohydrates is used immediately, the excess is stored in the form of fat within the body.

The human body does not actually need carbohydrate to survive, though other important nutrients such as **vitamins** are found in fruits and vegetables which are primarily carbohydrates with little or no fat or protein. Many cultures live healthy lives and consume only meat and **water**. These cultures, such as the Inuit or Eskimos, live long, healthy lives on diets essentially carbohydrate free.

In high fat/low carb dieting weight loss occurs because reducing carbohydrate intake causes the human body to convert fat stores into energy. This process is called ketosis. Ketosis is a very efficient form of energy production that does not involve the production of insulin. When insulin levels remain constant, excess energy is not stored as fat. Combining the fat-burning of ketosis and the stabile insulin levels created in the absence of carbohydrates, high fat/low carb diets generally lead to rapid weight loss. The rationale is that it is not fat or even calories that cause people to be overweight, but rather inefficient or unhealthy insulin cycles.

Nutritionists argue that, as with any weight loss plan, weight loss on high fat/low carb diets is caused by the reduction in calories caused by essentially eliminating an entire food group from the diet and not from a particular metabolic change.

## Benefits

Many of today's modern health concerns such as type II diabetes, heart disease, and obesity may be linked directly to improper insulin metabolism. Modern diets are high in carbohydrates. This excess carbohydrate consumption leads the body to be in a constant state of insulin production causing high levels of insulin to remain in the blood stream. This excess insulin may leads to a condition called Insulin Resistance Syndrome which causes illnesses such as diabetes, heart disease, and obesity.

Proponents of high fat/ low carb diets suggest that following these plans will lead to rapid weight loss, lower blood cholesterol levels, and increased energy.

## Precautions

While following a High Fat/ Low Carb diet, individuals must drink plenty of water. When the body burns fat for energy it creates waste products called ketones or ketone bodies. Drinking plenty of water helps to flush these by products out of the body.

## Risks

Individuals with kidney disease should not attempt high fat/low carb diets because of the risk of kidney failure. Similarly, a diet high in fats may be harmful to individuals with advanced coronary artery disease or gout. These conditions may be worsened by the increased fat consumption.

Nutritionists express concerns over the long term adherence to a diet high in saturated fats. The American Heart Association has repeatedly expressed concerns about any diet plan that encourages increased fat consumption and a reduced consumption of a variety of fruits and vegetables fearing that this diet will lead to increased risk of **coronary heart disease**, stroke, and **cancer**.

There have been individual case reports of individuals who experienced severe metabolic acidosis or too much acid in the blood, after following a high fat/ low carb diet. However, this appears to an isolated and rare complication of this diet, and many doctors argue that in individuals with normal kidney and liver function, high fat/low carb diets will not cause this condition. At least two long term studies with significant numbers of participants reported no cases of metabolic acidosis.

## Research and general acceptance

### *General acceptance*

While the ideas behind most of the high fat/low carb diet plans have been circulating since the late 1800s, debate has continued about the health benefits of a high fat/low carb diet. Many nutrionists and doctors believe this way of eating is not healthy in the long term. However, other doctors and proponents believe that the medical community is vested in a set of **dietary guidelines** is fundamentally flawed and has lead to the epidemic of obesity and obesity-related

heath issues so prevalent in American society. For the past decade, high fat/low carb diets have gained popularity, and millions of books about these diets continue to sell. Recently there has been more research to investigate the health benefits and weight loss claims of high fat/low carb diet plans.

### *Research*

In 2007, the *Journal of the American Medical Association (JAMA)* published the results of a Stanford University study comparing the Adkins diet with the Zone, LEARN, and Ornish diets. The study followed 311 over-weight women for a period of two years and eight months. The women were randomly assigned to one of the four diet plans. At the end of 12 months, participants who followed the high fat/low carb diet (Atkins) had lost the most amount of weight and had either comparable or better screenings for cholesterol, glucose and insulin, and blood pressure.

In 2004 researchers compared the effects of low carbohydrate diet and **low fat diet** on over weight individuals with high cholesterol. 120 over weight individuals with high cholesterol were randomly assigned to either a low carb diet or a low fat/calorie restricted diet. Both groups were given exercise recommendations, and the low carb group was also given supplements. At the end of 24 weeks the low carb group had lost more weight and had a greater reduction in cholesterol levels than the low fat/ low calorie group. Additionally, fewer participants dropped out of the low carb group than dropped out of the low fat/ low calorie group.

Doctors Atkins and Eades who have published books about high fat/low card diets have many case histories of patients they have treated in their individual practices who have experienced significant weight loss and improvement of medical conditions such as diabetes, high cholesterol, and coronary artery disease.

As far back as 1863, published reports support the efficacy and benefits of a high fat/low carb diet. Anthropologists have examined the remains of many cultures that ate diets consisting almost exclusively of meat and water with few if any carbohydrates. These cultures such as the Inuit of the Artic, Pacific Island tribes, and African tribes such as the Maasai, had virtually no incidence of obesity, heart disease, cancers, and other diseases that plague our society today. However, when these groups begin to eat a diet similar to diets in the United States, they develop the same obesity related illnesses prevalent in modern Western culture.

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Deborah L. Nurmi, MS

# High-fiber diet

## Definition

A high-fiber diet is a diet in which the individual consumes foods that meet or exceed the dietary reference intake (DRI) for dietary **fiber** set by the United States Institute of Medicine (IOM) of the National Academy of Sciences

## Origins

No single person developed the high-fiber diet. Over the years, researchers have compared the rate of various chronic diseases in populations that had high-fiber diets with those that had lower dietary fiber intake. They found, for example, that native Africans who ate a high-fiber, plant-based diet are rarely bothered by **constipation**. However, in industrialized countries where a lot of animal products are consumed, constipation is common. Observations like this encouraged researchers to look at other roles that dietary fiber might play in health. From their findings came a consensus that a high-fiber diet is a healthy diet. This is reflected in the Dietary Guidelines for Americans 2005, which encourage people to eat more high-fiber foods such as whole grains.

**Food sources of fiber**

| Soluble fiber | Insoluble fiber |
|---|---|
| Apples | Apples (with skin) |
| Bananas | Barley |
| Black beans | Bran and bran cereals |
| Black-eyed peas | Brown rice |
| Blackberries | Bulgur |
| Blueberries | Carrots |
| Broccoli | Cauliflower |
| Brussels sprouts | Celery |
| Chickpeas | Couscous, whole wheat |
| Citrus fruit (oranges, grapefruit) | Cucumbers |
| Kidney beans | Green beans |
| Lentils | Pears (with skin) |
| Navy beans | Tomatoes |
| Northern beans | Vegetables, raw |
| Nuts and seeds | Wheat bran |
| Oat bran | Whole grain cereals |
| Oatmeal and foods made with oats | Whole grains |
| Peaches | Whole wheat breads |
| Pears | Whole wheat pasta |
| Peas, dried | Zucchini |
| Pinto beans | |
| Plums | |
| Prunes | |
| Strawberries | |

**Common diets based on eating a diet low in carbohydrates and an increased consumption of proteins and fats.** *(Illustration by GGS Information Services/Thomson Gale.)*

## Description

The United States Institute of Medicine (IOM) of the National Academy of Sciences has set **dietary reference intakes** (DRIs) for fiber based on research data that applies to American and Canadian populations. DRIs provide nutrition guidance to both health professionals and consumers. The current daily DRIs for fiber are as follows:

- children ages 1–3 years: 19 grams
- children ages 4–8 years: 25 grams
- men ages 14–50: 38 grams
- men age 51 and older: 30 grams
- girls ages 9–18: 26 grams
- adult women ages 19–50: 25 grams
- women age 51 and older: 21 grams
- pregnant women: 28 grams
- breastfeeding women: 29 grams

## KEY TERMS

**Cholesterol**—A waxy substance made by the liver and also acquired through diet. High levels in the blood may increase the risk of cardiovascular disease.

**Constipation**—Either having fewer than three bowel movements a week or having difficulty passing stools that are often hard, small, and dry.

### Function

The average American consumes only 14 grams of fiber each day, despite extensive research that shows that higher levels off fiber provide increased health benefits. The purpose of a high-fiber diet is to encourage people to eat more fiber in order to receive the advantages of those health benefits. The high-fiber diet is not designed specifically to be a weight loss diet, although weight loss may occur as a side effect of the diet.

Dietary fiber is the collective name for a group of indigestible carbohydrate-based compounds found in plants. They are the materials that give the plant rigidity and structure. Two types of fiber are important to human health, insoluble fiber and soluble fiber.

Insoluble dietary fiber from the plants moves through the digestive system essentially unchanged. It is not digested, and it does not provide energy (calories). Instead, fiber adds bulk to the waste (stool or feces) in the large intestine (colon). Increased bulk causes the walls of the intestine to contract rhythmically (peristalsis), so that waste moves through the large intestine more rapidly. In the colon, most of the **water** in digested food is reabsorbed into the body, and then the solid waste is eliminated. By passing through the colon more rapidly, less water is reabsorbed from the waste. The stool remains soft and moist and is easy to expel without straining.

Good sources of insoluble fiber include:

- whole grains and foods made of whole grains, such as whole wheat bread and whole wheat pasta, couscous, or bulgur
- bran and bran breakfast cereals
- brown rice
- carrots, cucumbers, and other raw vegetables.

Soluble fiber is found dissolved in water inside plant cells. Like insoluble fiber, it is not digested and does not provide energy, although it may be consumed by bacteria that live in the digestive tract. In water, soluble fiber forms a gel-like substance. This gel absorbs water and helps to keep the stool soft. Good sources of insoluble fiber include:

- oatmeal and foods made with oats
- foods such as chili or split pea soup that contain dried beans and peas
- lentils
- apples
- pears
- citrus fruits

Because fiber is so important in the diet, the amount of fiber in canned goods, frozen foods, and other processed foods sold commercially must be shown on the label. A food that is labeled "high in fiber" contains 5 or more grams of fiber per serving. As of mid-2007, manufacturers were required to show only the total amount fiber in each serving of food. However, at this time regulations were under consideration that that would require soluble dietary fiber to be listed separately from total fiber. This is because soluble fiber has health benefits that insoluble fiber does not. A good list of high-fiber foods can be found at <http://www.gicare.pated/edtgs01.htm>.

### Benefits

Perhaps the most important health benefit of a high-fiber diet is its potential to protect against heart disease. Multiple large, well-designed studies have shown that soluble fiber can lower blood cholesterol levels. High levels of cholesterol can lead to the build up of plaque, a hard, waxy substance, on the walls of arteries. This can block blood flow and result in stroke or heart attack. The mechanism for lowering cholesterol appears to be connected to the fact that cholesterol binds with soluble fiber in the intestine and can then be eliminated from the body or bile acids. Soluble fiber in oats and oat products appears to be more effective in lowering cholesterol than soluble fiber from other grains. This finding has been accepted by the American Heart Association which recommends a high-fiber diet to maintain or improve heart health.

A high-fiber diet can prevent digestive system problems such as constipation, **hemorrhoids**, and diverticulitis by keeping stool soft and easy to expel. Hemorrhoids are swollen veins around the anus caused by straining to eliminate stool. Diverticulitis is a disease in which, sections of the intestine bulge out to form pockets called diverticuli that collect food and become infected. Increased bulk and moisture from

## QUESTIONS TO ASK THE DOCTOR

- Is this diet good for my entire family?
- Should I be taking any nutritional supplements while I am on this diet?
- Does this diet pose any special risks for me that I should be aware of?
- Is it safe for me to become pregnant while on this diet?

dietary fiber helps materials move more easily through the intestine and not become trapped in these pockets.

Claims have been made that a diet high in fiber reduces the risk of colon **cancer**. The theory is that fiber speeds up the elimination of waste from the colon. This decreases the time that cells lining the intestinal wall are exposed to potential cancer-causing agents. However, in the mid-2000s, a study that followed 80,000 nurses for 16 years found no relationship between dietary fiber and colon cancer. More research remains to be done in this area.

### Precautions

Fiber should be increased in the diet gradually. If fiber intake increases suddenly, abdominal pain, gas, and diarrhea may result. Also, when eating a high-fiber diet, it is important to drink at least 8 glasses (64 oz or 2 L) of water or other fluids daily. People whose fluid intake must be restricted for medical reasons should avoid a high-fiber diet.

### Risks

Few risks are associated with a high-fiber diet in healthy individuals. However, in people with gastrointestinal disorders such as **irritable bowel syndrome** and **inflammatory bowel disease**, a high-fiber diet may irritate the bowel and worsen their symptoms. Likewise, people who have had a surgical weight-loss procedure may be unable to tolerate a high-fiber diet. Adding bran fiber to foods is not recommended due to the risk of poor intakes of some **vitamins** that bind with phytates aor oxalates in many high-fiber foods.

### Research and general acceptance

Many large, well-designed, long-term studies have been done on the health effects of a diet high in fiber, as noted in the Benefits section. The almost universally accepted result is that health benefits result when individuals meet or exceed the DRI for fiber for their age group. This concept is so well accepted that it has become the official position of the National Institutes of Health and other U.S. government agencies charged with improving the health of the nation. Increased fiber intake is included in the government-promoted goals for Healthy People 2010.

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American Cancer Society. 1599 Clifton Road NE, Atlanta GA 30329-4251. Telephone: 800 ACS-2345. Website: <http://www.cancer.org>

American College of Gastroenterology. P.O. Box 342260 Bethesda, MD 20827-2260. Telephone: (301) 263-9000. Website: <http://www.acg.gi.org>

American Gastroenterological Association. 4930 Del Ray Avenue, Bethesda, MD 20814, Telephone: (301) 654-2089. Website: <:http://www.gastro.org>

National Digestive Diseases Information Clearinghouse (NDDIC). 2 Information Way Bethesda, MD 20892-3570. Telephone: (800) 891-5389. Fax: (703) 738-4929. Website: <http://digestive.niddk.nih.gov>

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Tish Davidson, A.M.

# High-protein diet

## Definition

High **protein** diets are diets in which 20% or more of the total daily calories comes from proteins. A very high protein diet is one where 30% or more of the total daily calories comes from protein. By comparison, in the average American diet about 12–16% of calories come from protein.

## Origins

High protein diets have been popular off and on since the 1960s. In the 1960s, Dr. Maxwell Stillman of the Stillman Diet was one of the first to advocate a high protein, no carbohydrate, **low fat diet** for fast weight loss. In the 1990s, diet books promoting high protein diets began to appear on bestseller lists. The most popular of these "new" high protein diets was the Atkins Diet. Other high protein diets include the **Zone Diet**, Protein Power, and Sugar Busters. These diets are the heirs to the Stillman Diet, slightly modified to include some **carbohydrates**, and repackaged with some updated terminology and scientific explanations. They encourage high protein diets for weight loss and/or for bodybuilding.

## Description

All human protein is made from about 20 different small molecules called amino acids. Out of these 20 amino acids, nine are considered essential amino acids. They are essential because the body cannot make them from other nutrients and they must be obtained fully formed from diet.

Both animals and plants are sources of protein. Animal protein has the higher biological value because it is a complete protein. Complete proteins contain all nine essential amino acids. Animal proteins include meat, poultry, fish, egg whites, and dairy products.

Plant proteins have a lower biological value because they are incomplete proteins that do not contain all nine essential amino acids. Some plants are better sources of protein than others because they lack only one or two essential amino acid. Better plant proteins include dried beans and bean products such as tofu (made from soybeans), nuts, and grains such as corn and quinoa. Many cultures have developed dishes such as red beans and rice or corn tortillas and beans that combine these incomplete proteins in the same meal to provide all the essential amino acids needed for health.

### KEY TERMS

**Amino acid**—molecules that are the basic building blocks of proteins

**B-complex vitamins**—a group of water-soluble vitamins that often work together in the body. These include thiamine ($B_1$), riboflavin ($B_2$), niacin ($B_3$), pantothenic acid ($B_5$), pyridoxine ($B_6$), biotin ($B_7$ or vitamin H), folate/folic acid ($B_9$), and cobalamin ($B_{12}$).

**Dietary fiber**—also known as roughage or bulk. Insoluble fiber moves through the digestive system almost undigested and gives bulk to stools. Soluble fiber dissolves in water and helps keep stools soft.

**Enzyme**—a protein that change the rate of a chemical reaction within the body without themselves being used up in the reaction

**Essential amino acid**—an amino acid that is necessary for health but that cannot be made by the body and must be acquired through diet.

**Glucose**—a simple sugar that results from the breakdown of carbohydrates, and under some conditions proteins and fats. Glucose circulates in the blood and is the main source of energy for the body.

**Glycogen**—A compound made when the level of glucose (sugar) in the blood is too high. Glycogen is stored in the liver and muscles for release when blood glucose levels are too low.

**Mineral**—an inorganic substance found in the earth that is necessary in small quantities for the body to maintain a health. Examples: zinc, copper, iron.

**Osteoporosis**—a condition found in older individuals in which bones decrease in density and become fragile and more likely to break. It can be caused by lack of vitamin D and/or calcium in the diet.

**Quinoa**—a high-protein grain native to South America (pronounced keen-wah)

**Vitamin**—a nutrient that the body needs in small amounts to remain healthy but that the body cannot manufacture for itself and must acquire through diet

The federal Dietary Guidelines for Americans 2005 recommends that no more than 15% of an individual's daily calories come from protein. The American Heart Association and the National Institutes of Health state that protein equaling 10-12% of an

adult's total daily calories or about .36 g/lb (.8 g/kg) of ideal body weight is a reasonable amount of protein to maintain health. By contrast, some of the high protein diets recommend between 35% (Atkins) and 64% (Stillman) of daily calories come from protein. This is equivalent to about 1–2 g/lb (2.2-4.4 g/kg) of ideal body weight.

Extra amino acids are not stored in the body. Instead, they are split apart by enzymes, and the part containing nitrogen is excreted by the kidney in urine, while the remainder is either converted into glucose (a simple sugar) and used for energy or stored as glycogen, a compound that can later be reconverted into glucose.

High protein diets are also high in saturated **fats**. Saturated fats are animal fats. They are considered "bad" fats because they raise the level of LDL cholesterol ("bad" cholesterol) in the blood. High LDL cholesterol levels are associated with an increased the risk of heart disease. High protein diets also restrict calories by severely restricting carbohydrates. Whole-grain carbohydrates are a significant source of B-complex **vitamins**. There are groups who need extra protein—rapidly growing adolescents, pregnant and nursing women, bodybuilders, endurance athletes, and some **cancer** patients— but these groups need to increase protein as part of a well-balanced diet.

## Function

High protein diets do promote fast initial weight loss, although most of the loss comes from losing **water**. The reason for this is that they drive the body into a state called ketosis. The body prefers to break down carbohydrates into glucose and use that glucose for energy. When the body is starved for carbohydrates, it begins converting fat into glucose. The process of converting fat into glucose releases water molecules which then leave the body as urine.

Dieters, of course, want to burn fat, but when they burn fat exclusively, a side effect of this reaction is that molecules called ketones build up in the blood. If the body is deprived of carbohydrates for a long time, these ketones accumulate and cause metabolic imbalances that can seriously harm the kidney and other organs. Ketones are part of the body's defense against starvation. They suppress appetite. They also cause bad breath.

## Benefits

High-protein diets offer fast weight loss. The Stillman Diet claims an individual can lose up to 30 lb (13.5 kg) in 28 days. Some high protein diets also claim health benefits. The Zone diet claims it will improve physical and mental performance, prevent chronic cardiovascular diseases, improve immune system functioning, decrease signs of aging, and increase longevity.

Rapid weight loss does occur with high protein diets, but much of the loss comes from losing water. This weight soon returns when the dieter goes off the diet. Other health claims have not been proven by any rigorous, scholarly research studies.

## QUESTIONS TO ASK THE DOCTOR

- Is a high protein diet better for me than a regular calorie-reduced diet?
- Does this diet pose any special risks for me that I should be aware of?
- Do I have any special dietary needs that this diet might not meet?
- Do I need to take a dietary supplement while I am on this diet?
- What are my risk factors for cardiovascular disease and how will this diet affect them?
- How long can I stay on this diet?
- Do you have any experience with the long-term success of this diet?
- If one of your family members wanted to go on a diet, would you recommend this one>

## Precautions

The risk of kidney damage is greater in individuals with poor kidney function who choose a high protein diet. High protein diets put an extra workload on the kidney because the nitrogen-containing part of excess amino acids is split off and has to be removed from the body in urine. Although this is not usually a problem for healthy kidneys, it can cause more damage in kidneys whose functioning is already reduced.

## Risks

Nothing about high protein diets is balanced. Virtually all high protein diets recommend that the dieter take some sort of vitamin or mineral supplement. By restricting carbohydrates, these diets reduce the amount of vitamins, mineral, and dietary **fiber**. High protein diets also increase the amount of **calcium** excreted by the kidney. This increases the loss of calcium from bone and can lead to **osteoporosis**. It also

increases the risk of kidney stones, which are more likely to form when large amounts of calcium are present. Cholesterol levels increase on high protein diets because of increased intake of saturated fats associated with animal protein. Finally, when the body is in a state of ketosis, the ketones that accumulate make the body more acidic, and this can cause major damage to various organs.

### Research and general acceptance

High protein diets have come in for a lot of criticism, even though several studies have shown that the Atkins diet is not as problematic as was originally thought. Nutritionists find high protein diets, especially high protein, high fat, severely carbohydrate restricted diets, to be unhealthy, unbalanced, and generally unnecessary because of the well-documented risks outlined above. The public, however, has embraced high-protein diets such as the Zone Diet and the Atkins Diet, at least until the next new diet comes along. Bodybuilders, weightlifters, and others wishing to gain muscle mass also look favorably on high protein diets. The Mayo Clinic concludes that high protein diets are probably not harmful to healthy individuals with good kidney function. The American Heart Association condemns these diets because they appear to increase the risk of cardiovascular disease. No studies have been done on the long-term effects of high-protein diets.

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#### ORGANIZATIONS

American Dietetic Association. 120 South Riverside Plaza, Suite 2000, Chicago, Illinois 60606-6995. Telephone: (800) 877-1600. Website: <http://www.eatright.org>

American Heart Association. 7272 Greenville Avenue, Dallas, TX 75231. Telephone: (800) 242-8721. Website: <http://www.americanheart.org>

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Tish Davidson, A.M.

## Hilton Head metabolism diet

### Definition

The Hilton Head metabolism diet was created by Peter M. Miller, PhD, who believes that a dieter's metabolism can be increased by eating five small meals a day and getting the correct amount and type exercise. This increase in metabolism will help allow the dieter to lose weight.

### Origins

The Hilton Head metabolism diet was created by Peter M. Miller. Miller was born on October 5, 1942. He attended the University of Maryland, from which he received a bachelor's degree in psychology in 1964. He then attended the University of South Carolina, from which he received a master's degree in 1966 and a doctoral degree in 1968, both in psychology. He is a professor in the Department of Psychiatry and Behavioral Sciences, and in the College of Graduate studies, at the Medical University of South Carolina. He is also the education coordinator of the Alcohol Research Center at the same institution.

Miller's writings on a variety of subjects have been published in many scholarly journals. In addition to publishing studies looking at saturated fat intake, **binge eating**, and weight loss intervention programs, he also studies alcoholism and other addiction behaviors. He is the editor of the journals *Addictive Behaviors,* and *Eating Behaviors,* and is on the editorial board of

## KEY TERMS

**Diabetes mellitus**—A condition in which the body either does not make or cannot respond to the hormone insulin. As a result, the body cannot use glucose (sugar). There are two types, type 1 or juvenile onset and type 2 or adult onset.

**Dietary supplement**—A product, such as a vitamin, mineral, herb, amino acid, or enzyme, that is intended to be consumed in addition to an individual's diet with the expectation that it will improve health.

**Mineral**—An inorganic substance found in the earth that is necessary in small quantities for the body to maintain a health. Examples: zinc, copper, iron.

**Vitamin**—A nutrient that the body needs in small amounts to remain healthy but that the body cannot manufacture for itself and must acquire through diet.

many other journals. He is board certified in clinical psychology.

In 1979, Miller founded what is now known as the Hilton Head Health Institute on Hilton Head Island in South Carolina. The institute is a weight loss and lifestyle modification retreat and spa where dieters can go to lose weight and learn new health and wellness skills. The Hilton Head metabolism diet was created by Miller using information and insights that he gained through helping dieters at the institute. Miller was the executive director of the institute until 2000.

The Hilton Head metabolism diet first appeared as a book of the same in 1983. The book was extremely popular and since then Miller has published additional books targeted at specific groups, including *The Hilton Head Over-35 Diet* and *The Hilton Head Diet for Children and Teenagers*. In 1996 he published an updated version of his original book, called *The New Hilton Head Metabolism Diet*.

## Description

The Hilton Head metabolism diet aims to increase a dieter's base metabolic rate. By doing this its intent is to not only help the dieter lose weight while on the diet, but to make weight maintenance easier for the dieter in the future. Miller says that 70% of the calories that a person burns each day are burned through metabolic processes, and only the other 30% are burned through exercise and activity. Metabolic activity is all of the processes that are required to support life, such as the processes necessary for temperature regulation, digestion, making new cells, breaking down products for use by the body, and creating proteins and other necessary substances. All of these processes require energy that is acquired each day from food. If not enough food is eaten to supply the body's energy needs, the body looks for energy elsewhere, such as in the form of stored fat.

Miller believes that because such a large percentage of caloric expenditure comes from metabolic activity, weight loss can be achieved more effectively through increased metabolism than through increased exercise alone. This diet is intended to help dieters raise their metabolic rates leading to increased calorie usage, which in turn can lead to weight loss through the burning of fat stores as energy.

An important aspect of this diet is that Miller provides psychological and emotional help to dieters that may have been struggling for many years with their weight, and who may feel uncomfortable or ashamed about their weight or appearance. He tells dieters that it is not their fault that they are overweight, and that they should not allow others to put them down. He says that although overweight people do not usually have metabolisms that are abnormal, they do often have metabolisms that are slow compared to the metabolisms of thinner people. This is why it is so important for overweight people to change their metabolism if they are going to lose weight, and keep it off.

The diet plan consists of a six week weight loss phase followed by a two week weight maintenance phase. This eight week plan can be repeated as many times as necessary until the desired weight loss has been achieved. Miller suggests that at first dieters aim to lose 10% of their body weight, especially very overweight dieters, because it is through this first amount of weight loss that the greatest health benefits are often seen.

Miller provides meal plans and recipes to go along with this diet. During the weight loss phase the dieter is limited to what amounts to about 1000 calories per day. On the weekends, however, the dieter is allowed an increased caloric consumption, usually about 200 to 250 more calories each day than during the week. During the weight maintenance phase the dieter is allowed a number of calories based on various personal needs.

The diet provides meal plans that are generally low in fat, usually fewer than 15 to 20 grams per day,

and that include many different fruits and vegetables. The diet also includes **carbohydrates** and lean meats. Miller recommends that at least five eight-ounce glasses of **water** or other liquids be drank each day while on the diet. Although the dieter has many drink choices, no caffeinated beverages are allowed, and low or no calorie drinks are recommended.

The Hilton Head metabolism diet recommends that dieters walk for 20 minutes, two times each day. Three times each week a set of strength training exercises should be done in place of one of the walks. Miller also recommends that dieters may want to take a multivitamin and a **calcium** supplement while on this diet.

## Function

The Hilton Head metabolism diet is intended to help dieters lose weight by increasing their base metabolic rate. The six weeks of weight loss followed by two weeks of weight maintenance can be repeated as many times as necessary for the desired amount of weight loss to be achieved.

It is intended to also be a lifestyle changing plan that provides recommendations for exercise and helpful information to help dieters who might be feeling upset about their weight. A long-lasting purpose of this diet is that the increase in the dieter's metabolism is supposed to make weight control easier in the future.

## Benefits

There are many benefits to weight loss and increased fitness. There are many diseases and conditions for which **obesity** if considered a risk factor, including type II diabetes, heart disease, and **hypertension**. Generally the more overweight a person is, the higher his or her risk of developing these and other diseases is, and the more severe the symptoms will be. Weight loss, if achieved at a moderate pace through a healthy diet and regular exercise, can reduce these risks. Regular exercise, even just in the form of walking, can also reduce the risk of cardiovascular and other diseases.

An additional benefit of the Hilton Head metabolism diet is that it may be easier for dieters to stick to than some other diets. The diet provides meal plans which allow the dieter to choose among various recipes. There are many opportunities for the dieter to choose foods, such as vegetables, each day, as long as the dieter follows the guidelines of the meal plan. This opportunity to choose the foods that are eaten during the day may help dieters feel that they are in control of their diet, and means that dieters can eat foods that they enjoy and are not required to eat too much of any one type of food. The addition of more calories and food choices to the diet on the weekends not only can provide extra calories needed for any extra activity done on the weekends, but can make the diet easier to follow by providing treats to look forward to each week. The maintenance phase also allows dieters to eat increased calories, and this can also help dieters stick to the weight! loss phase by giving them something to look towards.

### QUESTIONS TO ASK THE DOCTOR

- Is this diet the best diet to meet my goals?
- At what level of intensity is it appropriate for me to begin exercising?
- Does this diet pose any special risk for me?
- Would a multivitamin or other dietary supplement be appropriate for me if I were to begin this diet?
- Is this diet appropriate for my entire family?
- Is it safe for me to follow this diet over a long period of time?
- Are there any sign or symptoms that might indicate a problem while on this diet?

## Precautions

Anyone beginning a new diet should consult a physician or other medical professional. Daily requirements of calories, **vitamins**, **minerals** and other substances can vary from person to person depending on age, weight, gender, activity level, and the presence of certain diseases and conditions. A physician can help the dieter determine what his or her specific requirements are. Diets that prescribe a certain amount and type of food to be eaten each day may not fit all dieters well. Working with a doctor can help a dieter ensure that he or she will stay healthy while working to achieve weight loss goals.

## Risks

There are some risks associated with any diet. When a dieter following a diet that limits the types and amounts of foods that can be eaten each day it can be difficult for the dieter to get all the vitamins and minerals required for good health. Pregnant or **breast-feeding** women need to be especially cautious because

deficiencies of vitamins or minerals can have negative effects on a baby. Dieters may want to consult a doctor or other medical professional about whether a multivitamin or supplement would be appropriate to help reduce the risk of deficiency while on this diet. Multivitamins and supplements have their own associated risks that should be carefully considered.

### Research and general acceptance

There may be some evidence that the Hilton Head metabolism diet does promote long term weight loss. A study that was done by the University of South Carolina showed that almost 70% of people who had lost weight while at the Hilton Head Health Institute had kept the weight off when they were contacted later. Although the people studied did not follow the Hilton Head metabolism diet as laid out in Miller's book, and had attended the Institute as residents, the ideas underlying the two programs are similar.

The role of metabolism in weight regulation is controversial in some ways, and agreed upon in other ways. The higher a person's base metabolism the more calories that person will burn during the day. A person with a higher base metabolic rate will be able to take in more calories throughout the day without gaining weight than someone with a lower base metabolic rate. However, the link between metabolism and obesity is not yet completely understood. Some studies show that a lower metabolism is correlated with obesity, but as with many issues that are complex, not all studies show exactly the same thing, and it can often be unclear which problem is the underlying cause of the issue and which is a symptom or outcome.

The United States Department of Agriculture makes recommendations in its MyPyramid food guide. These recommendations specify how many servings from each food group are needed daily for good health. Any diet that generally follows these guidelines and provides a minimum number of calories each day is generally considered appropriate for healthy weight loss. There is some debate about how many calories each day are a minimum requirement for good health. Because the requirement depends so heavily on age, weight, sex, and activity level it is not generally possible to make a broad recommendation for every dieter. In 2007, the United States Centers for Disease Control recommended 30 minutes of light to moderate exercise each day for good health. Walking is considered an excellent form of this type of exercise. Following the Hilton Head metabolism diet plan and walking for 20 minutes two times a day would exceed these minimum recommendations. Many studies have shown that exercise and diet are more effective at helping dieters achieve weight loss when done in combination than either is when done alone.

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American Dietetic Association. 120 South Riverside Plaza, Suite 2000, Chicago, Illinois 60606-6995. Telephone: (800) 877-1600. Website: <http://www.eatright.org>


#### OTHER


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Helen M. Davidson

# Hispanic and Latino diet

### Origins

The United States Census Bureau defines *Hispanics* as those who indicate their origin to be Mexican, Puerto Rican, Cuban, Central or South American (e.g., Dominican, Nicaraguan, Colombian) or other Hispanic origin. This designation is made independently of racial classification. According to the 2002 U.S. Census, 13.3% of the U.S. population (or over 37 million Americans) identified themselves as being of Hispanic origin. This number exceeds the number of non-Hispanic blacks, or African Americans, in the United States, making Hispanics the largest minority subpopulation within the nation. The three major subgroups that make up the Hispanic population are Mexican Americans, Puerto Ricans, and Cubans. By far the largest of these is the Mexican-American population, which represents at least twothirds of all Hispanics.

Ethnic and racial diversity within the U.S. increased dramatically during the latter part of the twentieth century, with much of the large-scale

immigration coming from Asia and Latin America. From 1980 to 2000 the Hispanic population within the United States doubled. More than 40% of Hispanics were living in the western part of the country at the end of the century. In 2000, New Mexico had a higher proportion of Hispanics in its population than any other state, with 42% of its population being of Hispanic origin. The high growth rate among Hispanics is attributable to higher fertility rates than those observed in other ethnic groups, and to increases in immigration, especially in border states such as California and Texas. Compared to the non-Hispanic white population, the Hispanic population in the United States is younger, less educated, economically disadvantaged, and more likely to live in larger households. However, there are significant differences among the Hispanic subpopulations, with those of Mexican origin being relatively less advantaged and those of Cuban origin being relatively more advantaged in terms of education and income.

## KEY TERMS

**cholesterol**—Multi-ringed molecule found in animal cell membranes; a type of lipid.

**diabetes**—Inability to regulate level of sugar in the blood.

**glucose**—A simple sugar; the most commonly used fuel in cells.

**macronutrient**—Nutrient needed in large quantities.

**saturated fat**—A fat with the maximum possible number of hydrogens; more difficult to break down than unsaturated fats.

## Description

### *Characteristics of the Hispanic diet*

The contemporary diet of Hispanics in the United States is heavily influenced by the traditional dietary patterns of their countries of origin, as well as by the dietary practices of the adopted communities in which they live. As such, there are many regional differences between Hispanic subgroups, both in terms of the composition of the diet and the means of food preparation. Despite the heterogeneous ancestral backgrounds of Hispanic Americans, many Hispanics still retain core elements of the traditional Hispanic diet, including a reliance on grains and beans and the incorporation of fresh fruits and vegetables in the diet. Family life has traditionally occupied a central place in Hispanic culture, and this has influenced dietary behaviors through home preparation of meals and the practice of families eating together.

Information about what Hispanics in the United States eat has been compiled through national surveys conducted by the U.S. Department of Agriculture (USDA). Among the highlights of these data are that Hispanics tend to eat more rice, but less pasta and ready-to-eat cereals, than their non-Hispanic white counterparts. With the exception of tomatoes, Hispanics are also less likely to consume vegetables, although they have a slightly higher consumption of fruits. Compared to non-Hispanic whites, Hispanics are more than twice as likely to drink whole milk, but much less likely to drink low-fat or skim milk. Hispanics are also more likely to eat beef, but less likely to eat processed meats such as hot dogs, sausage, and luncheon meats. Hispanics are more likely to eat eggs and legumes than non-Hispanic whites, and less likely to consume **fats** and oils or sugars and candy.

Analysis of the macronutrient content of the diet reveals that Hispanics, especially Mexican Americans, have a lower intake of total fat and a higher intake of dietary **fiber** compared to non-Hispanic white populations, with much of the dietary fiber coming from legumes. In general, Mexican Americans and other Hispanic subgroups are low in many of the same micronutrients as the general population, with intakes of **vitamin E**, **calcium**, and **zinc** falling below Recommended Daily Allowances.

### *Acculturation and the Hispanic Diet*

Just as Hispanics have altered American cuisine, American culture has also altered the diet of Hispanic Americans. As with many other immigrant groups in the United States, the lifestyle of Hispanic Americans is undergoing a transition away from one based on the traditional values and customs of their ancestry, as they begin to adopt the values and behaviors of their adopted country. With regard to health behaviors, this process of acculturation is typically characterized by a more sedentary lifestyle and a change in dietary patterns. The effects of acculturation on the Hispanic diet are illustrated in national dietary survey data that show that Hispanic Americans who continue to use Spanish as a primary language eat somewhat more healthful diets than those who use English as a primary language. These healthier eating behaviors include lower consumption of fat, saturated fat, and cholesterol. Additional analysis of these survey data reveals that these dietary differences do not appear to be the result of greater nutritional knowledge or greater awareness of food-disease relationships.

The degradation of diet quality that occurs as Hispanic Americans become acculturated into the mainstream U.S. population occurs in the context of improvements in, rather than degradation of, economic status. For example, first-generation Mexican-American women, despite being of lower socioeconomic status than second-generation Mexican American or non-Hispanic white women, tend to have higher intakes of protein,vitamins A and C, folic acid, and calcium than these other groups. The diets of second-generation Mexican American women more closely resemble those of non-Hispanic white women of similar socioeconomic status.

### Risks

The process of acculturation and the changing nature of the Hispanic diet has serious implications for the state of Hispanic health. The prevalence of type 2 **diabetes mellitus** is two to three times higher in Hispanic Americans than in non-Hispanic whites, with an estimated 10% of adults over the age of twenty and 25 to 30% of those over the age of fifty affected. The prevalence of the disease is especially high among Mexican Americans. Diabetes, a disease characterized by high levels of glucose in the blood, is a major cause of death and disability in the United States. Compared to non-diabetic individuals, those with the disease are also at two to four times higher risk of developing cardiovascular disease, the leading cause of death in the country. Accompanying this increased risk of diabetes among Hispanics is a marked increase in the risk of **obesity**.

Much of the increased risk of diabetes experienced by Hispanic Americans is believed to be attributable to the changing lifestyle that accompanies the acculturation process, including the changing quality of the Hispanic diet and the adoption of a more sedentary lifestyle. These trends are occurring across all segments of the Hispanic population, although the extent of the changes are more pronounced in some subgroups (e.g., Mexican Americans in large urban areas) than in others. Although Hispanic Americans generally smoke less than their non-Hispanic white counterparts, the direction of Hispanic health is also threatened by an increasing frequency of cigarette smoking, particularly among younger segments of the population.

Approaches for improving the health of Hispanics need to be broad-based and to consider the complexities of a variety of lifestyle factors. Nutrition education programs aimed at improving the quality of the Hispanic diet are currently based on a combination of preserving some elements of the traditional Hispanic diet—including a reliance on beans, rice, and tortillas—and a change in others—such as reduced consumption of high-fat dairy products and less use of fat in cooking.

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Braxton D. Mitchell

HIV diet *see* **AIDS/HIV infection**

# Hollywood diet

### Definition

The Hollywood diet products are intended to produce extreme weight loss in a very short time. The Hollywood diet 30 Day Miracle Program is intended

to allow dieters to lose weight over the course of a month by using various Hollywood diet products combined with healthy living strategies.

## Origins

The Hollywood diet products were created by Jamie Kabler. He is a self-proclaimed "diet counselor to the stars." According to the Hollywood diet website, Kabler invented the Hollywood 48 Hour Miracle Diet after visiting a European health spa. He was at the spa to help him manage his own weight, and afterwards decided that he wanted to help people lose weight and detoxify their bodies by creating a product that everyone could afford. The Hollywood 48 Hour Diet was first available in December of 1997. According to its website, more than 10 million people have used the product since then. The Hollywood 48 Hour Miracle Diet was the first of the Hollywood Diet products, but since that time the line has been expanded to include the Hollywood 24 Hour Miracle Diet, the Hollywood Daily Miracle Diet Drink Mix Meal Replacement, and various **dietary supplements**.

## Description

The Hollywood 48 Hour Miracle Diet is probably the best known of the various Hollywood products. It is an orange colored drink that is intended to be a complete food replacement for a 48 hour period. Dieters are instructed to shake the bottle well and then mix four ounces of the drink with four ounces of **water** (bottled water is recommended) and sip this mixture over the course of four hours. This is to be repeated four times each day. The dieter is instructed to drink eight glasses of water each day while on this diet.

For the two days that the dieter is following the Hollywood 48 Hour Miracle Diet, the drink mixture and water are all that the dieter is allowed to consume. The dieter cannot eat or drink anything else. This restriction even includes drinks that have no calories, such as diet sodas and chewing gum. During this time the dieter is told that for optimal results he or she cannot have any **caffeine** or alcohol while on the diet, and cannot smoke.

The Hollywood 24 Hour Miracle Diet is largely the same as the 48 Hour formulation, except that is intended only for one day use. The same restrictions about food, caffeine, and alcohol intake apply, as does the ban on smoking. The website recommends that dieters use one version of the diet or the other at least one time per month, and says that it many people choose to do the 48 Hour Diet once a week.

### KEY TERMS

**Calorie**—A measurement of the energy content of food, also known as a large calorie, equal to 1000 scientific calories.

**Dietary supplement**—A product, such as a vitamin, mineral, herb, amino acid, or enzyme, that is intended to be consumed in addition to an individual's diet with the expectation that it will improve health.

**Mineral**—An inorganic substance found in the earth that is necessary in small quantities for the body to maintain a health. Examples: zinc, copper, iron.

Both Hollywood diet formulations are made mainly of fruit juice concentrates. They do contain a significant number of **vitamins**. The 24 hour version of the diet contains 100% of the daily recommended value of vitamins A, $B_6$, $B_{12}$, C, D, and E, as well as **thiamin**, **riboflavin**, **niacin**, folic acid, and **pantothenic acid** in each four ounce serving. The 48 hour formulation contains 75% of the daily required value of these vitamins and nutrients. Both formulations contain 25 grams of **carbohydrates**, 20 milligrams of **sodium**, 22 grams of sugar, and no **protein** in each four ounce serving.

Each four ounce serving of the Hollywood diet contains 100 calories. This means that if a dieter follows the diet's instructions and drinks four four-ounce servings over the course of the day, he or she will be ingesting 400 calories. Because no other food or drink products are allowed during this diet this means that anyone following it will only consume 400 calories per day. This qualifies the diet as a very low calorie diet. Very low calorie diets are usually used to treat extremely obese patients with more than 30% excess body fat, and are only administered under the supervision of a doctor or other trained medical professional. If either Hollywood diet formulation were to be used regularly or for an extended period of time this would be considered a traditional very low calorie diet and would require medical supervision.

The Hollywood diet website also includes an alternative diet plan that is more comprehensive than either the 48 or 24 Hour diets. This diet plan is called the 30 Day Miracle Program. It suggests that this program be followed to help the dieter maintain the positive results achieved during the 48 or 24 Hour Diets.

The first step of the 30 Day Miracle Program is for the dieter to do the 24 or 48 Hour Diet. After this diet is finished, and the dieter returns to eating solid foods, the second step is to replace one meal per day with another Hollywood Product, the Hollywood Daily Miracle Diet Drink Mix Meal Replacement. It is suggested that the dieter replace dinner for the most successful outcome. The dieter is also encouraged to avoid foods that are high in fat or salt, that contain sugar, and to avoid dairy products, red meat, and diet sodas.

The diet also recommends that the dieter take another Hollywood product, Hollywood Meta Miracle, twice each day. This product is supposed to be able to help dieters not feel hungry, boost their **metabolism**, and give them more energy. The other supplement recommended by the diet is the Hollywood Mega Miracle 75 nutritional supplement. The diet instruct that it be taken twice every day. This product supposedly contains 75 different nutrients needed by the body for good health.

The diet also suggests that dieters eat a healthy breakfast and lunch, do not eat after six pm each day, and eat fruits and vegetables as snacks. The diet recommends that a dieter take a brisk walk for 30 minutes or more each day. The final instruction of the diet is to repeat either the Hollywood 48 Hour Diet or the Hollywood 24 Hour diet on a regular basis. Once a month or each weekend are suggested.

## Function

Hollywood 48 Hour Miracle Diet and Hollywood 24 Hour Miracle Diet are intended to produce large amounts of weight loss in very short times. The 48 hour diet claims that dieters can lose up to 10 pounds in just two days. The 24 hour diet claims that dieters can lose up to 5 pounds in just one day. These diets suggest that they be repeated often until the desired weight loss has been achieved. These diets also claim that they will detoxify the body and rejuvenate the dieter. The 30 Day Miracle Diet is intended to provide more long term weight loss over a period of one moth. The amount of weight that dieters can expect to lose during that time period is not specified.

The Hollywood 48 and 24 Hour Diets are not intended to be lifestyle changing diets. They do not provide recommendations for exercise, and they do not provide the dieter with any other forms of healthy lifestyle support, such as stress reduction techniques. The 30 Day Miracle Diet encompasses the 48 and 24 Hour products, but is intended to be a lifestyle program for more long term weight loss. It does provide healthy eating and exercise recommendations for the dieter to follow during the course of the diet.

## Benefits

The Hollywood 24 and 48 Hour diets do contain fruit products and many vitamins and **minerals** that are part of a balanced diet. Drinking the diet product instead of a higher calorie, sugary drink such as soda, may have some health benefits. Used as a diet however the benefits are unclear. The dieter may lose weight on the diet, but it is likely to return quickly after the diet is stopped if old eating habits are resumed. There may be some psychological benefit to quick weight loss but this are likely to be undone if the weight is regained.

The 30 Day Miracle Program may have some benefits. The suggestions for helping dieters maintain the weight loss achieved by the 24 or 48 Hour Diets follows many guidelines for healthy eating and moderate exercise. Following these suggestions, such as avoiding sugar, red meat, and fatty foods, are more likely than the 24 and 48 hour diets to result in moderate, sustainable weight loss. Weight loss can have many health benefits if achieved through healthy eating and exercise. **Obesity** is a risk factor for many diseases and conditions, such as type II diabetes and heart disease. Weight loss can reduce this risk. Following the diet's recommendation for 30 minutes or more per day of brisk walking may also have health benefits. Regular exercise has been shown to reduce the risk of cardiovascular disease.

## Precautions

The Hollywood 24 and 48 Hour Diets specify that they should not be undertaken by pregnant or **breast-feeding** women, nor by people with diabetes, who are taking medication, or with any medical conditions. People without any of these conditions should also be extremely cautious about beginning this diet because of its very low calorie content. Anyone thinking of beginning this or any other diet should consult a physician or other medical professional.

## Risks

Although the 24 and 48 Hour diets may provide many essential vitamins and minerals, there are many substances necessary for good health that they do not provide. They do not provide significant amounts of protein or fat. Protein is a very important part of a healthy diet, and some fat is required for the body to function properly. The 24 and 48 Hour diets also do not contain other nutrients that are important for good health. This means that dieters who follow

## QUESTIONS TO ASK THE DOCTOR

- Is this diet safe for me?
- Will this diet help me reach my long term weight loss goals?
- Do I have any dietary requirements this diet might not meet?
- Would a multivitamin or other dietary supplement be appropriate for me if I were to begin this diet?
- Is it safe for me to follow this diet over an extended period of time?

these diet plans have a high risk of nutrient deficiencies. Dieters considering this diet should consult a doctor about an appropriate multivitamin or supplement to help reduce this risk. Vitamins and supplements have their own associated risks and are not regulated by the Food and Drug Administration in the same way as medicines.

There may be some negative side effects from following the 24 or 48 Hour diets. Some dieters who have tried them reported intestinal cramping, light headedness, and generally not feeling well. The website suggests that the first time a dieter try these products it be done on a day off or a weekend.

Repeating this diet frequently or for an extended period could have serious consequences. Very low calorie diets can have many negative side effects. For extremely obese people these risks of side effects can be reduced by proper medical supervision, and may be outweighed by the benefit of significant weight loss. Very low calorie diets are usually only prescribed for people who are suffering serious medical consequences from obesity. Very low calorie diets can result in many different side effects including **gallstones** and cardiovascular problems. Very low calorie diets are not appropriate for people who are not extremely obese, and are never appropriate without medical supervision.

### Research and general acceptance

There have been no significant scientific studies of Hollywood 24 or 48 Hour Diets, or any of the other Hollywood products. The use of very low calorie starvation type diets is generally accepted to be negative for the health. Some people do advocate the use of juice fasting as a way to detoxify the body, but this is extremely controversial, and there is no research on the Hollywood diets being safe or effective for this kind of use. It is generally recommended that for safe, effective, long term weight loss and maintenance dieters follow a reduced calorie diet full of fruits and vegetables and get regular exercise.

### Resources

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#### ORGANIZATIONS

American Dietetic Association. 120 South Riverside Plaza, Suite 2000, Chicago, Illinois 60606-6995. Telephone: (800) 877-1600. Website: <http://www.eatright.org>

#### OTHER

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# Hoodia

## Definition

Hoodia is a genus of desert plants containing 13 species. One species, *Hoodia gondonii*, is marketed in the United States as a weight-loss supplement. In this entry, hoodia refers only to *Hoodia gondonii*.

## Purpose

Marketers of hoodia claim that it suppresses the appetite so that individuals eat less and lose weight. Claims that hoodia is a safe and effective weight-loss supplement are highly controversial.

## Description

Hoodia is a succulent desert plant that looks like a cactus. Its upright stem bears sharp spines and large pinkish flowers. The plant takes 4–6 years to mature and can reach a height of 3 ft (1 m). When eaten,

**Flowering hoodia plant.** *(Anthony Bannister; Gallo Images/ CORBIS. Reproduced by permission.)*

## KEY TERMS

**Conventional medicine**—Mainstream or Western pharmaceutical-based medicine practiced by medical doctors, doctors of osteopathy, and other licensed health care professionals.

**Dietary supplement**—A product, such as a vitamin, mineral, herb, amino acid, or enzyme, that is intended to be consumed in addition to an individual's diet with the expectation that it will improve health.

**Functional food**—Also called nutraceuticals, these products are marketed as having health benefits or disease-preventing qualities beyond their basic supply of energy and nutrients. Often these health benefits come in the form of added herbs, minerals, vitamins, etc.

**Succulent**—Plants with large, fleshy leaves, stems, and roots capable of storing a lot of water. These plants grow in dry environments.

chemicals in the stem are said to prevent the body from feeling hungry.

Hoodia grows wild in the very dry Kalahari and Namib Deserts of South Africa, Botswana, and Namibia. For many years, the San Bushmen who live this region have eaten hoodia to dull their appetite on long trips through the desert. Hoodia is an endangered species. It is protected by both international and national laws in the countries where it grows wild. A special license is required to harvest the plant from the wild and export it.

### *The politics of hoodia*

In the 1970s, the South African Council for Scientific and Industrial Research (CSIR) began a program to investigate bush foods, including hoodia. As part of this program, scientists isolated from hoodia an appetite suppressant ingredient that they called P57. In 1996, CSIR licensed P57 to Phytopharm, a British Company that produces functional foods whose active ingredients come from plants with traditional medicinal uses. Because hoodia is rare and endangered, Phytopharm began the difficult task of cultivating the plant on farms in Africa. Meanwhile, Phytopharm partnered with Pfizer, a large, traditional international pharmaceutical company, to work on ways to extract and purify P57 from plants or to make it synthetically it in the laboratory.

In 2002, a lawyer representing the San threatened to sue the CSIR for "bio-piracy" of hoodia. The threat of legal action resulted in an agreement that the San, a poor and marginalized ethnic group in South Africa, would share in the profits of marketing any products that contained hoodia. That same year, Pfizer ended its relationship with Phytopharm and P57. Although Pfizer scientists had been able to make synthetic P57, the company felt it was too difficult and too expensive to manufacture in the large amounts needed to produce a commercial weight-loss supplement. In addition, Pfizer's research suggested that the compound might rapidly be inactivated in the body and that it had negative side effects on the liver.

In 2003, with Pfizer out of the picture, Phytopharm decided to market products containing natural hoodia and continued their efforts to grow hoodia on plantations in South Africa. At the same time, they reached an agreement with Unilever, a consumer products company, to find ways to add hoodia to

various Unilever foods and beverages. These new products were expected to reach the market in 2008.

Meanwhile, in 2004, hoodia received high profile media coverage when *60 Minutes* reporter Leslie Stahl visited a South African hoodia plantation, ate some of the plant, and declared on television that it had kept her from feeling hungry all day without any side effects. Stahl's report stimulated interest among the public in hoodia as a diet aid. Hoodia supplements began to be advertised heavily, especially over the Internet.

### *Health claims*

Manufacturers of products containing hoodia claim that it reduces or eliminates the desire to eat and drink by tricking the brain into believing that the body does not need food and **water**. This claim is made only for *Hoodia gondonii* and not the other 12 species of hoodia. Hoodia/P57 is available primarily in capsules of various strengths, and can also be added to foods such as diet bars, diet shakes, and lollipops.

Hoodia is considered a dietary supplement in the United States. The Food and Drug Administration (FDA) regulates **dietary supplements** under the 1994 Dietary Supplement Health and Education Act (DSHEA). At the time the act was passed, legislators felt that because many dietary supplements like hoodia come from natural plant sources and have been used for hundreds of years in herbal and folk healing, these products did not need to be as rigorously regulated as prescription and over-the-counter drugs used in conventional medicine.

Under the terms of DSHEA, hoodia is regulated in the same way that food is regulated. Like food manufacturers, manufacturers of products containing hoodia do not have to prove that it is either safe or effective before their products can be sold to the public. Instead, the burden of proof falls on the FDA to show that the supplement is either unsafe or ineffective before the supplement can be restricted or banned. Information about a dietary supplement's safety and effectiveness is normally gathered only after people using the product develop health problems or complain that the product does not work.

Hoodia is a relative newcomer to the world of diet supplements and has not been well studied in humans. The claim that hoodia helps people to lose weight is controversial because:

- The amount and strength of hoodia in dietary supplements is not standardized and a wide range of doses are used.
- Few animal studies have been done on hoodia, and it is not possible to verify that hoodia will have the same effect in humans as it does in laboratory animals.
- The only human studies have a very small sample size.
- The results of human studies have not been published in peer-reviewed journals or duplicated by independent scientists.
- Most hoodia studies have sponsored by Phytopharm and others who have a financial interest in obtaining positive results.

One hoodia study done at Brown University Medical School injected P57 directly into the brain of rats. The rats did eat less and lose weight. However, humans take hoodia by mouth in much smaller quantities, so the results of the rat study are not necessarily going to be seen in humans. Other human studies have had fewer than 10 participants who have taken hoodia only for short periods.

### *The future of hoodia*

In the United States, dietary supplements are required to be clearly labeled with the word "supplement." In addition, the label must show the volume or weight of the contents, the serving size, a list of dietary ingredients and nondietary ingredients (e.g. artificial color, binders, fillers, flavorings), the name of the manufacturer, packer, or distributor, and directions for use. If the supplement is an herb, such as hoodia, the label must contain its scientific name.

Real *Hoodia gondonii* is expensive and in very short supply. Several independent laboratories have tested products claiming to contain hoodia. About half the products contained no hoodia at all and others contained much less than the label claimed. The lack of hoodia in weight-loss products claiming to contain the herb has lead to lawsuits. New Jersey and California have both sued the manufacturers of TrimSpa's X32 hoodia product that was marketed by the now deceased celebrity spokesperson Anna Nicole Smith. Other lawsuits are likely to follow as investigations prove that other hoodia weight-loss products contain no real hoodia. Many Web sites promoting hoodia appear to contain false testimonials and inaccurate or false information about scientific results of hoodia studies. In March 2006, the independent *Consumer Reports* magazine investigated hoodia supplements and declared that it could not recommend hoodia as a weight-loss product.

### Precautions

Consumers have no way of telling by looking at or tasting the product whether it actually contains hoodia. In addition, very little is known about the safety of hoodia when used on a daily basis for an extended time, nor has any standard dosage been developed. It is true that the San have used this herb for many years to curb hunger. However, they use hoodia only occasionally and for short periods.

### Interactions

Not enough is know about hoodia to know if or how it interacts with drugs or other herbs.

### Complications

Very little is known about the long-term effects of hoodia use. There are some anecdotal stories about people using hoodia forgetting to drink and suffering complications of **dehydration**.

### Parental concerns

Parents should be aware that the safe dose of many herbal supplements has not been establsihed for children. Accidental overdose may occur if children are give adult herbal supplements.

#### Resources


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**PERIODICALS**

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Khalsa, K. P. S. "Halt Hunger With Hoodia?" *Better Nutrition* 69, no. 1 (January 31, 2007):26.

**ORGANIZATIONS**

Alternative Medicine Foundation. P. O. Box 60016, Potomac, MD 20859. Telephone: (301) 340-1960. Fax: (301) 340-1936. Website: http://<www.amfoundation.org>

National Center for Complementary and Alternative Medicine Clearinghouse. P. O. Box 7923, Gathersburg, MD 20898. Telephone: (888) 644-6226. TTY: (866) 464-3615. Fax: (866) 464-3616. Website: http://<nccam.nih.gov>

**OTHER**

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Tish Davidson, A.M.

## Hyperactivity and sugar

### Definition

Hyperactivity is behavior characterized by overactivity, impulsivity, distractibility, and decreased attention span. A popular but controversial belief is that children are more likely to be hyperactive if they eat sugar.

### Description

Hyperactive children tend to be overly active, and have constant difficulty paying attention. Activity levels in children vary with their age. It is entirely normal for a 2-year old to be more active, and to have a shorter attention span, than an older child. Attention levels also vary depending on the child's interest for a given activity. Hyperactive children are those whose activity levels for their age are consistently higher than expected.

The hyperactivity-sugar controversy is due to numerous claims made by parents after observing hyperactivity in children who eat foods containing sugar, or **artificial sweeteners** such as aspartame. However, most researchers steadfastly reported that the effects of sugar on children were negligible, with several studies reporting that sugar does not cause hyperactivity in children. From a physiological point of view however, sugar should affect children's activity, simply because it can enter the bloodstream quickly, while producing rapid changes in blood glucose levels and triggering adrenaline. Adrenaline is the substance made by the body when under stress and it provides a short-term energy boost to cope with fight or flight situations. A new study by pediatric researchers at Yale University recently confirmed the sugar-adrenaline link. The study showed that within hours

**Names for added sugars that appear on food labels**

- Brown sugar
- Corn sweetener
- Corn syrup
- Corn syrup frutose
- Dextrose
- Fructose
- Fruit juice concentrates
- Galactose
- Glucose
- High-fructose corn syrup
- Honey
- Invert sugar
- Lactose
- Maltose
- Malt syrup
- Molasses
- Raw sugar
- Sucrose
- Sugar
- Syrup

*(Illustration by GGS Information Services/Thomson Gale.)*

after healthy children were given large doses of sugar on an empty stomach, their bodies released large amounts of adrenaline, which induced shakiness, anxiety, excitement and concentration problems. These reactions were observed only in children, and an examination of their brain waves revealed significant changes in their ability to pay attention. However, no direct link was established with dietary sugar, since the study involved the ingestion of large amounts of sugar on an empty stomach. Thus, it can only be concluded that sugar can cause hyperactivity in children only if taken in large quantities.

## Demographics

Hyperactive children vary from three to 15% of all children depending on the studies. Comparative U.S. Department of Agriculture (USDA) data shows that sugar consumption increased by 30% between 1983 and 1999. According to the most recent data, Americans eat or drink on average approximately five pounds of sugar a month. USDA stated in 2000 that the average American, who consumes about 2,000 calories per day, can eat up to 10 teaspoons of added sugars, if he or she eats a healthful diet containing all the recommended servings of fruits, dairy products, and other foods. In fact, though, the average American is not eating that healthful diet and consumes at least 20 teaspoons per day of sugar.

## Causes and symptoms

The causes of hyperactivity can include:

- Attention hyperactivity deficit disorder (ADHD). Behavior characterized by inattentiveness, overactivity, and impulsivity. An ADHD diagnosis requires that children should have at least 6 attention symptoms or 6 activity and impulsivity symptoms. These should be present for at least 6 months, observable in 2 or more settings, and not caused by another problem.
- Emotional disorders. When a child is unhappy or stressed, hyperactivity is a common response, often combined to aggressive behavior.
- Brain or central nervous system disorders. Schizophrenia, bipolar disorder (manic depression), obsessive compulsive disorder, panic disorder, borderline personality disorder, autism, pervasive developmental disorders, and Tourette's syndrome are all neurological disorders for which hyperactivity is a symptom.
- Hyperthyroidism. Hyperthyroidism is a condition caused by the effects of too much thyroid hormone on tissues of the body. Palpitations, nervousness and hyperactivity are common symptoms of this disorder.
- Lead contamination. Exposure to high levels of lead can lead to hyperactivity in children. Children who live in old buildings in which lead still exists in the plumbing or in lead paint that has been painted over may be at risk.

## Diagnosis

It can be difficult to distinguish between hyperactivity and the normal activity level of a child. This is because supervising adults are rarely as active as children may be, and so it can happen that a child is normally active for his or her age, but in the care of an adult with little tolerance for childhood rambunctiousness.

A medical evaluation will reveal whether the hyperactivity is due to neurological disorders or hyperthyroidism. As for ADHD hyperactivity, the American Academy of Pediatrics (AAP) has issued guidelines for pediatricians to clarify the issue. Likewise, child psychologists can determine whether the hyperactivity has an underlying emotional origin. The following tests may be used to evaluate hyperactivity:

- Parent and teacher questionnaires
- Psychological evaluation of the child and of the family
- Developmental, mental, nutritional, physical, and psychosocial examinations

## Treatment

If the hyperactivity is related to an underlying neurological or psychological cause, treatment of the condition will result in improvement. For hyperactivity unrelated to a medical condition, the following measures will help:

- limit stimulation in the child's environment
- provide instruction on an individual basis
- ensure that the child gets enough sleep

## KEY TERMS

**Adrenaline**—Hormone produced by the adrenal glands that increases heart and respiration rates.

**Autism**—A brain disorder that begins in early childhood and persists throughout adulthood. It affects three important areas of development: communication, social interaction, and creative or imaginative play.

**Bipolar disorder**—A psychiatric disorder marked by alternating episodes of mania and depression.

**Borderline personality disorder**—A serious mental illness characterized by ongoing instability in moods, interpersonal relationships, self-image, and behavior.

**Caffeine**—The drug contained in coffee. A bitter white alkaloid derived from coffee (or tea) and used in medicine as a mild stimulant or to treat certain kinds of headache.

**Distractibility**—Inability to concentrate or attend to the task on hand; inattentiveness.

**Hyperthyroidism**—Over production of the thyroid hormone by the thyroid gland.

**Impulsivity**—Acting or speaking too quickly (upon impulse) without first thinking of the consequences.

**Obsessive compulsive disorder**—A disorder which causes people to experience obsessions, meaning recurring unwanted thoughts which are difficult to stop, and compulsions, meaning rituals of checking behavior or repetitive actions which are carried out in an attempt to relieve the thoughts.

**Pervasive developmental disorder**—An impairment in the development of social skills.

**Schizophrenia**—A mental illness in which the person suffers from distorted thinking, hallucinations, and a reduced ability to feel normal emotions.

**Tourette's syndrome**—A neurological disorder characterized by involuntary body movements called tics, and uncontrollable speech.

### Nutrition/Dietetic concerns

Children need plenty of **fiber** in their diet to keep adrenaline levels more constant. Fiber is found in whole grain products such as whole meal bread, brown rice, high fiber cereals, potatoes, fresh and dried fruits, vegetables, and beans. It is also recommended to limit the amount of processed sugars that children eat as much as possible. High-sugar foods tend to have fewer **vitamins** and **minerals**, and should be replaced by more nutritious foods. They are responsible for tooth decay and also contribute to obesity. It is also established that the brain of a child appears to be more sensitive than the adult brain to the effect of low blood sugar, hence children are more prone to experiencing sugar **cravings**. Since sugar can enter the bloodstream quickly, its effects can be reduced if it is consumed along with other nutrients like fat and **protein**. As a rule, sweet desserts after mixed meals that include protein, fat, complex carbohydrate and fiber are preferable to eating sweet snacks between meals. Besides sugars, many sodas also contain **caffeine**, a stimulant that contributes to hyperactivity. They should be avoided and replaced by **water**, juices and caffeine-free drinks.

Some good selections for an afternoon snack include: peanut butter on whole wheat bread, cold chicken and a glass of milk, a hard boiled egg on oatmeal bread, grilled cheese sandwich, yogurt, a bagel or muffin and a glass of milk, a bowl of cereal with milk, and raw vegetables such as carrots, celery and tomatoes with a low fat dip or chopped avocado.

### Therapy

Drug therapy is not recommended for hyperactivity that has no medical cause. In particular, medications prescribed for ADHD that decrease hyperactivity, such as Concerta and Ritalin, should only be considered if the ADHD diagnosis is established.

Massage and relaxation therapies are starting to be considered beneficial in lowering hyperactivity. Studies performed on hyperactive adolescents have shown a lowering of hyperactivity and improved moods in students undergoing massage therapy for 10 consecutive school days.

Effective measures include schools that can provide a structured classroom environment, and parent education to address discipline and limit-setting. For instance, children can be taught to have "quiet time" periods so that they can learn to calm themselves at home.

### Prognosis

There is no cure for hyperactivity. Hyperactive children seldom outgrow it, but some learn to put it to constructive use as they mature.

## Prevention

While there is no proven way to prevent hyperactivity, early identification can prevent the development of ADHD and other developmental disorders.

### Resources

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#### ORGANIZATIONS

Attention Deficit Disorder Association (ADDA). 15000 Commerce Parkway, Suite C, Mount Laurel, NJ 08054. 856-439-9099. <www.add.org>.

Children and Adults with Attention Deficit Hyperactivity Disorder. 8181 Professional Place, Suite 150, Landover, MD 20785. 301-306-7070. <www.chadd.org>.

Food and Drug Administration, Center for Food Safety and Applied Nutrition. 5100 Paint Branch Parkway, College Park, MD 20740-3835. 1-888-SAFEFOOD (1-888-723-3663). <vm.cfsan.fda.gov>.

Monique Laberge, Ph.D.

# Hyperlipidemia

## Definition

Hyperlipidemia, also known as hyperlipoproteinemia or dyslipidemia, is an elevation of lipid levels (**fats**) in the bloodstream. These lipids include cholesterol, cholesterol compounds, phospholipids and **triglycerides**, all carried in the blood as part of large molecules called lipoproteins.

## Description

Hyperlipidemia affects the way lipids are produced, used, carried in the blood, or disposed of by the body. There are three types of hyperlipidemias:

- Hyperlipoproteinemia: elevated levels of lipoproteins in the blood;
- Hypercholesterolemia: high cholesterol levels in the blood;
- Hypertriglyceridemia: high triglyceride levels in the blood.

It has been shown that people with a hyperlipidemia disorder are more likely to develop heart disease. For example, the normal body makes enough cholesterol for its needs. But when there is too much cholesterol, it accumulates in arteries, which can lead to their narrowing (atherosclerosis) and to heart disease or stroke.

The lipoproteins present in blood plasma that transport lipids belong to the following major groups:

- Very high–density lipoprotein (VHDL). VHDL consists of proteins and a high concentration of free fatty acids.
- High–density lipoprotein (HDL). HDL helps remove fat from the body by binding with it in the bloodstream and carrying it back to the liver for excretion in the bile and disposal. A high level of HDL may lower chances of developing heart disease or stroke.
- Intermediate–density lipoprotein (IDL). IDLs are formed during the degradation of very–low–density lipoproteins; some are cleared rapidly into the liver and some are broken down to low–density lipoproteins.

**Cholesterol levels**

**Able to control**

**What you eat.** Certain foods have types of fat that raise your cholesterol level.

- Saturated fat raises your low-density lipoprotein (LDL) cholesterol level more than anything else in your diet.
- *Trans* fatty acids (*trans* fats) are made when vegetable oil is hydrogenated to harden it. *Trans* fatty acids raise cholesterol levels.
- Cholesterol is found in foods that come from animal sources, for example, egg yolks, meat, and cheese.

**Weight**. Being overweight tends to increase your LDL level, lower your high-density lipoprotein (HDL) level, and increase your total cholesterol level.

**Activity level.** Lack of regular exercise can lead to weight gain, which could raise your LDL cholesterol level. Regular exercise can help you lose weight and lower your LDL level. It can also help you raise your HDL level.

**Unable to control**

**Heredity.** High blood cholesterol can run in families. An inherited genetic condition (familial hypercholesterolemia) results in very high LDL cholesterol levels. It begins at birth, and may result in a heart attack at an early age.

**Age and sex**. Starting at puberty, men have lower levels of HDL than women. As women and men get older, their LDL cholesterol levels rise. Younger women have lower LDL cholesterol levels than men, but after age 55, women have higher levels than men.

SOURCE: National Heart, Lung and Blood Institute, National Institutes of Health, U.S. Department of Health and Human Services

*(Illustration by GGS Information Services/Thomson Gale.)*

## KEY TERMS

**Adipose**—Tissue that contains fat cells.

**Artery**—A blood vessel that carries blood from the heart to the body.

**Atherosclerosis**—Clogging, narrowing, and hardening of the large arteries and medium–sized blood vessels. Atherosclerosis can lead to stroke, heart attack, eye problems and kidney problems.

**Bile**—A digestive juice secreted by the liver and stored in the gallbladder that helps in the digestion of fats.

**Blood plasma**—The pale yellowish, protein–containing fluid portion of the blood in which cells are suspended. 92% water, 7% protein and 1% minerals.

**Cholesterol**—Soft, waxy substance found among the lipids present in the bloodstream and in all cells of the body.

**Extrahepatic**—Originating or occurring outside the liver.

**Fatty acid**—Any of a large group of monobasic acids, especially those found in animal and vegetable fats and oils, having the general formula CnH.

**Heart attack**—A heart attack occurs when blood flow to the heart muscle is interrupted. This deprives the heart muscle of oxygen, causing tissue damage or tissue death.

**Lipids**—Group of chemicals, usually fats, that do not dissolve in water, but dissolve in ether.

**Lipoproteins**—Proteins present in blood plasma. The five majoe families are: chylomicrons, very low–density lipoproteins (VLDL),intermediate–density lipoproteins (IDL), low–density lipoproteins (LDL), and high–density lipoproteins (HDL).

**Phospholipid**—Any phosphorous–containing lipid, such as lecithin and cephalin, composed mainly of fatty acids, a phosphate roup, and a simple organic molecule.

**Plant sterols**—Plant sterols are present naturally in small quantities in many fruits, vegetables, nuts, seeds, cereals, legumes, vegetable oils, and other plant sources.

**Psyllium**—Psyllium husk comes from the crushed seeds of the Plantago ovata plant, an herb native to parts of Asia, the Mediterranean and North Africa. Similar to oats and wheat, psyllium is rich in soluble fiber and has been used as a gentle bulk–forming laxative for constipation.

**Saturated fat**—A type of fat that comes from animals and that is solid at room temperature.

**Sterols**—Any of a group of predominantly unsaturated solid alcohols of the steroid group.

**Stroke**—he sudden death of some brain cells due to a lack of oxygen when the blood flow to the brain is impaired by blockage or rupture of an artery to the brain.

**Triglycerides**—Triglycerides are the chemical form in which most fat exists in food as well as in the body.

**Triglyceride**—The storage form of fat consisting of three fatty acids and glycerol. Triglycerides are used by the body to store energy.

**Unsaturated fat**—A type of fat derived from plant and some animal sources, especially fish, that is liquid at room temperature.

**Whole grain foods**—A grain is considered whole when all three parts, bran, germ and endosperm, are present. Common whole grain foods include wild rice, brown rice, whole wheat breads and cookies, oatmeal, whole oats, barley, whole rye, bulgar, and popcorn.

- Low–density lipoproteins (LDL). LDL transports cholesterol to extrahepatic tissues (outside the liver) to other parts of the body. A high LDL level may increase chances of developing heart disease.
- Very low–density lipoprotein (VLDL). VLDLs carry triglycerides from the intestine and liver to fatty (adipose) and muscle tissues; they contain primarily triglycerides. A high VLDL level can cause the buildup of cholesterol in arteries and increase the risk of heart disease and stroke.
- Chylomicrons. Proteins that transport cholesterol and triglycerides from the small intestine to tissues after meals.

Generally speaking, LDL levels should be low, and HDL levels high. This is why HDL is often called the "good cholesterol" and LDL the "bad cholesterol".

### Demographics

According to the Center for Disease Control (CDC), approximately 17% of the adult population

has high blood cholesterol in the United States. All persons, including children, can develop high blood cholesterol. It has been shown to represent a major risk factor for heart disease, the leading cause of death in the country. In 2004, there were 6.5 million visits to doctors' offices that included a cholesterol test being done or ordered. Among African Americans, about 16.6% of women and 12.5% of men have high total cholesterol. Among Mexican Americans, about 12.7% of women and 17.6% of men have high total cholesterol. Among whites, 17.4% of women and 17.0% of men have high cholesterol. In 2005, 73% of adults reported that that they had their cholesterol checked within the previous 5 years, according to data from CDC's Behavioral Risk Factor Surveillance System. Some 23% reported that they never had their cholesterol checked.

## Symptoms

Hyperlipidemia by itself does not cause symptoms, so people are generally not aware that their lipid levels are too high.

## Diagnosis

Simple blood tests are done to check blood lipid levels. The National Cholesterol Education Program recommends that people be tested every 5 years after age 20. A lipoprotein test, also called a fasting lipid test, is commonly performed as part of a routine medical examination. The test measures lipid levels and usually reports on four groups:

- Total cholesterol (normal: 100–199 mg/dL)
- LDL (normal: less than 100 mg/dL)
- HDL (normal: 40–59 mg/dL)
- Triglycerides (normal: less than 150 mg/dL)

A total cholesterol value greater than 200 mg/dL is indicative of a greater risk for heart disease. However, LDL levels are a better predictor of heart disease, and they determine how your high cholesterol should be treated.

## Treatment

Treatment depends on lipid levels, the presence of risk factors for heart disease, and general health. When lipid levels are not balanced, the goal is to bring them under control and this is done with changing dietary habits. Hyperlipidemia is accordingly first treated by modifying eating habits:

- Reducing saturated fat intake to 7% of the daily intake of calories.
- Reducing total fat intake to 25–35% of the daily intake of calories.
- Limiting the dietary cholesterol to less than 200 mg per day.
- Ensuring the intake of 20–30 g a day of soluble fiber.
- Ensuring the intake of plant sterols to 2–3 g daily.

If dietary changes do not correct the hyperlipidemia, a course of drug therapy may be indicated. In the Unites States, men older than age 35 and post–menopausal women are generally candidates for lipid–lowering medications.

## Nutrition/Dietetic concerns

To treat hyperlipidemia, a diet low in total fat, saturated fat, and cholesterol is recommended, along with reducing or avoiding alcohol intake. The American Heart Association (AHA) endorses the following dietary recommendations for people with high blood cholesterol:

- Total fat: 25% of total calories
- Saturated fat: less than 7% total calories
- Polyunsaturated fat: up to 10% total calories
- Monounsaturated fat: up to 20% total calories
- Carbohydrates: 50–60% total calories
- Protein: ~15% total calories
- Cholesterol: less than 200 mg/dL
- Plant sterols: 2 g
- Soluble fiber such as psyllium: 10– 25g

Categories of appropriate foods include:

- Lean meat/fish: less than 5 oz/day
- Eggs: less than 2 yolks per week (whites unlimited)
- Low fat dairy products (<1% fat): 2–3 servings/day
- Grains, especially whole grains: 6–8 tsp/day
- Vegetables: less than 6 servings per day
- Fruits: 2–5 servings per day

These recommendations translate into the following practical **dietary guidelines**:

- Select only the leanest meats, poultry, fish and shellfish. Choose chicken and turkey without skin or remove skin before eating. Some fish, like cod, have less saturated fat than either chicken or meat.
- Limit goose and duck. They are high in saturated fat, even with the skin removed.
- Some chicken and turkey hot dogs are lower in saturated fat and total fat than pork and beef hot dogs. There are also lean beef hot dogs and vegetarian (tofu) franks that are low in fat and saturated fat.

- Dry peas, beans and tofu can be used as meat substitutes that are low in saturated fat and cholesterol. Dry peas and beans also have a lot of fiber, which can help to lower blood cholesterol.
- Egg yolks are high in dietary cholesterol. A yolk contains about 213 mg. They should be limited to no more than 2 per week, including the egg yolks in baked goods and processed foods. Egg whites have no cholesterol, and can be substituted for whole eggs in recipes.
- Like high fat meats, regular dairy foods that contain fat, such as whole milk, cheese, and ice cream, are also high in saturated fat and cholesterol. However, dairy products are an important source of nutrients and the diet should include 2 to 3 servings per day of low–fat or nonfat dairy products.
- When shopping for hard cheeses, select them fat–free, reduced fat, or part skim.
- Select frozen desserts that are lower in saturated fat, such as ice milk, low–fat frozen yogurt, low–fat frozen dairy desserts, sorbets, and popsicles.
- Saturated fats should be replaced with unsaturated fats. Select liquid vegetable oils that are high in unsaturated fats, such as canola, corn, olive, peanut, safflower, sesame, soybean, and sunflower oils.
- Limit butter, lard, and solid shortenings. They are high in saturated fat and cholesterol.
- Select light or nonfat mayonnaise and salad dressings.
- Fruits and vegetables are very low in saturated fat and total fat, and have no cholesterol. Fruits and vegetables should be eaten as snacks, desserts, salads, side dishes, and main dishes.
- Breads, cereals, rice, pasta, grains, dry beans, and peas are high in starch and fiber and low in saturated fat and calories. They also have no dietary cholesterol, except for some bakery breads and sweet bread products made with high fat, high cholesterol milk, butter and eggs.
- Select whole grain breads and rolls whenever possible. They have more fiber than white breads.
- Most dry cereals are low in fat. Limit high–fat granola, muesli, and cereal products made with coconut oil and nuts, which increases the saturated fat content.
- Limit sweet baked goods that are made with saturated fat from butter, eggs, and whole milk such as croissants, pastries, muffins, biscuits, butter rolls, and doughnuts.
- Snacks such as cheese crackers, and some chips are often high in saturated fat and cholesterol. Select rather low–fat ones such as bagels, bread sticks, cereals without added sugar, frozen grapes or banana slices, dried fruit, non–oil baked tortilla chips, popcorn or pretzels.

## Therapy

Generally, drug therapy is considered when:

- the LDL cholesterol is 190 mg/dL or higher.
- the LDL cholesterol is 160 mg/dL or higher and there is one risk factor for heart disease.
- the LDL cholesterol is 130 mg/dL or higher and there are two risk factors for heart disease or diabetes.
- the LDL cholesterol is 100 mg/dL or higher and there is heart disease.
- the LDL cholesterol is greater than 70 mg/dL and there is recent heart disease along with diabetes, smoking, high blood pressure, or high triglycerides, low HDL, and obesity.

There are several types of drugs available to help lower blood cholesterol levels, and they work in different ways. Some are better at lowering LDL cholesterol, some are good at lowering triglycerides, while others help raise HDL cholesterol. Lipid–lowering medications include:

- Statin drugs, such as lovastatin, that prevent the liver from manufacturing cholesterol;
- Bile acid resins, such as cholestyramine and colestipol, that prevent the body from reabsorbing the cholesterol present in bile;
- Fibrates, such as bezafibrate, fenofibrate, or gemfibrozil, particularly effective in treating high triglyceride levels;
- Niacin (vitamin $B_5$).

## Prognosis

Prognosis depends on the presence any additional risk factors for heart disease, such as diabetes, high blood pressure, being male and over age 45 or female and over age 55, having a first–degree female relative diagnosed with heart disease before age 65, or a first–degree male relative diagnosed before age 55 and **obesity**. Outcome is also highly related to early diagnosis and treatment and compliance with therapy.

## Prevention

Hyperlipidemia can be prevented by keeping a healthy diet, maintaining a normal weight, and being physically active. Everyone can take steps to maintain proper cholesterol levels. The most important are to eat foods that are low in saturated fat, to exercise

regularly, to lose weight if overweight and to get routine medical examinations and cholesterol tests.

### Resources

#### BOOKS

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#### ORGANIZATIONS

American Heart Association (AHA). 7272 Greenville Avenue, Dallas, TX 75231. 1-800-242-8721. <www.americanheart.org>.

Center for Disease Control (CDC). Division for Heart Disease and Stroke Prevention, 4770 Buford Hwy NE, Atlanta, GA 30341-3717. 770-488-2424. <www.cdc.gov/cholesterol/faqs.htm>.

National Heart Lung and Blood Institute (NHLBI). P.O. Box 30105, Bethesda, MD 20824-0105. 301-592-8573. <www.nhlbi.nih.gov>.

Monique Laberge, Ph.D.

# Hypertension

## Definition

Hypertension is the medical term for high blood pressure. Each time the heartbeats, it forces blood into the arteries. Blood pressure is the force created when blood moving through the body's arteries pushes against the artery walls. Arteries are the blood vessels that carry blood from the heart throughout the body. Though many factors can cause hypertension, diet plays a major role in controlling high blood pressure.

**Blood pressure**

| | |
|---|---|
| Normal | <120/80 |
| Prehypertension | 120–129/80–84 |
| Hypertension | 130–139/85–89 |
| Stage 1 | ≥140/90 |
| Stage 2 | 140–180/90–110 |

SOURCE: National Heart, Lung and Blood Institute, National Institutes of Health, U.S. Department of Health and Human Services

*(Illustration by GGS Information Services/Thomson Gale.)*

## Description

Blood pressure is measured as it pushes against the inside of artery walls. The low blood pressure point, when the heart is at rest, is called diastolic pressure. Blood pressure is measured in millimeters of mercury (mm Hg) and the systolic reading is read and recorded first, with the diastolic pressure reading following. For example, if a person's high, or systolic, pressure is 118 and his or her low pressure is 70, the blood pressure would be announced and recorded as 118/70 mm Hg, or "118 over 70." This would fall into the normal range, according to the American Heart Association (AHA). The association's recommended blood pressure levels are less than 120 mm Hg for systolic pressure and less than 80 mm Hg for diastolic pressure.

If a person's systolic pressure rises above 120 mm Hg and up to 139 mm Hg or diastolic pressure rises to a level of 80-80 mm Hg, the person is considered "prehypertensive." High blood pressure is defined as a reading above 140 mm Hg systolic or 90 mm Hg diastolic. If the systolic raises above 160 mm Hg or the diastolic goes above 100, the person is considered in the Stage 2 high blood pressure range. High blood pressure can have serious health consequences. In particular, it is a major risk factor for stroke and heart attack.

Diet is an important part of controlling high blood pressure. A diet to control hypertension consists of eating fewer calories, reducing salt, eating more potassium, reducing **alcohol consumption** and eating lots of fruits and vegetables. Eating fewer calories and reducing fat, especially saturated fat, will help keep weight down. And lowering weight to normal range usually helps lower blood pressure. Salt is well known as a problem for people with high blood pressure. Most diets for hypertension includes decreasing use of table salt and **sodium** in processed foods.

## KEY TERMS

**Monounsaturated fat**—Fats that contain one double or triple bond per molecule. Though these fats still have many of calories, they can help lower blood cholesterol if used in place of saturated fats. Examples of monounsaturated fats are canola oil and olive oil.

**Triglyceride**—A storage form of energy that often is used to measure fat ingestion and metabolism, and resulting risk for heart disease.

Potassium can do the opposite of sodium; it can help lower blood pressure. Potassium is best found in foods rather than in supplements. Foods rich in potassium include apricots, avocados, bananas, melons, kiwis, lima beans, oranges, prunes, spinach, tomatoes, squash, potatoes, and whole grains. Fresh fruits and vegetables are low in sodium, rich in potassium and **fiber**, as well as **vitamins** and **minerals**.

Plant proteins also may help lower blood pressure; the best sources of proteins come from **soy** products, beans, peas, lentils, peanuts, brown rice, broccoli, and potatoes. A hypertension diet may be supplied by a physician, a center that specializes in heart healthy lifestyles, a nutritionist, or be based on the "DASH" or Dietary Approaches to Stop Hypertension eating plan.

The **DASH diet** emphasizes lean meats, fish, chicken, low-fat dairy, fruits, vegetables, whole grains, legumes, nuts, and seeds. Vegetarian diets also may help keep blood pressure low. The OmniHeart diet is similar to DASH but may emphasize a particular food group, such as **protein**, more. Other lifestyle changes, such as quitting cigarette smoking and increasing activity by regularly exercising also may be recommended.

## Demographics

Nearly one in three adults, or about 65 million people, in the United States have high blood pressure. Of these, about one-third do not know they have the disease because there are no real symptoms. The American Heart Association reports that in 2002, high blood pressure killed more than 49,000 Americans and was listed as a primary or contributing cause of death in more than 261,000 deaths in the United States. Blacks get high blood pressure more often than whites. Men are more likely to develop the disease between age 35 and 55, while women are more at risk for hypertension after menopause. In 2003, a report found that high blood pressure incidence was even rising among children and was most likely due to the increased number of overweight and obese children and adolescents.

## Origins

For years, physicians have known that controlling the amount of salt one eats could help control hypertension. But this can be difficult, since much of the sodium people eat today comes from prepared and pre-packaged foods. Other dietary factors also contribute to high blood pressure. In the 1990s, scientists from the National Heart, Lung, and Blood Institute (NHLBI) conducted key studies to look at the effects of diet on blood pressure. These trials, called "DASH", showed that an eating plan low in saturated fat, cholesterol and total fat, but high in fruits, vegetables and low-fat dairy foods helped lower blood pressure. DASH trials also followed the effects of a reduced sodium diet on blood pressure. As a result, a comprehensive eating plan was developed with specific suggestions from each food group.

The American Heart Association revised its **dietary guidelines** in 2000 to build upon the Step 1 Diet, also created by the NHLBI to reduce risk of cardiovascular disease. Later research found that eating fiber could lower blood pressure. In 2006, scientists also recommended that as long as people were on a healthy diet, replacing some of the **carbohydrates** recommended in diets such as DASH, with proteins and monounsaturated **fats** can further lower blood pressure.

## Function

High blood pressure cannot be cured and is a condition that lasts a lifetime. People with hypertension must work throughout their lives to control their blood pressure and keep it within normal ranges. Many will do so with careful monitoring of blood pressure and a combination of lifestyle and diet changes, as well as possible use of medications.

A hallmark of controlling high blood pressure is to eat foods rich with potassium and avoid foods high in sodium. Another important component of controlling blood pressure is reducing saturated fat intake. Diets like the DASH diet encourage eating more servings of fresh fruits and vegetables, which are naturally low in sodium. They also encourage keeping a check on total calories, fat, carbohydrates, and eating a balanced diet. Together, these diet strategies help keep

weight and the balance of sodium and other of the body's minerals in balance.

Since manufacturers add sodium to preserve canned fish and poultry, choosing fresh fish and poultry instead can make a big difference in the level of sodium in the diet. Alternatives to canned and instant products include Fresh vegetables and pastas and rice.

## Benefits

Not everyone is sensitive to salt; some people have high blood pressure for other reasons such as heredity. But it is estimated that about one-half of people with high blood pressure are "salt-sensitive". When they eat excessive amounts of salt, their blood pressure rises. Overweight and **obesity** are other factors affecting blood pressure control; therefore, developing dietary and lifestyle habits aimed at maintaining or losing weight are encouraged. Closely following a diet such as DASH or one prescribed by a physician to keep weight in the normal range will help control blood pressure. In addition to controlling blood pressure, people who follow eating plans that consist of controlled portions, balanced intake from all food groups, and reduced sodium will enjoy other heart-healthy benefits, such as lower cholesterol.

## Precautions

Eating plans such as DASH or those suggested by a physician must be followed carefully in order to work. Learning how to read labels and to recognize hidden salt in prepared dishes is as important as pushing away the saltshaker at meals. People who begin the DASH eating plan may want to gradually work up to the increased amount of fiber to prevent bloating and potential diarrhea. People with kidney trouble or heart failure should talk with their physicians before starting a diet that boosts potassium.

A diet for hypertension helps prevent high blood pressure or is one tool to control blood pressure. Diet is not a substitute for prescribed medications, so patients should never stop taking medicines prescribed for high blood pressure without checking with their physicians.

## Risks

It is important to involve a physician or registered dietitian in diet planning for high blood pressure and to check the advice of credible organizations such as the American Heart Association, the American Dietetic Association, or the National Heart, Lung, and Blood Institute for information on diets recommended by those other than physicians and health care providers. People with high blood pressure should not rely on "fad" diets for quick weight or blood pressure fixes.

### QUESTIONS TO ASK YOUR DOCTOR

- How do I know what diet is best for my individual condition?
- What's my daily sodium limit?
- What foods should I avoid?
- What foods should I choose more often?

## Research and general acceptance

In a clinical trial the DASH diet lowered systolic blood pressure for patients with high blood pressure by an average of 11 mm Hg and diastolic blood pressure by an average of 5.5 mm Hg. A review of research also shows that patients with high blood pressure who lost 3% to 9% of their body weight experienced a drop of 3 mm Hg in both systolic and diastolic blood pressure measurements.

Research shows that decreased use of sodium helps lower blood pressure. A review of 17 clinical trials showed that people with hypertension who ate a reduced-sodium diet had reductions of 5 mm Hg in systolic blood pressure and 3 mm Hg in diastolic blood pressure. Research also has shown a link between increased sodium intake and obesity in the United States. Reducing alcohol consumption by nearly two-thirds resulted in improvements of between 2.5mm Hg and 4 mm Hg in blood pressure. Research has shown that vegetarians in industrialized countries generally have lower blood pressures, but in clinical trials, the vegetarian diets reduced systolic blood pressure but had no real effect on diastolic blood pressure.

## Resources

### BOOKS

Heller, Marla. *The DASH Diet*. Amidon Press, 2005.

### ORGANIZATIONS

American Heart Association. 7272 Greenville Ave., Dallas, TX 75231. (800) 242-8721. <http://www.americanheart.org >

National Heart, Lung, and Blood Institute. P.O. Box 30105, Bethesda, MD 20284. (301) 592-8573. <http://www.nhlbi.nih.gov >

Teresa G. Odle

# Hypertriglyceridemia

## Definition

Hypertriglyceridemia is an elevation of triglyceride levels in the bloodstream.

## Origins

Hypertriglyceridemia is a condition characterized by elevated triglyceride levels. **Triglycerides** are the chemical form in which more than 90% of dietary fat and body fat exist. There are two sources of triglycerides: they are either obtained from the diet (dietary triglycerides) or manufactured by the body itself in the liver. They circulate constantly with all the lipoprotein carriers of the blood. The most important lipoproteins are:

- Very high-density lipoprotein (VHDL). VHDL consists of proteins and a high concentration of free fatty acids.
- High-density lipoprotein (HDL). HDL helps remove fat from the body by binding with it in the bloodstream and carrying it back to the liver for excretion in the bile and disposal. A high level of HDL may lower chances of developing heart disease or stroke, this is why it is called the "good cholesterol".
- Intermediate-density lipoprotein (IDL). IDLs are formed during the degradation of very-low-density lipoproteins; some are cleared rapidly into the liver and some are broken down to low-density lipoproteins.
- Low-density lipoproteins (LDL). LDL transports cholesterol to extrahepatic tissues (outside the liver) to other parts of the body. A high LDL level may increase chances of developing heart disease, this is why it is referred to as the "bad cholesterol".
- Very low-density lipoprotein (VLDL). VLDLs carry triglycerides from the intestine and liver to fatty (adipose) and muscle tissues; they contain primarily triglycerides. A high VLDL level can cause the buildup of cholesterol in arteries and increase the risk of heart disease and stroke.
- Chylomicrons. Proteins that transport cholesterol and triglycerides from the small intestine to tissues after meals.

A blood cholesterol test usually reports on both cholesterol and triglyceride levels. The American Heart Association endorses the National Cholesterol Education Program (NCEP), a division of the National Institutes of Health (NIH), and its guidelines for the detection of high cholesterol. The following are considered normal results:

- Total cholesterol (100–199 mg/dL)
- LDL (less than 100 mg/dL)
- HDL (40–59 mg/dL)
- Triglycerides (less than 150 mg/dL)

**Possible causes of Hypertriglyceridemia**

- Acute pancreatitis
- Certain medications
- Diabetes mellitus
- Excessive alcohol intake
- High-carbohydrate diet
- High-sugar diet
- Hypothyroidism
- Genetics
- Metabolic syndrome
- Nephrotic syndrome
- Obesity
- Pregnancy

*(Illustration by GGS Information Services/Thomson Gale.)*

Hypertriglyceridemia is a common disorder in the United States. It is made worse by uncontrolled **diabetes mellitus**, **obesity**, cirrhosis of the liver and sedentary habits, all of which are more common in industrialized countries than in developing nations. The condition generally occurs in people who have low **protein** and high carbohydrate diets, but also has genetic causes, not very well-defined. One inherited form is "familial hypertriglyceridemia", affecting about 1 out of 300 individuals in the United States. Hypertriglyceridemia can also result from a disorder of lipoprotein **metabolism** (dyslipidemia). Triglyceride levels increase gradually in men until about age 50 years and then decline slightly. In women they continue to increase with age.

In 2001, the National Cholesterol Education Program (NCEP) released recommendations on triglyceride levels that should determine whether hypertriglyceridemia treatment is required or not:

- Normal: less than 150 mg/dL
- Borderline: 150–199 mg/dL
- High: 200–499 mg/dL
- Very high: higher than 500 mg/dL

In the Fredrickson classification of hyperlipidemias, the general term for elevated lipids in the blood, hypertriglyceridemia is classified as four different types:

## KEY TERMS

**Adipose**—Tissue that contains fat cells.

**Artery**—A blood vessel that carries blood from the heart to the body.

**Atherosclerosis**—Clogging, narrowing, and hardening of the large arteries and medium-sized blood vessels. Atherosclerosis can lead to stroke, heart attack, eye problems and kidney problems.

**Blood plasma**—The pale yellowish, protein-containing fluid portion of the blood in which cells are suspended. 92% water, 7% protein and 1% minerals.

**Cholesterol**—Soft, waxy substance found among the lipids present in the bloodstream and in all cells of the body.

**Chylomicronemia**—An excess of chylomicrons in the blood.

**Chylomicrons**—Intestinal triglycerides.

**Cirrhosis**—A life-threatening disease that scars liver tissue and damages its cells. It severely affects liver function, preventing it from removing toxins like alcohol and drugs from the blood.

**Diabetes mellitus**—A group of disorders in which there is a defect in the transfer of glucose (sugar) from the bloodstream into cells, leading to abnormally high levels of blood sugar (hyperglycemia).

**Dyslipidemia**—A disorder of lipoprotein metabolism, including lipoprotein overproduction or deficiency. Dyslipidemias may be manifested by elevation of the total cholesterol, the "bad" low-density lipoprotein (LDL) cholesterol and the triglyceride concentrations, and a decrease in the "good" high-density lipoprotein (HDL) cholesterol concentration in the blood.

**Fatty acid**—Any of a large group of monobasic acids, especially those found in animal and vegetable fats and oils, having the general formula CnH.

**Fredrickson classification**—A classification system of hyperlipidemias by ultracentrifugation followed by electrophoresis that uses plasma appearance, triglyceride values, and total cholesterol values. There are five types: I, II, III, IV, and V.

**Heart attack**—A heart attack occurs when blood flow to the heart muscle is interrupted. This deprives the heart muscle of oxygen, causing tissue damage or tissue death.

**Hyperlipidemia**—Elevation of lipid levels (fats) in the bloodstream. These lipids include cholesterol, cholesterol compounds, phospholipids and triglycerides, all carried in the blood as part of large molecules called lipoproteins.

**Lipids**—Group of chemicals, usually fats, that do not dissolve in water, but dissolve in ether.

**Metabolic syndrome X**—Also called the insulin resistance syndrome or pre-diabetic syndrome. The syndrome is closely associated with hypertriglyceridemia and with low HDL-"good" cholesterol.

**Omega-3 fatty acids**—Any of several polyunsaturated fatty acids found in leafy green vegetables, vegetable oils, and fish such as salmon and mackerel, capable of reducing serum cholesterol levels and having anticoagulant properties.

**Triglycerides**—Triglycerides are the chemical form in which most fat exists in food as well as in the body. They consist of three fatty acids and glycerol. Triglycerides are used by the body to store energy

**Unsaturated fat**—A type of fat derived from plant and some animal sources, especially fish, that is liquid at room temperature.

- Type I: This is a rare disorder characterized by severe elevations in chylomicrons and extremely elevated triglyceride levels, always well above 1000 mg/dL and reaching as high as 10,000 mg/dL or higher. Because chylomicrons also contain cholesterol, blood cholesterol levels are also quite high.
- Type IIb: This is a mixed hyperlipidemia (high cholesterol and triglycerides) caused by elevations in both LDL and VLDL.
- Type III: This form is characterized by elevated total cholesterol and triglyceride levels. This type is easily confused with type IIb, but type III also features elevations in IDL.
- Type IV: This type is characterized by abnormal elevations of VLDL, with triglyceride levels almost always lower than 1000 mg/dL. Blood cholesterol levels are normal.

When levels exceed 150 mg>dL, health care practitioners will recommend a diet aimed at lowering levels.

### Description

Since there are different types of hypertriglyceridemias, often associated with other diseases or disorders (diabetes mellitus, obesity), diets needs to be individually

tailored. In general, people with hypertriglyceridemia are typically advised to lose weight and limit the consumption of processed foods, simple sugars, alcohol, and saturated **fats**. These fats are primarily found in animal foods, such as meat, eggs, and dairy products, and in tropical oils such as palm and coconut. Specific **dietary guidelines** include:

- Total fat intake should be restricted if weight loss is also required. If triglyceride levels are greater than 1000 mg/dL, allowing no more than 10% of total calories from fat usually lowers levels quickly and significantly.
- If dietary intake of white flour products is significant, restricting simple carbohydrates and increasing dietary fiber can lower triglyceride levels substantially.
- Alcohol should be avoided or limited to no more than 1 standard alcoholic beverage per day.
- Omega-3 fatty acids, found mainly in fatty fish and some plant products such as flax seed have a significant effect on triglyceride levels. In large amounts (10g daily or more), they lower triglycerides by 40% or more. To achieve this dose however, requires supplements or eating very large amounts of fatty fish, such as sardines, herring, and mackerel.
- Refined sugars increases triglyceride levels, and people with elevated levels should accordingly lower their intake of sugar, sweets, and other sugar-containing foods.
- Individuals who consume a lot of tea and coffee should change to decaffeinated products, as eliminating caffeine has been shown to reduce triglyceride levels.
- Water-soluble fibers, such as pectin found in fruit, guar gum and other gums found in beans, and beta-glucan found in oats, may be particularly beneficial in lowering triglycerides.

Most foods contain several different types of fats and some kinds are better, not only to reduce fat during a hypertriglyceridemia diet, but for improving overall health. The four main types of fats are:

- Saturated fats: These fats consist of fatty acid chains that have no double bonds between the carbon atoms of the chain. They are called saturated because they are fully saturated with hydrogen atoms and cannot incorporate more. They are solid at room temperature and are most often of animal origin. Examples are butter, cheese, and lard.
- Monounsaturated fats: These are composed mostly of monounsaturated fatty acids, meaning molecules with one double-bonded carbon, with all the others carbons being single-bonded. They are liquid at room temperature. Examples are olive, peanut and canola oil.
- Polyunsaturated fats: These fats are composed mostly of fatty acids such as linoleic or linolenic acids which have two or more double bonds in each molecule, as for example corn oil and safflower oil. They are also liquid at room temperature and can be further divided into the omega-6 and the omega-3 families. Fatty fish contain omega-3s, and they are also found in walnuts and some oils like soybean and rapeseed.
- Trans fatty acids. Unsaturated fats come in different chemical structures: a bent *cis* form or a straight *trans* form. When they adopt the trans form, they are called trans fatty acids. They are produced by the partial hydrogenation of vegetable oils and present in hardened vegetable oils, most margarines, commercial baked foods, and many fried foods.

Unsaturated, monounsaturated and polyunsaturated fats are considered better than others to lower your risk of heart disease since they lower the total and LDL cholesterol levels. **Omega-3 fatty acids** may be especially beneficial to the heart. They appear to decrease the risk of coronary artery disease and may also protect against irregular heartbeats and help lower blood pressure levels. Saturated and trans fats are considered less healthy because they can increase the risk of heart disease by increasing total and LDL cholesterol levels. Tips to limit fat in the diet are accordingly focused on reducing foods high in saturated and trans fats. For example, the Mayo Clinic offers the following:

- Cook with olive oil instead of butter.
- Use olive oil instead of vegetable oil in salad dressings and marinades. Use canola oil when baking.
- Sprinkle chopped nuts or sunflower seeds on salads instead of bacon bits.
- Snack on a small handful of nuts rather than potato chips or processed crackers.
- Add slices of avocado, rather than cheese, to sandwiches.
- Prepare fish such as salmon and mackerel, which contain monounsaturated and omega-3 fats, instead of meat one or two times a week.

## Function

The function of a hypertriglyceridemia diet is to bring triglyceride levels back to normal recommended levels (less than 150 mg/dL).

## Benefits

The benefits of normal triglyceride levels are numerous. Triglycerides carry fat-soluble **vitamins** A, D, E and K to where they are required, they help the synthesis of some hormones and protect cell membranes. The fat tissues in which they are stored also cushion and protect organs such as the kidneys and provide thermal insulation.

## Precautions

The National Heart, Lung and Blood Institute (NHLBI), through its National Cholesterol Education Program (NCEP), recommends that the triglycerides of diabetic individuals should be checked regularly. Diabetes can increase triglycerides significantly, especially when blood sugar is out of control. Healthy adults over 40 should get their triglycerides tested at least once a year, and more often if levels are high until they reach the desirable level.

Fat restriction should be carefully evaluated. When reducing fat intake results in a required weight loss, triglyceride levels usually improve. When they are severely elevated (>1000 mg/dL), a **low-fat diet** will decrease chylomicron and VLDL. However, when triglycerides are only moderately elevated, a low-fat diet will increase them and may also decrease HDL levels.

## Risks

Triglycerides do not cause complications until elevations of 1000 mg/dL or more are reached. There is a risk of chylomicronemia syndrome when levels are 800 mg/dL or higher. The syndrome causes recurrent episodes of abdominal pain that may be accompanied by nausea and vomiting. Extreme elevations of triglycerides, usually greater than 1000 mg/dL, may cause an inflammation of the pancreas (pancreatitis). The pancreas is the organ that makes insulin and substances to help digest food and pancreatitis is accordingly a serious disorder. People with hypertriglyceridemia are also at risk for fatty liver, the accumulation of fat in liver cells. Triglyceride levels of 4000 mg/dL or higher, may cause a condition known as lipemia retinalis, in which eye examination reveals retinal blood vessels that have a pale pink, milky appearance.

Women with elevated triglycerides before conception may develop severe hypertriglyceridemia with levels well above 1000 mg/dL, and the associated risk of pancreatitis. These women require counseling for diet, exercise, and weight management before becoming pregnant and should be monitored closely during their pregnancies.

## QUESTIONS TO ASK YOUR DOCTOR

- What is hypertriglyceridemia?
- What causes hypertriglyceridemia?
- What type of hypertriglyceridemia do I have?
- Can it be cured?
- How is it treated?
- How serious is this condition?
- How effective is diet in controlling hypertriglyceridemia?
- What are some simple steps for reducing triglyceride levels in my diet?
- Are there foods that should be avoided?
- Are there foods that are recommended?
- Should I get help from a dietician to prepare an eating plan?

## Research and general acceptance

Though it is unclear if elevated triglycerides independently contribute to cardiovascular disease, they have been associated with multiple conditions that contribute to diabetes and metabolic syndrome X. After much debate, consensus is emerging among medical experts that lowering elevated triglycerides is beneficial. For a long time, triglycerides were overshadowed by other blood lipids, especially by LDL, the "bad cholesterol", previously considered more important than triglycerides as a contributing factor to cardiovascular disease. In 1994, a study published in the American Heart Association's journal Circulation reported that LDL seemed to be masking arterial damage caused by triglyceride-rich VLDL and IDL. The study found that despite aggressive treatment of the LDL, patients with high triglyceride levels continued to suffer damage to arterial walls. Another report, in the New England Journal of Medicine HealthNews, described a Danish study involving 3,000 healthy men which concluded that the risk of having a first heart attack was twice as high in the men with the highest triglyceride levels, compared to those with the lowest levels. The connection between high triglycerides and heart disease is now established. However, some uncertainty remains concerning the relationship between triglycerides and HDL, the "good cholesterol". It has been observed that whenever triglycerides are increased, HDL cholesterol decreases. Researchers are still investigating whether the increased risk associated with high triglycerides is due to the triglycerides themselves, or to

the associated reduction in HDL cholesterol and increase in LDL cholesterol.

The NCEP triglyceride recommendation of less than 150 mg/dL per day has recently been challenged. Cardiologists at the University of Maryland Medical Center have presented evidence that the recommended level may still represent a significant risk for heart disease. Their study suggests that less than 100 mg/dL would be more appropriate.

## Resources

### BOOKS


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### ORGANIZATIONS


American Heart Association (AHA). 7272 Greenville Avenue, Dallas, TX 75231. 1-800-242-8721. <www.americanheart.org>.

Center for Disease Control (CDC). Division for Heart Disease and Stroke Prevention, 4770 Buford Hwy NE, Atlanta, GA 30341-3717. 770-488-2424. <www.cdc.gov/cholesterol/faqs.htm>.

National Heart Lung and Blood Institute (NHLBI). P.O. Box 30105, Bethesda, MD 20824-0105. 301-592-8573. <www.nhlbi.nih.gov>.

Nutrition.gov. USDA National Agricultural Library, Food and Nutrition Information Center, Nutrition.gov Staff, 10301 Baltimore Avenue, Beltsville, MD 20705-2351. <www.nutrition.gov>.



Monique Laberge, Ph.D.

Indian diet *see* **Asian diet**

# Infant nutrition

## Definition

Children between the ages of birth and one year are considered infants. Infants grow very rapidly and have special nutritional requirements that are different from other age groups.

## Purpose

Infant nutrition is designed to meet the special needs of very young children and give them a healthy start in life. Children under one year old do not have fully mature organ systems. They need nutrition that is easy to digest and contains enough calories, **vitamins**, **minerals**, and other nutrients to grow and develop normally. Infants also need the proper amount of fluids for their immature kidney's to process. In addition, infant nutrition involves avoiding exposing infants to substances that are harmful to their growth and development.

## Description

Infancy is a time of incredibly rapid growth and development. Getting the right kinds of nutrients in the right quantities and avoiding the wrong kinds of substances gives infants the best chance at a healthy start to life. Parents are responsible for seeing that their infant's nutritional needs are met. Infant nutrition is so important that the United States Department of Agriculture has developed the WIC program. This program provides free health and social service referrals, nutrition counseling, and vouchers for healthy foods to supplement the diet of pregnant and **breastfeeding** women, infants, and children up to age 5 who are low-income and nutritionally at risk. In 2004, WIC serve about 7.9 million people, including 2 million infants and 1.9 million pregnant and nursing women.

### *Breastfeeding*

Human milk is uniquely suited to the nutrition needs of newborns. Many health organizations, including the American Academy of Pediatrics (AAP), the American Medical Association (AMA), the American Dietetic Association (ADA), and the World Health Organization (WHO) support the position that breast milk is the best and most complete form of nutrition for infants. The AAP recommends that infants should be exclusively breastfed for the first 6 months of life and that breastfeeding should continue for at least 12 months.

Breastfeeding in the United States slowly increased in acceptance in the last decade of the twentieth century. In 1998, 64% of American mothers breastfed their babies for a short time after birth. Only 29% were still breastfeeding by the time their baby was 6 months old. The United States Department of Health and Human Services developed a set of health goals for the nation to aim for by the year 2000. One of these goals involved breastfeeding. The Healthy People 2000 goal was for 75% of American women to breastfeed their babies for a period immediately after birth and 50% to breastfeed for the first 6 months of their infant's life. Although there is significant variation in support for breastfeeding among different racial and ethnic groups in the United States, no racial group met this target. In 2000, the Department of Health and Human Services estimated that:

- 45% of African American mothers breastfed their infants for a short time after birth; &19% were breastfeeding at 6 months; 9% at 12 months.
- 66% of Hispanic mothers breastfed their infants for a short time after birth; 28% were breastfeeding at 6 months; 19% at 12 months.

**Required nutrients for infant formula**

| Nutrient | Minimum(1) per 100 kilocalories | Maximum(1) per 100 kilocalories |
|---|---|---|
| **Protein (g)(2)** | 1.8 | 4.5 |
| **Fat:** | | |
| grams | 3.3 | 6.0 |
| % calories | 30.0 | 54.0 |
| **Essential fatty acids (linoleate):** | | |
| mg | 300.0 | |
| % calories | 2.7 | |
| **Vitamins:** | | |
| A (IU)(3) | 250.0 (75 mcg) | 750.0 (225 mcg) |
| D (IU) | 40.0 | 100.0 |
| K (mcg) | 4.0 | |
| E (IU) | 0.7 (with 0.7 IU/g linoleic acid) | |
| C (ascorbic acid) (mg) | 8.0 | |
| B1 (thiamine) (mcg) | 40.0 | |
| B2 (riboflavin) (mcg) | 60.0 | |
| B6 (pyridoxine) (mcg) | 35.0 (with 15 mcg/g of protein in formula) | |
| B12 (mcg) | 0.15 | |
| Niacin (mcg) | 250.0 | |
| Folic acid (mcg) | 4.0 | |
| Pantothenic acid (mcg) | 300.0 | |
| Biotin (mcg)(4) | 1.5 | |
| Choline (mg)(4) | 7.0 | |
| Inositol (mg)(4) | 4.0 | |
| **Minerals:** | | |
| Calcium (mg)(5) | 50.0 | |
| Phosphorus (mg)(5) | 25.0 | |
| Magnesium (mg) | 6.0 | |
| Iron (mg) | 0.15 | |
| Iodine (mcg) | 5.0 | |
| Zinc (mg) | 0.5 | |
| Copper (mcg) | 60.0 | |
| Manganese (mcg) | 5.0 | |
| Sodium (mcg) | 20.0 | 60.0 |
| Potassium (mg) | 80.0 | 200.0 |
| Chloride (mg) | 55.0 | 150.0 |

(1) Stated per 100 kilocalories (Kcal)
(2) The source of protein is at least nutritionally equivalent to casein
(3) Retinol equivalents
(4) Required to be included in this amount only in formulas that are not milk based
(5) Calcium to phosphorus ratio must be not less than 1.1 nor more than 2.0

*(Illustration by GGS Information Services/Thomson Gale.)*

- 68% of white mothers breastfed their infants for a short time after birth; 31% were breastfeeding at 6 months; 17% at 12 months.

Healthy People 2010, the health goals set for Americans during the first decade of the twenty-first century, include eliminating the differences among racial groups in the rate of breastfeeding. The goal for 2010 is for 75% of all women to be breastfeeding shortly after birth, 50% to be breastfeeding at 6 months, and 25% to breastfeed for a full year.

**ADVANTAGES OF BREASTFEEDING.** Research comparing formula-fed and breastfed babies convincingly shows that both full-term and premature breastfed infants have certain advantages over formula fed infants. One of the most important advantages conferred by breast milk is an increased resistance to infection.

An infant is born with an immature immune system that does not become fully functional for about two years. Since immune system cells makes antibodies to fight infection, an incompletely developed immune system leaves the infant vulnerable to many bacterial and viral infections. However, the nursing mother has a fully developed immune system, and many of the antibodies and other components of her immune system pass into her breast milk. Nursing infants take in their mother's antibodies along with the other nutrients in breast milk. These antibodies survive passage through the infant's digestive system and are absorbed into the infant's blood, where they help protect against infection. Well-designed studies have repeatedly documented the fact that breastfed babies have fewer ear infections, bouts of diarrhea, respiratory infections, and cases of meningitis than formula-fed babies. Overall, the death rate of breastfeed babies during the first year of life is lower than the death rate of formula-fed babies.

Another way that breastfeeding protects against infection is by keeping the infant from being exposed to waterborne contaminants. In developing countries, many **water** supplies are contaminated with bacteria and chemicals. Using this water to mix formula increases the exposure of the baby to these pathogens and toxins. Breastfed babies do not have to worry about being exposed to this type of contamination.

Another advantage of breastfeeding is that infants are unlikely to gain too much weight. **Childhood obesity** is a major concern in the United States. Since mothers are unable to measure how much breast milk their baby consumes, they are less likely to encourage overfeeding. Research suggests that breastfed babies have a lower risk of developing type 2 diabetes. Other research suggests that the rate of other chronic diseases such as asthma, **celiac disease**, **inflammatory bowel disease**, and various allergies appears to be lower in breastfed babies than in babies fed formula. Premature babies especially appear to benefit from reduced chronic disease as a result of breastfeeding.

Breastfeeding also provides benefits to the nursing mother. To start with, breastfeeding is more economical than buying formula, even taking into account the extra food—about 500 calories daily— that the mother needs to eat when she is nursing. Since

## KEY TERMS

**Antibodies**—proteins produced by immune system cells that destroy or disable viruses or bacteria. Antibodies are generally specific to each species of virus or bacteria, so that antibodies against one type of virus will not affect another type.

**celiac disease**—a digestive disease that causes damage to the small intestine. It results from the ability to digest gluten found in wheat, rye, and barley.

**Exclusive breastfeeding**—All an infant's nutrient and fluid needs are met from breast milk

**Meningitis**—a serious infection of the membranes surrounding the brain

**Type 2 diabetes**—sometime called adult-onset diabetes. This disease prevents the body from properly using glucose (sugar).

**celiac disease**—digestive disease that causes damage to the small intestine. It results from the ability to digest gluten found in wheat, rye, and barley.

breastfed babies on average get sick less than formula-fed babies, the family is also likely to save money on doctor visits, medicine, and time off from work to care for a sick child.

The mother's health also benefits from breastfeeding. Nursing mothers tend to lose the weight they put on during pregnancy faster than mothers who do not nurse. The hormones that are released in the mother's body when her infant nurses also help her uterus contract and become more nearly the size it was before pregnancy. Mothers who nurse their babies also seem to be less likely to develop breast, ovarian, or uterine **cancer** early in life. Finally, breastfeeding offers psychological benefits to the mother as she bonds with her baby and may reduce the chance of postpartum depression.

**DISADVANTAGES OF BREASTFEEDING.** Although breast milk is the best food for an infant, breastfeeding does cause some disadvantages to the mother. Initially babies breastfeed about every two to three hours. Some women find it exhausting to be available to the baby so frequently. Later, when the infant is older, the mother may need to pump breast milk for her child to eat while she is away or at work. Fathers sometimes feel shut out during the early weeks of breastfeeding because of the close bond between mother and child. In addition, women who are breastfeeding must watch their diet carefully. Some foods or substances such as **caffeine** can pass into breast milk and cause the baby to be restless and irritable. Finally, some women simply find the idea of breastfeeding messy and distasteful, and resent the fact that they need to be "on tap" much of the time. For women who cannot or do not want to breastfeed, infant formula provides an adequate alternative.

### *Formula feeding*

Although infant formula is not as perfect a food as breast milk for infants (it is harder for them to digest and is not a chemical replica of human milk), formula does provide all the nutrients a baby needs to grow up healthy. The United States Food and Drug Administration (FDA) regulates infant formula under the Federal Food, Drug, and Cosmetic Act (FFDCA). The FDA sets the minimum amounts of 29 nutrients that must be present in infant formula and sets maximum amounts for 9 other nutrients. Some of these nutrients include Vitamins A, D, E, and K, and **calcium**. Some formulas contain **iron**, while others do not.

Substances used in infant formulas must be foods on the approved Generally Recognized as Safe (GRAS) list. Facilities for manufacturing infant formula are regularly inspected by the FDA, and the manufacturer must keep process and distribution records for each batch of formula. Every container of formula must show an expiration or use by date. The FDA must be informed of any changes made to the formula.

Infant formulas are either cow's milk based or **soy** based. Infants who show signs of lactose-intolerance (colicky, restless, gassy, spitting up) usually do well on soy-based formula. Formula comes in three styles:

- ready-to-feed. This is the easiest type of formula to use. It can be poured straight from the can into a bottle. It is also the most expensive form of formula.
- Concentrated liquid. This needs to be mixed with an equal portion of water. Concentrated liquid is less expensive than ready-t0-feed.
- Powder. This needs to be mixed with water. Advantages are that it is the least expensive formula and that it keeps longer than the liquid varieties. The main disadvantage is that it requires accurate measuring of powder and water.

### *Reasons to formula feed*

Not every woman wants or is able to breastfeed. Aside from personal preference, here are some reasons why some women should formula feed.

- They are adoptive parents.
- They have HIV, active tuberculosis, or hepatitis C. These diseases can be passed on to their infants through breast milk.
- They use street drugs or abuse prescription medicines. Many drugs pass into breast milk and can permanently damage a baby's health.
- They are taking chemotherapy drugs, certain mood stabilizers, migraine headache medications or other drugs that pass into breast milk and whose effect on the infant is negative or unknown.
- They have alcoholism or are binge drinkers. The alcohol they drink will be present in breast milk.
- They have difficult to control diabetes and may have increased difficulty controlling their blood sugar level if they choose to breastfeed.
- They are going to be separated from their baby for significant periods.
- They have had breast surgery that interferes with milk production.
- They are emotionally repelled by the idea of breastfeeding.
- A few babies are born with a genetic inborn error in metabolism that prevents them from digesting any mammalian milk. These babies must be fed soy-based formula in order to survive.

### *Pros and cons of formula feeding*

Formula feeding has some definite advantages. Anyone, not just the mother, can feed the infant. This gives the mother more flexibility in her schedule and allows the father or other relatives to enjoy a special closeness with the baby that comes with feeding. Also, the mother does not need to be concerned about how her diet affects her baby and she does not need to worry about breast milk leakage. In addition, since formula is digested more slowly than breast milk, feedings are less frequent. Some women feel uncomfortable nursing in front of other people or find it difficult to locate places to nurse in private. Formula feeding eliminates this problem.

There are also disadvantages to formula feeding. Aside from the fact that formula is not an exact duplicate of breast milk and is harder to digest, it also costs more and requires more advance preparation. Bottles need to be washed, and the water used to mix formula, at least in the early months, needs to be boiled or be special bottle water suitable for infants. The Academy of General Dentistry warns that some public water supplies are fluoridated at levels too high for infants, and that fluorodosis of the primary (baby) teeth may result. Fluorodosis is a cosmetic problem. It causes brown spots on the teeth, but does not weaken them in any way. Finally, formula must be refrigerated once it is mixed or a can is opened. It can only be kept about 2 days in the refrigerator, so is there is more likely to be waste. Likewise, when traveling, bottles need to be refrigerated. Although most babies do not mind cold formula, many parent like to heat their child's bottle to body temperature, another inconvenience when traveling.

### *Transitioning to solid foods*

When an infant is between four and six months old, most pediatricians recommend introducing the infant to solid food. By this age, infants begin to have the muscle coordination to swallow runny solids. If there is a family history of food allergies, some pediatricians recommend waiting until 6 months or older to start solid food.

Normally solid feeding begins with a small amount of iron-fortified rice or other single-grain cereal mixed into a slurry the consistency of thin gravy with formula or breast milk. The infant is then offered a small amount of cereal on a small spoon. It may take many attempts before the infant is happy with the new food. After runny cereal is accepted, a thicker cereal can be offered. When the child eats this with ease, parents can begin feeding one new pureed food every week. Commercial baby food is available in jars or frozen. Baby food can also be made at home using a blender or food processor. Portions can be frozen in an ice cube tray and thawed as needed.

About the same time babies begin eating solid food, they are ready to take small sips of apple, grape, or pear juice (but not citrus juices) from a cup. Juice should not be served in a bottle. By the end of the first year, infants can eat a variety of ground or chopped soft foods that the rest of the family eats.

### *Foods that should not be fed to infants*

Some foods are not appropriate for children during their first year. These include:

- homemade formula. The nutrient requirements for infants are very specific and even a small excesses or deficits of a particular nutrient can permanently harm the child's development.
- cow's milk. Plain cow's milk should not be offered before 6 months, after this it can be introduced in small amounts as part of weaning foods but should not be offerd as the main drink before age 1. The cow's milk in formula has been altered to make it acceptable for infants.

- honey. Honey can contains spores of the bacterium *Clostritium botulinum*. This bacterium causes a serious, potentially fatal disease called infant botulism. Older children and adults are not affected. *C. botulinum*. can also be found in maple syrup, corn syrup, and undercooked foods.
- well cooked eggs can be offered between 6-9 months (later if any family history of atopy), fish (can be offered from 6-9 months, shellfish, peanuts, and peanut butter. These often trigger an allergic reaction during the first year.
- orange, grapefruit, or other citrus juices. These often cause a painful diaper rash during the first year.
- home prepared spinach, collard greens, turnips, or beets. These may contain high levels of harmful nitrates from the soil. Jarred versions of these foods are okay.
- raisins, whole grapes, hot dog rounds, hard candy, popcorn, raw carrots, nuts, and stringy meat. These and similar foods can cause choking, a major cause of accidental death in infants and toddlers.

## Precautions

Mothers with certain health conditions such as those mentioned above should not breastfeed. Women with chronic diseases should discuss this with their healthcare provider.

Mothers using certain drugs should not breastfeed.

Parents using concentrated liquid and powdered formulas must measure and mix formula accurately. Inaccurate measuring can harm the infant's growth and development. Water used in mixing formula must be free of pathogens, contaminants, and excessive levels of **fluoride**

## Interactions

Street drugs, many prescription and over-the-counter drugs, and alcohol pass into breast milk and have the potential to permanently harm an infant's growth and development. Before taking any drugs, a pregnant or breastfeeding woman should consult her healthcare provider. Caffeine also passes into breast milk. Some women find that even moderate amounts of coffee or caffeinated sodas cause their infant to become restless and irritable, while others find little effect. Breastfeeding women should monitor their caffeine intake and try to keep it to a minimum.

## Complications

Many women have trouble getting the newborn to latch on and begin breastfeeding. This can usually be overcome with the help of a lactation consultant or pediatric nurse. Breastfeeding can cause the mother to develop sore, infected nipples. This is usually a temporary condition that should not be a reason to stop breastfeeding.

Complications from bottle feeding tend to be related to the infant's difficulty in digesting formula. Some infants become gassy and colicky and may fuss, cry for long periods, and spit up cow's milk-based formula. A switch to soy-based formula on the advice of a healthcare professional usually relieves this problem. Other complications of formula feeding are generally related to improper mixing of formula.

## Parental concerns

Breastfeeding parents often are concerned about whether their baby is getting enough milk, since there is no way to directly measure how much milk a baby consumes when nursing. Newborns should have a minimum of 6-8 wet diapers and four bowel movements during the first two weeks of life. As the child grows, these numbers will gradually decrease. In addition, a woman's breasts should feel hard and full (sometimes even painful) before nursing, and softer after nursing. Newborns nurse every 2–3 hours, but they should seem satisfied after nursing. The most definite sigh that the baby is getting enough food is that he or she is gaining weight.

Infants grow in irregular spurts. They may eat hungrily for a few days and then eat little few days later. Parents often worry about this, but it is a normal occurrence.

The transition to solid food is often a slow process. Infants eat very small amounts and often must be exposed to a new food multiple times before they will eat it willingly. Since childhood **obesity** is a major problem in the United States, parents and caregivers should avoid encouraging the infant to overeat.

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### ORGANIZATIONS

American Academy of Pediatrics. 14 Northwest Point Blvd. Elk Grove, IL 60007. Telephone: (874)434-4000. Website: <http://www.aap.org>

American Dietetic Association. 120 South Riverside Plaza, Suite 2000, Chicago, Illinois 60606-6995. Telephone: (800) 877-1600. Website: <http://www.eatright.org>

International Food Information Council. 1100 Connecticut Avenue, NW Suite 430, Washington, DC 20036. Telephone: 202-296-6540. Fax: 202-296-6547. Website: <http://ific.org>

La Leche League International. P. O. Box 4079, Schaumburg, IL 60168-4079. Telephone: (847) 519-7730. TTY: (847) 592-7570 Fax: (847)519-0035. Website: <http://www.lalecheleague.org>

United States Department of Agriculture. 1400 Independence Avenue, S.W., Room 1180, Washington, DC 20250. Website: <http://www.usda.gov/wps/portal/usdahome>

United States Food and Drug Administration (FDA), Center for Food Safety and Applied Nutrition, Office of Nutritional Products, Labeling, and Dietary Supplements. 5100 Paint Branch Parkway, College Park, Maryland 20740. Fax: 301-436-2639. Website: <http://www.cfsan.fda.gov/~dms/onplds.html>

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Tish Davidson, A.M.

# Inflammatory bowel disease

## Definition

Inflammatory bowel disease (IBD) refers to a group of inflammatory disorders mostly of the large intestine including ulcerative colitis and **Crohn's disease**, that cause the intestines to become inflamed.

## Description

Although ulcerative colitis and Crohn's disease have some features in common, there are some important differences.

**Ulcerated intestine (colored in yellow) caused by inflammatory bowel disease.** *(David Mack/Photo Researchers, Inc. Reproduced by permission.)*

### *Crohn's disease*

Crohn's disease (CD) can involve ongoing (chronic) inflammation of the gastrointestinal tract, from the mouth to the anus, with ulceration and formation of fistulas and perianal abscesses. Five types are recognized, depending on the affected region:

- Ileocolitis. This is the most common form, it affects the lowest part of the small intestine (ileum) and the large intestine (colon).
- Ileitis. This type affects the ileum.
- Gastroduodenal CD. This type causes inflammation in the stomach and first part of the small intestine, called the duodenum.
- Jejunoileitis. This type causes spotty inflammation in the top half of the small intestine (jejunum).
- Granulomatous CD colitis. This type affects the large intestine.

### *Ulcerative colitis*

Ulcerative colitis typically involves continuous inflammation from the rectum to the entire colon. The disease usually begins in the rectal area and may eventually spread to the entire large intestine. Repeated inflammation thickens the wall of the intestine and rectum with scar tissue.

## Demographics

More than 600,000 Americans are diagnosed every year with some type of inflammatory bowel disease. Ulcerative colitis may affect any age group, although there are peaks at ages 15 to 30 and at ages 50 to 70. Crohn's disease may occur at any age, but it commonly affects persons between ages 15 and 35. Risk factors include a family history of Crohn's disease, Jewish ancestry, and smoking. Men and women appear to be at equal risk of developing IBD. According to the Crohn's and Colitis Foundation of America, two- thirds to three-quarters of patients with Crohn's disease will need bowel surgery at some time.

## Causes and symptoms

The exact causes of IBD are unknown. The disease may be caused by a germ or by an immune system problem. It is known that IBD is not contagious and it seems to be hereditary. In the case of ulcerative colitis, symptoms vary in severity and may start gradually or suddenly. They usually include all or some of the following:

- Abdominal pain and cramps that usually disappear after a bowel movement;
- Constipation, difficulty passing stool;
- Diarrhea. It can be intermittent to very frequent;
- Fever;
- Gastrointestinal bleeding;
- Gurgling or splashing sound heard over the intestine;
- Nausea and vomiting;
- Pain in the joints;
- Undesired weight loss.

The exact cause of Crohn's disease is also unknown, but it has been linked to a problem with the body's immune system (autoimmune disease). The immune system helps protect the body from harmful foreign substances and pathogens. But in patients with Crohn's disease, the immune system can no distinguish between the body's own cells and foreign invaders. The result is an overactive immune response that leads to chronic inflammation. Since Crohn's Disease can affect any part of the gastrointestinal tract, symptoms can vary greatly between affected individuals. The following may be observed:

- Abdominal fullness and gas
- Abdominal pain and cramps
- Blood clotting problems
- Constipation
- Diarrhea. (It is usually persistent and watery)
- Eye inflammation
- Fatigue
- Fever
- Fistulas
- Foul-smelling stools
- Gastrointestinal bleeding
- Gurgling or splashing sound heard over the intestine

## KEY TERMS

**Abdomen**—Part of the body that extends from the chest to the groin.

**Anal fissures**—Splits or cracks in the lining of the anus resulting from the passage of very hard or watery stools.

**Autoimmune disorder**—Autoimmune disorders are conditions in which a person's immune system attacks the body's own cells, causing tissue destruction.

**Cecum**—The pouch-like start of the large intestine that links it to the small intestine.

**Colon**—Part of the large intestine, located in the abdominal cavity. It consists of the ascending colon, the transverse colon, the descending colon, and the sigmoid colon.

**Diverticulitis**—Inflammation of the small pouches (diverticula) that can form in the weakened muscular wall of the large intestine.

**Duodenum**—The first section of the small intestine, extending from the stomach to the jejunum, the next section of the small intestine.

**Fistula**—Abnormal, usually ulcerous duct between two internal organs or between an internal organ and the skin. When open at only one end it is called an incomplete fistula or sinus. The most common sites of fistula are the rectum and the urinary organs.

**Gastrointestinal tract (GI tract)**—The tube connecting and including the organs and paths responsible for processing food in the body. These are the mouth, the esophagus, the stomach, the liver, the gallbladder, the pancreas, the small intestine, the large intestine, and the rectum.

**Ileum**—The last section of the small intestine located between the jejunum and the large intestine.

**Jejunum**—The section of the small intestine located between the duodenum and the ileum.

**Immune system**—The integrated body system of organs, tissues, cells, and cell products such as antibodies that protects the body from foreign organisms or substances.

**Large intestine**—The terminal part of the digestive system, site of water recycling, nutrient absorption, and waste processing located in the abdominal cavity. It consists of the caecum, the colon, and the rectum.

**Mucosa**—Lining of the digestive tract. In the mouth, stomach, and small intestine, the mucosa contains glands that produce juices to digest food.

**Pancreas**—The pancreas is a flat, glandular organ lying below the stomach. It secretes the hormones insulin and glucagon that control blood sugar levels and also secretes pancreatic enzymes in the small intestine for the breakdown of fats and proteins.

**Perianal abscess**—Abscess that can occur when the tiny anal glands that open on the inside of the anus become blocked and infected by bacteria. When pus develops, an abscess forms.

**Prebiotics**—Substances that help manage bacteria. Two principal types commonly used are the mannanoligosaccharides (MOS) that bind potentially harmful bacteria in the gut and allow beneficial bacteria to dominate, and fructanoligosaccharides (FOS) that deliver fructans into the fore gut to 'feed' the acid producing bacteria.

**Probiotics**—Probiotics are dietary supplements containing potentially beneficial bacteria or yeast.

**Rectum**—Short, muscular tube that forms the lowest portion of the large intestine and connects it to the anus.

**Ulceration**—Formation of ulcers on a mucous membrane accompanied by pus and necrosis of surrounding tissue.

- Kidney stones
- Loss of appetite
- Pain in the joints
- Rectal bleeding and bloody stools
- Skin rash
- Swollen gums
- Undesired weight loss

### Diagnosis

Based on a careful history of symptoms, the examining physician will be able to distinguish between Crohn's disease and ulcerative colitis. But diagnosis can be troublesome because other diseases have IBS-like symptoms. For example, Crohn's disease is commonly misdiagnosed as **celiac disease**, or diverticulitis. This is because it can affect various regions of the

gastrointestinal tract. Physicians accordingly use additional tests such as:

- Barium enema before x rays. In this test, also called a "lower gastrointestinal (GI) series", an enema tube is inserted into the patient's rectum and a barium solution is allowed to flow in to improve the contrast of the x rays.
- Colonoscopy. Test that allows the physician to look inside the colon using a colonoscope, a long, flexible tube that has a miniaturized color-TV camera at one end. It is inserted through the rectum into the colon, and provides a view of the lining of the lower digestive tract on a television monitor.
- Complete blood count (CBC) test. This test measures the number of red and white blood cells, the amount of hemoglobin in the blood, the fraction of the blood composed of red blood cells (hematocrit), and the size of the red blood cells.
- C-reactive protein (CRP). CRP is a test that measures the amount of a protein in the blood that signals acute inflammation.
- Endoscopic ultrasound (EUS). Technique that uses sound waves to create a picture of the inside of the body. It uses a special endoscope that has an ultrasound device at the tip. It is placed in the gastrointestinal tract, close to the area of interest.
- Esophagogastroduodenoscopy (EGD). EGD is a technique used to look inside the esophagus, stomach, and duodenum. It uses an endoscope to investigate swallowing difficulties, nausea, vomiting, reflux, bleeding, indigestion, abdominal pain, or chest pain.
- Flexible sigmoidoscopy. Technique that allows to look at the inside of the large intestine from the rectum through the last part of the colon, called the sigmoid colon.
- Sedimentation rate (ESR). This test draws blood from a vein, usually from the inside of the elbow or the back of the hand. It measures the distance that red blood cells settle in unclotted blood toward the bottom of a specially marked test tube.
- Stool guaiac. This test finds hidden (occult) blood in the stool.

## Treatment

The primary goal of treatment is to control inflammation and reduce the symptoms of pain, diarrhea, and bleeding when present. Many types of medicine can reduce inflammation, including anti-inflammatory drugs such as sulfasalazine (Azulfidine), corticosteroids such as prednisone, and immune system suppressors such as azathioprine (Imuran) and mercaptopurine (Purinethol). An antibiotic, such as metronidazole (Flagyl), may also be helpful for destroying germs in the intestines, especially for Crohn's disease. Anti-diarrheal medication, laxatives, and pain relievers may also be prescribed. If symptoms are severe, such as diarrhea, fever or vomiting, hospitalization may be required to administer intravenous fluids and medicines.

In the case of severe ulcerative colitis that can not be helped by medications, a type of surgery called bowel resection may be performed to remove a damaged part of the intestine or to drain an abscess. If a part of the bowel is removed, a procedure is done to connect the remaining two ends of the bowel (anastomosis). In very severe cases, removal of the entire large intestine (colectomy) is required. Bowel resections may also be performed for Crohn's disease patients.

## Nutrition/Dietetic concerns

An exact IBD diet does not actually exist, since no specific diet has been shown to improve or worsen bowel inflammation. However, eating a diet sufficient in energy and balanced in **macronutrients** and essential micronutrients is important to avoid malnutrition and weight loss. Foods that worsen diarrhea should also be avoided. People who have blockage of the intestines may need to avoid raw fruits and vegetables. Those who have difficulty digesting lactose (lactose intolerance) also need to avoid milk products. The following guidelines, upon approval by the treating physician or a registered dietician, can help prevent malnutrition and extreme weight loss:

- Drinking plenty of fluids (8–10 servings daily) helps to keep body hydrated and prevent constipation.
- A daily multivitamin and mineral supplement may be indicated to replace lost nutrients.
- Eating a high fiber diet can help when IBD is under control. High fiber foods include grains (whole grain breads, buns, bagels, muffins, bran cereals, Corn bran, shredded whole wheat, 100% bran and fiber cereal, cooked cereal such as oat bran, whole-wheat pastas, whole grains such as barley, popcorn, corn and brown rice), fruits (dried fruits such as apricots, dates, prunes and raisins, berries such as blackberries, blueberries, raspberries and strawberries, oranges, apple with skin, avocado, kiwi, mango and pear), vegetables (broccoli, spinach, green peas and other dark green leafy vegetables, dried peas and beans such as kidney beans, lima beans, black-eyed beans, chick peas and lentils), and nuts and seeds (almonds, whole flaxseed and soynuts).

- During an IBD attack, however, a low residue diet may help give the bowel a rest and minimize symptoms. A low residue diet includes grains that are not whole (enriched refined white bread, buns, bagels, english muffins, plain cereals such as Cornflakes, cream of wheat, Rice Krispies, or Special K, arrowroot cookies, tea biscuits, soda crackers, plain melba toast, white rice, refined pasta and noodles), fruits, peeled when necessary (fruit juices except prune juice, applesauce, apricots, cantaloupe, canned fruit cocktail, grapes, melon, peaches), but avoiding raw and dried fruits, raisins and berries. As for vegetables, they may include vegetable juices, potatoes (without skin), well-cooked vegetables such as alfalfa sprouts, beets, green or yellow beans, carrots, celery, cucumber, eggplant, lettuce, mushrooms, green or red peppers, squash, zucchini, while avoiding vegetables from the cabbage family such as broccoli, cauliflower, brussels sprouts, cabbage, and kale. Meats should be well-cooked, and tender, fish and eggs fresh. Beans, lentils, all nuts and seeds, as well as foods that may contain seeds (such as yogurt) should be avoided.
- Lactose-containing foods such as dairy products should be avoided if lactose intolerance is present. Calcium-fortified soy milk can be substituted.
- During flare-ups, small frequent meals may be preferable. A high protein diet with lean meats, fish and eggs, may also help relieve symptoms.
- Caffeine, alcohol and sorbitol should be restricted, as these may exacerbate IBD symptoms. Sorbitol is an artificial sweetener present in many brands of chocolate, snacks and candy.
- Gas-producing foods such as cabbage-family vegetables (broccoli, cabbage, cauliflower and brussels sprouts), dried peas and lentils, onions and chives, hot or chilli peppers and carbonated drinks should be restricted.
- Fat intake should be reduced if part of the intestine has been surgically removed, because high fat foods usually cause diarrhea and gas for such patients.
- Some studies suggest that fish oil and flax seed oil may be helpful in managing IBD. Recent studies also suggest a role in the healing process for probiotics and prebiotics such as psyllium, a soluble fiber that comes from a plant called Plantago afra. These may also be helpful in helping the recovery of the intestines.

## Therapy

The management of IBD depends on the type diagnosed and pharmacologic and other therapies are accordingly tailored to individual cases, depending on severity and patient history. This also requires careful selection of therapeutic agents based on symptom severity and drug side effects. Since IBD is a chronic illness with an important and unpredictable impact on a person's life, an effective therapy usually requires much more than the simple treatment of symptoms. Patient cooperation is crucial for improvement, as dietary and lifestyle changes have been shown to be beneficial. Whatever the symptoms, patients also need to get enough rest while learning to manage the stress in their lives, as intestinal problems tend to get worse in overly stressed persons. The Crohn's and Colitis Foundation of America (CCFA) can provide patient information on IBD and support groups that can often help with the stress of dealing with IBD, with useful tips for finding the best treatment and coping with the disease.

## Prognosis

The outcome of the ulcerative colitis is variable. It may be dormant and then worsen over a period of years, or progress quickly. The risk of colon **cancer** increases after ulcerative colitis is diagnosed.

There is no cure for Crohn's disease, but it is not a deadly illness. Periods of improvement are often followed by flare-ups of symptoms. People with Crohn's disease have an increased risk of small bowel or colorectal cancer.

## Prevention

IBD is not considered preventable, and once it occurs it is a lifelong disease. However, it is possible to prevent IBD secondary complications. For instance, depression is a common problem in people diagnosed with IBD. This may be the result of the underlying diagnosis or the medications used to treat these chronic inflammatory processes. Specific information is available for patients and their families about ways to manage their condition and treatment and prevent themselves against becoming depressed.

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**ORGANIZATIONS**

American Gastroenterological Association. 930 Del Ray Avenue, Bethesda, MD 20814. (301)654-2055. <www.gastro.org>.
Cleveland Clinic Foundation. 9500 Euclid Ave. NA31 Cleveland, OH 44195. Department of Patient Education and Health Information: 1-800-223-2273). <www.clevelandclinic.org/health/>.
Crohn's and Colitis Foundation of America. 386 Park Avenue South, 17th Floor, New York, NY 10016. 1-800-932-2423. <www.ccfa.org>.
International Foundation for Functional Gastrointestinal Disorders Inc. P.O. Box 170864, Milwaukee, WI 53217-8076. 1-888-964-2001. <www.iffgd.org>.
National Institute of Diabetes and Digestive and Kidney Diseases (NIDDK), National Institutes of Health. 31 Center Drive, MSC 2560, Bethesda, MD 20892-2560. 1-800-891-5389. <digestive.niddk.nih.gov/ddiseases/pubs/facts/index.htm>.

Monique Laberge, Ph.D.

# Intuitive eating

## Definition

The central premise of the intuitive eating program is that people's bodies possess innate biological wisdom that already knows what foods and eating habits are best for them, beyond all the different dietary recommendations that flood the market and create confusion among consumers. Intuitive eating steers away from scientific explanations and rigid dietary requirements and values the psychological component of eating as an important factor in nutrition. The task for practitioners of intuitive eating is to recover the innate wisdom of the body, and the program offers practices to facilitate this process.

## Origins

Intuitive eating has been developed by two California-based nutritionists, Evelyn Tribole and Elyse Resch. Their book, *Intuitive Dieting: A Revolutionary Program That Works*, was published in 1995 and updated and reprinted in 2003.

## Description

The originators of the intuitive eating program state that they developed it in response to indications that conventional diet programs are not working, and from the observations of so many failed dieting experiences. For instance, even while Americans were dieting more than ever in the 1990s, and new diet programs and information were proliferating, Americans were still witnessing increasing obesity rates. In addition to this contradiction, the founders of intuitive eating also take note of what they call the "diet backlash," the observation that dieting can lead to eating disorders and unhealthy behaviors such as compulsions, guilt, self-loathing, binging, and the consumption of unhealthy foods. As evidence of these phenomena surrounding dieting, the intuitive eating program cites a 1991 study in the *New England Journal of Medicine* by Dr. Leann Birch that examined the eating habits of children. The study concluded that children are naturally able to regulate their eating habits in a healthy manner. The study noted that parental control over their eating habits was counterproductive. Other studies have implied that children may develop eating disorders, such as anorexia and bulimia, as a result of parents putting pressure on them about dietary behaviors or due to negative self-images. Thus, children may have an innate dietary wisdom that can be obscured by social pressure and expectations. The originators of intuitive eating believe that adults can recover this wisdom that first gets lost in childhood.

The authors of *Intuitive Eating* note that all diets, no matter how well conceived and intentioned, are still programs of short-term starvation. The intuitive eating program draws upon insights from the anti-diet movement that shuns dieting and encourages people to accept their bodies and improve their self-image instead. The intuitive eating program also draws upon the work of the health movement, that recognizes that obesity and poor dietary habits lead to increased risks of illness and disease. Integrating both these schools, intuitive eating stresses the role that psychological patterns play in eating habits, while recognizing the need to encourage healthy eating habits into people's lifestyles.

## KEY TERMS

**Anorexia**—Also called anorexia nervosa, an eating disorder characterized by extreme weight loss, distorted body image, and fear of gaining weight.

**Bulimia**—Also called bulimia nervosa, an eating disorder characterized by binges, or eating much food in little time, followed by purging behaviors, such as throwing up or taking laxatives.

Although the intuitive eating program provides generalized recommendations, its goal is a highly personalized diet, because each person has different needs and preferences. The program stresses the value of moving away from struggles involving willpower toward the freedom of self-empowerment, from forced behaviors to ones that arise naturally. The intuitive diet is notably influenced by the fields of self-help and behavioral therapy. The founders stress that the program is process-oriented rather than results-oriented, which means that practitioners' programs will be full of both mistakes and successes that should be welcomed, accepted, and learned from.

### Function

Borrowing from the language of therapy, the intuitive eating program playfully asks people to become aware of their eating habits by identifying and naming their dominant 7l "eating personality." Common eating personalities that lead to problems are the Careful Eater, the Professional Dieter, and the Unconscious Eater. These personalities might be overly obsessive or guilty about food, or always on some kind of restrictive and difficult diet, or simply unaware about why one is making bad food choices.

By identifying and naming their eating personalities, people can then begin to learn what has caused the Intuitive Eater inside themselves to become lost or overshadowed. This is the part of the mind that knows how to eat, without guilt or compulsion, in order to provide the body with its nutritional needs. Awakening the intuitive eater happens in stages. First, people often hit the "diet rock bottom," realizing that dieting does not work and is fueled by guilt and poor body images. Next comes the "exploration" stage, where people are asked to become very aware of all the emotions, cravings, and behaviors that they exhibit around eating. This stage also entails releasing guilt over all foods ("making peace with foods"), sorting out which foods are liked and disliked, and learning to recognize the feelings of hunger and fullness, distinguishing between emotional and biological signals around eating. The next stage is "crystallization," in which principles of intuitive eating begin to be practiced regularly. In the next stage, the "intuitive eater awakens," in which intuitive eating patterns are internalized and become natural habits. When this happens, the final stage is entered, where people are enabled to "treasure the pleasure" of eating in a way that is emotionally and physically gratifying.

The intuitive eating program explains in detail its ten main principles that can bring about healthy and natural eating habits. It also recommends steps and practices that people can use to incorporate each principle into their lives. The first of these principles is to "reject the diet mentality." This means that all diets should be given up, as well as habits related to them such as calorie counting. Other people's advice and judgments are also limited. Next comes the "honor your hunger" principle, which emphasizes playing close attention to biological hunger signals and reacting to them by eating without guilt. Principle three is to "make peace with food," which means giving oneself permission to eat whatever one really likes. After this comes the principle to "challenge the food police," which means paying close attention to how one internally judges and talks about food. Principle five is to "feel your fullness," or learning how to detect when enough has been eaten, to avoid overeating. Then practitioners are then asked to "discover the satisfaction factor," or to learn to take pleasure in eating and to savor the experience. Principle seven asks the eater to "cope with your emotions without using food," in order to stop confusing biological with emotional signals. By asking practitioners to "respect your body," principle eight helps people overcome the habits caused by negative self-image. Principle nine, "exercise and feel the difference," suggests that people adopt exercise programs that are easy and fun, and to enjoy the feelings of well-being that result from exercise. Finally, principle ten asks people to "honor your health by gentle nutrition." This means making food choices that are nutritious and pleasurable and that help the body to feel and function well. This principle also notes that healthy food choices evolve over time, and that occasional missteps are a natural part of the process.

### Benefits

The founders of the intuitive eating program believe that their system represents a paradigm shift around eating. People are asked to perceive life and eating in a different way, moving away from guilt and

negative self-images into mindsets that value acceptance and emotional awareness. The end result of this program is that it reminds people of their fundamental relationship to food: that eating can be a source of pleasure and satisfaction in daily life, instead of a source of obsession and stress. The intuitive eating plan trains its advocates to distinguish between emotional cravings, which may lead to destructive eating habits, and physical cravings, which are the body's means of communicating its valid nutritional needs. The program also teaches that people can easily learn to detect authentic feelings of hunger and fullness, to avoid binging and overeating.

### Precautions

The intuitive eating program is recommended by its authors as an adjunct treatment for eating disorders such as anorexia and bulimia, that have their origins in psychological issues. Those with eating disorders should first seek treatment by qualified medical practitioners, counselors, or psychologists in conjunction with programs such as intuitive eating.

### Research and general acceptance

In April 2007, researchers at the University of California at Los Angeles published a report in the journal *American Psychologist* that studied the long-term results of dieting. This study concluded that about two-thirds of the dieters had not lost weight after five years of dieting, and in frequent cases had actually gained weight. Statistics such as these reinforce the idea among intuitive eaters that conventional diets do not work as planned. In addition, a 2006 study in the *American Journal of Health Education* concluded that intuitive eaters had lower obesity rates, increased pleasure around eating, and fewer dieting behaviors and food anxieties.

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Schwartz, Bob. *Diets Don't Work: Stop Dieting, Become Naturally Thin, Live a Diet-Free Life*. Rochester, NY: Breakthru Press, 2002.

Tribole, Evelyn and Elyse Resch. *Intuitive Eating: A Revolutionary Program That Works*. New York: St. Martin's, 2003.

#### ORGANIZATIONS

National Association of Anorexia Nervosa and Associated Disorders (ANAD). P.O. Box 7, Highland Park, IL 60035. Crisis Hotline: (847) 831-3438. Website: http://www.ANAD.org.

National Eating Disorders Association. 603 Steward Street, Suite 803, Seattle, WA 98101. Hotline: (800) 931-2237. Website: http://www.nationaleatingdisorders.org.

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Douglas Dupler, MA

## Intussusception

### Definition

Intussusception is a medical emergency in which one portion of the intestine (bowel) slides or "telescopes" into another section of bowel, cutting off the blood supply and blocking the flow of materials through the digestive system.

### Description

In the process of intussusception, one part of the intestine infolds into another section the intestine. The most common place for this to occur is at the junction where the end of the small intestine (the ileum) meets the large intestine (the colon). Here, the small intestine slides into the large intestine. Occasionally one part of the small intestine will slide into another part of the small intestine, but this is much less common.

Once the infolding begins, the blood supply is to intestines and the tissue (mesentery) that surrounds it and holds it in place is cut off. The intestines are a long tube. The infolding tissue creates an obstruction that blocks the passage of material through the intestine. The walls of the intestine and the surrounding tissue begin to swell, increasing the blockage. The intestine may bleed or rupture, and eventually gangrene develops as the tissue dies.

### Demographics

Intussusception occurs most often in infants and toddlers. It is the leading cause of intestinal obstruction in children ages 3 months to 5 years. The highest rate of intussusception occurs in children age 3 to 12 months. Two-thirds of cases occur before the child's

## KEY TERMS

**Gangrene**—death of body tissue due to a cutting off of the blood supply

**Idiopathic**—occurring from unknown causes

**Perforation**—a whole in the wall of an organ in the body

**Polyp**—a tissue growth that extends out into the hollow space of an organ such as the intestine or uterus.

**Rectum**—the last few inches of the large intestine

first birthday. Intussusception is the leading cause of abdominal surgery in children age 5 and younger.

In infants, 3 boys develop intussusception for every 2 girls that do, but as children age, the rate changes sharply and the disorder becomes much more common in boys. By age 4, the boy:girl ration is 8:1. There is no difference in the rate of intussusception among races or ethnic groups. Internationally, although few statistics are available, the rate seems to be about the same as in the United States.

Adults can develop an intussusception, but the condition is rare.

### Causes and symptoms

The cause of most cases of intussusception cannot be identified (idiopathic intussusception). In general, researchers believe that uneven forces on the wall of the intestine start the process. In some cases, a spot called a lead point develops. This seems to be a heavy spot or pocket on the wall of the intestine that then "leads" the slide of one section of intestine into another. Some lead points develop around surgical scar tissue, tumors, polyps, collections of blood or fluid in the intestinal wall, or, in the case of cystic fibrosis, the accumulation of sticky mucus on the wall of the intestine. However, a lead point is identified in less than 12% of cases in children.

Another theory on why intussusception develops suggests that the process is set off by uncordinated bowel contractions (peristalsis). Viral infection may also play a role. There is an association between recent viral infection and intussusception, but no clear cause and effect relationship has been determined. At one time, it appeared that vaccination for rotavirus, a virus that causes severe diarrhea in young children, increased the rate of intussusception. The vaccine in question was withdrawn from the U. S. market. As of 2007, a new vaccine used in the United States against rotavirus, RotaTeq, has shown no association with increased intussusception.

Intussusception is a medical emergency. Symptoms of intussusception usually appear suddenly in an otherwise healthy child. The classic symptoms of intussusception are abdominal pain, vomiting, and passing reddish, jelly-like stools called "current jelly" stools. The jelly-like material comes from shedding of mucus from the intestinal wall, and the red is from fresh blood. However, this constellation of three symptoms is present in only about 20% of children. About 50% of children have abdominal pain and current jelly stools without vomiting.

Normally an infant who appears healthy suddenly draw up his or her legs and scream or cry frantically in pain. The child may vomit. This is followed by a period when the pain disappears and the child appears normal. Painful episodes return, however, at roughly 10–20 minute intervals. The child may have loose watery stools at first. Over time, the stools become reddish and jelly-like. Eventually the child becomes lethargic between bouts of pain and may develop a swollen abdomen and fever. If left untreated, intussusception is fatal.

Adults can also experience intussusception, although the disorder is uncommon to rare. In adults, the cause is often an unsuspected tumor or polyp growing in the intestine. Symptoms often appear much more gradually in adults and may come and go over a long period. Adult symptoms of intussusception include changes in bowel frequency, urgent desire to have a bowel movement, abdominal cramps, pain in a single area of the abdomen, rectal bleeding, nausea and vomiting. These symptoms resemble the symptoms of other gastrointestinal disorders complicating diagnosis.

### Diagnosis

Diagnosis is made on the basis of patient history and imaging studies. X ray images of the abdominal region will show a mass or obstruction in the bowels. Computed tomography (CT) scans or ultrasound may be done in addition to x rays. If there is no sign that the bowel has torn (perforated) or ruptured, a contrast x ray is done on the large intestine. In a contrast colon x ray, a liquid containing barium is inserted through the rectum and into the colon. The barium contrasts with the surrounding tissue to provide clearer x ray images of the affected area.

## Treatment

With intussusception, diagnosis sometimes results in treatment. Forcing barium into the colon may reduce the intussusception as pressure from the barium pushes the infolded piece of bowel back out of the large intestine. This occurs in as many as 75% of cases. Sometimes the procedure needs to be repeated to get complete reversal of the infolding. When a barium enema provides effective treatment, the pain stops immediately and the child becomes dramatically better. The child is usually hospitalized for observation for about 18–24 hours. This precaution is taken because most recurrences of the intussusception occur within that time.

If the initial x rays show that the bowel has ruptured, has a perforation, or if massive infection is present (peritonitis), a barium enema cannot be used and emergency surgery is required. Surgery is also required if the barium enema is ineffective in reversing the blockage. About 25% of children require surgery. Recovery after surgery is usually complete and no complications are expected.

## Nutrition/Dietetic concerns

Individuals whose intussusception is successfully treated without surgery can return to a normal diet immediately. Individuals who require surgery will initially be fed intravenously (IV), followed by a clear liquid diet, then progressing to soft foods until normal bowel function is established. At this time they can return to their regular diet.

## Prognosis

Untreated intussusception is fatal, usually within 2–5 days. Death is caused by complications from gangrene and massive infection. Individuals who are successfully treated for intussusception recover, usually without complications. Repeat intussusception can be as high as 10% in individuals whose intussusception is cleared by barium enema. Most of the time, if recurrence is going to occur, it happens within the first 24 hours, although a longer time frame is always possible.

## Prevention

There is no way to prevent intussusception. However, prompt medical care can prevent death.

### Resources


#### BOOKS

Lalani, Amina and Suzan Schneeweiss, eds. *The Hospital for Sick Children Handbook of Pediatric Emergency Medicine*. Sudbury, MA: Jones & Bartlett Publishers, 2007.

#### ORGANIZATIONS

American Academy of Family Physicians. P. O. Box 11210, Shawnee Mission, KS 66207. Telephone: (913)906-6000. Website: <http://www.aafp.org>

American Academy of Pediatrics. 14 Northwest Point Blvd. Elk Grove, IL 60007. Telephone: (874)434-4000. Website: <http://www.aap.org>

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Tish Davidson, A.M.

# Iodine

## Definition

Iodine (I) is a non-metallic element that the body needs in very small (trace) amounts in order to remain healthy. It can only be acquired through diet. Deficiencies of iodine are a serious health problem in some parts of the world.

## Purpose

Iodine is essential to the formation of the thyroid hormones triiodothyronine (T3) and thyroxine (T4). Thyroid hormones regulate many basic metabolic processes. Solutions containing iodine can be used on the skin as a disinfectant because iodine kills bacteria. It can also be used to purify **water** contaminated with bacteria. In medical settings, iodine is used in diagnostic radioisotope scanning and it has other industrial uses.

## Description

The thyroid gland is a located in the front of the neck just below the Adam's apple. It is part of a complex, tightly-controlled feedback cycle that regulates basic aspects of **metabolism**, such as how fast the body burns calories, growth rate, and body temperature.

Under stimulation by thyroid stimulating hormone (TSH) produced by the pituitary gland, the thyroid produces two hormones, triiodothyronine (T3) and thyroxine (T4). The formation of one

**Iodine**

| Age | Recommended Dietary Allowance (mcg) | Tolerable upper intake level (mcg) |
|---|---|---|
| Children 0–6 mos. | 110 | Not established |
| Children 7–12 mos. | 130 | Not established |
| Children 1–3 yrs. | 90 | 200 |
| Children 4–8 yrs. | 90 | 300 |
| Children 9–13 yrs. | 120 | 600 |
| Adolescents 14–18 yrs. | 150 | 900 |
| Adults 19≥ yrs. | 150 | 1,100 |
| Pregnant women 18≤ yrs. | 220 | 900 |
| Pregnant women 19≥ yrs. | 220 | 1,100 |
| Breastfeeding women 18≤ yrs. | 290 | 900 |
| Breastfeeding women 19≥ yrs. | 290 | 1,100 |

| Food | Iodine (mcg) |
|---|---|
| Seaweed, dried, 1 oz. | up to 18,000 |
| Kelp, ¼ cup wet (amount is highly variable) | 415+ |
| Salt, iodized, 1 tsp. | 400 |
| Haddock, 3 oz. | 104–145 |
| Cod, 3 oz. | 99 |
| Salt, iodized, 1 g | 77 |
| Milk, 1 cup | 55–60 |
| Turkey breast, cooked, 3 oz. | 34 |
| Cottage cheese, ½ cup | 25–75 |
| Shrimp, 3 oz. | 21–37 |
| Egg, 1 large | 18–29 |
| Processed fish sticks, 1 piece | 17 |
| Tuna, canned, 3 oz. | 17 |
| Ground beef, cooked, 3 oz. | 8 |

mcg = microgram

*(Illustration by GGS Information Services/Thomson Gale.)*

molecule of T3 requires three molecules of iodine, while formation of T4 requires four molecules of iodine. The body contains between 20 and 30 mg of iodine, 60% of which is stored in the thyroid. The remainder is found in the blood, muscles, and ovaries. Thyroid hormones are broken down in the liver and some of the iodine is recycled. The rest is lost to the body in urine.

Iodine is found in soil and in the ocean. The amount of iodine varies widely by location. In mountainous regions where heavy rain and snow cause erosion or in low-lying regions where regular flooding occurs, the soil is especially deficient in iodine. The mountains of the Himalayas, Andes, and Alps are all iodine-poor as is the Ganges river valley. The International Council for the Control of Iodine Deficiency Disorders (ICCIDD) estimates that 38% of the world's population, or about 2.2 billion people, live in areas where they are unlikely to get enough iodine without supplementation.

Iodine deficiency disorders (IDDs) create serious health problem. In the early 1900s, iodine deficiency

## KEY TERMS

**Hormone**—A chemical messenger that is produced by one type of cell and travels through the bloodstream to change the metabolism of a different type of cell.

**Mineral**—An inorganic substance found in the earth that is necessary in small quantities for the body to maintain a health. Examples: zinc, copper, iron.

**Pituitary gland**—A small gland at the base of the brain that produces many regulating hormones.

was common in interior regions of the United States and Canada, as well as many other non-coastal regions of the world. In the 1920s, the United States began a voluntary program of adding iodine (in the form of potassium iodide) to salt. Salt was chosen because all races, cultures, and economic classes use it, its consumption is not seasonal, and it is inexpensive. Adding 77 mcg of iodine per gram of salt costs about $0.04 per year per person in the United States. About 50% of table salt sold in the United States contains iodine. It is labeled "iodized salt." All table salt sold in Canada is iodized. In most other countries iodine is added at lower concentrations ranging from 10–40 mcg/gram.

### *Normal iodine requirements*

The United States Institute of Medicine (IOM) of the National Academy of Sciences has developed values called **Dietary Reference Intakes** (DRIs) for **vitamins** and **minerals**. The DRIs consist of three sets of numbers. The Recommended Dietary Allowance (RDA) defines the average daily amount of the nutrient needed to meet the health needs of 97–98% of the population. The Adequate Intake (AI) is an estimate set when there is not enough information to determine an RDA. The Tolerable Upper Intake Level (UL) is the average maximum amount that can be taken daily without risking negative side effects. The DRIs are calculated for children, adult men, adult women, pregnant women, and **breastfeeding** women.

The IOM has not set UL levels for iodine in children under one year old because of incomplete scientific information. RDAs for iodine are measured in micrograms (mcg). The following are the daily RDAs and IAs for iodine for healthy individuals. They are the same as the recommendations made by the World Health Organization (WHO).

- children birth–6 months: RDA 110 mcg; UL not available
- children 7–12 months: RDA 130 mcg; UL not available
- children 1–3 years: RDA 90 mcg; UL 200 mcg
- children 4–8 years: RDA 90 mcg: UL 300 mcg
- children 9–13 years: RDA 120 mcg; UL 600 mcg
- adolescents 14-18 years: RDA 150 mcg; UL 900 mcg
- adults 19 years and older: RDA 150 mcg; UL 1,100 mcg
- pregnant women under age 19: RDA 220 mcg; UL 900 mcg
- pregnant women age 19 and older: RDA 220 mcg; UL 1,100 mcg
- breastfeeding women under age 19: RDA 290 mcg; UL 900 mcg
- breastfeeding women age 19 and older: RDA 290 mcg; UL 1,100 mcg

### *Sources of iodine*

Iodine must be acquired from diet. Marine plants and animals, such as cod, haddock, and kelp (seaweed), are an especially good source of iodine because they are able to concentrate the iodine found in seawater. Freshwater fish are a less good source. Plants contain varying amounts of iodine depending on the soil in which they are grown.

In industrialized countries, feed for cattle, chickens, and other domestic animals is often fortified with iodine. Some of this iodine finds its way into animal products that humans eat— milk, eggs, and meat. In developing countries where feed is not enriched or cattle are raised on grass, these animal products do serve as a source of iodine.

Commercially processed foods are often made with iodized salt. The iodine content of salt changes very little during processing. Sometimes an iodine-containing stabilizer is added to commercial bread dough. This increases the iodine content of bread. The stabilizer is used less often now than it was in the twentieth century. However, for many people, commercially processed foods are their main source of iodine. Iodine is also found in most multivitamin tablets.

Iodine can be absorbed through the skin from iodine-based disinfectant solutions. Automobile exhaust puts some iodine into the air, and this can be absorbed through the lungs. Neither of these provide significant amounts of iodine for most people.

The following list gives the approximate iodine content for some common foods:

- kelp, 1/4 cup wet: 415 mcg or more. Amount is highly variable
- salt, iodized, 1 g: 77 mcg; 1 teaspoon: 400 mcg
- haddock, 3 ounces: 104–145 mcg
- cod, 3 ounces: 99 mcg
- shrimp, 3 ounces: 21–37 mcg
- processed fish sticks: 17 mcg per piece
- tuna, canned, 3 ounces: 17 mcg
- milk, 1 cup: 55-60 mcg
- cottage cheese, 1/2 cup: 25–75 mcg
- egg, 1 large: 18–29 mcg
- turkey breast, cooked, 3 ounces: 34 mcg
- ground beef, cooked, 3 ounces: 8 mcg
- seaweed, dried, 1 ounce: up to 18,000 mcg

### *Iodine deficiency*

Because of iodine supplementation, iodine deficiency is not a serious health problem in most industrialized countries, but it is in many developing countries. Internationally, about 2.2 billion people are at risk for IDDs. Women who do not get enough iodine have higher rates of infertility, miscarriages, pregnancy complications, and low birth weight babies than women who have adequate iodine intakes. However, iodine deficiency has its most damaging effects on the developing fetus.

Iodine deficiency is the leading cause of preventable mental retardation worldwide. Children born to iodine-deficient mothers have a condition called cretinism. Cretinism involves severe and permanent brain damage. These children have mental retardation and developmental disorders such as deafness, mutism, and inability to control muscle movements. Iodine deficiency in newborns and infants also results in abnormal brain development and retardation.

The most visible sign of iodine deficiency in children, adolescents, and adults is the development of a goiter. A goiter is a lump near the throat that signals an enlarged thyroid. When not enough iodine is available, the thyroid grows larger in a futile attempt to make more thyroid hormone. In adults hard lumps may form inside the goiter. When iodine deficiency is pronounced enough for a goiter to develop, memory and language skills decline. In children IQ may be affected. Some of these effects can be reversed in children, but not adults, by increasing iodine intake. In adults with goiter, increasing iodine intake may send the thyroid into overdrive, causing it to produce too

much thyroid hormone, a serious condition called hyperthyroidism. Other conditions can also cause the thyroid gland to produce too much or too little hormone. A urine test is used to determine if an individual is iodine deficient, and blood tests can check for other thyroid function problems.

### Precautions

Pregnant and breastfeeding women must be especially careful to get enough iodine, since iodine deficiency has its greatest effect on the fetus and newborn. Vegans, who do not eat animal products and depend on **soy** for much of their **protein**, are at higher risk of iodine deficiency than the general population.

### Interactions

Amiodarone (Cordarone) a drug used to prevent irregular heart rhythms, contains enough iodine that it may affect thyroid function.

Some foods contain substances called goitrogens that interfere with the body's ability to absorb or use iodine. These include broccoli, cabbage, cauliflower, and brussel sprouts. Other foods that contain goitrogens are canola oil, soybeans, turnips, peanuts, and cassava. These foods should not cause iodine deficiency unless they are tine mainstay of a very limited diet.

**Selenium** deficiency amplifies the effects of iodine deficiency. **Vitamin A** deficiency may amplify iodine deficiency.

### Complications

Complications of iodine deficiency are discussed above. Iodine excess rarely is caused by diet, although an excess of thyroid hormones may result from other causes.

### Parental concerns

In developed countries, parents should have few concerns about their healthy children getting enough iodine, so long as they use iodized table salt.

#### Resources


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**ORGANIZATIONS**

International Council for the Control of Iodine Deficiency Disorders. < http://indorgs.virginia.edu/iccidd>

Linus Pauling Institute. Oregon State University, 571 Weniger Hall, Corvallis, OR 97331-6512. Telephone: (541) 717-5075. Fax: (541) 737-5077. Website: <http://lpi.oregonstate.edu>

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Helen Davidson

Irish diet *see* **Northern European diet**

## Iron

### Definition

Iron (Fe) is a metal essential to almost all bacteria, plants, and animals. In humans, iron is a compnent of the red pigment hemoglobin that gives red blood cells their color and affects the transport of oxygen throughout the body, conversion of nutrients into energy, production of new deoxyribonucleic acid (DNA, genetic material), and regulation of cell growth and cell differentiation. Without iron, life on Earth would not exist. Humans must acquire all the iron they need from diet.

**Iron**

| Age | Recommended dietary allowance (mg) | Tolerable upper intake level (mg) |
|---|---|---|
| Children 0–6 mos. | 0.27 | Not established |
| Children 7–12 mos. | 11 | Not established |
| Children 1–3 yrs. | 7 | 40 |
| Children 4–8 yrs. | 10 | 40 |
| Children 9–13 yrs. | 9 | 40 |
| Boys 14–18 yrs. | 11 | 45 |
| Girls 14–18 yrs. | 15 | 45 |
| Men 19–50 yrs. | 8 | 45 |
| Women 19–50 yrs. | 18 | 45 |
| Adults 51≥ yrs. | 8 | 45 |
| Pregnant women | 27 | 45 |
| Breastfeeding women 18≤ yrs. | 10 | 45 |
| Breastfeeding women 19≥ yrs. | 9 | 45 |

| Food | Heme Iron (mg) |
|---|---|
| Chicken liver, cooked, 3 oz. | 12.8 |
| Oysters, 6 med. | 5.04 |
| Beef, cooked, 3 oz. | 3.2 |
| Turkey, light meat, cooked, 3 oz. | 2.3 |
| Shrimp, cooked, 8 large | 1.36 |
| Tuna, light, canned, 3 oz. | 1.3 |
| Chicken, dark meat, cooked, 3 oz. | 1.13 |
| Halibut, cooked, 3 oz. | 0.9 |
| Crab, cooked, 3 oz. | 0.8 |
| Pork loin, cooked, 3 oz. | 0.8 |

| Food | Nonheme Iron (mg) |
|---|---|
| Cereal, 100% iron fortified, 1 cup | 18 |
| Soybeans, boiled, 1 cup | 8.8 |
| Tofu, firm, ½ cup | 6.22 |
| Beans, kidney, cooked, 1 cup | 5.2 |
| Beans, lima, cooked, 1 cup | 4.5 |
| Beans, pinto, cooked, 1 cup | 3.6 |
| Blackstrap molasses, 1 tbsp. | 3.5 |
| Potato, med. with skin | 2.75 |
| Cashew nuts, 1 oz. | 1.70 |
| Bread, whole wheat, 1 slice | 0.9 |
| Raisins, small box, 1.5 oz. | 0.89 |

mg = milligram

*(Illustration by GGS Information Services/Thomson Gale.)*

## Purpose

Most iron in the body is used to transport oxygen. Oxygen is carried in red blood cells through the circulatory system to all cells in the body. Hemoglobin is the **protein** within red blood cells that makes this possible, and iron is at the center of the hemoglobin molecule. An average-size adult man has about 4 grams of iron in his body, and an adult woman has about 3.5 grams. Approximately two-thirds of this iron is in hemoglobin. Myoglobin, a protein in muscle, also contains iron. Myoglobin provides short-term storage for oxygen. When muscles do work, this oxygen is released to meet the increased metabolic needs of muscle cells.

Iron is found in every cell in the body, including brain cells. It is needed to synthesize adenosine triphosphate (ATP), the compound that supplies most of the energy to drive cellular **metabolism**. Iron is also used in enzyme reactions that create new DNA, and in this way it affects cell division and differentiation. Iron is also essential to other enzyme reactions that break down potentially harmful molecules formed when immune system cells attack bacteria.

## Description

Plants absorb iron from the earth, and humans acquire iron through eating both plants and animals. In the stomach, acid in gastric juice acts on iron and changes it into a form that the body can absorb. Absorption takes place mainly in the first part of the small intestine (the duodenum). Once iron is absorbed into the bloodstream, it binds to a protein called transferrin and is carried to all parts of the body, including the bone marrow where new red blood cells are made. Once in the cells, some iron is transferred to ferritin, a protein that holds the iron in reserve. When too much iron is absorbed, there is not enough transferrin to bind all of it. Free iron can build up in cells and trigger activities that cause damage and create health problems. Too little iron interferes with the body's ability to get enough oxygen.

### *Sources of iron*

The body has complex mechanisms to achieve iron balance by regulating iron absorption, reuse, and storage processes. Red blood cells live about 120 days. When they die, most of the iron in hemoglobin is recycled in the liver and sent to the bone marrow where it reused in new red blood cells. As a result, humans lose only a small amount of iron daily.

Only about 10–20% of the iron in food, or 1–2 mg for every 10 mg eaten, is absorbed into the bloodstream. Under normal conditions, when iron stores in the body are low, more iron is automatically absorbed. When they are high, less is absorbed. Iron that is not absorbed enters cells that line the intestine. As these cells fill up with iron, they fall into the intestine and leave the body in waste.

Both plant and animal foods provide humans with iron, but that iron comes in two forms, heme and nonheme, that are not equally available to the body. Heme iron comes from hemoglobin. It is found mainly in animal tissue. Red meat is an especially rich source of heme iron. Only trace amounts of heme iron are found in plants. Heme iron is in a form that is easier for humans to use. It is absorbed at a higher rate than

## KEY TERMS

**Cell differentiation**—The process by which stem cells develop into different types of specialized cells such as skin, heart, muscle, and blood cells.

**Dietary supplement**—A product, such as a vitamin, mineral, herb, amino acid, or enzyme, that is intended to be consumed in addition to an individual's diet with the expectation that it will improve health.

**Enzyme**—A protein that change the rate of a chemical reaction within the body without themselves being used up in the reaction.

**Mineral**—An inorganic substance found in the earth that is necessary in small quantities for the body to maintain a health. Examples: zinc, copper, iron.

nonheme iron, and its rate of absorption is less influenced by other foods that simultaneously are present in the digestive system.

The following list gives the approximate iron content for some common sources of heme iron:

- chicken liver, cooked, 3 ounces: 12.8 mg
- beef, cooked, 3 ounces: 3.2 mg
- turkey light meat, cooked, 3 ounces: 2.3 mg
- chicken dark meat, cooked, 3 ounces: 1.13 mg
- pork loin, cooked, 3 ounces: 0.8 mg
- oysters, 6 medium: 5.04 mg
- shrimp, cooked, 8 large: 1.36 mg
- tuna, light, canned, 3 ounces: 1.3 mg
- halibut, cooked, 3 ounces: 0.9 mg
- crab, cooked, 3 ounces: 0.8 mg

About 40–45% of iron in animal tissue and functionally all the iron in plants is nonheme iron. Nonheme iron is also the type of iron found in **dietary supplements** and added to iron-fortified foods. Nonheme iron is less easily used by humans; it must be changed in the digestive system before it can be absorbed. Only about 2–10% of nonheme iron in food is absorbed compared to 20–25% of heme iron. In addition, the absorption of nonheme iron is strongly influenced by other substances present in the digestive system. The ability of the body to absorb nonheme iron is decreased by the simultaneous presence of tea, coffee, dairy products, phytic acid (a substance found in grains, dried beans and rice), eggs, **soy** protein, and some chocolates. Absorption of nonheme iron is increased by the simultaneous presence of **vitamin C**, certain organic acids, and a small amount of meat, fish, or poultry, which boosts the absorption of nonheme iron as well as providing heme iron. Vegetarians and vegans should take into consideration the influence of other foods on iron absorption when planning meals.

The following list gives the approximate iron content for some common foods that contain nonheme iron:

- cereal, 100% iron fortified, 1 cup: 18 mg
- soybeans, boiled, 1 cup: 8.8 mg
- tofu, firm, 1/2 cup: 6.22 mg
- kidney beans, cooked, 1 cup: 5.2 mg
- lima beans, cooked, 1 cup: 4.5
- pinto beans, cooked, 1 cup: 3.6 mg
- blackstrap molasses, 1 tablespoon: 3.5 mg
- raisins, small box, 1.5 ounces: .89 mg
- potato, medium with skin: 2.75 mg
- cashew nuts, 1 ounce: 1.70 mg
- whole wheat bread, 1 slice: 0.9 mg

### *Normal iron requirements*

The United States Institute of Medicine (IOM) of the National Academy of Sciences has developed values called **Dietary Reference Intakes** (DRIs) for **vitamins** and **minerals**. The DRIs consist of three sets of numbers. The Recommended Dietary Allowance (RDA) defines the average daily amount of the nutrient needed to meet the health needs of 97–98% of the population. The Adequate Intake (AI) is an estimate set when there is not enough information to determine an RDA. The Tolerable Upper Intake Level (UL) is the average maximum amount that can be taken daily without risking negative side effects. The DRIs are calculated for children, adult men, adult women, pregnant women, and **breastfeeding** women.

Iron requirements vary substantially at different ages. Periods of rapid growth in children increase the need for iron. Women who menstruate need more iron because of blood loss during menstruation. Pregnancy puts high demands on the iron supply in the body because of increased production of red blood cells to supply the developing fetus. In 2001, the IOM set RDAs for iron based on preventing iron deficiency at each age. Iron passes into breast milk, and infants can meet their iron needs through breast milk or iron-fortified formula. RDAs and ULs for iron are measured in milligrams (mg).

The following list gives the daily RDAs and IAs and ULs for vitamin C for healthy individuals as established by the IOM.

- children birth–6 months: RDA 0.27 mg; UL not established
- children 7–12 months: RDA 11 mg; UL not established
- children 1–3 years: RDA 7 mg; UL 40 mg
- children 4–8 years: RDA 10 mg; UL 40 mg
- children 9–13 years: RDA 9 mg; UL 40 mg
- boys 14–18 years: RDA 11 mg; UL 45 mg
- girls 14–18 years: RDA 55 mg; UL 45 mg
- men age 19–50: RDA 8 mg; UL 45 mg
- women age 19–50: RDA 18 mg; UL 45 mg
- men who smoke: RDA 125 mg; UL 45 mg
- pregnant women: RDA 27 mg; UL 45 mg
- breastfeeding women 18 years and younger: RDA 10 mg; UL 45 mg
- breastfeeding women 19 years and older: RDA 9 mg; 45 mg

## Precautions

Pregnant women should consult their healthcare provider before the fifteenth week of pregnancy about the need for iron supplementation. They should not start taking an iron supplement on their own.

Men and women over age 55 are not at risk for iron deficiency and should take a multivitamin containing iron only on instructions from their healthcare provider.

People with kidney disease, liver damage, alcoholism, or **ulcers** should consult a healthcare professional before taking a supplement containing iron.

## Interactions

Iron interacts with many drugs and nutritional supplements. General categories of substances that may increase or decrease the amount of iron that is absorbed include medications that decrease stomach acidity (e.g. antacids, Tagamet, Zantac), pancreatic enzyme supplements, **calcium** supplements and dairy products, vitamin C, citric, malic, tartaric, and lactic acids, and copper.

The presence of iron also increases or decreases the effectiveness of many prescription drugs. Individuals should review their medications with a doctor or pharmacist when they begin taking an iron supplement to see if their other medications need adjustment.

## Complications

### *Iron deficiency*

The World Health Organization (WHO) considers iron deficiency to be the most widespread dietary disorder in the world. WHO estimates that up to 80% of the world's population is iron deficient and up to 30% have iron deficiency anemia. The two main causes of iron deficiency are low dietary intake and excessive blood loss. In the United States, women of childbearing age, young children, people with diseases that interfere with the absorption of iron (e.g. Crohn's disease, **celiac disease**), and people receiving kidney dialysis are most likely to seriously be iron deficient. American men rarely have low levels of iron because the tend to eat more meat than women and do not lose blood through menstruation.

At first, the body is able to use stored iron to make up for an iron deficit, but over time, the amount of hemoglobin decreases and a condition called iron deficiency anemia develops. (This is only one type of anemia; other anemias have other causes.) Iron deficiency anemia decreases the amount of oxygen reaching cells in the body. Symptoms of iron deficiency anemia include:

- lack of energy
- feelings of weakness
- frequently feeling cold
- increased infections
- irritability
- decreased work or school performance
- sore swollen tongue
- drive to eat dirt, clay or other non-food substances (pica)

The preferred way to treat mild iron deficiency is through changes in diet. If these changes are ineffective, iron supplements may be used. Dietary supplements contain different formulations such as ferrous fumarate, ferrous sulfate, and ferrous gluconate. Iron in these different formulations is absorbed at differing rates. Because too much iron can cause serious health problems, iron supplements should be taken under the supervision of a healthcare professional.

### *Iron excess*

Iron overload caused by an inherited disorder is called hereditary hemochromatosis. This disorder affects as many as one of every 200 people of northern European descent. These people have a genetic mutation that causes them to absorb iron from the

intestine at a rate far higher than normal. Hereditary hemochromatosis is treated by avoiding iron-rich foods and removing blood (usually through blood donation) from the individual on a regular basis.

People who have many blood transfusions can also develop iron overload, but by far the most common cause of excess iron is accidental poisoning. Over 20,000 American children accidentally ingest iron—usually in the form of dietary supplements—each year. Iron poisoning is the leading cause of poisoning deaths in children under age 6 in the United States. Iron overdose is a medical emergency. Symptoms occurring within the first 12 hours include nausea, vomiting, abdominal pain, black stool, weakness, rapid pulse, low blood pressure, fever, difficulty breathing, and coma. If death does not occur within the first 12 hours, damage to the kidney liver damage, cardiovascular system and nervous system may appear within two days. Long-term damage to survivors of iron poisoning include cirrhosis (liver damage), permanent central nervous system damage, and stomach problems.

### Parental concerns

Parents should be aware that the RDA and UL for vitamins and minerals are much lower for children than for adults. Accidental overdose may occur if children are give adult vitamins or dietary supplements. Accidental iron overdose is a leading cause of poisoning deaths in young children. Parents should keep all dietary supplements away from children, just as they would other medicines.

### Resources


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#### ORGANIZATIONS

American Dietetic Association. 120 South Riverside Plaza, Suite 2000, Chicago, Illinois 60606-6995. Telephone: (800) 877-1600. Website: <http://www .eatright.org>

International Food Information Council. 1100 Connecticut Avenue, NW Suite 430, Washington, DC 20036. Telephone: 202-296-6540. Fax: 202-296-6547. Website: <http://ific.org>

Iron Disorders Institute. 2722 Wade Hampton Blvd., Suite A, Greenville, SC 29615. Telephone: (864) 292-1175. Fax: (864) 292-1878. Website: <http://www.irondisorders.org>

Linus Pauling Institute. Oregon State University, 571 Weniger Hall, Corvallis, OR 97331-6512. Telephone: (541) 717-5075. Fax: (541) 737-5077. Website: <http://lpi.oregonstate.edu>

Office of Dietary Supplements, National Institutes of Health. 6100 Executive Blvd., Room 3B01, MSC 7517, Bethesda, MD 20892-7517 Telephone: (301)435-2920. Fax: (301) 480-1845. Website: <http://dietary-supplements.info.nih .gov>

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Tish Davidson, A.M.

# Irradiated food

### Definition

Irradiated foods are foods that have been exposed to a radiant energy source to kill harmful bacteria, insects, or parasites, or to delay spoilage, sprouting, or ripening.

**Approved uses of irradiation**

| Food | Approved use | Dose |
|---|---|---|
| Spices and dry vegetable seasoning | Decontaminates and controls insects and microorganisms | 30 kGy |
| Dry or dehydrated enzyme preparations | Controls insects and microorganisms | 10 kGy |
| All foods | Controls insects | 1 kGy |
| Fresh foods | Delays maturation | 1 kGy |
| Poultry | Controls disease-causing microorganisms | 3 kGy |
| Red meat (such as beef, lamb and pork) | Controls spoilage and disease-causing microorganisms | 4.5 kGy (fresh) 7 kGy (frozen) |

KGy = kiloGray

SOURCE: Food and Drug Administration, U.S. Department of Health and Human Services

**The U.S. Food and Drug Administration approved the first use of irradiation in 1963 on wheat and wheat flour. The FDA sets the maximum radiation dose the product can be exposed to, measured in a unit called kiloGray (kGy).** *(Illustration by GGS Information Services/Thomson Gale.)*

## KEY TERMS

**Ion**—an electrically charged particle.

**Ionizing radiation**—radiation that produces ions.

**Vitamin**—A nutrient that the body needs in small amounts to remain healthy but that the body cannot manufacture for itself and must acquire through diet.

**Pathogen**—an organism that causes a disease

## Purpose

There are many reasons that foods are irradiated. The most common reason is for increased **food safety**. The United States Centers for Disease Control (CDC) estimates that there are about 76 million cases of foodborne illness each year in the United States, resulting in about 5,000 deaths annually. Irradiating foods can reduce the risk of many foodborne illnesses by killing the bacteria or pathogens responsible, or harming them to such an extent that they are not able to reproduce or cause disease. The National Aeronautics and Space Administration (NASA) exposes the food that astronauts eat while in space to a level of irradiation far higher than that approved for commercial use in order to reduce the risk that astronauts will develop illness while in space. Patients who have diseases that severely impair the functioning of the immune system are often fed irradiated foods to decrease the risk that they will develop a serious disease.

Irradiation can also be used to destroy insects and other pests that may be present on produce. When produce is shipped from Hawaii to the mainland United States, it must be fumigated to kill any insects or insect eggs that might be present so that they do not spread to the mainland. Irradiating this produce is sometimes used as an alternative to fumigation, and does not leave residue of chemicals on the produce in the way that fumigation can.

Some fruits and vegetables can be kept fresh longer by the use of low to moderate levels of irradiation. When exposed to low levels of radiation, potatoes, onions, and other vegetables do not sprout as quickly. Strawberries and other berries can benefit from irradiation as well, as irradiation can significantly delay the growth of mold. Strawberries stay fresh from 3–5 days when they are not irradiated or treated in any way, but can stay fresh and unspoiled for up to three weeks after being irradiated.

## Description

Irradiated foods are foods that have been exposed to ionizing radiation. Ions are electrically charged particles, and ionizing radiation is radiation that produces these charged particles. Nonionizing radiation is produced by microwaves, television and radio waves, and visible light. Ionizing radiation is higher in power than these types of radiation, although it is in the same spectrum. The kinds of ionizing radiation used for food irradiation include gamma rays, beams of high-energy electrons, and x rays.

When foods are irradiated, they are exposed to the source of the ionizing radiation for a short time. This radiation produces short-lived compounds that damage the deoxyribonucleic acid (DNA) of living organisms, such as bacteria that are in the food. Because DNA makes up the genes that contain the instructions that tell an organism how to grow and reproduce, once the DNA is damaged the organism cannot do this correctly and will die.

The amount of radiation required to irradiate foods depends on the type and thickness of the food product and the type of organism that are present. The larger the DNA of the organism, generally the less radiation is required to irradiate it. Insects and parasite have the larger DNA and require the lowest levels of radiation, while bacteria generally require slightly more, and viruses have very small amounts of DNA and require very high levels of radiation. Most parasites, insects, and bacteria can be eliminated at levels of

radiation approved for commercial use, but many viruses cannot.

Irradiating foods does not make the foods radioactive in any way. Irradiation done using beams of high-energy electrons or X-rays do not even use any radioactive material. Irradiation done using gamma rays involves exposure of the food to a radioactive substance, usually cobalt 60 or cesium 137, for a short period. The radioactivity of this substance is not in any way transferred to the food that is exposed to it.

### Precautions

Irradiation is not a substitute for safe food handling practices. Although irradiation kills or disables many pathogenic organisms, these organisms can be reintroduced to the foods if cross contamination occurs. In addition, not every pathogen is completely destroyed by irradiation, and leaving foods such as raw meat out at room temperature can allow these pathogens to reproduce to significant levels. Irradiation should be viewed as an extra step to help ensure that the food supply is safe, not as a replacement for food safety practices that are already in place.

### Interactions

Irradiated foods are not expected to interact with any other foods, medicines, or products.

### Complications

There are no complications expected from consuming irradiated foods. Some concerned groups have expressed fears that the long-term effects of eating irradiated food are unknown. However, many different scientific studies have examined the effects on both animals and humans of consuming irradiated foods. There has not been any evidence that irradiated foods are harmful in either the short or the long term. One study even examined many generations of animals fed irradiated foods and found no harmful effects. Irradiating food is accepted as a safe practice and is endorsed by many organizations including the World Health Organization, the Centers for Disease Control, the United States Food and Drug Administration, and the American Medical Association.

### Parental concerns

Some parents may have concerns that the vitamin and nutrient content of irradiated foods may be reduced compared to the content of the same foods that have not been irradiated. For most **vitamins**, **minerals**, and nutrients this is not the case. Studies have shown that the levels of most vitamins in irradiated foods are not significantly different from the levels in foods that have not been irradiated. Some vitamins however, such as thiamine (vitamin $B_1$), have been found to be sensitive to irradiation. The extent to which such vitamins are destroyed however, depends greatly on type of food being irradiated. Thiamine was found to be decreased by 50% in a **water** solution that was exposed to radiation, but only decreased by 5% in a dried egg exposed to the same level of radiation. Many vitamins, like thiamine, that are sensitive to irradiation are as sensitive, or even more sensitive, to heat, and are broken down at least as much by the process of canning or heat treatments. Therefore, although levels of some vitamins may be decreased in irradiated foods compared to fresh foods, the levels of these vitamins may be higher in irradiated foods than in comparable canned or otherwise sterilized foods.

### Resources

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#### ORGANIZATIONS

United States Department of Agriculture. 1400 Independence Avenue SW, Washington, DC 20250. Website: <http://www.usda.gov>

United States Centers for Disease Control. 1600 Clifton Road, Atlanta, GA 30333. Telephone: (800) 311-3435. Website: <http://www.cdc.gov>

United States Food and Drug Administration. 5600 Fishers Lane, Rockville, MD 20857-0001. Telephone: (888) 463-6332. Website: <http://www.fda.gov>

World Health Organization. Telephone: +41-22-791-2222. Website: <http://www.who.int/en/>

#### OTHER

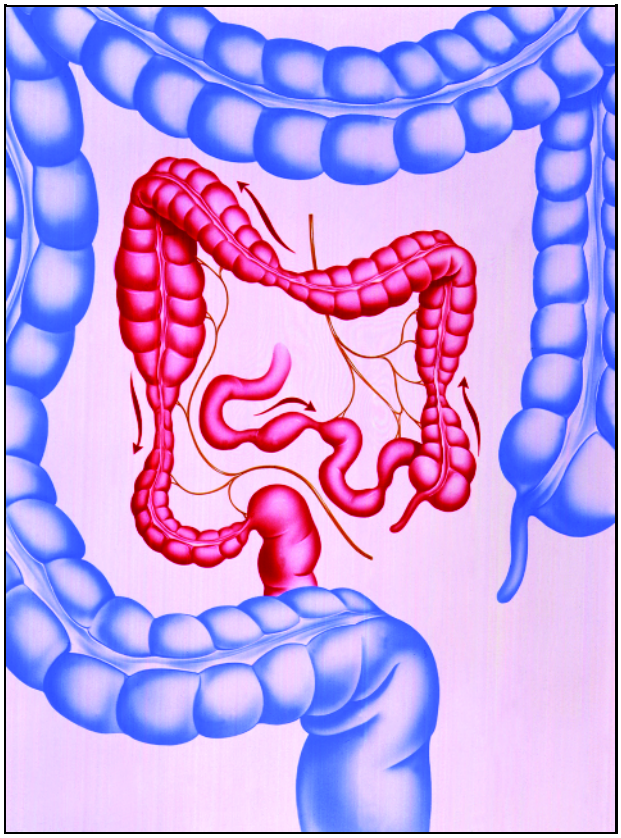
Organic Consumers Association. "Food Irradiation." 2007. <http://www.organicconsumers.org/irradlink.cfm>

Tish Davidson, M.A.

## Irritable bowel syndrome

### Definition

Irritable bowel syndrome (IBS) is an idiopathic functional gastrointestinal disorder. More simply, the bowel appears normal, but does not function correctly,



**Normal and diseased (center) colons. Areas of constriction in the colon cause constipation, while areas of distention cause diarrhea.** *(John Bavosi/Science Photo Library. Custom Medical Stock Photo, Inc. Reproduced by permission.)*

and the reason for this is unknown. IBS is also called spastic colon.

## Description

Irritable bowel syndrome is not a life-threatening disorder and does not progress to any more serious conditions, but it is the cause of about one of every 10 doctor visits in the United States. Its symptoms, although not medically serious, are varied, changeable, and intrusive enough to impact an individual's quality of life. IBS causes people to miss school or work, avoid certain activities, and it interferes with personal relationships.

IBS involves both the large intestine (colon) and the small intestine. It is best described as a disorder in which the all tests show that the bowel is structurally normal—no infection, no tumors or polyps, no abnormalities in the cells lining of the intestinal wall. It is not contagious, and it is not strictly inherited, yet the individual with IBD has pain, cramping, and either

### KEY TERMS

**Idiopathic**—Occurring from unknown causes.

**Neurotransmitter**—One of a group of chemicals secreted by a nerve cell (neuron) to carry a chemical message to another nerve cell, often as a way of transmitting a nerve impulse. Examples of neurotransmitters include acetylcholine, dopamine, serotonin, and norepinephrine.

**Rectum**—The last few inches of the large intestine.

**constipation**, diarrhea, or alternating periods of both, so something is clearly wrong.

IBS should not to be confused with **inflammatory bowel disease** (IBD). Inflammatory bowel diseases such as **Crohn's disease**, ulcerative colitis, and **celiac disease** cause changes in the cells lining the wall of the intestine. These cell abnormalities can be seen in samples (biopsies) taken from the wall of the intestine. In a person who has IBD, the cells in samples taken from the lining of the intestine look normal. Inflammatory bowel diseases increase the risk of developing intestinal cancers; IBS does not.

## Demographics

As many as one out of every five Americans has symptoms of irritable bowel syndrome. The disorder appears to be most common in Western countries. However poor access to medical care, different cultural attitudes toward illness, and the fact that the disorder is neither life threatening nor contagious and does not have to be reported to any central authority makes it difficult to tell what the actual rates are in developing countries. In Western countries estimates of the number of people with IBD range from 9–23% of the population.

IBS occurs in both children and adults. About 14% of high school students and 6% of middle school students report IBD symptoms. In these groups, IBS accounts for 4–5% of all absences from school. In about half of all people who have the disorder, symptoms begin before age 35; 30% say that their symptoms began in childhood. Most other people with IBS develop symptoms between ages 35 and 50. Women are two to three times more likely to have IBS than men.

## Causes and symptoms

The cause of IBS is unknown. Some researchers believe that the bowel of people with IBS is inappropriately sensitive and overreacts to normal things

such as the passage of food and stress. Other researchers suggest that there is a flaw in the way the brain and the gut interact. Some suggest that an earlier infection predisposes some people to develop IBS. Other researchers have found that there are abnormal numbers of receptors for the neurotransmitter serotonin in the gastrointestinal tract of people with IBS. Neurotransmitters are chemicals that carry nerve impulses from one nerve to another. Abnormal levels of these chemicals could make the bowel more reactive. In fact, low doses of some antidepressant drugs that affect serotonin levels improve IBS symptoms in some people.

Whatever the cause, symptoms of IBS include pain or discomfort in the abdomen, feeling bloated or having a lot of gas, diarrhea, constipation, or alternating periods of both, and mucus in the stool. The symptoms come and go and can change in a single individual over time. The impact of symptoms can range from mild to severe, and the intensity of symptoms can also change over time. Symptoms are usually reduced or relieved by a bowel movement.

Although they are not the cause of IBS, certain things can trigger symptoms. Triggers vary from person to person.

- Food. Different foods are triggers for different people. Some common trigger foods are dairy products, sorbitol (a sweetener used in sugar-free products), foods containing caffeine, chocolate, and alcohol.
- Stress. Stress from any source often triggers or worsens symptoms in people with IBS.
- Illness. Other gastrointestinal illnesses caused by bacteria or viruses can trigger symptoms.
- Menstruation. Women seem to have more severe symptoms when they are menstruating, suggesting that changing hormone levels may affect symptoms.

## Diagnosis

There are no tests for IBS. As a result, there are two different ways to arrive at a diagnosis of IBS. One is to perform tests to specifically eliminate other disorders with similar symptoms, such as ulcerative colitis. When other possible disease have been eliminated, then IBS is diagnosed.

The other approach to diagnosis is to use what is known as the Rome criteria for diagnosis. Following the Rome criteria, IBS is diagnosed if the symptoms of abdominal pain, diarrhea and/or constipation are present for at least 12 weeks (the weeks do not have to be consecutive) and several of the following conditions are met:

- A change in the frequency of bowel movements
- A change in the consistency of the stool
- Straining to empty the bowels or a feeling or urgency to empty the bowels
- Frequently feeling that the bowel is not completely empty
- Mucus in the stool
- Bloating
- Symptoms are reduced by having a bowel movement.

Note that blood in the stool, vomiting, fever, and diarrhea that awakens a person at night are not symptoms of IBS. Individuals with these symptoms should see a doctor promptly.

Often these two approaches to diagnosis are combined, and the physician may initially perform a sigmoidoscopy or a colonoscopy to look at the inside of the bowel. In these procedures, a tube called an endoscope is inserted through the rectum and into the colon. At the end of the endoscope is a tiny camera that allows the doctor to see if there is damage to the cells lining digestive tract. During this procedure, the doctor also removes small tissue samples (biopsies) in order to look for abnormal cells under the microscope. This can eliminate inflammatory bowel syndrome as the cause of symptoms.

The doctor may also do a lactose intolerance test. Lactose is a sugar found in milk. People who lack the enzyme to break down this sugar have symptoms similar to those of irritable bowel syndrome. Lactose intolerance is common, and a lactose intolerance test can confirm or eliminate lactose as the source of the symptoms.

The doctor may also do a blood test to determine if symptoms are caused by early or mild celiac disease. People with celiac disease are sensitive to gluten, a **protein** found in wheat, barley, rye, and the products made from these grains. Eating foods containing gluten often causes symptoms similar to IBS in people with celiac disease.

## Treatment

Because no functional problems can be found in people with IBS, family members and even some healthcare providers may be inclined to dismiss symptoms as caused by emotional problems or similar psychological upsets. However, the disease is real and not something that the patient can control. Finding a doctor with whom the patient can establish good communication and feel comfortable is an important first step in treatment.

Treatment of IBS is aimed at relieving symptoms and falls into three categories, lifestyle adjustments, learning new coping skills, and drug therapy. Lifestyle adjustments are include:

- increasing fiber in the diet (see irritable bowel syndrome diet entry)
- keeping a food diary to learn which foods are trigger foods and then avoiding them
- drinking at least 6 glasses of water daily to help prevent constipation
- getting regular exercise
- eating meals at regular times; not skipping meals

Learning new coping skills may involve psychotherapy (talk therapy) or professional counseling to help resolve problems that are causing stress or learning techniques to cope with stress. Some of these coping techniques include biofeedback techniques to reduce stress, yoga, massage, meditation, deep breathing exercises, progressive relaxation exercises, and hypnosis.

Drug therapy depends on specific symptoms. Over the counter anti-diarrheal products such as loperamide (Imodium) can give the individual better bowel and reduce the impact of IBS on daily activities. Over the counter laxatives can be helpful to treat constipation but they must be used sparingly because regular use creates bowel dependence.

Bulk-forming or **fiber** supplement laxatives are generally the safest type of laxative. Some common brand names of fiber-supplement laxatives are Metamucil, Citrocel, Fiberall, Konsyl, and Serutan. These must be taken with **water**. They provide extra fiber that absorbs water and helps keep the stool soft. The extra bulk also helps move materials through the colon.

Stool softeners help prevent the stool from drying out. They are recommended for people who should not strain to have a bowel movement, for example, people recovering from abdominal surgeries or childbirth. Brand names include Colace and Surfak.

Stimulant laxatives such as Ducolax, Senokot, Correctol, and Purge increase the rhythmic contractions of the colon and move the material along faster.

Lubricants add grease to the stool so that it moves more easily through the colon. Mineral oil is the most common lubricant.

Saline laxatives such as Milk of Magnesia draw water from the body into the colon to help soften and move the stool.

As of April 2007, the only prescription drug to treat IBS is alosetron (Lotronex). In the United States, this drug was temporarily withdrawn from the market because of serious side effects including four deaths, but was reapproved with limitations. The drug can only be prescribed by doctors enrolled in a special program, and should only be used for cases of severe diarrhea-type IBS that has failed to respond to all other treatments. This drug is only approved for use in women. Tegaserod (Zelnorm), previously prescribed for severe constipation, was withdrawn from the American market at the request of the Food and Drug Administration in March 2007 because of serious heart-related side effects.

Some people with IBS have seen their symptoms improve when treated with low levels of tri-cyclic antidepressants that affect serotonin levels in the brain. The dosage of these drugs is lower than that used to treat depression. Serotonin is a neurotransmitter that some researchers think play a role in IBS Newer selective serotonin reuptake inhibitor (SSRI) antidepressants seem to be less effective. People whose symptoms do no improve with lifestyle changes may want to talk to their doctor about this and also seek treatment for any depression or anxiety that accompanies the disorder.

## Nutrition/Dietetic concerns

The main dietary concern of people with constipation-type IBS is increasing the amount of fiber in their diet. Insoluble fiber helps material move through the large intestine faster so that less water is reabsorbed by the body and the stool remains softer. Soluble fiber dissolves in water and forms a gel that keeps the stool soft. Good sources of fiber include apples with skin, dried beans, pears with skin, brown rice, oatmeal, and popcorn.

## Prognosis

Every year the symptoms of about 10% of people with IBD spontaneously disappear. The reason for this is not understood. For most people, however, IBS is a chronic disorder. Symptoms are erratic and changeable; there are periods of symptoms improve and periods when symptoms worsen. IBD is not a symptom of any other disorder, and it does not develop into any other more serious disease such as inflammatory bowel disorder or colon **cancer**.

## Prevention

Since the cause of IBS is unknown, the disorder cannot be prevented. Once the disorder is established,

suggestions in the Treatment section may help prevent symptoms.

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American Gastroenterological Association. 4930 Del Ray Avenue, Bethesda, MD 20814. Telephone: (301) 654-2055. Fax: (301) 654-5920. Website: <http://www.gastro.org>

IBS Self Help and Support Group 1440 Whalley Avenue, ndash145, New Haven, CT 06515. Website: <http://www.ibsgroup.org>

International Foundation for Functional Gastrointestinal Disorders. P. O. Box 170864, Milwaukee, WI 53217, Telephone: (888) 964-2001. Fax: (414) 964-7176. Website: <http://www.iffgd.org>

National Digestive Diseases Information Clearinghouse (NDDIC). 2 Information Way Bethesda, MD 20892-3570. Telephone: (800) 891-5389. Fax: (703) 738-4929. Website: <http://digestive.niddk.nih.gov>

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Tish Davidson, A.M.

# Irritable bowel syndrome diet

## Definition

The **irritable bowel syndrome** diet is a set of recommendations designed to reduce the symptoms of both **constipation** and diarrhea that are common with irritable bowel syndrome (IBS). It is not a diet designed for weight loss.

## Origins

No specific person or organization originated the irritable bowel syndrome diet. Instead, it has developed out of research, observations, and trial and error by gastroenterologists and their patients with IBS.

## Description

Irritable bowel syndrome is a disorder in which the intestine (bowel) appears normal, but does not function correctly. The disorder is very common, but its cause is not known. About one of every five Americans has symptoms of IBS, ranging from mild and annoying to severe and lifestyle-altering.

The main symptoms of IBS are pain or discomfort in the abdomen, feeling bloated, having a lot of gas (flatulence), diarrhea, constipation, or alternating periods of both. Symptoms come and go, and over time they can vary in severity in a single individual. Although diet does not cause IBS, certain foods can trigger symptoms. These foods differ from person to person. Common food triggers include alcohol, dairy products, beverages that contain **caffeine**, and the **artificial sweeteners** sorbitol and mannitol. The IBS diet is designed to avoid foods that will trigger symptoms and encourage the consumption of foods that help correct diarrhea and constipation and reduce gas.

## Function

The function of the irritable bowel syndrome diet is to give the individual more control over his or her symptoms of IBS and thus improve the quality of live.

## KEY TERMS

**Gastroenterologist**—a physician who specializes in diseases and disorders of the digestive system.

**Type 2 diabetes**—sometime called adult-onset diabetes, this disease prevents the body from properly using glucose (sugar), but can often be controlled with diet and exercise.

The challenge of this diet is twofold. First, constipation and diarrhea are opposite in their effect, yet they can appear in the same individual as part of the same disorder. Constipation occurs when food stays in the large intestine (colon) too long. Too much **water** is reabsorbed into the body, and the stool (waste) in the large intestine becomes hard, dry, and difficult or painful to eliminate. With diarrhea, food moves too quickly through the large intestine. Not enough water is reabsorbed. Stools are loose and watery, and the individual may feel extreme urgency to have a bowel movement.

The second challenge to this diet is that individuals with IBS may respond to the same food in different ways. The IBS diet is not a list of "must eat" and "must not eat" foods, but rather a group of suggested foods that the individual must personalize through trial and error. Keeping a food journal often helps the person with IBS to pinpoint which foods are beneficial and which worsen symptoms.

### *High-fiber/low-fat IBS diet*

Dietary **fiber** is the collective name for a group of indigestible carbohydrate-based compounds found in plants. They are the materials that give the plant rigidity and structure. The IBS diet is a high fiber/low fat diet. The role of fiber is crucial in controlling the quality of stool in the colon, while reducing the consumption of fat is both healthful and avoids counteracting the actions of fiber. Fiber is also called roughage or bulk.

Two types of fiber are important to human health, insoluble fiber and soluble fiber. Insoluble fiber is fiber that moves through the digestive system essentially unchanged. It is not digested, and it does not provide energy (calories). What fiber does is provide bulk to stool that helps it move through the large intestine. It also traps water, which helps the stool remain soft and easy to eliminate. In people with diarrhea, it can help trap excess water.

Studies find that the average American eats only 5–14 grams of fiber daily, but the recommended amounts are much higher. The United States Institute of Medicine (IOM) of the National Academy of Sciences has issued the following daily Recommended Dietary Intakes (RDIs) for fiber.

- men age 50 and younger: 38 grams
- women age 50 and younger: 25 grams
- men age 51 and older: 30 grams
- women age 51 and older: 21 grams
- children: 5 grams plus at least one gram for every year of age

To follow the IBS diet, individuals should gradually increase their consumption of fiber to meet or exceed the RDI. Foods that are high in insoluble fiber include:

- whole grains and foods made of whole grains, such as whole wheat bread and whole wheat pasta, couscous, or bulgur
- bran and bran breakfast cereals
- brown rice
- carrots
- cucumbers

Soluble fiber dissolves in water to form a gel-like substance. This gel helps keep stool soft. Good sources of insoluble fiber include:

- oatmeal and foods made with oats
- foods such as chili or split pea soup that contain dried beans and peas
- lentils
- apples
- pears
- citrus fruits

The total amount of fiber per serving must be listed on food labels in the United States. In 2007, regulations were under consideration that that would require soluble dietary fiber to be listed separately. A good list of high-fiber foods can be found at <http://www.gicare.pated/edtgs01.htm>. Most foods that are high in fiber are naturally low in fat.

People who have trouble consuming enough fiber and are still having difficulty with IBS symptoms can ask their doctor about bulk-forming or fiber supplement laxatives. These supplements are quite safe, although they should not be used for long periods unless directed by a doctor because the colon will become dependent on them to move stool. Some common brand names of fiber-supplement laxatives are Metamucil, Citrocel, Fiberall, Konsyl, and Serutan.

These must be taken with water. They provide extra fiber that absorbs intestinal water and helps keep the stool soft. The extra bulk also helps move materials through the colon.

### *Low residue/low fat IBS diet*

For some people, the high fiber/low fat diet controls both constipation and diarrhea. For others, the high fiber foods trigger diarrhea. These individuals may have better control of diarrhea on the low fiber/low residue diet. This diet substitutes cooked fruits and vegetables for raw ones and reduces the amount of whole-grain products. Along with these changes, the individual chooses a variety of low-fat foods.

Some foods that help control diarrhea on the low residue IBS diet include:

- applesauce
- low-fat mashed potatoes
- grated apples without the skin
- avocado
- cream of rice
- smooth peanut butter
- tapioca

Other eating tips to control diarrhea are:

- Consume food and drink at room temperature rather than at hot temperatures
- Drink liquids between meals rather than with meals
- Limit dairy products
- Rest after meals. This slows down the digestive process

Because symptoms and triggers for IBS vary greatly, these diets are starting points for individuals to develop their own list of foods that control their individual symptoms. Keeping a food journal that records what was eaten and what caused symptoms can speed the development of a personalized IBS diet.

## Benefits

In addition to controlling symptoms, the IBD high fiber/low fat diet has several other benefits.

- A high fiber/low fat diet has been proven in large studies to lower cholesterol levels. High cholesterol levels are directly related to heart disease.
- A high fiber diet appears to help prevent type 2 diabetes
- A high fiber diet helps prevent diverticulitis. In this disease, sections of the intestine bulge out to form pockets called diverticuli that can collect food and become infected. Increased fiber helps materials move more easily through the intestine and not become trapped in these pockets.
- The increased bulk of high-fiber foods helps people feel full faster, so they may eat less, resulting in weight loss.

## QUESTIONS TO ASK THE DOCTOR

- Will this diet meet my long-term dietary needs?
- Should I be taking a dietary supplement? If so, which one(s)?
- Is this diet appropriate for my whole family?
- Will I have to stay on this diet my entire life to control my IBS symptoms?
- Does this diet pose any special risks for me that I should be aware of?
- What are the treatment options if this diet fails to control my symptoms?

## Precautions

This diet is safe for anyone, although it may not control the symptoms of IBS for every individual. Symptoms may worsen while the individual is experimenting with personalizing the food plan.

## Risks

Individuals who do not drink enough water on a **high-fiber diet** may develop abdominal pain and constipation.

The amount of fiber in the diet should be increased gradually. Increasing fiber too rapidly can result in abdominal pain and large amounts of gas.

## Research and general acceptance

This diet is accepted as healthy and often helpful in controlling the symptoms of IBS by almost all gastroenterologist. High-fiber diets are endorsed as having health benefits by the American Heart Association, the American Dietetic Association, the United States Department of Health and Human Services, and many individual healthcare organizations.

### Resources

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**ORGANIZATIONS**

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Monique Laberge, Ph.D.

# J

Japanese diet *see* **Asian diet**

## Jenny Craig diet

### Definition

Jenny Craig is a calorie-based three-stage lifestyle weight-loss program that incorporates pre-packaged food, transition to regular food, and long-term weight maintenance.

### Origins

Jenny Craig and her husband Sig Craig founded Jenny Craig Weight Management Program in Australia in 1983. The program has since expanded to the United States, Canada, New Zealand, and Puerto Rico and offers both a center-based program and an at-home program. Craig, who has no training as a nutritionist, based her program on her own successful experience with personalized weight loss. The program has a medical advisory board consisting of at least one physician, nutritionist, and behaviorist. Pre-packaged meals are planned by a registered dietitian.

### Description

The Jenny Craig program is a three-stage program. In the first stage, dieters eat only Jenny Craig pre-packaged foods that are supplemented with approved fruits, vegetables, and non-fat dairy products. These meals contain 50–60% **carbohydrates**, 20-25% **protein**, and 20–25% **fats**, and contain between 1,200 and 2,500 calories daily. This generally is in line with the federal Dietary Guidelines for Americans 2005. Vegetarian options are available. However, no other food is permitted during the first stage of the program, which can make eating away from home difficult. The pre-packaged meals are intended to model healthy eating and portion control. In the United States in 2007, the cost of one month of pre-packaged meals was about $500. A personalized exercise program supplemented by optional workout videos and workout equipment encourage the dieter to become more active.

Once dieters have used the pre-packaged meals to become familiar with healthy foods and correct portion sizes, they move to the second stage of the program in which written material supported by consultants teach techniques for healthy meal planning, cooking, and eating out. This stage of the program is designed to develop lifelong habits of moderation and good food choices. The consultant also addresses behavioral issues such as handling stress and emotional triggers for eating.

The final stage of the Jenny Craig program is a maintenance stage. Dieters move into this stage when their weight-loss goal is met. This final stage is designed to keep weight off for life.

Dieters can join the Jenny Craig program in one of two ways. Jenny Craig Weight Loss Centers are physical locations that the dieter visits weekly for individual consultations with a Jenny Craig counselor. Unlike some other center-based weight-loss programs (e.g. **Weight Watchers**), Jenny Craig centers do not offer group meetings. The philosophy behind the Jenny Craig program is one-on-one weight loss help.

Dieters who live too far from a Jenny Craig center or who do not wish to attend one can join Jenny Direct. This is a complete at-home weight-loss program. In the Jenny Direct program, pre-packaged meals and weight-loss literature are delivered to the dieter's home. The dieter is supported by online tools accessed through the Jenny Craig Web site and a required private 15-minute telephone consultation with a Jenny Craig consultant once a week. Consultants do not have formal training in nutrition.

To join either Jenny Craig program, one must first talk to a consultant by telephone. Several different

levels of Jenny Craig membership provide different benefits. Jenny Craig advertises heavily and often has special membership discounts. All programs require that the dieter buy Jenny Craig food.

The Jenny TuneUp is targeted at people who have fewer than 20 lb (10 kg) to lose. It is an entry-level program with a low enrollment fee. In 2007, the Jenny TuneUp was advertised in the United States as "Lose 20 lb for $20." JennyOnTrack is a six-month program, and Jenny Rewards is a long-term program. Jenny Craig does not reveal the enrollment costs of the OnTrack and Rewards programs on its Web site, but they amount to several hundred dollars plus the cost of food. Lifetime memberships are available, as are programs for 13–17 year olds and **breastfeeding** women. All Jenny Craig advertising is geared toward getting the dieter to call a toll-free telephone number for additional information.

## Function

The stated goals of the Jenny Craig program are to help the dieter:

- develop a healthy relationship with food
- live an active lifestyle
- achieve a balanced approach to living

The dieter is supported in reaching these goals by a 24-hour 7-day-a-week customer care telephone line, personalized meals and activity plans, one-on-one consultant support, online e-tools, and weight-loss manuals. By achieving these goals, the dieter learns to eat healthy foods in appropriate portions, incorporate exercise into the daily routine, and nurture her (90% of Jenny Craig clients are female) mental and physical well being.

## Benefits

Jenny Craig promises dieters that if they follow her program, they will lose 1–2 pounds or 1% of their body weight weekly. Once the weight-loss goal is met, a maintenance program is designed to solidify lifestyle changes and keep the weight off. Jenny Craig does not make any claims about the percentage of people who successfully keep weight off for an extended period.

The Jenny Craig program appeals to dieters who want low-calorie meals without having to weigh and measure or dieters who are embarrassed to attend group weight-loss programs. They may be a good solution for single people who do not want to cook. However dieters with families may find that the pre-packaged approach is less convenient if they still have to cook for family members.

## QUESTIONS TO ASK THE DOCTOR

- Are their other diet programs that would better meet my goals?
- Do I have any special dietary needs that this diet might not meet?
- At what level of intensity is it appropriate for me to begin exercising?
- Do you have any experience with the long-term success of this diet?
- If one of your family members wanted to go on a diet, would you recommend this one

## Precautions

Jenny Craig is a diet and exercise program that meets the basic nutritional needs of most people. As with all diet and exercise programs, individuals should check with their healthcare provider to make sure the program is suitable for them.

## Risks

Meals on the Jenny Craig plan fall within the federal Dietary Guidelines for Americans 2005, and **dietary supplements** provided with the pre-packaged meals assure that the dieter of getting an adequate supply of **vitamins** and **minerals**. The greatest risk to this diet program is that people do not learn how to shop and prepare healthy meals on their own. They lose weight eating the pre-packaged meals, but when they transition to the next stage of the diet, they go back to their old eating habits and gain the weight back. This type of **weight cycling** or yo-yo dieting can cause potential health problems.

## Research and general acceptance

The main client complaint about the Jenny Craig program is cost. Prepackaged food can cost around $500 per month in addition to steep enrollment fees and optional extras such as exercise videos and equipment. Some clients complain that the Jenny Craig personal consultants do not have any formal training in nutrition, and are more like sales people than counselors. Clients also criticize the taste and selection of meals. There is no way try Jenny Craig meals before committing to the program.

Professional nutritionists say that the dietitian-planned pre-packaged meals provide adequate nutrition for a low calorie diet, but question whether clients

will become bored with pre-packaged foods. They praise the level of support the program offers through their online site and telephone contact, but question whether the program prepares dieters to go back to preparing regular food once the first stage of the program is completed.

The Jenny Craig Web site offers many testimonials and inspiring success stories, but is thin on results from independently conducted research studies. One preliminary study that looked at weight loss, triglyceride levels (an indication of the amount of fats in the blood) and carotenoid levels (an indication of vegetable intake) was paid for by Jenny Craig and performed by a former Jenny Craig advisory board member.

### Resources

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Tish Davidson, A.M.




# Jillian Michaels diet

## Definition

The Jillian Michaels diet focuses on self, science, and sweat to help dieters achieve weight loss, toning, and increased health and fitness.

## Origins

Jillian Michaels is best known as one of the stars of the popular television program "The Biggest Loser." "The Biggest Loser" aired on NBC, and pitted two teams of significantly overweight individuals against each other to see who could lose the most weight. Jillian Michaels was the strength trainer and life coach for one of the teams of contestants. The strategies that she used to help her contestants lose weight are some of the techniques that inspired her diet and exercise program.

In addition to being a television personality, Jillian Michaels is also the co-owner of the Sky Sport and Spa fitness club in Beverly Hills, California. She is certified by two programs that certify personal trainers, the National Exercise and Sports Trainers Association, and the American Fitness Association of America. She also has been doing martial arts since the age of 14, and is experienced in Muay Thai and Akarui-Do, two forms of martial arts. She has achieved the status of black belt in Akarui-Do. Michaels believes that she brings a special understanding of the needs of people struggling with their weight to her program because she has not always been fit herself. At one time she reports that she was 50 pounds overweight. She used her own experiences becoming fit and healthy to help her design a program that would help other people reach their weight and fitness goals.

## Description

Jillian Michaels' diet begins with a very basic premise. This premise is that for weight loss to occur calories going out have to be greater than calories coming in. Calories out include all calories lost through basic day to day activities and the calories burned providing energy to the body's cells during the day. This base line caloric use is added to the number of calories that are burned during exercise. Calories in include all calories from any food and drink consumed during the day. To lose weight the calories out need to be greater than the calories coming in. This way fat will be broken down to provide the additional calories needed by the body.

## KEY TERMS

**Dietary supplement**—A product, such as a vitamin, mineral, herb, amino acid, or enzyme, that is intended to be consumed in addition to an individual's diet with the expectation that it will improve health.

**Mineral**—An inorganic substance found in the earth that is necessary in small quantities for the body to maintain a health. Examples: zinc, copper, iron.

**Obese**—More than 20% over the individual's ideal weight for their height and age or having a body mass index (BMI) of 30 or greater.

**Vitamin**—a nutrient that the body needs in small amounts to remain healthy but that the body cannot manufacture for itself and must acquire through diet.

The diet can be customized to allow a dieter to determine how many calories should be consumed each day based on how many calories are being expended during the day generally, how many are being used through exercise, and what a person's specific weight loss goals are. A pound of fat is comprised of about 3500 calories. That means that to lose a pound each week a dieter would have to use up 3500 more calories than are taken in that week. Spread evenly thought the week this means that each day 500 more calories should be used than are taken in. So if a dieter calculates that he or she is using 2000 calories a day that person should consume 1500 each day to lose one pound per week.

Jillian Michaels breaks her diet down into three parts: self, science, and sweat. Each of these parts comprises one of the parts she feels is important for successful, long-term weight loss and better health. Her diet provides information, recommendations, and opportunities for the dieter to customize their program in each of these areas.

By "self" Michaels means all of the psychological and emotional issues and problems associated with eating, bad habits, and being overweight. She shares many of her own insights that she gained from when she was overweight, and ways that she managed to overcome her own problems.

Michaels focuses largely on ways to change problem behaviors. Problem behaviors include any kind of eating behaviors that stem from reasons other than hunger or necessary nutrition. These include eating when a person feels stressed or upset instead of when they are hungry. Michaels believes that it is important to identify and change these problem behaviors because these are often the reasons that people have difficulty controlling their calorie intake. She provides suggestions for ways to change these behaviors, and offers alternative ways to deal with the underlying issues such as stress. She also deals with issues like the emotional aspects of being overweight. Throughout all of her diet and exercise program she provides inspiration to help the dieter overcome any setbacks and find the inner force to keep going and meet their goals.

"Science" means information about basic nutrition and how the body uses food and calories. Michaels believes that the reason many diets do not work for most people is that they are general, and not designed to meet the individual needs of the dieter. To this end she believes that there are three different ways that people metabolize food, and that the diet cannot be successful unless it is specifically designed for the dieter's metabolic type. The three types she identifies are fast oxidizers, slow oxidizers, and balanced oxidizers.

Michaels believes that dieters with different metabolic types need different combinations of **fats**, **protein**, and carbohydrate to make their meals the most efficient for that dieter. Fast oxidizers change the **carbohydrates** in their food to energy very quickly, and so tend to have spikes of blood sugar right after meals. Because of this Michaels says that people who are fast oxidizers should eat meals that have higher levels of protein and fats, which are converted to energy more slowly, and lower amounts of carbohydrates, so that the energy levels are more stable during the periods after and between meals.

Slow oxidizers are the opposite of fast oxidizers, and they have metabolisms that break down carbohydrates into energy very slowly. Michaels suggests that slow oxidizers should eat meals that contain large percentages of carbohydrates, and lower amounts of fats and proteins. Balanced oxidizers should eat balanced amounts of all three, fats, proteins, and carbohydrates. This is because their **metabolism** converts food neither very quickly nor very slowly. Michaels provides a detailed quiz to determine what kind of metabolizer a dieter is so that menus can be customized effectively.

"Sweat" refers to exercise. Michaels believes that not only is exercise the most effective way to increase the number of calories going out, but that in addition to the calories used during the actual exercise, the

average number of calories going out during regular daily activities increases as overall fitness and muscle mass increases.

Michaels believes in a balanced combination of cardiovascular exercises and strength training. She suggests exercising for 60 minutes a day, with five minutes at the beginning and the end being used for stretching, warm up and cool down, and 50 minutes being used for the rigorous exercise. She provides many different exercises and routines that be customized for the fitness level of the dieter. She also provides information about how muscles work, what the main muscle groups are, and which exercises are best for training which areas of the body. Her exercises and routines draw from many different areas of fitness such as Pilates, yoga, kickboxing, weight lifting, and traditional aerobics. One aspect of her exercise routines that she finds very helpful to many dieters is that her exercises are designed to be done at home, and she says that there is no need to join a gym.

## Function

Jillian Michaels' diet and exercise program is intended to allow people to lose weight, become more fit, and achieve better overall health and well being. She also intends it to give people the ability to feel better and more empowered in their daily lives as they take control of their weight, appearance, and health.

## Benefits

There are many benefits to losing weight and being more fit. The benefits of weight loss can be very significant, and are even greater for people who are the most obese. People who are obese are at higher risk of diabetes, heart disease, and many other diseases and disorders. The risk and severity of these disorders is generally greater the more obese a person is. Weight loss, if achieved at a moderate pace through a healthy diet and regular exercise can reduce the risk of these and many other obesity-related diseases. Increased exercise can also reduce the risk of cardiovascular and other diseases.

## Precautions

Anyone thinking of beginning a new diet and exercise regimen should consult a medical practitioner. Requirements of calories, fat, and nutrients can differ significantly from person to person, depending on gender, age, weight, and many other factors such as the presence of any disease or conditions. Pregnant or **breastfeeding** women should be especially cautious because deficiencies of **vitamins** or **minerals** can have a significant negative impact on a baby. Exercising too strenuously can cause injury, and exercise should be started gradually until the dieter knows what level of intensity is appropriate. It is especially important with this diet to remember that the contestants on "The Biggest Loser" did work out many hours a day and adhere to strict diets, and that although they lost a lot of weight in a relatively short amount of time this will not necessarily be the result for all dieters. Contenstants on the show were were closely monitored by physicians and other professionals, and had diet and exercise plans were specifically tailored to their dietary needs and level of fitness.

### QUESTIONS TO ASK THE DOCTOR

- Is this diet the best diet to meet my goals?
- At what level of intensity is it appropriate for me to begin exercising?
- Does diet or exercise pose any special risk for me that I should be aware of?
- Would a multivitamin or other dietary supplement be appropriate for me if I were to begin this diet?
- Is this diet appropriate for my entire family?
- Is it safe for me to follow this diet over a long period of time?
- Are there any sign or symptoms that might indicate a problem while on this diet?

## Risks

With any diet or exercise plan there are some risks. It is often difficult to get enough of some vitamins and minerals when eating a limited diet. Anyone beginning a diet may want to consult their physician about whether taking a vitamin or supplement might help them reduce this risk. Injuries can occur during exercise, such as strained or sprained muscles, and proper warm up and cool down procedures should be followed to minimize these risks. It is often best to begin with light or moderate exercise and increase the intensity slowly over weeks or months to minimize the risk of serious injury that could occur if strenuous exercise is begun suddenly and the body is not sufficiently prepared.

## Research and general acceptance

Jillian Michael's diet has not been the subject of any significant scholarly research. It was the diet

followed by many of the contestants on NBC's "The Biggest Loser". Many of those contestants had problems with obesity-related diseases and conditions when they began the show. These included diabetes, sleep apnea, and high cholesterol levels. By the end of the show, when large amounts of weight had been lost and better fitness had been achieved, many of the contestants no longer suffered from these conditions, or had reduced symptoms, and some were even able to discontinue many of their medications. These results do not necessarily represent what is likely to occur for a person following the more general form of the diet on their own at home. These results also did not necessarily result from this specific diet, but were more likely to be the result of the weight loss achieved through reduced caloric intake and increased exercise. There is, however, no reported scientific evidence to suggest that people can be fats or slow oxidizers. These terms and quiz are created BY Jillian Michaels.

Although this diet has not been studied specifically, limiting caloric intake, eating a diet low in fats and carbohydrates and high in vegetable and plant products is generally accepted as a healthy diet for most people. As of 2007 the U.S. Center for Disease Control recommended a minimum of 30 minutes per day of light to moderate exercise for healthy adults. Following Michael's fitness and exercise program would exceed these minimum recommendation.

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Helen Davidson

# Juice fasts

## Definition

Juice fasts, sometimes called juice therapy, are short-term dietary practices—typically one to three days in length—during which the dieter consumes only fruit, vegetable, or other plant juices in order to cleanse the body of heavy metals and other chemical toxins; as a practice related to Ayurvedic medicine; as the first step in the treatment of colitis, arthritis, depression, **cancer**, HIV infection, or other diseases; for weight reduction; as part of a vegetarian, fruitarian, or vegan lifestyle; or as a part of a general program of eliminating such other unhealthy habits as smoking, drinking large amounts of alcohol or caffeinated beverages, and overeating. Some people drink large amounts of freshly extracted fruit or vegetable juices as part of their regular diet without necessarily fasting; this practice is called juicing.

Many people who undergo juice fasts combine them with massage therapy or the use of laxatives and enemas to completely relax the body and cleanse the digestive tract.

## Origins

Juice fasts can be traced back for over 5500 years to an annual ritual of bodily detoxification and spiritual preparation known as *pancha karma*, which is part of the practice of Ayurvedic medicine in India. Ayurveda is a traditional system of health care that dates back to about 3500 BC; its name is Sanskrit for "science of long life." Pancha karma is undergone for disease prevention, which in Ayurvedic practice requires spiritual renewal and the breaking of negative emotional patterns as well as physical purification. It has three phases: a preparation phase, in which the person eliminates sweets, caffeinated drinks, and processed foods from the diet, as well as spending more time in meditation and taking walks in natural surroundings; the cleansing phase, which includes bloodletting, emesis (forced vomiting), nasal cleansing, and the use of enemas and laxatives as well as a very restricted diet; and a rejuvenation phase, in which solid foods are gradually reintroduced to the diet. It is not unusual for people to experience spiritual and psychological changes during this third phase. In addition to pancha karma, contemporary Ayurvedic practice recommends juice fasts for colitis and other ailments of the digestive tract. Ayurvedic medicine is a system that emphasizes the prevention of disease by identifying and treating imbalances within the body rather than making diagnoses of existing illnesses in

the usual Western fashion. Juice fasts are therefore regarded as a way of restoring balance within the person's physical constitution rather than as "treatments for illness" in the Western sense.

The second major influence on the popularity of juice fasts in Canada and the United States is naturopathy, which is an approach to health care that developed out of the natural healing movement in Germany and North America in the late nineteenth century. Naturopaths of the twenty-first century use a variety of techniques in treating patients, including hydrotherapy, spinal manipulation, and physical therapy as well as nutrition and dietary advice. Like Ayurveda, naturopathy emphasizes prevention of disease and recommends noninvasive treatments that rely on the body's own self-healing powers. Juice fasts are an important part of naturopathic dietary therapy.

The third factor that has contributed to interest in juice fasts since the 1970s has been the widespread adoption of vegetarian and vegan lifestyles. People who are concerned in general to minimize or eliminate meat from their diet, whether for environmental, religious, or health-related reasons, are often drawn to juice fasts as periodic intensifications of their normal vegetarian practices. Two subgroups of vegetarians that are particularly likely to practice regular juice fasts are raw-food vegetarians and fruitarians. Raw-food vegetarians, also known as raw foodists, are attracted to juice fasts and juicing because of their belief that cooking destroys most of the nutrients in food. The two best-known proponents of juice therapy in the 1980s, Jay Kordich, "the Juiceman," and Bernard Jensen, a chiropractor in California who died in 2001, were both raw-food vegetarians.

## Description

The following description focuses on juice fasting as it is usually practiced in North America, as the Ayurvedic practice of pancha karma has already been summarized.

### *Preparation*

Most practitioners of juice fasting recommend restricting it to the warmer months of the year, or traveling to a spa in a warm climate for a wintertime juice fast. Most people undergo juice fasting only once or twice a year; however, some undergo a one-day juice fast every week, or a two-day fast once a month.

Beginning 7 to 10 days before the fast, the person should reduce their intake or eliminate entirely all stimulants (coffee, tea, cocoa, and cola drinks), alcoholic beverages, animal meats, fish, eggs and dairy products, sugar, and wheat. The diet during this preparation period should consist entirely of organic fruits, vegetables, and beans.

### *Making and consuming the juice*

The dieter is instructed to drink between 32 and 64 ounces of juice per day, with 6 glasses of warm filtered **water** in addition. Some therapists recommend one or more cups of herbal tea each day in addition to the juice and water. The juice should be made in a juicer from fresh organic produce; prepackaged juices should not be used because they are pasteurized to retard spoilage. The heat required for pasteurization destroys some of the **vitamins** and enzymes in the fruit. If organic fruits and vegetables are unavailable, ordinary supermarket produce may be used, provided it is peeled or washed in a special produce cleaner (available at health food stores) to remove pesticide residue. A combination of fruits and vegetables is recommended rather than fruit or vegetable juice alone. The juice should be consumed within half an hour of processing in the juicer because the natural enzymes in the fruits or vegetables begin to break down the other nutrients in the juice after that time. It should not be refrigerated.

There are a number of recipe books for combining fruit and vegetable juices to make the fast as tasty as possible. Fruits and vegetables that are commonly recommended in these books for juicing include:

- Greens: parsley, beet greens, kale, chard, celery, spinach, dandelion greens
- Cruciferous vegetables: broccoli, cabbage, Brussels sprouts
- Root vegetables: carrots, beets, sweet potatoes
- Fruits: grapes, apples, watermelon, pineapple, cranberries, strawberries, peaches, some citrus fruits
- Herbs: fennel, yucca, spearmint, peppermint, basil, ginger, garlic
- Wheatgrass and bean sprouts
- Aloe vera gel: sometimes taken orally as part of a juice fast for treatment of arthritis

### *Bowel care*

An important part of juice fasting is the use of laxatives or enemas to cleanse the lower digestive tract because the juice will not supply enough **fiber** to keep the bowels moving. Since many practitioners believe that juice fasts are necessary to detoxify the body, the removal of wastes is considered essential to prevent the toxins in the digestive tract from being reabsorbed into the bloodstream. Some juice therapists recommend mixtures of slippery elm or other herbs to cleanse the

## KEY TERMS

**Ayurveda**—The traditional system of natural medicine that originated in India around 3500 BC. Its name is Sanskrit for "science of long life." Juice fasts can be traced back to Ayurvedic practice.

**Bioavailability**—The rate at which a substance or chemical is absorbed into the body or made available for a specific physiological process. Juice fasting sometimes affects the bioavailability of prescription medication.

**Colonic**—Sometimes called colonic hydrotherapy, a colonic is a procedure similar to an enema in which the patient's colon is irrigated (washed out) with large amounts of water. Some people undergoing a juice fast have one or more colonics to remove fecal matter remaining in the intestines during their fast; however, this procedure is discouraged by mainstream physicians because of its potential risks to health.

**Detoxification diets**—A group of diets that are followed in order to purify the body of heavy metals, toxic chemicals, harmful microbes, the waste products of digestion, and other substances held to be harmful. Juice fasts are one type pf detoxification diet.

**Fruitarian**—A vegetarian who eats only plant-based products, as fruits, seeds, and nuts, that can be obtained without killing the plant. Many fruitarians make occasional use of juice fasts.

**Naturopathy**—A system of disease treatment that emphasizes natural means of health care, as water, natural foods, dietary adjustments, massage and manipulation, and electrotherapy, rather than conventional drugs and surgery. Naturopaths (practitioners of naturopathy) often recommend juice fasts as a way of cleansing the body.

**Pancha karma**—An intensive one- to two-week ritual of detoxification practiced in Ayurvedic medicine that includes enemas, bloodletting, and nasal irrigation as well as fasting.

**Pasteurization**—A process for partial sterilization of milk or beverage juices by raising the liquid to a temperature that destroys disease organisms without changing its basic taste or appearance. Pasteurized fruit or vegetable juices are considered unsuitable for juice fasts on the grounds that pasteurization destroys important nutrients in the juices.

**Spa**—A hotel or resort for relaxation or health and fitness-related activities. Some people undergoing a juice fast do so at a spa in order to combine the fast with colonics, massage therapy, and other practices associated with juice fasts. The English word *spa* comes from the name of a famous health resort in Belgium.

**Vegan**—A vegetarian who excludes all animal products from the diet, including those that can be obtained without killing the animal. Vegans are also known as strict vegetarians. Some vegans practice juice fasting.

colon; others prefer saltwater laxatives, enemas, or colonics for cleansing the bowel. A colonic is a procedure in which a large amount of water, sometimes as much as 20 gallons, is infused into the colon through the rectum a few pints at a time. It differs from an enema in that much more fluid is used, and a colonic is infused into the colon, whereas an enema infuses water or a cleansing solution into the rectum only. The reader should note, however, that *mainstream physicians do not recommend colonics*, on the grounds that they are unnecessary, based on a nineteenth-century misunderstanding of the process of digestion, and very often uncomfortable for the patient. In some cases they pose serious risks to health.

### *Breaking the fast*

People should not return to solid foods immediately at the end of a juice fast because the intestines need time to readjust to grains and other solid foods. One sequence of breaking the juice fast through a gradual return to a full diet is as follows:

- Day 1: Two pieces of fruit, each divided in half.
- Day 2: Steamed non-starchy vegetables, such as spinach or zucchini.
- Day 3: Green salads and brown rice. Rice and other solid foods should be thoroughly chewed to assist digestion.
- Day 4: Organic yogurt and eggs.
- Day 5: Chicken, fish, red meat (if a normal part of the diet), or tofu.
- Day 6: Beans and grains other than rice.
- Day 7: All other foods.

## Function

As has been mentioned, people may undergo juice fasting for one or more of the following reasons:

### *Spiritual or religious practice*

Some people find a juice fast to be useful as part of a general religious or spiritual retreat. As was noted earlier, the first stage of an Ayurvedic pancha karma includes extra time given to meditation and nature walks as well as gradual exclusion of stimulants and solid foods from the diet. Those who undertake a juice fast in order to wean themselves from smoking, drugs, or a food addiction are also often looking for spiritual as well as physical release from the habit they are struggling to break. Many people report relief from emotional stress as a side benefit of juice fasting.

### *Detoxification*

Naturopaths frequently recommend juice fasting as a way of ridding the body of various toxins, which they identify as coming from several sources:

- Heavy metals. These include such substances as cadmium, arsenic, nickel, aluminum, chromium, mercury, vanadium, strontium, antimony, cobalt, and lead, which are used in various manufacturing processes and some medical procedures as well as being present in batteries, electronic equipment, coins, cookware, food containers, and other common household items.
- Toxic chemicals taken directly into the digestive tract through alcoholic beverages, pesticide residues on supermarket produce, additives in processed foods, or drugs of abuse; or taken into the respiratory tract through breathing household solvents (nail polish remover, spot or stain removers containing benzene, etc.)
- Toxins in the digestive tract produced by yeast and other microorganisms. Ridding the body of this group of toxins is frequently cited as a reason for combining laxatives or enemas with a juice fast. The reader should note that mainstream physicians dispute the notion that normal digestion produces toxic substances in the colon that must be removed by a laxative or enema.
- Ammonia, urea, and other breakdown products of protein metabolism. Naturopaths often recommend a vegetarian lifestyle as well as periodic juice fasts in order to minimize the production of these byproducts of meat and dairy products consumption.

### *Treatment of specific illnesses*

Juice fasting is sometimes recommended for the treatment of specific diseases and disorders, most commonly arthritis, autoimmune disorders, and depression, but it has also been claimed to be an effective treatment for severe infections (including AIDS), multiple sclerosis, and cancer. Both Jay Kordich and Bernard Jensen have maintained that juice fasts healed them of cancer. One theory that is sometimes advanced to explain the healing power of juice fasting is that the energy that the body would normally use digesting heavy or high-protein meals can instead be directed to its natural self-healing capacity. The medical profession would not recomment the thes practices as a sole treatment and many would discourage their use as they may interfere with and complicate conventional treatments.

## Benefits

The benefits of juice fasting include a rapid immediate weight loss, an effect frequently mentioned in client testimonials. Average weight loss runs between three and five pounds for adults for a three- or four-day juice fast. Mainstream medical research also indicates that juice fasts are useful in providing a period of rest for the digestive tract for patients with **irritable bowel syndrome** or other functional disorders of the intestines. Lastly, juice fasts have sometimes been helpful in identifying food allergies. As solid foods are gradually reintroduced after the fast, some people discover that they have a previously unsuspected allergy to such foods as corn, wheat, or tomatoes.

## Precautions

In general, anyone considering a juice fast should consult a health professional beforehand. Some groups of people, however, should not undertake a juice fast:

- Pregnant or lactating women.
- Children.
- People with any of the following medical conditions: diabetes, hypoglycemia, anorexia or bulimia nervosa, kidney or liver disease, gout, asthma, impaired immune function, epilepsy, cancer, terminal illness, active infections, anemia, malnutrition, or ulcerative colitis.
- People who are underweight.
- People who have increased energy needs such as those who have recently undergone surgery or treatment for severe burns.

People taking any prescription medication should consult their primary care physician before a juice fast,

as the bioavailability of some drugs is affected by fasting. In addition, grapefruit or pomegranate juice should *not* be used for a juice fast because the juices of these fruits may increase the blood levels of prescription medications in the body.

Juice fasts should not be extended beyond three or four days without medical supervision, as longer fasts can lead to poor intakes of nutrients such as **protein** and **calcium** and could lead to deficiencies. In addition, anyone who feels faint or dizzy, develops an abnormal heart rhythm, feels nauseated or vomits, or has signs of low blood pressure, should discontinue the fast and consult their doctor at once.

On the economic side, juice fasting is a potentially expensive form of dietary therapy. Readers interested in juice fasts at home or in juicing as a dietary addition should be prepared to pay between $60 and $200 for a juicer or juice extractor—although some deluxe models are marketed for as much as $2000. The chief difference is that juice extractors remove the fruit or vegetable pulp from the juice (and are difficult to clean) while juicers generally leave the pulp in the juice. In addition to the cost of the machine and the fruits or vegetables to be juiced, people on a juice fast will usually need to purchase laxatives or enemas for cleansing the bowel. Colonics cost anywhere from $50 to $105 per treatment (as of 2007), while a 5-day juice fast retreat at a spa costs at least $1600 per person at double-occupancy rates.

### Risks

The major risks to health from juice fasts include metabolic crises in patients with undiagnosed diabetes or hypoglycemia; dizziness or fainting due to sudden lowering of blood pressure; diarrhea, which may result in **dehydration** and an imbalance of **electrolytes** in the body; and protein or calcium deficiencies from unsupervised long-term juice fasts.

Minor side effects include headaches, fatigue, **constipation**, acne, bad breath, and increased body odor.

Juice fasters who undergo colonics are at risk of contracting an infection from improperly sterilized colonic equipment; of serious illness or death from electrolyte imbalances in the blood; or of serious illness or death resulting from perforation of the intestinal wall by improperly inserted equipment. Colonics can also worsen the symptoms of ulcerative colitis.

### Research and general acceptance

Juice fasts as a specific dietary practice have not received much attention from mainstream medical researchers; however, they have received some evaluation within clinical studies of Ayurveda and naturopathy as alternative medical systems. Part of the difficulty is that Ayurveda and naturopathy do not lend themselves easily to the standard clinical trial protocol, which generally focuses on only one illness or one medication at a time rather than on multimodal therapies or the general lifestyle changes recommended by Ayurvedic practitioners and naturopaths.

There have been two studies conducted in Germany in 2005 and 2006 that have reported on the benefits of juice fasting in general lifestyle adjustment and in treating functional bowel disorders. In the United States, the National Center for Complementary and Alternative Medicine (NCCAM) has carried out clinical trials of two specific plants that are often used in juice fasts, aloe vera (*Aloe barbadensis*) and cranberry (*Vaccinium macrocarpon*). Cranberry juice is still being studied as of 2007 for its possible usefulness in preventing urinary tract infections in women. With regard to aloe vera, NCCAM warns that the gel from the plant has a laxative effect that causes cramps and diarrhea in some people, and may inhibit the absorption of prescription drugs.

Juice fasts as a treatment for AIDS and other severe diseases, however, have come in for severe criticism from mainstream physicians. Jay Kordich, t“ the Juiceman,” has been attacked for his claims that he was cured of cancer when he was 20 by drinking 13 glasses of carrot/apple juice each day. In particular, Kordich’s claims that raw vegetable juices boost the human immune system or improve digestion are questionable. One physician summarizes his critique of juicing by saying, “The enzymes in plants help regulate the metabolic function of plants. When ingested, they do not act as enzymes within the

### QUESTIONS TO ASK YOUR DOCTOR

- What are the potential benefits, if any, for a person of my age, sex, and lifestyle in taking a periodic juice fast?
- What are the potential health risks of a juice fast, if any, for me as an individual?
- What specific types of juices would you recommend for a juice fast? Have you tried any of them yourself?
- Are there any specific types of juice that you would not recommend, and why?

human body, because they are digested rather than absorbed intact into the body.... Sensible eating, which is not difficult to do, furnishes an adequate nutrient supply.... Since the fiber in fruits and vegetables is an important part of a balanced diet, there is no reason to remove it while making juice. There's nothing wrong with including extracted juices in a diet that is adequate in fiber. But promoting them as alternatives to whole foods or as powerful healing agents is irresponsible."

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### ORGANIZATIONS

American Association of Naturopathic Physicians (AANP). 4435 Wisconsin Avenue NW, Suite 403, Washington, DC 20016. Telephone: (866) 538-2267 or (202) 237-8150. Website: http://www.naturopathic.org.

American Vegan Society (AVS). 56 Dinshah Lane, P. O. Box 369, Malaga, NJ 08328. Telephone: (856) 694-2887. Website: http://www.americanvegan.org/index.htm.

Juice Fast for Health. [no mailing address] (760) 508-8117. Website: http://www.juicefastforhealth.com.

National Center for Complementary and Alternative Medicine (NCCAM). 9000 Rockville Pike, Bethesda, MD 20892. Telephone: (888) 644-6226. Website: http://nccam.nih.gov.

National Institute of Ayurvedic Medicine (NIAM). 584 Milltown Road, Brewster, NY 10509. Telephone: (845) 278-8700. Website: http://niam.com.

North American Vegetarian Society (NAVS). P.O. Box 72, Dolgeville, NY 13329. Telephone: (518) 568-7970. Website: http://www.navs-online.org.

Rebecca J. Frey, PhD

# K

## Ketogenic diets

### Definition

Ketogenic diets are a group of high-fat, moderate-protein, and very low-carbohydrate diets given to treat some children and adolescents with epilepsy, and some adults with epilepsy and other diseases. The name *ketogenic* refers to the increased production of ketone bodies as a result of this special diet. Ketone bodies are three compounds that are formed during the **metabolism** of **fats** and are ordinarily excreted in the urine. An abnormally high level of ketone bodies is called ketosis, and this condition is the goal of the ketogenic diet. It is thought that ketosis helps to control the frequency and severity of epileptic seizures, even though the reasons for this effect are not fully understood as of 2007.

### Origins

It has been known since Biblical times that some people with epilepsy were helped by prolonged periods of fasting, with good results. In earlier periods of history, children were kept on clear liquids for as long as two or three weeks until their seizures improved. This type of fasting, however, was obviously not sustainable as a long-term treatment. In 1921, a doctor at the Mayo Clinic named R. M. Wilder devised a diet for patients with epilepsy that was intended to mimic the biochemical changes that take place during fasting—ketosis, acidosis, and **dehydration**. Dr. Wilder's ketogenic diet provided 10–15 grams of **carbohydrates** per day, 1 gram of **protein** for each kilogram of the patient's body weight, and the remaining calories from fat. The calorie level was 75% of the normal daily allowance for the patient's weight, and fluids were restricted to 80 percent. Wilder's diet was almost identical to the protocol used at Johns Hopkins in 2007.

Until the late 1930s, the Mayo Clinic ketogenic diet was used to treat adults as well as children with epilepsy. In 1938, however, the first anticonvulsant drug—phenytoin (Dilantin)—was introduced, and was quickly followed by others. As of the early 2000s, there are 20 different anticonvulsant medications given to patients with epilepsy. After these medications were introduced, people were less interested in the ketogenic diet; many doctors considered it unnecessary or too much trouble. The number of hospitals that used it as therapy fell off sharply, while many practitioners regarded it as a "holistic" or even "alternative" treatment for epilepsy.

Interest in the ketogenic diet was reawakened in the mid-1990s, when the father of a 2-year-old with seizures that had not responded to any medications or surgical procedures read about the diet in medical textbooks. He started his son on the ketogenic diet with very good results; the child stopped having seizures and was able to discontinue his medications. The father then established the Charlie Foundation, which continues to provide information and guidance about the ketogenic diet to parents, dietitians, and other health care professionals. Since 1994, the diet has been generally accepted by doctors; it is used in about 40 countries around the world for the treatment of childhood epilepsy. The costs of the diet are reimbursed by most insurance carriers in the United States.

### Description

#### *Classic ketogenic diet (Johns Hopkins protocol)*

The ketogenic diet used at the Johns Hopkins Pediatric Epilepsy Center is commonly considered the standard or classic form of this diet. Its usual protocol for children between the ages of 3 and 12 years provides a ratio of 4 parts fats to 1 part protein and carbohydrates combined. Infants, toddlers, and adolescents are usually started on a 3:1 ratio. Individual patients may require ratios ranging from 2.5:1 to

**Potential side effects of the Classic Ketogenic Diet**

- ✓ Abnormally high levels of blood lipids after discontinuing the diet
- ✓ Decreased bone density
- ✓ Dehydration
- ✓ Growth retardation caused by protein deficiency
- ✓ Inflammation of the pancreas
- ✓ Kidney stones or gallstones
- ✓ More frequent infections due to a weakened immune system
- ✓ Nausea, vomiting, or constipation
- ✓ Protein deficiency, causing growth retardation
- ✓ Menstrual irregularities
- ✓ Vitamin and mineral deficiency

*(Illustration by GGS Information Services/Thomson Gale.)*

5:1; these ratios are worked out by fine-tuning the diet once the child has been started on it.

**PREPARATION.** The most important aspect of preparation for the ketogenic diet is deciding whether it will benefit the child. Most doctors prefer not to use it if the child is taking medications that are effective in controlling seizures without producing severe side effects. If, however, the child has tried two or more anticonvulsants without success, or is having serious side effects from the drugs, the ketogenic diet offers a chance to have a more normal life. It helps if the child is not a fussy eater and is willing to try foods that he or she might not ordinarily choose. The child also must be capable of self-control, as eating only a few cookie crumbs or anything else containing sugar (including toothpaste and other oral care products), will break the effect of the diet and possibly bring on a seizure.

Another important aspect of preparation is commitment on the part of the entire family. It takes considerable time and care to measure food portions, test the child's urine at home, watch for possible side effects, and keep a balance between the needs of the epileptic child and the food preferences of other family members. Parties and holiday meals may require some advice from the dietitian so that the child can have a treat that won't break the diet and will allow him or her to enjoy the meal or party with other friends or family members.

**INITIAL FAST.** The classic ketogenic diet begins with placing the child on a 24- to 48-hour fast followed by a stay of several days as a hospital inpatient, so that his or her body fluids can be measured and possible side effects monitored. The reason for the fast is to force the body to exhaust its glucose supply and begin burning stored fat for energy. The foods that are given after the fast are intended to keep the process of fat burning going by providing slightly fewer calories than the body needs and providing 80% of those calories in the form of fat.

## KEY TERMS

**Amyotrophic lateral sclerosis (ALS)**—A rare progressive and eventually fatal disease affecting the nerve cells that control movement. It is also known as Lou Gehrig's disease. As of the early 2000s, there is some evidence that the ketogenic diet can slow the progression of ALS.

**Anticonvulsant**—A drug given to prevent or control seizures.

**Double-blind study**—A study in which neither the researchers nor the subjects know the identity of the persons in the experimental and control groups during the course of the research.

**Ketone bodies**—A group of three compounds (acetoacetic acid, acetone, and beta-hydroxybutyric acid) that are formed in an intermediate stage of fat metabolism and excreted in the urine. Measuring the level of ketone bodies in the urine of a patient on the ketogenic diet is the primary way of assessing the diet's effectiveness.

**Ketosis**—An abnormally high level of ketone bodies in the blood or urine, produced when the body begins to burn fat for energy instead of glucose (sugar).

**Longitudinal study**—A clinical study in which the researchers follow the same group of patients over a period of time. Most studies of the ketogenic diet have been longitudinal studies.

Prior to coming to the hospital, the child's food records are kept over a three-day period so that the doctors will know the average daily calorie intake in order to tailor the special diet to the child's need for growth. The goal is to maintain the child's **body mass index** at the 50th percentile. The amount of protein in the diet is based on the child's age, kidney function, and stress factors. While the child is in the hospital, the parents are given a four-day educational program to help them understand the diet and give them practice in preparing meals as well as monitoring the child.

The Johns Hopkins schedule for the child's hospital stay is as follows:

- Sunday (night before admission): Child begins fasting at home in the evening.
- Day 1 (Monday): Child is admitted to the hospital; fasting continues; fluid intake is restricted; and blood glucose is monitored every 6 hours.

- Day 2 (Tuesday): Child is given "eggnog" for dinner (1/3 of the maintenance calorie allotment for dinner); blood glucose checks are discontinued. The parents are asked to start checking the child's urine ketone levels. Ketone levels should be between 80 and 160 mg/dL when the diet is working properly.
- Day 3 (Wednesday): Breakfast and lunch are given as eggnog (1/3 of the maintenance calorie allotment for those meals); dinner (more eggnog) is increased to 2/3 maintenance level.
- Day 4 (Thursday): Breakfast and lunch are given at 2/3 maintenance level; dinner is the child's first full ketogenic meal (not eggnog).
- Day 5 (Friday): After a full ketogenic breakfast, the child's prescriptions are reviewed, follow-up is arranged, and the child is discharged from the hospital.

Some hospital programs do not require fasting to initiate the child's diet. Follow-ups for most children take place at three-month intervals, although infants may be seen monthly. Children must take multivitamins and mineral supplements (particularly **calcium**) while on the ketogenic diet. Anticonvulsant medications are usually continued for the first few months of the diet, but may be given in lower dosages if the child responds well to the diet, or even discontinued altogether.

**SAMPLE MENUS.** A typical day's menu for a child on the standard 4:1 ratio diet, allowing 1500 calories per day:

- Breakfast: egg with bacon, made with heavy whipping cream and butter, plus an apple
- Snack: peanut butter mixed with butter
- Lunch: tuna salad made with celery, mayonnaise, and heavy whipping cream, served with lettuce
- Snack: keto yogurt (made with heavy whipping cream, sour cream, strawberries, and artificial sweetener)
- Dinner: cheeseburger with lettuce and green beans
- Snack: keto custard (heavy whipping cream, egg, and pure unsweetened vanilla flavoring)

A computer program is available (listed in the resources below) to help parents and dietitians devise menus that will take the individual child's food preferences into account as well as keep the meal selections within the correct nutritional ratio.

**TAPERING AND TERMINATION.** The ketogenic diet is a long-term diet but is not intended for indefinite use in children. Most children who respond favorably to it remain on it about two years. The diet must not be stopped abruptly, however; most doctors recommend that parents slowly start to add regular foods to the child's menu to see whether the seizures are still controlled.

### *Sanggye Paik Hospital diet*

The Sanggye Paik Hospital diet is a version of the ketogenic diet developed in Korea for the treatment of Asian children, whose diets typically contain much less fat than the diets of Western children. The Sanggye Paik protocol does not require an introductory fast and introduces high-fat foods to the patient's diet gradually, although it uses the same 4:1 ratio of fats to protein and carbohydrates as the Johns Hopkins protocol. It is reported to have the same proportion of successes in patients as the Johns Hopkins ketogenic diet.

### *Modified Atkins diet*

In 2003 the Johns Hopkins treatment center initiated a case series of six children and adults who used a modified version of the **Atkins diet** to control seizures rather than the classic 4:1 ketogenic diet. These patients were not admitted to the hospital; did not have to fast at the beginning of the diet; did not have calories, protein, or fluid intake restricted; were limited to 10–grams of carbohydrates per day; and were encouraged to eat foods rich in fats. Half the patients showed a marked reduction in seizures.

Based on this initial success, the Johns Hopkins doctors drew up a modified Atkins diet protocol for a group of 20 children, as follows:

- A carbohydrate counting guide is given to the patient's family.
- Carbohydrate intake is limited to 10g per day for the first month.
- A generous intake of fats in the form of mayonnaise, butter, oils, heavy cream, etc. is encouraged, although precise amounts are not defined.
- Clear carbohydrate-free fluids and calories are unrestricted.
- The patient is given a low-carbohydrate multivitamin and a calcium supplement.
- Ketones in the urine are checked twice a week and weight once a week.
- Low-carbohydrate store-bought products (shakes, snack bars, etc.) are discouraged for at least the first month.
- The patient is given a complete blood test and metabolic workup every three months.

Of the 20 patients, two-thirds had a significant reduction in seizures, 9 were able to reduce medication dosages, and none developed kidney stones.

## Function

The function of ketogenic diets is therapeutic—improved control of seizures in children, adolescents, and some adults with epilepsy; treatment of some other rare metabolic disorders; and slowing the progression of such other diseases as amyotrophic lateral sclerosis.

## Benefits

The benefits of the ketogenic diet are improved seizure control without the need for large doses of anticonvulsant drugs with their associated side effects. Patients who respond well to the diet are able to lead more nearly normal lives.

Patients with amyotrophic lateral sclerosis or other disorders being treated experimentally with a ketogenic diet may benefit by having their disease progress at a slower rate even when a cure is not possible.

## Precautions

The most important precaution to note is that the ketogenic diet is *not* a do-it-yourself nutritional regimen. It is a serious form of therapy and requires careful medical supervision as well as parental monitoring. Patients on the diet must be followed by an experienced treatment team, usually based in a specialized epilepsy treatment center. Even though the diet may seem like a more "natural" way to control seizures than taking medications, it is based on a highly unnatural selection of foods and forces the body to obtain its necessary energy in an unusual way.

Another important precaution is preventing the child from accidentally ingesting sugar in over-the-counter medications, toothpastes, mouthwashes, or similar products. A list of sugar-free products can be found in PDF format on the Charlie Foundation website.

## Risks

### *Success rate*

Not all patients respond to the ketogenic diet. According to the Johns Hopkins treatment center, about half the children who begin the classic ketogenic diet will have at least a 50-percent reduction in seizures within 6 months. Half of that group will show greater than 90-percent improvement, with about 15% completely seizure-free. Many families are able to taper or completely eliminate the use of anticonvulsant medications.

As of the early 2000s, there is no way to predict ahead of time whether a child will respond to the diet. It is recommended that the child follow the diet for a period of 2–6 months before deciding that it isn't working. Ineffectiveness is the single most common reason for children's discontinuing the diet, although some discontinue it because they cannot tolerate the foods allowed even after fine-tuning, or because of side effects. The Johns Hopkins program reports that about half the children who begin the ketogenic diet in their treatment center are still using it a year later.

### *Side effects*

Because the 4:1 ketogenic diet is an unnatural way to obtain nutrition, it has some potential side effects. Reported adverse effects in patients using the classic ketogenic diet include:

- Growth retardation caused by protein deficiency.
- Vitamin and mineral deficiencies.
- Nausea, vomiting, or constipation.
- Abnormally high levels of blood lipids after discontinuation of the diet.
- Kidney stones or gallstones. Parents are taught to monitor the child's urine for blood as well as ketone levels, because blood in the urine is often an early sign of kidney stone formation.
- More frequent infections due to a weakened immune system.
- Inflammation of the pancreas.
- Dehydration.
- Decreased bone density.
- Menstrual irregularities (in adolescent and adult females).

## Research and general acceptance

The 4:1 ketogenic diet was the subject of a number of longitudinal studies in the years immediately following Dr. Wilder's initial case report in 1921. Although research lagged in the years after World War II, there has been a significant burst of interest in the diet since the 1990s, with over 200 articles published in the period between 1996 and 2006. As of early 2007, the National Institutes of Health (NIH) is recruiting subjects for three clinical studies of the effectiveness of the classic ketogenic diet and the modified Atkins diet in weight reduction as well as in the management of epilepsy. The NIH recently completed a double-blind study of the effectiveness of the ketogenic diet compared to other forms of treatment in children with epilepsy but has not released its findings

as of early 2007. The National Institute of Neurological Disorders and Stroke (NINDS) is conducting ongoing research in the biochemical effects of the ketogenic diet; scientists are hoping that they might be able to eventually formulate a medication that will have the same effectiveness as the diet itself without the potential side effects.

Another area of recent research is the use of the ketogenic diet in the treatment of other disorders. It appears to be beneficial in the treatment of patients with glucose transporter defects (genetically transmitted disorders in which glucose in the blood cannot cross the blood-brain barrier) and a few other inborn metabolic disorders. In 2006 a group of researchers at Mount Sinai School of Medicine in New York reported that the diet shows promise in slowing the progression of amyotrophic lateral sclerosis, a progressive and fatal disease of the nerve cells that control movement.

## Resources

### BOOKS

"Carbohydrate Metabolism Disorders." Chapter 296, Section 19 in the *Merck Manual of Diagnosis and Treatment*, 18th ed. Edited by Mark H. Beers and Robert Berkow. Whitehouse Station, NJ: Merck, 2007.

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Turner, Zahava, RD, and Eric H. Kossoff, MD. "The Ketogenic and Atkins Diets: Recipes for Seizure Control." *Practical Gastroenterology* (June 2006): 53–64.

Zhao, Z., D. J. Lange, A. Voustianiouk, et al. "A Ketogenic Diet as a Potential Novel Therapeutic Intervention in Amyotrophic Lateral Sclerosis." *BMC Neuroscience* 7 (April 3, 2006): 29.

### VIDEOS AND COMPUTER PROGRAMS

Abrahams, Jim, and Meryl Streep (narrator). *Introductory Video to the Ketogenic Diet*. This is a video for parents of children with epilepsy using the ketogenic diet. It shows step-by-step meal preparation, food choices for the diet, and frank discussions of parents' initial concerns as well as problems that families encounter in adhering to the diet. To order the video, parents should send a written letter and a check for $10 to cover shipping and handling costs to The Charlie Foundation at the address given below.

Ketogenic Diet Program, Epilepsy Association of Maryland. *Ketogenic Diet Computer Program*. This is a computer program for dietitians and parents to help plan meals for a child on a ketogenic diet. It is a Windows-based program requiring an IBM-compatible machine. The computer disk can be purchased ($150 for dietitians, $75 for parents, plus $5 fee for shipping and handling) at the following address: Ketogenic Diet Program, c/o Epilepsy Association of Maryland, 300 East Joppa Road, Suite 1103, Towson, MD 21286-3018. Telephone: (410) 828-7700.

### OTHER

Epilepsy Foundation. *General Information about the Ketogenic Diet*. Landover, MD: Epilepsy Foundation, 2007. Available online at http://www.epilepsyfoundation.org/answerplace/Medical/treatment/diet/ (accessed March 28, 2007).

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Zupec-Kania, Beth, RD. *Non-prescription Products and Medications*. Santa Monica, CA: The Charlie Foundation, 2007. Available online in PDF format at http://www.charliefoundation.org/frames/diet/nonprescriptionproducts.pdf (accessed March 28, 2007). This is a list, updated periodically, of toiletries and over-the-counter medications (moisturizers, sunscreens, liquid antacids, toothpastes, infant teething products, pain relievers, antihistamines, etc.) that are safe for use by persons on a ketogenic diet.

**ORGANIZATIONS**

The Charlie Foundation to Help Cure Pediatric Epilepsy. 1223 Wilshire Boulevard, Suite 815, Santa Monica, CA 90403. Telephone: (800) FOR-KETO or (310) 395-6751. Website: http://www.charliefoundation.org.

Epilepsy Foundation. 8301 Professional Place, Landover, MD 20785. Telephone: (800) 332-1000. Website: http://www.epilepsyfoundation.org.

Johns Hopkins Pediatric Epilepsy Center, Meyer 2-147, The Johns Hopkins Hospital, 600 North Wolfe Street, Baltimore, MD 21287-7247. Telephone: (410) 955-9100. Website: http://www.neuro/jhml.edu/Epilepsy/keto.html.

National Institute of Neurological Disorders and Stroke (NINDS) Brain Resources and Information Network (BRAIN). P. O. Box 5801, Bethesda, MD 20824. Telephone: (800) 352-9424. Website: http://www.ninds.nih.gov.

U. S. Food and Drug Administration (FDA). 5600 Fishers Lane, Rockville, MD 20857-0001. Telephone: (888) INFO-FDA. Website: http://www.fda.gov/.

Rebecca J. Frey, PhD

# Kidney diet

## Definition

The kidney diet, also known as the renal diet, is a set of guidelines for people with kidney disease. The types of foods prescribed depend on the level of kidney failure the patient is experiencing, but generally the diet involves controlling the amount of **sodium**, potassium, phosphorus, **protein**, and fluid that a person ingests. People with kidney disease should be in consultation with a renal dietitian.

## Origins

The kidney diet has been developed and refined by the medical science community, including doctors and hospitals, who have worked with patients with kidney disease. It is based upon scientific research done by many professionals in many different settings, including laboratories, clinics, and hospitals. This research in combination with other available information has been used to develop a set of guidelines to allow patients with kidney failure to eat and drink in a way that helps to manage their disease most effectively.

## Description

There is no single kidney diet. The kidney diet is a set of guidelines for patients experiencing some level of kidney failure. Because every kidney patient is unique, each kidney diet may be slightly different. People who have been diagnosed with kidney failure should see a renal dietician to determine the exact specifications of the kidney diet they should follow. Whether a person is experiencing early or late stages of kidney failure, whether they are receiving dialysis treatment and which type, as well as regular nutritional factors such as height, age, and weight will play a role in determining what sort of diet should be followed. In any case, renal patients must be very careful and take their diet seriously. Careful adherence to a kidney diet can lessen the symptoms of kidney failure and prolong the usefulness of the kidneys.

### *Sodium*

Sodium is a mineral found in many foods and is important to many different bodily functions. One of the most important functions of sodium involves maintaining fluid levels. If too much sodium builds up in the body it causes thirst and fluid buildup. Normally functioning kidneys help to maintain proper levels of sodium in the body. If the kidneys begin to fail however, it becomes more important to maintain appropriate levels of sodium intake.

The easiest way to avoid excess sodium intake is to eliminate putting extra salt on foods. People frequently add salt during cooking and at the table. Even just topping these behaviors will usually cut back significantly on the amount of sodium ingested. It is also important to avoid particularly salty foods such as theater popcorn, potato chips, salted pretzels, bacon and other cured meats, and processed cheese. Checking the ingredients list of processed, frozen, and canned foods is a good way to see how much sodium the product contains. Canned soups are often surprisingly high in salt, but often times there are low-sodium alternatives available.

## KEY TERMS

**Amino acid**—Molecules that are the basic building blocks of proteins.

**Electrolyte**—Ions in the body that participate in metabolic reactions. The major human electrolytes are sodium (Na+), potassium (K+), calcium (Ca 2+), magnesium (Mg2+), chloride (Cl-), phosphate ($HPO_4$ 2-), bicarbonate ($HCO_3$-), and sulfate ($SO_4$ 2-).

**Ion**—An atom or molecule that has an electric charge. In the body ions are collectively referred to as electrolytes.

**Mineral**—An inorganic substance found in the earth that is necessary in small quantities for the body to maintain a health. Examples: zinc, copper, iron.

**Vitamin**—A nutrient that the body needs in small amounts to remain healthy but that the body cannot manufacture for itself and must acquire through diet.

Because salt contributes so much to the flavor of foods, it may be helpful to find replacements for it. Using lemon juice or herb mixtures can add flavor without adding sodium, however mixtures such as garlic salt should not be used because they still have contain a high level of sodium. Artificial salt substitutes should also be avoided because these usually contain high levels of potassium, another mineral that people following a kidney diet need to monitor.

### *Potassium*

Potassium is a mineral found in varying amounts in almost all foods, including fruits, vegetables, meat, and dairy products. The body uses potassium for a variety of important functions such as maintaining fluid and electrolyte balance, sending nerve impulse to muscles, and aiding in metabolic processes. When a person's kidneys are functioning normally they filter out excess potassium, helping to maintain the proper amount in the body. Without properly functioning kidneys, patients need to control their potassium intake.

Avoiding foods with high levels of potassium, while maintaining a healthy diet, can be quite difficult because many fruits and vegetables are high in potassium. Oranges, broccoli, tomatoes, potatoes, and carrots are all high in potassium. Apples, blueberries, grapes, strawberries, lettuce, and onions are all relatively low in potassium. Canned vegetables and the juices they are usually canned are particularly high in potassium. For patients with kidney problems who want to eat certain high potassium vegetables, there is one method for removing some of the potassium, called leaching. This process varies depending on the vegetable, but generally it involves repeatedly rinsing and boiling the vegetable in a large amount of **water**.

### *Phosphorus*

Phosphorus is another mineral found in many foods. The body must maintain a proper balance of phosphorus and **calcium** in order to build and preserve healthy bones. Normally, the kidneys help to maintain this balance by removing excess phosphorus from the bloodstream. However, patients with kidney disease may need to take steps to maintain this balance by watching what they eat, because their kidneys are no longer able to do this important job. If too much phosphorus builds up in the body it can pull calcium out of the bones, making them weak and easily breakable.

People following a kidney diet may be told to avoid foods that are high in phosphorus, such as beer, soda, cheese, milk, yogurt, oysters, beans, peas, nuts, and many whole grain products. A renal dietician may also prescribe a phosphate binder, which can help control the amount of phosphate that the body absorbs.

### *Protein*

Proteins are complex organic molecules made of amino acid chains. The body uses these chains to build and maintain muscles, organs, and glands. When the body breaks down protein it produces a waste product called urea. This waste product is usually filtered out by the kidneys and expelled from the body in urine. Patients experiencing kidney failure must be careful about the amount and type of protein they consume because the kidneys are no longer doing a good job of removing urea. If too much urea builds up in the body it can cause serious illness. Patients must be sure to get enough protein however, because without protein the body is not able to perform proper muscle maintenance.

Before kidney patients begin dialysis treatments, they are usually told to follow a **low-protein diet**. However, once dialysis treatment begins, a renal dietician will usually tell the patient to consume large amounts of high quality protein, otherwise known as

complete protein. While many plants do supply protein, high quality proteins are mainly found in meat and eggs.

### *Fluid Intake*

When patients are experiencing kidney failure, their kidneys are no longer removing water from the body with proper efficiency. The worse that the kidneys are functioning, the more important it is for patients to monitor their fluid intake. Water retention can cause swelling in the feet and ankles, as well as other parts of the body. The most recommended method for preventing water retention is to monitor salt intake, as recommended above.

## Function

The function of the kidney diet is to help patients with kidney disease to feel better, limit their symptoms, and slow the development of kidney failure. For people with kidney disease, it is important to maintain the proper balance of **electrolytes**, **minerals**, and fluid in the bloodstream. For patients undergoing dialysis treatments, this becomes even more important. This is because the kidneys work to rid the body of excess electrolytes, minerals, and fluid by filtering the blood. When a person's kidneys are not functioning properly, these substances can build up in the body and cause symptoms such as nausea, vomiting, tiredness, weakness, sleepiness, and other problems. If patients lower their intake of certain substances they can help to control these problems, but if they limit these same substances too severely, they can suffer from malnutrition. The kidney diet is designed to help patients find the best balance for their body.

## Benefits

The benefits of the kidney diet are enormous. Patients who have been diagnosed with early to late kidney failure must follow a special diet in order to slow deterioration and lessen their symptoms. Patients who do not follow a special diet will inevitably see their disease become worse more quickly. Patients who do follow this diet usually feel better and can prolong the use of their kidneys.

## Precautions

People with any level of kidney failure should be under medical supervision. Patients will usually need to work closely with a renal dietician who can monitor important levels of electrolytes, minerals, and fluids to make sure that patients are maintaining proper nutrition while limiting the load on their kidney and other bodily systems. The diet for dialysis patients is especially strict and should be taken extremely seriously in order avoid further complications.

## Risks

While there are risks to following the kidney diet guidelines, they are usually far outweighed by the risks of not following the guidelines. Patients should work with a renal dietician to determine their specific requirements. **Dietary supplements** will usually be needed to maintain proper nutrition.

A concern for kidney patients is that they maintain proper protein levels. Kidneys, when functioning normally, remove urea, a waste product of protein, from the bloodstream. When kidneys are not functioning properly, urea can build up in the system and make patients ill. Because of this patients with kidney failure need to limit the amount of protein in their diets. However, it is important for patients to not be overzealous in their limiting of protein, because too getting too little protein can also have serious health consequences.

Patients with kidney disease also run the risk of losing bone calcium due to high phosphorus levels. If patients do not take a phosphate binder, phosphorus in the blood will pull calcium from the bones, making them weak and brittle.

Potassium levels are also important to people with kidney disease. This mineral affects the steadiness of the heartbeat and its level in the bloodstream is normally kept steady by the kidneys. If there is too much potassium in the blood it can be very dangerous for the heart, and possibly even fatal.

Maintaining daily calorie intake is a concern for patients following a kidney diet. With the great number of restrictions placed on the kinds of foods a person can eat it can be difficult for a patient to eat enough calories each day. However if overall caloric intake is not maintained at high enough levels the patient can suffer body tissue breakdown.

If patients with later stages of kidney disease do not pay close attention to their sodium and fluid intake they have a serious risk of retaining water. Fluid can build up and cause painful swelling and weight gain. It also can cause blood pressure to rise which can adversely affect the heart. Kidney disease patients also have a greater risk of heart disease. Following a **low-fat diet** will usually be necessary.

## QUESTIONS TO ASK THE DOCTOR

- What kinds of foods should I avoid?
- What kinds of foods are best for me?
- How severe is my kidney failure?
- When should I begin consulting a renal dietician?
- Should I consider eating during dialysis?
- How will I know what levels of sodium, potassium, fluid, phosphorus, and protein are right for me?
- Are there any sign or symptoms that might indicate a problem while on this diet?

### Research and general acceptance

The kidney diet is the accepted diet for people with kidney disease, especially those patients who are on dialysis. The is little or no debate that it is essential for patients experiencing kidney failure to closely monitor their diet. A doctor may also prescribe other treatments in addition to a special diet.

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National Kidney Foundation. 30 East 33rd Street, New York, NY 10016. Telephone: (800) 622-9010. Website: <http://www.kidney.org>

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Helen Davidson

Korean diet *see* **Asian diet**

# L

## LA Weight Loss program

### Definition

The LA Weight Loss program is a diet plan based around weight loss centers. The centers offer counseling, personalized weight loss planning, and exercise guidelines.

### Origins

The LA Weight Loss Centers company was founded by Vahan Karian in 1989. It was founded as a privately held company and remains so today. The company grew very quickly; in 1994 there were 18 LA Weight Loss Centers and by 2006 there were more than 800. It claims to be one of the fastest growing weight management companies in the world. The company is headquartered in Horsham, Pennsylvania.

### Description

LA Weight Loss Centers can be found throughout the United States, with locations in every state except Alaska. They also have centers in Canada, Australia, Puerto Rico, and Costa Rica. These centers are the basis for the LA Weight Loss program. The centers provide personal one-on-one counseling and work with dieters to develop personalized meal plans and customized exercise guidelines. Counselors at the centers also provide emotional and motivational support.

The LA Weight Loss program involves helping dieters learn to use regular foods, available at their normal supermarket, to create healthy meals. Dieters have the option of purchasing special LA Weight Loss foods, but the company says this is not a necessary part of the program. Counselors at the LA Weight Loss Centers teach dieters about nutrition and how to eat a balanced diet. Dieters are also taught how to eat healthy nutritious foods, even when eating at their favorite restaurants. Counselors also help to develop an exercise program for each individual dieter.

The first step to the LA Weight Loss plan is an individual meeting with one of the counselors at an LA Weight Loss Center. In that meeting dieters determine their current health status and their weight loss goals. Together with a counselor, they also then build a plan for attaining those goals. After the initial meeting, dieters can call anytime they need encouragement or want to setup another meeting to review their progress.

In addition to the weight loss centers, the company offers an online version of their weight loss plan called "LA at Home." The online version is based on the same principles as the center-based plan. Dieters can receive online counseling that will design a personalized weight loss plan and provide ongoing support. Online tools are available to help with meal planning, choosing restaurants, ordering foods, and also allow dieters to track their progress. Dieters who join the online program can also submit their favorite recipes to the "LA Chef" and receive instructions on how to create a healthier version of their favorite foods. Through the website, dieters can also purchase LA Weight Loss food products.

One of the hallmarks of the LA Weight Loss Program has been celebrity endorsements. In television and print commercials, as well as through their website and other promotional materials, celebrities have partnered with the company and promoted its message. The list of celebrities to do this includes actress Whoopi Goldberg, actor Steve Harvey, Philadelphia Eagles Coach Andy Reid, Chicago Bears Coach Mike Ditka, as well as former NFL greats Ron Jaworski, Jim Kelly, Joe Greene, Ed Jones, and Dan Dierdorf.

Separate from their regular weight loss plan, LA Weight Loss Centers offer "The Man Plan." Unlike most diet plans, which tend to cater to women, this plan is aimed at men. Marketing materials for the plan

## KEY TERMS

**Dietary supplement**—A product, such as a vitamin, mineral, herb, amino acid, or enzyme, that is intended to be consumed in addition to an individual's diet with the expectation that it will improve health.

**Mineral**—An inorganic substance found in the earth that is necessary in small quantities for the body to maintain a health. Examples: zinc, copper, iron.

**Vitamin**—A nutrient that the body needs in small amounts to remain healthy but that the body cannot manufacture for itself and must acquire through diet.

feature famous sports figures who say they've lost weight using the plan. It is intended to satisfy a larger appetite using foods like pizza, hot dogs, and potatoes. Men can use the plan by going into one of the LA Weight Loss Centers or by joining online. Like the regular plan, it uses one-on-one counseling to design a personalized weight loss strategy. Also like the regular plan, "The Man Plan" allows dieters to eat at restaurants and prepare meals using foods available at the supermarket.

### *Legal troubles*

LA Weight Loss Centers, Inc. has been involved in several legal disputes. In 2002, New York State Attorney General Eliot Spitzer reached a settlement with the company over allegations that they made false claims about the cost of their weight loss program, were slow to issue refunds, and had not posted the bond required from health club service providers. The company was ordered to pay a civil penalty of $100,000, issue refunds to New York State customers who did not receive them, post a $275,000 bond, and cease misrepresenting the true cost of the program. In 2005, Washington State Attorney General Rob McKenna reached a settlement with the company over similar allegations. In that case, LA Weight Loss Centers were required to pay up to $800,000 in reimbursements to Washington customers and a separate fine to be used for consumer education. In neither case did the company admit any wrong doing.

## Function

LA Weight Loss Centers are intended to provide a source of support and guidance to those who want to lose weight and maintain good health. They are designed to provide one-on-one support for dieters, as well as help dieters design diet and exercise plans tailored to their specific needs and lifestyle.

## Benefits

There are many benefits to losing weight, being more healthy, and being more fit. The benefits of weight loss can be very significant, as many diseases and disorders, such as diabetes, are associated with being obese. The more overweight a person is, generally the greater their risk is for getting these diseases. Weight loss, if achieved at a moderate pace through a healthy diet and regular exercise can reduce the risk of these and other obesity-related diseases. Increased exercise can also reduce the risk of cardiovascular diseases, and can improve overall health.

The LA Weight Loss Center's program may have additional benefits for some people. Because the program is designed around the dieter meeting one-on-one with counselors, this may help some people stay on track to achieve their desired weight loss goals. This also means that counselors may be able to help the dieter design diet and exercise plans that center around the dieter's favorite foods or activities, or are designed to be able to fit into the dieter's busy schedule.

## Precautions

Anyone thinking of beginning a new diet or exercise program should consult a doctor or other medical practitioner. Requirements of calories, fat, and nutrients can differ from person to person, depending on gender, age, weight, and many other factors such as the presence of any disease or conditions. Pregnant or **breastfeeding** women should be especially cautious because they may need increased amounts of **vitamins** and **minerals**, and deficiencies can be harmful for a baby. Exercising too strenuously or beginning a rigorous exercise program too suddenly can lead to an increased risk of injury. Dieters should be advised that consultants for LA Weight Loss are not required to have certifications in personal fitness or nutrition. This means that dieters may want to consult other sources in addition to their counselors.

## Risks

With any diet and exercise plan there are some risks. It can be difficult for a dieter to get enough vitamins and minerals when eating a limited diet. Anyone beginning a diet may want to consult their physician about whether taking a vitamin or supplement might help them reduce this risk. Supplements have

## QUESTIONS TO ASK THE DOCTOR

- Is this diet the best diet to meet my goals?
- At what level of intensity is it appropriate for me to begin exercising?
- Does diet or exercise pose any special risk for me that I should be aware of?
- Would a multivitamin or other dietary supplement be appropriate for me if I were to begin this diet?
- Is this diet appropriate for my entire family?
- Is it safe for me to follow this diet over a long period of time?
- Are there any sign or symptoms that might indicate a problem while on this diet?

their own risks and possibilities of side effects. Following proper warm up and cool down procedures can help to minimize the risk of injury during exercise. It may be recommended that a dieter begin with light or moderate exercise and slowly increase the intensity of the exercise over weeks or months.

### Research and general acceptance

There have been no scientific studies of the methods promoted by LA Weight Loss Centers. Their food products have not been proven to help dieters lose weight or live a more-healthy lifestyle. Because each dieter's diet will be different it is difficult to say if the LA Weight Loss program will provide what is generally recognized as a healthy, well balanced diet. The United States Department of Agriculture provides food guidelines in its MyPyramid, the updated version of the food guide pyramid. Generally, for healthy adults, any diet program that is healthy should follow these guidelines. They can be found online at <http://www.mypyramid.gov>.

The LA Weight Loss plan is generally expected to include some form of exercise plan. In 2007 the Centers for Disease Control recommended that healthy adults get at least 30 minutes a day of light to moderate exercise. Because each dieter will have a personalized plan it is not possible to determine if this minimum recommendation will be met. Exercise is a very important part of a healthy lifestyle and has been shown to reduce the risk of cardiovascular disease. Studies have shown that weight loss is achieved more effectively through programs that combine diet and exercise than programs that focus on just one aspect alone.

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Helen Davidson

# Lactose intolerance diet

### Definition

Lactose intolerance is a condition caused by the inability to digest lactose, a sugar found in milk. The lactose intolerance diet is a diet designed to treat the symptoms that result from undigested lactose.

### Origins

No single person originated the lactose intolerance diet. Physicians treating symptoms of lactose intolerance have developed this diet through observation and trial and error by their patients.

### Description

Lactose is the main sugar in milk. Normally when lactose reaches the small intestine, it is broken down into simpler sugars by the enzyme lactase. These simpler sugars are absorbed into the bloodstream and eventually are used as fuel for he body.

Lactase is made in the cells that line the small intestine. In some people, these cells do not make enough

**Calcium and lactose in common foods**

| Foods | Calcium content (mg) | Lactose content(g) |
|---|---|---|
| Soymilk, fortified, 1 cup | 200–300 | 0 |
| Sardines, with edible bones, 3 oz. | 270 | 0 |
| Salmon, canned, with edible bones, 3 oz. | 205 | 0 |
| Broccoli, raw, 1 cup | 90 | 0 |
| Orange, 1 medium | 50 | 0 |
| Pinto beans, ½ cup | 40 | 0 |
| Tuna, canned, 3 oz. | 10 | 0 |
| Lettuce greens, ½ cup | 10 | 0 |
| **Dairy products** | | |
| Yogurt, plain, low-fat, 1 cup | 415 | 5 |
| Milk, reduced fat, 1 cup | 295 | 11 |
| Swiss cheese, 1 oz. | 270 | 1 |
| Ice cream, ½ cup | 85 | 6 |
| Cottage cheese, ½ cup | 75 | 2–3 |

SOURCE: National Institute of Diabetes and Digestive and Kidney Diseases, National Institutes of Health, U.S. Department of Health and Human Services

*(Illustration by GGS Information Services/Thomson Gale.)*

lactase. In a few people, they do not make any at all. When people do not make enough lactase, they cannot digest some portion of the lactose they have eaten. Lactose that is not broken down cannot be absorbed into the blood. Instead, it remains in the large intestine (colon) where bacteria convert it into lactic acid. Lactic acid is a laxative and an irritant to the colon.

Symptoms of lactose intolerance include nausea, bloating, abdominal pain or cramps, abundant gas, and diarrhea. These symptoms usually begin anywhere from 30 minutes to 2 hours after eating a food that contains lactose. Symptoms of lactose intolerance can be uncomfortable enough to temporarily interfere with daily activities, however, they do not harm the digestive system and lactose intolerance does not progress to any other disease or disorder.

Lactose intolerance is an extremely common condition. It rarely develops before age six, and is due to a genetically programmed decline in lactase. This decline begins around age two, the age when most infants have finished the transition from breast milk to solid food. In some people this decline continues to the point where in late childhood or early adulthood they develop lactose intolerance symptoms. Lactose intolerance is strongly linked to race and ethnicity. People of Northern European ancestry have the lowest rate of lactose intolerance, about 5% In Hispanic, Jewish, and Southern European populations, the rate is about 70%, and it reaches 90% or more in Asian and African populations. Worldwide, in adults the inability to digest lactose is much more common than the ability to digest it. Although the symptoms are similar, lactose intolerance is not the same as cow's milk intolerance. Cow's milk intolerance is a food allergy and causes an allergic reaction. Only about 3.4% of Americans have cow's milk intolerance.

## KEY TERMS

**Enzyme**—a protein that change the rate of a chemical reaction within the body without themselves being used up in the reaction

The degree to which people are lactose intolerant varies widely. Some people can drink a glass of milk daily without developing unpleasant symptoms. Others can drink only small amounts of milk at a time, and have fewer symptoms if milk is mixed with food. Some people can eat cheese, ice cream, or yogurt, but cannot drink milk. A few people are 100% lactose intolerant and even the smallest amount of lactose will produce unpleasant symptoms.

Although the greatest quantities of lactose are found in milk and dairy products, milk is used in the preparation of many processed foods such as chocolate bars, puddings, and soups. Food labels must list all the ingredients in processed foods. Lactose intolerant individuals should look for these words on the label that indicate the presence of lactose: milk, condensed milk, whey, curds, milk-by-products, dry milk solids.

Lactose is found in other unlikely places such as:

- bread and baked goods and biscuit, pancake, and cookie mixes
- processed breakfast cereals and breakfast drinks
- instant mashed potatoes
- lunch meats (except kosher meats which are lactose-free)
- salad dressings
- all chocolate candies, caramels, butterscotch, and many others
- as filler in medications. As many as 6% of prescription and over-the-counter drugs contain lactose.

The amount of lactose found in these hidden sources is not enough to affect most people, but for the severely lactose intolerant, it can be enough to cause symptoms and make meal planning a necessity and eating out difficult.

Many individuals diagnose themselves as lactose intolerant using an elimination diet. However people

who think they may be lactose intolerant should see their physician because the symptoms of lactose intolerance can be quite similar to those of more serious and sometimes progressive diseases such as **celiac disease** (a gluten intolerance), **Crohn's disease**, giardia (a parasitic infection of the bowel), and **inflammatory bowel disease**. Lactose intolerance can be diagnosed by giving the individual lactose and then measuring changes in the sugar (glucose) level in their blood. In lactose intolerant individuals lactose is not broken down into sugars that can be absorbed from the intestine. Therefore, the level of glucose in the blood will be lower than expected. Lactose can also be diagnosed by a hydrogen breath test.

## Lactose and diet

Lactose intolerance is treated by eliminating lactose from the diet beyond the level where it produces symptoms. Alternately, enzymes such as LACTAID or Dairy Ease can be added to milk 24 hours before drinking. These enzymes pre-digest lactose and can eliminate 70–99% of it. Lactose-reduced milk is available at many supermarkets. All LACTAID and Dairy Ease milk is 70% lactose-free except for non-fat LACTAID, which contains no lactose. When eating other foods that contain lactose, LACTAID and Dairy Ease capsules are taken at the same time that an individual begins eating. These capsules contain enzymes to help digest lactose.

Since dairy products are the main source of **calcium** in the standard American diet, people who eliminate milk, cheese, yogurt, and other dairy products must adjust their diet to get enough calcium. Calcium is critical to building and maintaining strong bones and teeth and is needed for metabolic processes such as muscle contraction and nerve impulse transmission.

The United States Institute of Medicine (IOM) of the National Academy of Sciences has developed values for the adequate intake (AI) of calcium. These values are based on age and gender. Some nutritionists and researchers believe that they are too low. The AI values for calcium are listed below.

- children birth–6 months: AI 210 mg
- children 7–12 months: AI 270 mg
- children 1–3 years: AI 500 mg
- children 4–8 years: AI 800 mg
- children 9–13 years: IA 1,300 mg
- adolescents 14–18 years: IA 1,300 mg
- adults age 19–50: IA 1,000 mg
- adults over age 50: IA 1,200 mg
- pregnant women 18 years and younger: IA 1,300 mg
- pregnant women over age 18: IA 1,000 mg
- breastfeeding women 18 years and younger: IA 1,300 mg
- breastfeeding women over age 18: IA 1,000 mg

Some good sources of calcium that do not contain lactose are:

- sardines with bones, canned in oil, 3 ounces: 270–325 mg
- salmon with bones, canned, 3 ounces: 180–205 mg
- tofu, firm, made with calcium sulfate added, 1/2 cup: 204 mg
- pinto or red beans, cooked, 1/2 cup: 43 mg
- white beans, cooked, 1/2 cup: 113 mg
- bok choy, 1/2 cup cooked: 61 mg
- bread, whole wheat, 1 slice: 20 mg
- orange juice, fortified with calcium, 6 ounces: 200–260 mg
- soymilk, 1 cup: 200–300 mg

A dietitian can help the severely lactose intolerant person develop a meal plan that will meet their dietary need for calcium and/or recommend a calcium supplement. Calcium supplements are available over-the-counter at pharmacies and supermarkets.

## Function

Lactose intolerance cannot be cured. The purpose of the lactose intolerance diet is to bring the symptoms of bloating, gas, abdominal discomfort, and diarrhea under control so that the individual is comfortable, and the symptoms do not disrupt his or her daily activities.

## Benefits

The benefit of a lactose intolerant diet is that the uncomfortable symptoms of bloating, nausea, stomach cramps, and diarrhea are controlled.

## Precautions

Lactose intolerance is variable. Individuals must work out through trial and error how much and which lactose-containing foods then can eat without stimulating symptoms. During trial and error experimentation, there will be moments of misjudgment when symptoms develop.

## Risks

The greatest risk to this diet is that the individual will not get enough calcium.

## QUESTIONS TO ASK THE DOCTOR

- Why do you think my symptoms are caused by lactose intolerance and not another gastrointestinal disorder.
- Do you recommend using lactose-reduced milk or enzyme pre-treatment of milk, or is it better to simply eliminate milk from my diet?
- Should I take a calcium supplement? If so, how much and how often?
- Can my children inherit this condition?

### Research and general acceptance

The lactose intolerant diet is accepted by medical professionals as a standard treatment for this condition. The diet has existed for many years and is not controversial.

### Resources

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International Foundation for Functional Gastrointestinal Disorders. P. O. Box 170864, Milwaukee, WI 53217, Telephone: (888) 964-2001. Fax: (414) 964-7176. Website: <http://www.iffgd.org>

National Digestive Diseases Information Clearinghouse (NDDIC). 2 Information Way Bethesda, MD 20892-3570. Telephone: (800) 891-5389. Fax: (703) 738-4929. Website: <http://digestive.niddk.nih.gov>

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# Lacto-vegetarianism

### Definition

The term 'vegetarian' is non-specific. It is used to describe a whole range of diets, practiced with differing degrees of restrictio9n. Vegetarians are sometimes referred to as 'semi-' of 'demi-' vegetarian, if they merely exclude meat. Then more widely accepted classifications are listed below.

Semi/Demi- vegetarian: refers to individuals who exclude red meat or all meat, but fish and other animal products are still consumed. Some people also exclude poultry.

Lacto-ovo-vegetarian: this term refers to individuals who consume dairy produce and eggs but who exclude all meat, fish and poultry. This is the most common type of vegetarian diet adopted in modern society.

Lacto-vegetarian: this term refers to individuals who adopt similar eating patterns to lacto-ovo-vegetarians however, lacto-vegetarians do not consume eggs.

Vegan: this term refers to individuals who will not consume foods of animal origin.

Fruitarian: is an extreme form of veganism which excludes all food of animal origin but also excludes pulses and cereals.

Macrobiotic: is an extreme diet which dictates that bodily spiritual well-being is dependent on the balance between Yin and Yang, representing the positive and negative aspects of life. The diet progresses thorough ten levels, becoming increasingly restrictive and gradually eliminating foods of animal origin, fruit and vegetables. At the final levels only cereal (brown rice)

is eaten. Although the earlier levels of the diet may be sufficiently varied to permit a nutritionally complete status this is unlikely in the final stages.

The above classification system has developed over the years to help reflect the differing degrees of adoption of **vegetarianism**. It is lacto-vegetarianism, which is discussed here.

## Origins

Vegetarianism has been practised throughout history for a variety of religious, cultural, philosophical, social and economic reasons. Similarly, for centuries, people have expressed concerns about animal welfare, environmental, ethical and proposed health benefits associated with the consumption of animals and animal-based products. Consequently, many individuals over the years have chosen to either exclude or reduce their consumption of animal meats and associated products. Many followers of religions faiths have similarly adopted differing degrees of vegetarian-type eating patterns including Buddhism, Jainism and Hindus.

Vegetarian eating patterns are not a recent phenomenon, but rather date back over hundreds of years. Interestingly, famous vegetarians include, Plato, Socrates, Pythagoras plus writers Pope and Shelley. The following of the vegetarian movement over the years has lead to the creation of many different societies. The majority of these societies aim to provide forums for people to increase their knowledge and make informed choice in terms of commencing or maintaining vegetarian eating patterns.

In the earlier stages of the vegetarian movement there was a scarcity of evidence and knowledge to help support people making the decision to adopt vegetarian eating patterns. Over the years, however, a wealth of evidence-based research has provided the public with information about how to go about ensuring that dietary intake is balanced despite the exclusion of animal products. Research has also suggested health benefits associated with vegetarianism.

## Description

A varied lacto-vegetarian diet aims to provide all of the essential nutrients that the body requires in suitable amounts to help ensure nutritional adequacy and minimise the risk of deficiencies of nutrients.

As with any pattern of eating, it is difficult to make generalisations about the pros and cons of vegetarianism as the diet adopted by each individual will vary considerably depending on the reasons for adopting vegetarianism and consequently the restrictions practised. Whether or not a vegetarian diet is nutritionally balanced is dependent on the range and amounts of foods selected.

The general dietary recommendations are that the general healthy eating guidelines as applied to the general meat-eating population also apply to vegetarians. As with all diets, care needs to be taken to ensure that foods are selected with a view to ensuring a nutritionally balanced mix. Consequently, for lacto-vegetarians the principles of healthy eating as illustrated by the food pyramid can be adapted to reflect the dietary needs of this cohort of individuals. Ensuring that substitute foods of similar nutritional value are introduced helps achieve an adequate dietary intake. The principles of healthy diet suggest:

Eating regular meals (and snacks if required) throughout the day based on starchy carbohydrates (bread, potatoes, pasta, rice, cereals) at each mealtime.

Large intake of fruit and vegetables to help ensure micronutrient (vitamins and minerals) intake is adequate to help reduce the risk of cancer and heart disease. This includes fresh, dried, frozen and juiced fruit and vegetables.

Moderate portions of protein sources such as soy, a high quality protein (instead of meat, fish and eggs) and dairy produce (cheese, milk and yogurts).

Beans, pulses, legumes, and nuts—low quality proteins that need to be combined with other sources of protein to ensure adequate intakes of essential amino acids.

Inclusion of small portions of foods high in refined sugar and fat as large intakes of these foods can increase risk of obesity, cancer and heart disease.

In summary, eating a broad range of foods on a daily basis can help ensure that lacto-vegetarians achieve their full nutritional requirements daily. Therefore, discussing each of the shelves individually as applied to the lacto-vegetarians will help translate and apply the information from the food pyramid.

## The Starchy Carbohydrate shelf

The bottom shelf, which is the largest shelf contains starchy **carbohydrates** and is relatively similar for both meat eaters and lacto-vegetarians. Foods on this shelf include, bread, cereals, rice, potatoes, yams, oats, corn, rye, millet, rye, barley, quinoa, buckwheat and cous cous. Foods including pasta made with egg are not an option for lacto-vegetarians but are for meat eaters. However, egg-free pasta is now readily available as a suitable substitute.

## KEY TERMS

**Amino Acids**—These compounds are the building blocks of protein. Some amino acids can be synthesised by the body but some cannot. The latter are referred to as essential amino acids and therefore must be obtained from protein in the diet.

**Anaemia**—Anaemia refers to a reduction in the quantity of the oxygen-carrying pigment haemoglobin in the blood. The main symptoms of anaemia are excessive tiredness and fatigability, breathlessness on exertion, pallor and poor resistance to infection.

**Calcium**—Calcium is a mineral present in large quantities in the body, mainly in the bones and teeth. A deficiency of calcium in the diet can increase risk of osteoporosis. Rich sources of calcium include mil, cheese, yoghurt and tofu.

**Carbohydrates**—carbohydrates are a major source of energy. Carbohydrates in the diet are principally made up of starches, sugars and dietary fibre.

**Fats**—Fat is a concentrated source of energy. Foods that are high in fat provide a lot of energy and are good sources of vitamins, A, D, E, and K and provide essential fatty acids.

**Fiber**—Dietary fiber is a non-specific term for that fraction of dietary carbohydrate that cannot be digested in the human small intestine. An adequate intake of dietary fiber is required to maintain bowel function. Some types of fiber can help lower cholesterol.

**Minerals**—These are elements which are essential for the body's normal function including calcium, iron, phosphorous, magnesium, sodium, chloride, iodine, manganese, copper, and zinc.

**Proteins**—These are large molecules which are made up of thousands of amino acids. The primary function of protein is growth and repair of body tissues.

**Vitamins**—These are compounds required by the body in small amounts to assist in energy production and in cell growth and maintenance. They are essential for life and with the exception of vitamin D, cannot be made in the body. They should ideally be consumed from food. However, individuals who struggle to eat can obtain their vitamin requirements from dietary supplements.

**Vitamin $B_1$ (thiamin)**—A vitamin which plays an important role in carbohydrate metabolism. A deficiency can lead to a disorder called Beri Beri, which results in a widespread nerve degeneration, which can damage the brain, spinal cord and heart. Good sources of this vitamin for lacto-vegetarians include cereals, beans, potatoes and nuts.

**Vitamin $B_2$ (riboflavin)**—A vitamin or co-enzyme, which functions by helping the enzymes in the body function correctly. A good source of this vitamin for lacto-vegetarians is milk.

This is the largest shelf because these foods are low in fat, are good sources of energy and provide varying amounts of fiber (not all starchy carb foods are broken down slowly). Therefore, these foods help us feel full quickly and for longer and reduce the risk of snacking throughout the day. Some of these foods are available in fiber-rich varieties, for example, brown rice, wholemeal pasta and bread. Fiber-rich options help enhance the sensation of fullness, further delay the rate at which the foods are broken down and again contribute to reducing the risk of snacking. They do this by helping to ensure that our energy levels (blood sugar levels) remain consistent throughout the day and reduce sensations of hunger. Fiber-containing foods also help to regulate bowels and reduce the risk of **constipation**. In general, these foods provide energy, B **vitamins** and some contain fibre. For optimum benefits, food from this food group should be included at each mealtime.

### The Fruit and Vegetable shelf

The second shelf from the bottom, includes fruit and vegetables. This shelf is again similar for meat eaters and lacto-vegetarians. These foods aim to provide essential vitamins and **minerals**, which can help reduce our risk of **cancer**, stroke and heart disease and contribute to the maintenance of general good health. These foods supply nutrients including, **vitamin A**, **vitamin C**, **folate** and are a good source of fiber. The worldwide recommendations for fruit and vegetables vary somewhat, however, the general consensus encourages a minimum of 5 portions of fruit and vegetables per day.

## The Milk and Dairy Foods shelf

The middle shelf, contains dairy produce including, milk, cheese, yogurt, fromage frais, soya products. Lacto-vegetarians include dairy produce as part of their intake. Nonetheless, some lacto-vegetarians may still choose to include some dairy-free options such as soya-based products as part of their dietary intake. It is important to note that soya-based products are typically low in **calcium** and individuals are encouraged to opt for brands, which indicate on the food labels that they are fortified with calcium.

The main nutrient that these foods provide is calcium, which is a mineral essential for healthy bones and teeth. These foods are also a rich source of **protein**, energy, vitamin $B_2$ (**riboflavin**), vitamin A and vitamin $B_{12}$. Calcium requirements vary greatly from one individual to the next depending on age and gender. However, for adults, a minimum of three portions is recommended per day from this shelf to help achieve an adequate calcium intake. Low fat versions of the foods from this group are encouraged, as some of the foods on this shelf can be naturally high in fat.

## The Protein shelf

This shelf for Lacto-vegetarians, aims to help achieve protein requirements. The foods on this shelf include pulses, lentils, vegetarian cheese, nuts, quorn, textured vegetable protein and meat analogues, seeds, tofu and peas, for example, gungo and chick peas.

The main nutrient provided by this food group is protein. Protein is a very important nutrient because it makes up part of the structure of every cell in our bodies. There is a constant turnover of cells in the body, therefore an adequate supply of protein is essential for good health. Protein foods should not be the main source of fuel for the body; this should come from starchy carbohydrates. Protein can only be used efficiently if there is sufficient energy (calories) in the diet; for example, someone consuming large intakes of protein and only small amounts of starchy carbohydrates will end up using protein as their main energy source. This means there may be insufficient amounts to meet the daily protein needs of the body. Following diets, which suggest this regimen, should be discussed with a qualified doctor or dietitian, in advance of commencing such restrictive patterns, as this type of diet is generally not advisable and may be dangerous.

The foods on this shelf also provide energy, B vitamins, **iron** and some calcium. The recommended daily intake from this food group varies from one individual to the next but, in general, two to three portions are required from this food group per day for children and adults.

## The Top Shelf

This shelf contains food high in fat and sugar. It includes oils, sugar (including sugary drinks), honey, fruit spreads, pastries, croissants, pies, cream, vegetarian spreads, mayonnaise, confectionery including sweets, chocolate and cakes, and biscuits and crisps. Alcoholic beverages are also included as part of this group. These foods should be seen as occasional foods. They are typically high in calories, sugar or fat and very low in vitamins and minerals. It is acceptable to include foods from this group on a daily basis however most of your daily food intake should not come from this shelf.

## Benefits

A well planned lacto-vegetarian diet can be nutritionally balanced and health promoting for both adults and children. However, it is essential to ensure if certain foods are excluded from the diet that these are replaced with suitable nutritionally equivalent foods. The secret of a good diet is to eat a wide variety of foods and people need to avoid the temptation to choose the same meals and foods when grocery shopping.

Much research suggests that individuals who adopt vegetarian eating patterns are less likely to suffer from **Obesity**, **Coronary Heart Disease** (CHD), high blood pressure, type 2 Diabetes, certain nutrition-related cancers and constipation. Other research indicates that vegetarians tend to be of lower body weight and consequently they have a lower risk of the aforementioned illnesses. However, it is important to note that risks of these illnesses in meat eaters are also reduced if dietary intake is based on the recommended food pyramid. In general, however, people who choose vegetarian diets tend to be more healthy in their lifestyles and other food choices.

## Precautions

A Lacto-vegetarian diet is generally lower in fat and higher in both fibre and **antioxidants** than a meat-based diet. People wishing to adopt lacto-vegetarian-eating habits need to know how to go about it safely. It requires a good deal of thought in the early stages. Therefore it is worthwhile briefly touching on some of the nutrients that may require additional care to ensure intake is adequate as a lacto-vegetarian.

### *Iron*

Iron is essential for the formation of red blood cells, which carry oxygen to all parts of the body. A low body iron level can result in anaemia. Iron from non-meat sources is referred to as non-haem iron whereas iron from meat sources is haem iron. The body is able to absorb haem iron better than non-haem iron. Consequently, in the past individuals were concerned about ability to achieve sufficient iron intakes owing to the exclusion of iron-rich (haem) sources of meat, poultry and fish and therefore the increased risk of iron-deficiency anaemia. However, it is now recognised that iron (non-haem) is also found in green leafy vegetables, pulses, wholemeal bread, fortified cereals, dried fruit and nuts and seeds including sesame, pumpkin and sunflower seeds. It is recommended that to aid the absorption of non-haem iron from food that individuals aim to include a vitamin C source when consuming food rich in non-haem iron as vitamin C help to enhance the absorption of the iron in this form, for example, having a glass of pure orange juice with a bowl of breakfast cereal or an egg sandwich can help aid absorption.

### *Vitamin $B_{12}$*

Vitamin $B_{12}$ is essential for healthy blood and nerve cells. This vitamin is not naturally found in plant foods and the main sources of this vitamin are from animal based foods. Alternative sources for lacto-vegetarians include dairy produce, yeast extracts, some vegetable stocks, soya milks, fortified breakfast cereals and textured vegetable protein.

### *Fatty Acids*

The omega-3 essential fatty acids found in oily fish are also found in vegetarian foods such as rapeseed oil, flax sees and walnuts. It is now recognized that these oils play an important role in the development of the baby's brain whilst in the womb. Therefore, pregnant women should aim to include sources of omega-3 in their diet.

### *Calcium*

Calcium is essential for the formation of strong bones and teeth. During childhood, bones develop and become more dense until mid thirties. The combination of adequate dietary calcium intake and **vitamin D** levels in conjunction with regular exercise is essential to the development of bone mineral density and helping to safeguard against the development of **osteoporosis** (brittle bones) in later life.

Lacto-vegetarians typically consume dairy produce and receive most of their calcium intake from this source. Other sources of calcium include tofu, dried figs, pulses, tahini, sesame seeds, and some green vegetables for example, curly kale and white bread. It is important to note for people who consume soya-based dairy produce that they are typically low in calcium. Individuals are therefore encouraged to either opt for brands, which are fortified with calcium or ensure that calcium intake from other foods is sufficient.

### *Zinc*

**Zinc** is an essential nutrient for health, growth, male fertility and wound healing. Vegetarian diets in general may not always provide adequate intake therefore it is important for Lacto-vegetarians to be aware of zinc-rich foods. These include cheese, pulses, nuts, seeds and wholegrain cereals.

## Risks

Risks associated with Lacto-vegetarian eating patterns are minimal as long as eating patterns are based on the basic healthy eating principles outlined above. Attention should be paid to the above nutrients to ensure adequate intakes. It is questionable whether vegetarians live longer than non-vegetarians. It is a challenge to take all of the factors that impact on longevity into account in a research trial and to categorically suggest that vegetarians live longer.

Nonetheless, it is important to note that is a vegetarian diet is too restrictive it may be that the individuals may become malnourished and deficient in certain essential nutrients. Consequently, this would not be beneficial for overall health. Therefore, care is needed when making statement s on the healthy' nature of vegetarian eating patterns.

## Research and general acceptance

Further research is required to equivocally suggest if vegetarian eating patterns have additional health benefits over and above meat eating dietary habits. Such research would need to consider all factors that may impact on health and lifestyle including, genetic susceptibility, social, dietary, economic and social factors and so on.

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Latino diet *see* **Hispanic and Latino diet**

# Liquid diets

## Definition

Liquid diets is a term that encompasses a wide range of diets that serve a variety of functions. It can mean either partial or full meal replacement by either clear or non-clear fluids. Doctors often prescribe a liquid diet for before or after certain surgeries, or for patients who are medically obese. People also use them for fasting or weight loss.

## Origins

The first uses of liquid diets date back centuries because ancient religious ceremonies often involved fasting, and many cultures served only broth to sick patients. Doctors have been prescribing a liquid diet to patients before they were to undergo surgery for decades. Only in the past few decades have several medically monitored weight loss programs, such as **Optifast**, and commercially available weight loss programs, such as **Slim Fast**, become available.

## Description

Liquid diets is a broad category of diets that can be used for a number of different reasons. In essence, it means any diet which replaces regular meals of solid foods, with fluid drinks. For many medical procedures it is helpful, or even necessary, that patients consume only liquids before or after the operation. People also consume only liquids during periods of fasting. When a person is diagnosed as seriously obese, a physician may decide that he or she should undergo a medically observed weight loss program, like Optifast. There are also several programs like Slim Fast, that mimic the medically-observed programs, but in a less severe way that can be followed without supervision.

### *Liquid Diets For Medical Procedures*

Before patients undergo certain medical procedures a physician may recommend a liquid diet. This is done to clear out the digestive system and decrease the strain on the digestive organs. It allows a patient to acquire the necessary calories, nutrients, and fluids, while minimizing the digestive impact. Tests which might require this include sigmoidoscopy, colonoscopy, MRI, and certain x-rays. Surgical procedures that can require a liquid diet include most types of serious oral surgery as well as almost any stomach or bowel surgery. Many surgical procedures, such as **bariatric surgery**, may also require that a patient follow a liquid diet after the operation, while they regain the ability to digest solid foods.

Though guidelines will differ depending upon the procedure, following a liquid diet in preparation for a medical procedure will generally mean drinking only liquids that can be seen through at room temperature. This means that **water**, juice, broth, water ice, and gelatin are usually acceptable. Soups that contain vegetables, noodles, meat, or rice are generally not allowed. While milk is usually acceptable, yogurt is usually restricted. When a physician prescribes a liquid diet he or she will tell the patient the specific guidelines, including a time period during which the diet must be followed, and often provide literature that will describe the types of fluids that are allowed.

### *Fasting*

Many people carry out periods of fasting for a variety of reasons. While some fasts require the faster to only drink water, or to consume no liquid at all, fasting typically means to refrain from eating food, but not drinking liquids. Most of the world's popular religions call for periods of fasting at certain times for tradition, for reasons of atonement, to clear the mind, as a way of mourning, for purification, as well as for other spiritual reasons. Jewish tradition says that fasting should be done during Yom Kippur. Many Christians fast during Lent. Muslims traditionally fast during the days of Ramadan. Many ascetic Buddhists and Hindus also practice periodic fasting. Many people also fast for health-related reasons, because they believe that it can cleanse the body of toxins and some even believe it can cure disease. Historically, fasting has also been used for political reasons, as a form of

## KEY TERMS

**Diabetes mellitus**—A condition in which the body either does not make or cannot respond to the hormone insulin. As a result, the body cannot use glucose (sugar). There are two types, type 1 or juvenile onset and type 2 or adult onset.

**Fast**—A period of at least 24 hours in which a person eats nothing and drinks only water.

**Mineral**—An inorganic substance found in the earth that is necessary in small quantities for the body to maintain a health. Examples: zinc, copper, iron.

**Obese**—More than 20% over the individual's ideal weight for their height and age or having a body mass index (BMI) of 30 or greater.

**Vitamin**—A nutrient that the body needs in small amounts to remain healthy but that the body cannot manufacture for itself and must acquire through diet.

protest, like those carried out by Mohandas Gandhi in the 1920s and 1930s.

For whatever reason it is done, fasting should never be used for weight loss. Medical professionals disagree about whether fasting should be used for other reasons, but it is overwhelmingly accepted that fasting is not an effective way to lose weight and that it can be very dangerous. Not only does fasting slow down the metabolic processes, meaning that it can actually result in overall weight gain, it also weakens the immune system and can make people vulnerable to many serious diseases and conditions, including liver and kidney failure. People considering a fast should always consult with their doctor to make sure that they will not be risking their health.

### *Liquid Diets for Medical Weight Loss*

When a person is extremely obese, a physician may prescribe a medically monitored weight loss program that will usually involve replacing solid foods with a liquid substitute. The liquid substitute will usually supply between 500 and 800 calories each day, which means that it qualifies as a very low calorie diet. The liquid substitute will also supply all of the necessary **vitamins** and **minerals** that would normally be provided by solid food. Typically the liquid substitute comes in the form of a shake. Patients are told to drink a certain number of shakes every day, rather than eating, and to use that time period to break with old eating habits. After a number of weeks of rapid weight loss and frequent meetings with a physician, who monitors the health and progress of the patient, solid foods may be slowly reintroduced. The entire process is difficult and risky. It should only be undertaken when prescribed by a physician and it must be monitored by a medical professional! . Usually, this sort of liquid diet is only prescribed when serious health risks, caused by **obesity**, outweigh any risks from the program.

One popular medically observed liquid diet is called Optifast. It is produced by the Swiss company, Novartis Medical Nutrition Corporation, that is also known for making Gerber baby food. They report that, in a study of 20,000 people who used the Optifast program for 22 weeks, the average person lost 52 pounds and decreased their blood pressure by 10 percent. The Optifast system is extremely expensive and not intended for the typical dieter.

### *Commercially Available Liquid Diets*

Possibly because of the reputation for rapid weight loss in seriously obese patients, several less expensive, liquid meal replacements have become commercially available for weight loss without medical supervision. These products are not usually intended to replace every meal or all solid foods. These products are intended to help dieters lose weight quickly, though they often do little to affect long term lifestyle changes.

One of the more popular commercially available liquid meal replacements is called Slim Fast. The Slim Fast plan says dieters should eat one regular meal during the day and replace the rest with low-calorie shakes. The shakes each provide one-third of the daily recommendations for a healthy diet. Slim Fast is one of the few liquid replacement plans that defends its plan with controlled clinical studies. In a study done at the University of California, Los Angeles School of Medicine, 300 patients followed the Slim-Fast diet for 12 weeks. They lost an average of 15 pounds and 76% were able to keep at least 80% of the weight off by one year later. However, most dieticians still maintain that a liquid replacement diet is not an appropriate substitute for a healthy lifestyle.

## Function

Different liquid diets are intended for different functions. Many patients must follow a liquid diet before or after a medical procedure to clear out their digestive system. Fasting is done for religious, medical, and even political reasons. Physicians prescribe

medically supervised liquid diets to seriously obese patients to lower their risk of medical consequences of obesity. Many people also purchase similar, but commercially available, meal replacement diets to lose weight.

### Benefits

The possible benefits to a liquid diet depend upon which sort of liquid diet a person is considering. A patient that is told by a physician to refrain from eating solid foods can prevent everything from vomiting during surgery to an ineffective test. Some people believe that fasting can have spiritual benefits and others, including some health professionals, believe that fasting can help to remove toxins from the body.

The greatest health benefits of a liquid diet however, are probably experienced by extremely obese patients who lose weight on a medically supervised meal replacement liquid diet. Obesity has been linked with many serious diseases and such as diabetes, heart disease, kidney failure, liver failure and **cancer**. Obese individuals who lose weight can drastically reduce their risk of getting these diseases and even reduce the severity of their symptoms if they already suffer from them. Health benefits can also be gained by people who lose weight using a commercially available meal replacement liquid diet.

### Precautions

Anyone who has been prescribed a period of liquid diet because of a medical procedure should get as much information as possible about the specific guidelines and follow those guidelines precisely. Doing so will give the procedure its greatest chance of success. Anyone considering a fast should consult their physician and describe the nature of the fast to him or her so that it can be determined if the fast will carry serious risks. People with health problems should not engage in prolonged fasting.

Very low calorie liquid diets should not be undertaken without close medical supervision. These are only intended for people that have large amounts of weight to lose, generally over 50 pounds, and are experiencing health risks because of their obesity. People considering any kind of meal replacement liquid diet should consult their physician to be sure the diet is safe for them.

### Risks

Short term liquid diets for use before or after a medical procedure carry few risks and are generally considered safe if the patient follows the prescribed guidelines and is sure to get enough caloric intake through juice, broth, or other clear liquids. Longer fasting carries many risks including possible damage to the intestinal tract, impaired liver or kidney function, and hypoglycemia. Fasting also impairs the body's immune system which makes the body more vulnerable to communicable diseases such as influenza or streptococcus. Gaining fat is also a common risk of fasting because, though the body may use stores of fat during the fast, once the fast is over the body usually rebuilds these stores quickly and often rebuilds more than was originally available.

Medically supervised meal replacement diets can carry their own risks, though these are usually outweighed by the benefits of weight loss for the extremely obese. Side effects can include gallstone formation, nausea, fatigue, **constipation**, and diarrhea. Commercially available liquid diets also have many risks depending on the brand. Some are considered very low calorie diets which are likely to result in malnutrition. Many do not adequately replace the vitamins and minerals that would usually be supplied by solid foods. This can result in deficiencies that can cause problems. For example, if the body does not get enough **calcium**, the risk of **osteoporosis** and rickets increases.

### Research and general acceptance

It is generally accepted that, for certain medical procedures, it is necessary for patients to refrain from eating solid foods for at least 24 hours before the procedure. Most hospitals have prepared patient literature about the precise guidelines that should be followed for the most procedures.

Doctors disagree about whether fasting can have health benefits, though most agree that it must be undertaken carefully and carries many risks. Most also agree that toxins do buildup in the body when a

### QUESTIONS TO ASK THE DOCTOR

- What sort of liquids should I drink on this diet?
- How long should I go before I can eat solid foods?
- Is fasting safe for me?
- How will I know if my liquid diet is causing a problem?
- Will I get proper nutrition from my liquid diet?
- Is this liquid diet the best way for me to achieve my health goal?

person eats a diet that is high in processed foods and low in nutrients. However, the question of whether fasting can remove these toxins has yet to be conclusively answered. It is accepted that fasting is not a safe or effective method of weight loss.

Most medically supervised meal replacement liquid diets are generally accepted. Some doctors question whether more traditional weight loss methods are better in some cases of less extreme obesity, but it is generally believed that the risks and side effects of these programs are outweighed by the benefits for those for whom they are usually prescribed.

There are many commercially available liquid diets for weight loss and their acceptance depends upon the brand and its program. Brands that include regular food, at least 1200 calories each day, and some kind of exercise recommendations, like Slim Fast, are more accepted than programs that are very low in calories and do not include exercise, such as the Hollywood Celebrity Miracle Diet.

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Helen Davidson

Low-carb diets *see* **High-fat/low carb diets**

# Low-cholesterol diet

## Definition

A low cholesterol diet is a diet designed to reduce the amount of cholesterol circulating in the blood.

**Cholesterol levels**

| | |
|---|---|
| **Total Cholesterol** | |
| Desirable | <200 |
| Borderline high | 200–239 |
| High | ≥240 |
| **LDL Cholesterol (bad)** | |
| Optimal | <100 |
| Near/above optimal | 100–129 |
| Borderline high | 130–159 |
| High | 160–189 |
| Very high | ≥190 |
| **HDL Cholesterol (good)** | |
| Low | <40 |
| High | ≥60 |

SOURCE: National Heart, Lung and Blood Institute, National Institutes of Health, U.S. Department of Health and Human Services

*(Illustration by GGS Information Services/Thomson Gale.)*

## Origins

No single person originated the low cholesterol diet. However, the American Heart Association has been a major developer of this diet. The National Cholesterol Education Program organized by the National Heart, Lung, and Blood Institute monitors research and new developments in cholesterol control, including new approaches to low cholesterol dieting.

## Description

The low cholesterol diet is designed to lower an individual's cholesterol level. Cholesterol is a waxy substance made by the liver and also acquired through diet. Cholesterol does not dissolve in blood. Instead it moves through the circulatory system in combination with carrier substances called lipoproteins. There are two types of carrier-cholesterol combinations, low-density lipoprotein (LDL) or "bad" cholesterol and high-density lipoprotein or "good" cholesterol.

LDL picks up cholesterol in the liver and carries it through the circulatory system. Most of the cholesterol in the body is LDL cholesterol. When too much LDL cholesterol is present, it begins to drop out of the blood and stick to the walls of the arteries. The arteries are blood vessels carrying blood away from the heart to other organs in the body. The coronary arteries are special arteries that supply blood to the heart. The sticky material on the artery walls is called cholesterol plaque. (It is different from dental plaque that accumulates on teeth.) Plaque can reduce the amount of blood flowing through the arteries and encourage blood clots to form. A heart attack occurs if the

## KEY TERMS

**Dietary fiber**—also known as roughage or bulk. Insoluble fiber moves through the digestive system almost undigested and gives bulk to stools. Soluble fiber dissolves in water and helps keep stools soft.

**Fatty acids**—complex molecules found in fats and oils. Essential fatty acids are fatty acids that the body needs but cannot synthesize. Essential fatty acids are made by plants and must be present in the diet to maintain health.

**Hormone**—a chemical messenger that is produced by one type of cell and travels through the bloodstream to change the metabolism of a different type of cell

**Steroid**—A family of compounds that share a similar chemical structure. This family includes the estrogen and testosterone, vitamin D, cholesterol, and the drugs cortisone and prendisone.

coronary arteries are blocked. A stroke occurs if arteries carrying blood to the brain are blocked.

Researchers believe that HDL works opposite LDL. HDL picks up cholesterol off the walls of the arteries and takes it back to the liver where it can be broken down and removed. This helps to keep the blood vessels open. Cholesterol can be measured by a simple blood test. To reduce the risk of cardiovascular disease, adults should keep their LDL cholesterol below 160 mg/dL and their HDL cholesterol above 40 mg/dL

Cholesterol is a necessary and important part of cell membranes. It also is converted into some types of steroid (sex) hormones. Cholesterol comes from two sources. The liver makes all the cholesterol the body needs from other nutrients. However, other animals also make cholesterol. When humans eat animal products, they take in more cholesterol. Cholesterol is found only in foods from animals, never in plant foods. The foods highest in cholesterol are organ meats such as liver, egg yolk (but not egg whites), whole-fat dairy products (butter, ice cream, whole milk), and marbled red meat. To reduce the risk of cardiovascular disease, adults should keep their consumption of cholesterol below 300 mg daily. In 2007, the average American man ate 337 mg of cholesterol daily and the average woman ate 217 mg.

### *Cholesterol and fats*

There are three types of **fats** in food. Saturated fats are animal fats such as butter, the fats in milk and cream, bacon fat, the fat under the skin of chickens, lard, or the fat a piece of prime rib of beef. These fats are usually solid at room temperature and they are considered "bad" fats because they raise LDL cholesterol.

Unsaturated fats can be monounsaturated or polyunsaturated (This refers to one aspect of their chemical structure.) Monounsaturated fats are "good" fats that help lower cholesterol levels. Olive oil, canola oil, and peanut oil are high in monounsaturated fats. Corn oil, soybean oil, safflower oil, and sunflower oil are high in polyunsaturated fats. Polyunsaturated fats are not bad, they just are not as good as monounsaturated fats. Fish oils that are high in **omega-3 fatty acids** are polyunsaturated and are very beneficial in preventing heart disease.

*Trans* fat is made by a manufacturing process that creates hydrogenated or partially hydrogenated vegetable oils. *Trans* fat acts like saturated fat, raising the level of LDL cholesterol. It is found in some margarines and in many commercially baked and fried foods. Dietary Guidelines for Americans 2005 recommends that no more than 30% of an individual's daily calories should come from fat, no more than 10% of calories should come from saturated fat, and people should consume as little *trans* fat as possible.

## Managing a low cholesterol diet

People who need to reduce their cholesterol level can get help by reading food labels. Food labels are required to list in the nutrition information panel nutrition facts that include calories, calories from fat, total fat, saturated fat, *trans* fat, cholesterol, **sodium**, total **carbohydrates**, dietary **fiber**, sugars, **protein**, **vitamin A**, **vitamin C**, **calcium**, and **iron**. In addition, the following words have specific legal meanings on food labels.

- Cholesterol-free: Less than 2 mg of cholesterol and 2 g of saturated fat per serving.
- Low cholesterol: no more than 20 mg of cholesterol and 2 grams of saturated fat per serving.

The home cook can also reduce cholesterol in the diet in the following ways:

- Choose lean cuts of meat. Select USDA graded cuts of beef and lamb marked Choice and Select. These cuts are leaner and less expensive than Prime.
- Bake or broil meats on a rack set in a pan, so that the fat can drip off.
- Refrigerate homemade soups and stews, then skim the solidified fat off the top before serving.

- If using canned soup or broth that contains fat, put the can in the refrigerator for a few hours, and skim the solid fat off the top before heating.
- Try cooking with olive or canola oil rather than corn oil.

To reduce cholesterol in meals when eating out:

- Order menu items that have the Heart Healthy stamp.
- Choose items that are broiled, roasted or baked. Avoid fried foods.
- Select fish or chicken instead of beef or pork.
- Use margarine instead of butter on food
- Ask for salad dressing, sauces, and gravy on the side.
- Order non-fat or 1% milk.

In addition to reducing fats, increasing soluble dietary fiber that is found in whole grains also helps lower cholesterol. Soluble fiber is found dissolved in **water** inside plant cells. In the body, it lowers LDL cholesterol. Good sources of soluble fiber include:

- oatmeal and oat bran
- kidney beans,
- Brussels sprouts
- apples
- pears
- prunes

Walnuts and almonds are good sources of polyunsaturated fatty acids that help reduce blood cholesterol levels. Fish such as mackerel herring, sardines, lake trout, albacore tuna and salmon, as well as walnuts, **flaxseed**, canola and soybean oil are all rich in omega-3 fatty acids, These fatty acids help control fats in the blood and reduce blood clotting. Cholesterol-lowering drugs are available if changes in diet fail to control cholesterol levels. However, it is most desirable to control cholesterol through diet rather than medicine, as these drugs potentially have unwanted side effects.

## Function

Low cholesterol diets are healthy diets that can are most effective if they become lifetime habits. Low cholesterol diets work by reducing the amount of saturated (animal) fat to drive down LDL cholesterol and using more monounsaturated fats (olive oil, canola oil) and soluble fiber to drive up HDL cholesterol. By controlling fats in the diet, many individuals lose weight.

## Benefits

Low cholesterol diets have the following benefits:

- decreased intake of dietary cholesterol
- decreased intake of saturated fats
- increased soluble fiber in diet
- decreased risk of developing cardiovascular disease

### QUESTIONS TO ASK THE DOCTOR

- What are my current cholesterol numbers?
- What are my current risk factors for cardiovascular disease?
- Can my whole family go on this diet?
- Do I have any special health concerns that might affect this diet?

## Precautions

Anyone over age two can safely follow a low cholesterol diet. Children under age two need certain fats for the normal development of the nervous system and should be given whole-milk and whole-milk products.

## Risks

There are no known risks to following a low cholesterol diet.

## Research and general acceptance

The relationship between cholesterol and saturated fat intake and heart health has been documented in many studies. However, in a study of 49,000 women between the ages of 50 and 79 that was published in February 2007 in the *Journal of the American Medical Association,* women were divided randomly into a group that ate a **low-fat diet** and another group that had no restrictions and ate the average America diet. Researchers found no significant difference in the rates of heart attack or stroke between the two groups. They concluded that there was no justification in recommending a low-fat diet to the public as protection against heart disease. This study is particularly important because it was large, well-designed, independent (It was funded by the federal government.) and followed women for 8 years. This study has been extended and these women will be followed until 2010.

The American Heart Association has questioned these findings and continues to recommend a diet low in fat (especially animal fats) and low in cholesterol for the prevention of heart disease.

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Tish Davidson, A.M.

# Low-fat diet

## Definition

Different medical organizations, governments, and diet plans define "low fat" slightly different ways. In this essay, a low fat diet is one where 30% or less of the total daily calories come from **fats**. A very low fat diet is one where 15% or less of the total daily calories come from fat. By comparison, in the average American diet about 35–37% of calories come from fat.

## Origins

When metabolized in the body, fats provide 9 calories per gram compared to 4 calories per gram from proteins and **carbohydrates**. Because of this, diets plans repeatedly target reduction in fats as a good way to lose weight. Examples of low fat diets include the **Pritikin diet** and **Scarsdale diet**, both popular in the 1970s, Rosemary Conley's Hip and Thigh Diet (late 1980s), and the Dr. Dean Ornish Diet (2000s). Research into preventing cardiovascular disease also stimulated interest in low fat diets as a preventative health measure.

## Description

Over the past three decades, thinking about fats has changed. In the twenty-first century, all fats are not created equal. Fats are described as either saturated or unsaturated based on their chemical structure. Saturated fats are animal fats such as butter, the fats in milk and cream, bacon fat, the fat under the skin of chickens, lard, or the fat a piece of prime rib of beef. These fats are usually solid at room temperature. Exceptions are palm oil and coconut oil, which are both liquid saturated fats. Saturated fats are "bad" fats. They raise the level of LDL cholesterol ("bad" cholesterol) in the blood. High LDL cholesterol levels are associated with an increased the risk of heart disease.

Unsaturated fats have a slightly different chemical structure that makes them liquid at room temperatures. Unsaturated fats, especially monounsaturated fats, are "good" fats that help lower cholesterol levels. Olive oil, canola oil, and peanut oil are high in monounsaturated fats. Corn oil, soybean oil, safflower oil, and sunflower oil are high in polyunsaturated fats. Fish oils that are high in **omega-3 fatty acids** are also polyunsaturated and have beneficial health effects.

Another type of fat, *trans* fat, is made by a manufacturing process that creates hydrogenated or partially hydrogenated vegetable oils. *Trans* fat acts like saturated fat, raising the level of LDL cholesterol. It is found in some margarines, and in many commercially baked and fried foods. Starting in January 2006, the amount of *trans* fat in processed foods must be listed separately from total fat on food labels.

## KEY TERMS

**Cholesterol**—a waxy substance made by the liver and acquired through diet. High levels in the blood may increase the risk of cardiovascular disease.

**Dietary supplement**—a product, such as a vitamin, mineral, herb, amino acid, or enzyme, that is intended to be consumed in addition to an individual's diet with the expectation that it will improve health

**Fatty acids**—complex molecules found in fats and oils. Essential fatty acids are fatty acids that the body needs but cannot synthesize. Essential fatty acids are made by plants and must be present in the diet to maintain health.

**Fatty liver**—a condition in which liver cells accumulate fat. The condition is associated with alcohol abuse, obesity, and pregnancy and can result in serious damage to the liver.

**Triglycerides**—a type of fat found in the blood. High levels of triglycerides can increase the risk of coronary artery disease

The federal Dietary Guidelines for Americans 2005 recommends that no more than 30% of an individual's daily calories come from fat. Beyond that, no more than 10% of calories should come from saturated fat and people should consume as little *trans* fat as possible. The American Heart Association's Nutrition Committee joined with the American Cancer Society, the American Academy of Pediatrics, and the National Institutes of Health to endorse these guidelines as part of a healthy diet. However, some experts believe that for heart health the amount of fats consumed should be much lower.

Nathan Pritikin, originator of the Pritikin Diet Plan developed a very low fat diet for heart health. The Pritikin Plan calls for less than 10% of calories to come from fat. The diet is also low in **protein** and high in whole-grain carbohydrates. Respected independent research shows that this diet does cause weight loss and lower risk factors for heart disease such as cholesterol and blood **triglycerides**. Critics of the diet say that it is too difficult to stay on and that low the fat component of the diet does not allow people to get enough beneficial fats such as omega-3 fatty acids.

The Dr Dean Ornish Diet is another very low fat diet where only aboug15% of calories come from fat. The Ornish diet is an almost-vegetarian diet. It too is designed to promote heart health, and again critics claim hat it does not provide enough essential fatty acids.

Other low fat diets are designed for people who have digestive disorders. People who have **gallstones** or gallbladder disease often benefit from reducing the amount of fats they eat. Bile, a digestive fluid made in the gallbladder, helps break down fats. When the gallbladder is not functioning well, a low fat diet can improve digestion. Symptoms of other gastrointestinal problems, such as diarrhea, irritable bowel disorder, various malabsorptive disorders, and fatty liver, often improve on a low fat diet. People who have had weight loss surgery usually have fewer digestive problems if they eat a low fat diet.

### Managing a low fat diet

People on low fat diets need to avoid certain foods. High-fat foods include whole milk and whole milk products such as ice cream or cream cheese, fried foods, marbled beef, chicken skin, spare ribs or any meat with visible fat, tuna packed in oil, regular salad dressing, potato chips and fried snack foods, and many baked goods—cookies, cakes, pies, and doughnuts.

People wishing to reduce the fat in their diet must read food labels. Food labels are required to list in the nutrition information panel nutrition facts that include calories, calories from fat, total fat, saturated fat, *trans* fat, cholesterol, **sodium**, total carbohydrates, dietary **fiber**, sugars, protein, **vitamin A**, **vitamin C**, **calcium**, and **iron**. In addition, the following words have specific legal meanings on food labels.

- Fat-free: less than 0.5 grams of fat per serving.
- Low fat: no more than 3 grams or less of fat per serving.
- Less fat: A minimum of 25% less fat than the comparison food.
- Light (fat) A minimum of 50% less fat than the comparison food.

The home cook can also reduce fat in the diet in the following ways:

- Remove all visible fat from meat and skin from poultry before cooking.
- Bake or broil meats on a rack set in a pan, so that the fat can drip off.
- Refrigerate homemade soups and stews, then skim the solidified fat off the top before serving.
- If using canned soup or broth that contains fat, put the can in the refrigerator for a few hours, and skim the solid fat off the top before heating.

- Use low-fat yogurt and herbs on baked potatoes in place of butter or sour cream.
- Top pasta with vegetables instead of oil, butter, or cheese.

To reduce fat in meals when eating out:

- Choose items that are broiled, roasted or baked. Avoid fried foods.
- Select fish or chicken instead of beef or pork.
- Ask for salad dressing, butter, and gravy on the side.
- Fill up on salad with non-fat dressing at the salad bar.

## QUESTIONS TO ASK THE DOCTOR

- Why is a low fat diet better for me than a regular calorie-reduced diet?
- Does this diet pose any special risks for me that I should be aware of?
- Do I need to take a dietary supplement while I am on this diet?
- What are my risk factors for cardiovascular disease and how will this diet affect them?
- Is this diet appropriate for my entire family?

### Function

Low fat diets work as weight loss diets because they reduce calorie intake. The difficulty with low fat and very low fat diets is that they are difficult to maintain. Often when people go off these diets they gain weight back, then diet again, then gain weight back in a pattern of **weight cycling**. This happens with many diets, but some research shows that people who go off low fat diets tend to binge or overeat more than people who go off more moderate diets.

In the 1990s and early 2000s, the public was encouraged to eat a low fat diet not just to lose weight, but also to lower cholesterol and triglyceride levels. This, the public was told, would protect heart health and help prevent cardiovascular disease. This blanket statement is now in dispute. (See research and general acceptance below.)

Low fat diets are effective in improving certain digestive symptoms. A general low fat diet is usually prescribed first, and then fine-tuned with the aid of a physician to best treat the individual's digestive problems.

### Benefits

People who go on low fat diets can benefit in these ways:

- They lose weight.
- Their health usually improves.
- Their risk of developing cardiovascular disease may decrease.
- They get relief from unpleasant gastrointestinal symptoms.

### Precautions

Young children, pregnant women, **breastfeeding** women, and the elderly are not good candidates for very low fat diets. These groups have special nutritional needs that are unlikely to be met by very low fat intake.

Low fat diets are difficult to maintain for long periods. They may increase the risk of yo-yo dieting or weight cycling.

### Risks

Although many low fat diets have been shown to be healthy, individual diets vary, and some low fat diets are not nutritionally balanced.

### Research and general acceptance

Many health claims have been made for low fat diets. One is that they help people lose weight better than other diets. However, studies have shown that low fat diets are no better at helping people lose weight and keep that weight off than regular low-calorie diets. The total amount of calories has more effect on weight loss than the particular foods those calories come from.

For many years, the public was told that low fat diets helped protect against breast cancer, colon cancer, and heart disease. In a landmark study of 49,000 women between the ages of 50 and 79 that was published in February 2007 in the *Journal of the American Medical Association,* women were divided randomly into a group that ate a low fat diet and another group that had no restrictions and ate the average America diet. Researchers found no significant difference in the rates of breast cancer, colon cancer, or heart attack and stroke between the two groups. They concluded that there was no justification in recommending a low-fat diet to the public as protection against these diseases. This study is particularly important because it was large, well-designed, independent (It was funded

by the federal government.) and followed women for 8 years. This study has been extended and these women will be followed until 2010.

Critics of this study claim that the low-fat group did not reduce their fat significantly enough to make a difference in health and that the study did not cover enough time. Others said that eating unsaturated fat (a **Mediterranean diet**) was heart healthy and that this study did not distinguish between saturated and unsaturated fat intake. Supporters of the study have said that it shows that how much people eat and how much they exercise (their calorie balance) are more important than what they eat. This study is likely to stimulate more research into low fat diets and the health differences between unsaturated and saturated fats.

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# Low-protein diet

## Definition

A low **protein** diet, a diet in which people are required to reduce their intake of protein, is used by persons with abnormal kidney or liver function to prevent worsening of their disease.

## Origins

The low protein diet was developed by dietitians and nutritionists in response to adverse effects that protein can have on persons with kidney or liver disease. Proteins are required for growth, upkeep, and repair of body tissues. They also help the body fight infections and heal wounds. Protein contains 16% nitrogen, which the body eliminates in the urine as urea. In cases where liver or kidney function is impaired, urea, ammonia or other toxic nitrogen metabolites may build up in the blood. The low protein diet is designed to reduce these nitrogen metabolites and ammonia in individuals with liver disease or kidney failure and to reduce the workload on the kidney or liver. If the kidneys, which are responsible for excretion of urea, are not functioning properly (renal failure), or if high levels of protein are continually present in the diet, urea and other toxic nitrogen compounds build up in the bloodstream, causing loss of appetite, nausea, headaches, bad taste in the mouth, and fatigue as well as possibly further adversely affecting the kidney or liver.

## Description

The low protein diet focuses on obtaining most of a person's daily calories from complex **carbohydrates** rather than from proteins. There are two main sources of protein in the diet: higher levels are found in animal products, including fish, poultry, eggs, meat, and dairy products), while lower levels are found in vegetable products (breads, cereals, rice, pasta, and dried beans). Generally foods in the high protein food group contains about 8 grams of protein per serving. Cereals and grains have about 2 grams of protein in 1/2 cup or 1 slice. Vegetables have about 1 gram of protein in 1/2 cup, while fruits have only a trace amount of protein in 1/2 cup. To control protein intake, foods such as starches, sugars, grains, fruits, vegetables, **fats**, and oils should be eaten at levels sufficient to meet daily energy needs. If a person has diabetes, the diet must also be designed to control blood sugar.

Protein should never be completely eliminated from the diet. The amount of protein that can be

## KEY TERMS

**Kidney disease** —Most kidney diseases cause the kidneys to lose their cleaning ability. Damage to the kidneys may happen quickly because of injury or poisoning, but most kidney diseases destroy the kidneys slowly and silently over many years. The two most common causes of kidney disease are diabetes and high blood pressure.

**Liver disease**—Refers to any disorder of the liver. The liver is a large organ in the upper right abdomen that aids in digestion and removes waste products from the blood. Liver disease includes the following conditions: Cirrhosis, or scarring of the liver, inflammation (hepatitis) from infectious (hepatitis B, hepatitis C) or non-infectious causes (chemical or autoimmune hepatitis), umors, benign and malignant (liver cancer), and metabolic disorders. Alcohol abuse is one leading cause of liver disease. Infections, poisons, and inherited (genetic) conditions can also cause diseases of the liver.

included in the diet depends on the degree of kidney or liver damage and the amount of protein needed for an individual to maintain good health. Laboratory tests are used to determine the amount of protein and protein waste breakdown products in the blood. A suggested acceptable level of protein in a low-protein diet is about 0.6g/kg of body weight per day, or about 40 to 50 grams per day. A person suffering from a kidney disease such as nephrotic syndrome, where large amounts of protein is lost in the urine, should ingest moderate levels of protein (0.8 kg per kg of body weight per day).

A sample menu for one day might include:

Breakfast: 1 orange, 1 egg or egg substitute, 1/2 cup rice or creamed cereal, 1 slice whole wheat bread (toasted), 1/2 tablespoon margarine or butter, 1/2 cup whole milk, hot, non-caloric beverage, 1 tablespoon sugar (optional)

Lunch: 1 ounce sliced turkey breast, 1/2 cup steamed broccoli, 1 slice whole wheat bread, 1/2 tablespoon margarine or butter, 1 apple, 1/2 cup gelatin dessert, 1 cup grape juice, hot, non-caloric beverage, 1 tablespoon sugar (optional)

Mid-Afternoon Snack: 6 squares salt-free soda crackers, 1/2 tablespoon margarine or butter, 1 to 2 tablespoons jelly, 1/2 cup apple juice

Dinner: 1/2 cup tomato juice, 1 ounce beef, 1 baked potato, 1 teaspoon margarine or butter (optional), 1/2 cup steamed spinach, 1 slice whole wheat bread, 1/3 cup sherbet, 4 apricot halves, hot, non-caloric beverage

Evening Snack: 1 banana

This sample menu contains about 1850 calories, with a protein content of 8%.

Special, low protein products, especially breads and pastas, are available from various food manufacturers for persons who need to follow a low protein diet. Specific information on the protein content of foods can be found on food labels. Books that list protein contents of various foods as well as low protein cookbooks are also available.

In addition, it is recommended that fat calories be obtained from monounsaturated and polyunsaturated fats. In order to be effective, some persons may also be required to reduce their **sodium** and potassium ingestion in foods. Sodium restriction improves the ability to control blood pressure and body fluid build-up as well as to avoid congestive heart failure. Foods with high sodium contents, such as processed, convenience and fast foods, salty snacks, and salty seasonings, should be avoided. Potassium is necessary for nerve and muscle health. Dietary potassium restriction is required if potassium is not excreted and builds to high levels in the blood, which may result in dangerous heart rhythms. At very high levels, potassium can even cause the heart to stop beating.

As kidney function decreases, the kidneys may reduce their production of urine, and the body can become overloaded with fluids. This fluid accumulation can result in swelling of legs, hands and face, high blood pressure, and shortness of breath. To relieve these symptoms, restriction of fluids, including **water**, soup, juice, milk, popsicles, and gelatin, should be incorporated into the low protein diet. Liver disease may also require dietary fluid restrictions.

Tyrosinemia is a rare but serious inherited disease that may also require the use of a low-protein diet. Tyrosinemia is an inborn error of **metabolism** in which the body can not effectively break down the amino acid tyrosine.

### Function

The purpose of a low protein diet is to prevent worsening of kidney or liver disease. The diet is effective because it decreases the stress on the kidney or liver.

## Benefits

Protein restriction lessens the protein load on the kidney or liver, which slows down the continued development of disease.

## Precautions

A person requiring a low protein diet should consult a dietitian familiar with liver or kidney diseases to provide guidance on developing an appropriate diet as well as to learn how to follow the diet effectively. The diet must meet the person's nutritional needs, cut down the work load on the kidneys or liver, help maintain the kidney or liver function that is left, control the build-up of waste products, and reduce symptoms of the kidney or liver disease. Strict adherence to the diet can be difficult, especially for children. Small amounts of protein-containing food combined with larger amounts of low or no-protein foods can be used to make the diet more acceptable. Some persons eliminate meat, eggs, and cheese from their diets rather than measure the amounts of protein from these foods. However, care must be taken to make sure that adequate protein is included in a vegetarian diet to provide for growth and development, including building muscles and repairing wounds. Another approach, since it is difficult to manage portion sizes of foods other than milk, is to omit meats, fish, and chicken from the diet and use milk as the primary source of protein.

A person with both kidney disease and diabetes must be careful to eat only low-to-moderate amounts of carbohydrates along with monounsaturated and polyunsaturated fats.

The human body reacts to protein deficiency by taking amino acids (the building blocks of proteins) away from muscle tissue and other areas of the body. The process, in which the body basically metabolizes itself, is called catabolism and leads to muscle loss and weakness. The use of exercise and strength training is recommended to counter the effects of muscle loss.

## Risks

The levels of **calcium** and phosphorus must be monitored closely, for in persons with kidney disease, phosphorus levels can become too high, while levels of calcium can become too low. Monitoring of these two **minerals** may require an adjustment in dietary intakes of these minerals. Phosphorus is a mineral that helps to keep bones strong. Too much phosphorus, however, may cause itchy skin or painful joints. Calcium is required to maintain bone density and **vitamin D** is necessary to control the balance of calcium and phosphorus. If changes to add these nutrients to the diet are not adequate, then supplements and medications may be required. If phosphorus levels are too high, a person may have to take phosphorus binders that reduce the amount of phosphorus that enters the blood stream from the intestine. Dairy products as well as seeds, nuts, dried peas, beans, and processed bran cereals, are high in phosphorus, so the use of these food sources may need to be limited.

A low protein diet may also be deficient in some of essential amino acids (which are the building blocks of protein), the **vitamins niacin**, thiamine, and **riboflavin**, and the mineral **iron** (most people with advanced kidney disease have severe anemia). Vitamin supplementation is dependent on the amount of protein restriction, the extent of kidney damage, and the vitamin content of food that is eaten. A person with kidney failure may have decreased urine output. The amount of fluids a person needs to drink is based on the amount of urine produced daily, the amount of fluid being retained, the amount of sodium in the diet, the use of **diuretics**, and whether the person has congestive heart failure.

In persons with advanced kidney disease, a low protein diet may lead to malnutrition. The person may lose muscle and weight, lack energy, and have difficulty fighting infections. Daily calorie intake is dependent on the amount needed to prevent breakdown of body tissues. Body weight and protein status should be monitored periodically, which in some cases may be daily. Extra calories can be added to the diet by increasing the use of heart-healthy fats, eating candy and other sweet foods, such as canned or frozen fruits in heavy syrup.

### QUESTIONS TO ASK YOUR DOCTOR

- Where do I find out about this diet?
- What types of medical monitoring and oversight do I need?
- Where can I find support and information?
- What types of side effects should I watch out for?

## Research and general acceptance

Very low protein diets coupled with amino acid supplements have been shown to slow down the progression of and even cure certain types of kidney disease in persons in early stages of the disease. In adults

with moderate-to-severe chronic renal failure, reduced protein intake has also been shown to decrease the risk of end-stage renal disease, based on a systematic review of eight randomized trials with 1,524 patients who were followed for at least one year. Renal death was defined as initiation of dialysis, kidney transplant, or patient death. The incidence of renal death was 13.5% in patients following the low-protein diet compared with 19.4% in patients receiving the higher-protein diet. However, there was insufficient evidence to determine the optimal level of protein intake.

However, it is known that although the low-protein diet may help those with chronic kidney or liver disease, the diet is also known to lead to muscle loss. In 2004 researchers in the Nutrition, Exercise Physiology, and Sarcopenia Laboratory of the Jean Mayer USDA Human Nutrition Research Center on Aging at Tufts University (HNRCA) in Boston, Massachusetts, reported on a study involving a group of volunteers with chronic kidney disease who consumed a low protein diet. About half the group engaged in resistance training, while the other half served as a control group. Among the strength-trained participants who exercised for 45 minutes (including warm-up and cool-down) three times per week for 12 weeks, measurements showed that, on average, total muscle **fiber** increased by 32 percent, and muscle strength increased by 30 percent. Those who did not exercise lost on average about 3% of their body weight, or about 9 pounds.

Researchers studying a group of vegetarians who had maintained a diet relatively low in protein and calories found that they had lower blood levels of several hormones and other substances that have been tied to certain cancers. Additionally it has been shown that a low protein diet protects against gout, which is caused by too much uric acid in the blood. The excess uric acid forms crystal deposits in joints, particularly in the big toe, feet and ankles, resulting in episodes of pain.

A low protein diet has also been shown to help persons with Parkinson's disease. In this disease, dopamine-secreting neurons in the brain die-off, leading to tremors, slowness, and rigidity. The most common treatment is a dopamine precursor called levodopa. However, the effects of this drug can decrease over time, resulting in "on" periods when the person exhibits few symptoms and other "off" periods when the person suffers from high and often debilitating symptoms. A research team in Italy showed that lowering the protein content of the diet can improve levodopa therapy and reduce the number and length of the "off periods." Additional studies are needed to confirm these results.

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# Low-sodium diet

## Definition

A low **sodium** diet is a diet that is low in salt, usually allowing less than 1 teaspoon per day. Many diseases, including kidney disease, heart disease, and diabetes, require a patient to follow a low sodium diet.

## Origins

There is no single origin for the idea behind low sodium diets. Many hospitals and health centers have long recommended that people with diseases that are affected by sodium intake lower the amount of salt in their diet.

## Description

### *The Role of Sodium*

The majority of sodium consumed comes from sodium chloride (NaCl), better known as salt. Salt has many useful properties, both in food preservation and for the body. It helps to prevent spoilage by drawing the moisture out of foods. This helps to keep bacteria from growing in the food. It can also kill bacteria that are already growing on the surface of foods. Before refrigeration technology was developed,

## KEY TERMS

**Electrolyte**—ions in the body that participate in metabolic reactions. The major human electrolytes are sodium (Na+), potassium (K+), calcium (Ca 2+), magnesium (Mg2+), chloride (Cl-), phosphate ($HPO_4$ 2-), bicarbonate ($HCO_3$-), and sulfate ($SO_4$ 2-).

**Hyponatremia**—An abnormally low concentration of sodium in the blood.

**Mineral**—An inorganic substance found in the earth that is necessary in small quantities for the body to maintain a health. Examples: zinc, copper, iron.

salting was one of the few methods available for preserving foods, such as meat, through the winter. Salt also dissolves into the **electrolytes** Na + and Cl1 that help maintain the right balance of fluids in the body, transmit signals through the nervous system, and cause muscles to contract and relax.

The kidneys are responsible for regulating the amount of sodium in the body. When the body has too much sodium, the kidneys filter some out and the excess amounts are excreted from the body in the urine. When the body does not have enough sodium, the kidneys help to conserve sodium and return the needed amount into the bloodstream. When a person eats too much salt, however, and the kidneys are not able to filter enough out, sodium begins to build up in the blood. In the same way that salt pulls **water** out of foods, sodium in the blood pulls out and holds water from cells in the body. This increases the volume of the blood and puts strain on the heart and circulatory system.

### *Ways to Reduce Salt Intake*

According to a study done by the Mayo Clinic, the average American gets only 6% of their total salt intake from salt that is added at the table. Only 5% comes from salt that is added during cooking, and natural sources in food makeup only another 11 percent. The remaining 77% comes from processed or prepared foods. Many packaged meats, as well as canned and frozen foods, contain a surprising amount of salt. Salt is used so heavily by manufacturers because it acts as a preservative, adds flavor to foods, helps to keep foods from drying out, and can even increase the sweetness in desserts. Soups are often especially high in salt because salt helps to disguise chemical or metallic aftertaste.

One of the best ways to reduce salt intake is to cut back on heavily processed and prepared foods. Hot dogs, sausages, ham, and prepackaged deli meats usually contain much more salt than freshly sliced lean meats, such as chicken or fish. Most canned vegetables also have a much higher salt content than the same vegetable found in the fresh produce section. Frozen prepared meals should be avoided for the same reason, and canned soups usually contain much more salt than soups made a home. By reading the Nutrition Facts label on the side of commercially manufactured foods, dieters can determine how much sodium is in the food they are considering.

When choosing canned or frozen foods, dieters who wish to reduce their salt intake can often find a "low sodium" option. The Food and Drug Administration (FDA) sets legal standards for how much sodium can be contained in a product that is labeled "low sodium." Products labeled as such may not contain more than 140 milligrams of sodium per serving, while products labeled as "reduced sodium" need only contain 25% less sodium than the usual amount found in that product.

Meals served in restaurants are also often high in salt. Most restaurant kitchens use a great deal of processed foods. To this they often add salt because it is an inexpensive way to improve the taste. Recently, some chain restaurants have begun providing dietary information about their meals. Usually this is printed in a pamphlet that is separate from the menu, so customers may need to ask for it. Some restaurant chains even provide this information on their websites so that customers can decide on a low-sodium meal before they visit the restaurant. If this information is not available, dieters can use the same ideas for avoiding salt at the restaurant that they do at the supermarket. Salads and other foods made with fresh vegetables will usually have less salt than soups. Appetizers and meals with sauces should generally be avoided.

Another time that salt can be eliminated from the diet is when cooking or preparing meals at home. With the exception of baked goods, many recipes that call for salt do so only for taste, and it can be left out. By substituting herbs and spices for salt, the cook can avoid making bland food while still avoiding salt. When choosing an herb or spice mixture, it is important that the dieter select one that is not itself high in sodium. Using the zest of a lemon or lime is another a good way to add flavor without adding salt. There are also artificial salt substitutes available, although

kidney patients should avoid these as they are usually high in potassium, another mineral that is regulated by the kidneys.

The most obvious way to reduce salt intake is to cut back on the amount of salt added at the table. Since salt is an acquired taste, many doctors recommend simply removing the salt shaker from the table altogether. Most condiments like ketchup, mustard, and pickle relish are also high in salt. Eliminating these can also be a significant help. Many commercially available sauces, dips, and salad dressings also contain a lot of salt. By checking the labels on these condiments before purchasing, consumers can often find options with less sodium.

### *Sodium Content of Popular Foods*

Many people are unaware of just how much sodium is in some of the most popular foods. A low sodium diet generally consists of 1500 to 2400 milligrams of sodium each day. Some foods contain almost half of this in a single serving. The following is a list of foods and the approximate amount of sodium in one serving of each of them.

- 1 large cheeseburger: 1,220 mg
- 1 cup canned soup: 800 mg
- 1 hot dog: 650 mg
- 12-ounce can of soda: 25 mg
- 1/2 cup cottage cheese: 425 mg
- 1 Tablespoon soy sauce: 800 mg
- 1 bean burrito: 920 mg
- 1 Saltine cracker: 70 mg
- 1 frozen enchilada: 680 mg

## Function

The low sodium diet is designed to lower the amount of sodium that a person consumes. While this is generally considered healthy for most Americans, a low sodium diet is particularly important for people suffering from certain conditions and diseases.

For kidney patients, reducing sodium is important because the kidneys are no longer capable of effectively filtering sodium out of the body. If these patients do not reduce their sodium intake, the buildup of sodium will cause fluid retention, which can cause swelling in the lower extremities. A low sodium diet will help to prevent this problem. For heart patients, a low sodium diet is important to help reduce strain on the heart. Excess sodium in the bloodstream means that excess fluid is kept suspended, which increases the volume that the heart must pump.

## Benefits

There are benefits of a low sodium diet for people suffering from many different diseases and even for those who are not. A diet that is low in sodium can help to reduce blood pressure and the risk of heart disease and stroke. People who have a family history of heart problems, people of African decent, smokers, those who frequently drink alcohol, people who are overweight or do not exercise regularly, and people who live with a lot of unmanaged stress are all at higher risk for increase blood pressure and should consider a low sodium diet. For heart disease patients, a low sodium diet can be part of a plan to reduce their blood pressure and reduce the strain on their heart in order to slow the progress of current conditions and prevent future problems. For kidney patients, a low sodium diet is necessary to prevent fluid retention.

## Precautions

Anyone thinking of significantly altering their regular diet should talk to their physician. Each person has different dietary needs, which should be considered. In general, moderately lowering sodium intake is considered safe for most people. Dieters should be careful to not severely and abruptly increase their level of exercise and fluid intake while severely and abruptly lowering their sodium intake to avoid hyponatremia.

## Risks

The risks of following a low sodium diet are very low. Many experts believe that most Americans could benefit from following a low sodium diet, even if they do not yet suffer from any of the conditions that might require them to do so. Most Americans consume between 3000 and 5000 milligrams of sodium per day, and a low sodium diet reduces this to a healthier level of between 1500 and 2400 milligrams per day. Since the physiological requirement for sodium for adults is only 500 milligrams daily, there is little danger that a person following a low sodium diet will consume so little sodium that it will endanger their health.

Some athletes and others who exercise frequently and ingest very little sodium yet drink a lot of water may be at risk of hyponatremia, a condition that occurs when the body does not have enough sodium. Though rare, low sodium levels can cause headache, nausea, lethargy, confusion, muscle twitching, and convulsions.

## QUESTIONS TO ASK THE DOCTOR

- What kinds of foods should I avoid?
- How much sodium is best for me?
- Which foods are low in sodium?
- How will I know if I am consuming too little sodium?
- Are there any sign or symptoms that might indicate a problem while on this diet?

### Research and general acceptance

Low sodium diets are generally accepted as part of many programs that are aimed at lowering the serious risks posed by certain diseases, such as kidney and heart disease. Most health professionals agree that a low sodium diet is not only necessary for patients suffering from these diseases, but would also be healthy and beneficial for most Americans. There is a great deal of scientific research that supports a direct link between salt intake and blood pressure.

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#### ORGANIZATIONS

American Dietetic Association.120 South Riverside Plaza, Suite 2000, Chicago, Illinois 60606-6995. Telephone: (800) 877-1600. Website: <http://www.eatright.org>

American Heart Association. 7272 Greenville Avenue, Dallas, TX 75231. Telephone: (800) 242-8721. Website: <http://www.americanheart.org>

International Food Information Council. 1100 Connecticut Avenue, NW Suite 430, Washington, DC 20036. Telephone: 02-296-6540. Fax: 202-296-6547. Website: <http://ific.org>

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Tish Davidson, M.A.

# M

## Macrobiotic diet

### Definition

The macrobiotic diet is part of a philosophy and lifestyle that incorporates concepts of balance and harmony from Asian philosophy and beliefs about diet from Traditional Chinese Medicine. It is intended to be a weight-loss diet, although people who switch to this diet often lose weight.

### Origins

The macrobiotic diet is a set of life-long **dietary guidelines** that has its origin in Asian philosophy. It traces its roots to the Shoku-Yo or "food" cure movement founded in 1909 by Japanese healer Sagen Ishizuka (1893–1966). George Ohsawa (1893–1966) brought the movement to the United States in the 1950s and coined the name macrobiotics out of the Greek words "macro," meaning large or great, and "bios," meaning life.

Macrobiotics made little impression on the American public until the publication of Ohsawa's book *Zen Macrobiotics* in the 1960s. The diet and the philosophy it encompassed then attracted members of the 1960s counterculture movement including Beatle John Lennon and his wife Yoko Ono. The macrobiotic diet has changed somewhat over the past forty years. Originally it recommended moving through stages of food elimination to achieve a diet that consisted only of brown rice and **water**. These nutritionally unsafe dietary guidelines have mostly been replaced with a more moderate and balanced approach to eating.

### Description

The macrobiotic diet is a dynamic set of guidelines that change with geographical location, season, the availability of local foods, and even the time of day. At the heart of the diet is the Asian concept that everything has an energy or force that is either yin or yang. Yin represents female or cool, dark, inwardly focused energy. Yang represents male or warm, light, outwardly focused energy. For good mental and physical health and a harmonious life, yin and yang forces must be balanced. This balance must be reflected in the food the individual eats. Because environmental yin and yang forces change with the seasons, with climate, and time of day, the diet must change with them. For example, spring and summer foods should be lighter and cook more quickly than winter foods. In addition, diet is adjusted to reflect the individual's age, gender, activity level, and health.

Certain foods are preferred and others rejected or strongly discouraged on the macrobiotic diet. Unrefined whole grains such as brown rice, barley, millet, whole oats, and wheat berries are preferred foods. Processed whole grain foods such as flour are not desirable and should be used sparingly or not at all. Green leafy vegetables are preferred, as are foods in the cabbage family and root vegetables. Some of the vegetables to be avoided include asparagus, eggplant, bell peppers, spinach, okra, potatoes, and tomatoes. In addition tropical fruits (e.g. bananas, pineapple, mango) and tropical nuts are banned for people living in temperate climates because they are not local. The diet permits small portions of white fish (e.g. flounder, cod, halibut, sole) two or three times a week. Dried beans may be used sparingly, and **soy** products are generally acceptable. Red meats, poultry, most dairy products, eggs, **artificial sweeteners**, white rice, popcorn, coffee, chocolate, alcohol, and most baked goods are strongly discouraged. The resulting macrobiotic diet is a high carbohydrate/low **protein** diet that is high in dietary **fiber**. Estimates are that a macrobiotic diet is 50–55% whole grains, 20–30% fresh vegetables, 10% sea vegetables and about 10% beans, lentils, soy, and fish. Meals should be constructed to balance the yin and yang qualities of the foods. Acceptable foods should be eaten following these guidelines.

- Eat two or three meals daily.
- Eat only organic food.
- Choose foods that are grown locally or within about a 400 mile (650 km) radius of home. Avoid imported foods.
- Adjust the energy of the food to the energy of the seasons and the time of day.
- Cook food over a flame, not with an electric burner or microwave.
- Use cast iron, clay pots, or stainless steel cookware.
- Cook frequently with methods that use liquids (e.g. pressure cooking, boiling, steaming, soups, stews) instead of dry cooking methods (baking, broiling).
- Eat nothing that is commercially processed and contains food additives.
- Take no dietary supplements.

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#### ORGANIZATIONS


American Cancer Society. 1599 Clifton Road NE, Atlanta GA 30329-4251. Telephone: 800 ACS-2345. Website: <http://www.cancer.org>

American Dietetic Association. 120 South Riverside Plaza, Suite 2000, Chicago, Illinois 60606-6995. Telephone: (800) 877-1600. Website: <http://www.eatright.org>

Kushi Institute, Kushi Institute HR Department PO Box 7, Becket, MA 01223 Telephone: (800) 975-8744. Fax: (413) 623-8827. Website: <http://www.kushiinstitute.org>

National Center for Complementary and Alternative Medicine Clearinghouse. P. O. Box 7923, Gathersburg, MD 20898. Telephone: (888) 644-6226. TTY: (866) 464-3615. Fax: (866) 464-3616. Website: <http://nccam.nih.gov>

Ohsawa Macrobiotics. P.O. Box 3998, Chico, CA 95927-3998. Telephone: (800) 232-2372 or (530) 566-9765. Website: <http://www.gomf.macrobiotic.net/Info.htm>


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Tish Davidson, A.M.

# Macronutrients

## Definition

Nutrients are substances needed for growth, **metabolism**, and for other body functions. Macronutrients are nutrients that provide calories or energy. The prefix *makro* is from the Greek and means big or large, used because macronutrients are required in large amounts. There are three broad classes of macronutrients: proteins, **carbohydrates**, and **fats**.

## Purpose

The main function of macronutrients is to provide energy, counted as calories. While each of the macronutrients provides calories, the amount provided by each varies. Carbohydrate provides four calories per gram, **protein** also four while fat provides nine. For example, if the Nutrition Facts label of a given food indicates 12 g of carbohydrate, 2 g of fat, and 0 g of protein per serving, the food then has 12g carbohydrate x 4 calories = 48 calories + 2 g fat x 4 calories = 8 calories for a total of 48 + 8 calories = 56 calories per serving). Macronutrients also have specific roles in maintaining the body and contribute to the taste, texture and appearance of foods, which helps to make the diet more varied and enjoyable.

### *Proteins*

Proteins, from the Greek *proteios* meaning "first", are important biological molecules (biomolecules) that consist of strings of smaller units called amino acids, the "building blocks" of proteins. These amino acids are linked together in sequence as polypeptide chains that fold into compact shapes. Proteins vary in

**The three functions of macronutrients**

| Provide energy | Promote growth and development | Regulate body functions |
|---|---|---|
| Carbohydrates | Proteins | Proteins |
| Poteins | Lipids | Lipids |
| Lipids (fats and oils) | Vitamins | Vitamins |
| | Minerals | Minerals |
| | Water | Water |

*(Illustration by GGS Information Services/Thomson Gale.)*

shape and size, some consisting only of ~20–30 amino acids and others of several thousands. They are present in every living cell. In the skin, hair, callus, cartilage, muscles, tendons and ligaments, proteins hold together, protect, and provide structure to the body. As enzymes, hormones, antibodies, and globulins, they catalyze, regulate, and protect the body chemistry. Important biomolecules like hemoglobin, myoglobin and various lipoproteins, that carry oxygen and other substances within the body are also proteins.

Besides providing energy to the body, dietary protein is also required for growth—especially by children, teenagers, and pregnant women, tissue repair, immune system function, hormone and enzyme production, and for lean muscle mass and tone maintenance. When eaten, the proteins contained in foods are broken down into amino acids, an important dietary source of nitrogen. To make the proteins that it needs (protein biosynthesis), the body also needs them. There are 20 amino acids and the body can make some of them from components within the body, but it cannot synthesize nine of them, accordingly called the "essential amino acids" since they must be provided in the diet. They include: histidine, isoleucine, leucine, methionine, phenylalanine, threonine, tryptophan, and valine. Protein that comes from animal sources are called "complete proteins" because they contains all of the essential amino acids while protein from plants, legumes, grains, nuts, seeds and vegetables are called "incomplete proteins" because they are lacking one or more essential amino acid(s).

Proteins are complex molecules and the body needs time to break them down. This is why they are a slower and longer-lasting source of energy than carbohydrates. According to the **Dietary Reference Intakes** (RDI) published by the Unites States Department of Agriculture (USDA), adults need to eat about 60 grams of protein per day (0.8 g per kg of weight). Adults who are physically very active or trying to build muscle need slightly more. Children also need more. If more protein is consumed than is needed, the body stores its components as fat, which can be broken down and used for energy as need arises. Proteins are broken down during digestion, which exposes them to acid in the stomach and to degradation by the action of enzymes called proteases. Some ingested amino acids are converted to carbohydrates (gluconeogenesis), which is also used under starvation conditions to generate glucose from the body's own proteins, particularly those found in muscle.

### *Carbohydrates*

There are two basic types of carbohydrates, depending on their size. Simple carbohydrates (monosachharides) are those that cannot be broken down into simpler sugars. They include various forms of sugar, such as glucose and fructose. Complex carbohydrates are larger and consist of long strings of simple carbohydrates (disachharides, oligosachharides, polysachharides). They include sucrose, lactose, maltose, maltodextrins, fructo-oligo-saccharides, starch, amylose, and amylopectin. The human body uses carbohydrates in the form of glucose and it can convert both simple and complex carbohydrates into energy very quickly. The brain needs to use glucose as an energy source, since it cannot use fat for this purpose. This is why the level of glucose in the blood must be constantly maintained above the minimum level. The body also stores very small amounts of excess carbohydrate as energy reserve. The liver stores some as glycogen, a complex carbohydrate that the body can easily and rapidly convert to energy. Muscles also store glycogen, which they use during periods of intense physical activity. The amount of carbohydrates stored as glycogen is equivalent to about a day's worth of calories. A few other body tissues store carbohydrates as complex carbohydrates that cannot be used to provide energy.

Carbohydrates have two major roles: they are the primary energy source for the brain and they are a source of calories to maintain body weight. A diet containing an optimum level of carbohydrates may help prevent body fat accumulation. They are also involved in the construction of the body organs and nerve cells, and in the definition of a person's biological identity such as their blood group. Dietary **fiber**, which is a carbohydrate, also helps keep the bowel functioning properly. Because they are smaller, simple carbohydrates can be broken down by the body more quickly and they are the fastest source of energy. Fruits, dairy products, honey, and maple syrup contain large amounts of simple carbohydrates, which provide the sweet taste in most candies and cakes. Complex

## KEY TERMS

**Amino acid**—There are 20 amino acids. The body can synthesize 11, but the nine called essential amino acids must be consumed in the diet.

**Antibody**—A protein produced by the body's immune system that recognizes and helps fight infections.

**Biomolecule**—Any organic molecule that is an essential part of a living organism.

**Calorie**—A unit of food energy. In nutrition, a calorie of food energy refers to a kilocalorie and is therefore equal to 1000 true calories of energy.

**Disaccharide**—A molecule made up of two monosaccharides, such as sucrose, lactose, and maltose.

**Enzyme**—A protein that accelerates the rate of chemical reactions.

**Essential amino acids**—The nine amino acids that can not be made by the body: histidine, isoleucine, leucine, methionine, phenylalanine, threonine, tryptophan, and valine.

**Essential fatty acids**—Compounds that can not be made by the body and must be consumed in the diet. They include linoleic acid, linolenic acid, arachidonic acid, eicosapentaenoic acid, and docosahexaenoic acid.

**Gluconeogenesis**—The process of making glucose (sugar) from its own breakdown products or from the breakdown products of lipids or proteins. Gluconeogenesis occurs mainly in cells of the liver or kidney.

**Glycerol**—The central structural component of triglycerides and phospholipids. It is made naturally by animals and plants; the ratio of atoms in glycerol is three carbons, eight hydrogens, and three oxygens.

**Glycogen**—A polysaccharide that is the main form of carbohydrate storage and occurs primarily in the liver and muscles. Glycogen is used as a fuel during exercise.

**Hydrocarbon**—A substance consisting only of carbon and hydrogen atoms.

**Lipoprotein**—A combination of fat and protein that transports lipids in the blood.

**Monosaccharide**—Any of several carbohydrates, such as glucose, fructose, galactose, that cannot be broken down to simpler sugars.

**Polypeptide**—A molecule made up of a string of amino acids. A protein is an example of a polypeptide.

**Oligosaccharide**—A carbohydrate that consists of a relatively small number of monosaccharides, such as maltodextrins, fructo-oligo-saccharides.

**Polyol**—An alcohol containing more than two hydroxyl (OH) groups, such as sugar alcohols, inositol.

**Polysaccharide**—Any of a class of carbohydrates, such as starch, amylose, amylopectin and cellulose, consisting of several monosaccharides.

**Proteases**—Enzymes that break peptide bonds between the amino acids of proteins.

**Protein biosynthesis**—Biochemical process, in which proteins are synthesized from simple amino acids.

**Protein sequence**—The arrangement of amino acids in a protein.

**Starch**—Complex carbohydrate (polysaccharide) found chiefly in seeds, fruits, tubers, and roots.

carbohydrates occur in a wide variety of foods. For example, table sugar (sucrose) is a combination of the glucose and fructose that occurs naturally in sugar beet, sugar cane and fruits. Lactose is the main sugar in milk and dairy products and maltose is a sugar occurring in malt. Another type of carbohydrate are the polyols, the so-called sugar alcohols. They do occur naturally but most are made commercially by the transformation of sugars. Complex carbohydrates also include starch, the main energy reserve in root vegetables and cereals. Non-starch carbohydrates are the main components of dietary fiber. These are the indigestible portion of plant foods, such as cellulose, the major component of plant cell walls that consists of several thousand glucose units. Simple sugars are absorbed directly by the small intestine into the bloodstream, where they are then transported to where they are required. Complex carbohydrates are broken down by enzymes into their constituent sugars which are then absorbed into the bloodstream while dietary fiber moves food through the digestive system.

### *Fats*

Besides being a source of energy, fat stores protect the internal organs of the body. Some essential fats are also required for the formation of hormones. Fats are the slowest source of energy but the most energy-efficient form of food. Each gram of fat supplies the body with about 9 calories, more than twice

that supplied by the two other macronutrients. Because fats are such an efficient form of energy, they are stored by the body either in the abdomen (omental fat) or under the skin (subcutaneous fat) for use when the body needs more energy. Fats that are in foods are combinations of four main types:

- Saturated fats: These fats consist of fatty acid chains that have no double bonds between the carbon atoms of the chain. They are called saturated because they are fully saturated with hydrogen atoms and cannot incorporate more. They are solid at room temperature and are most often of animal origin. Examples are butter, cheese, and lard. These fats provide a concentrated source of energy in the diet and building blocks for cell membranes and a variety of hormones and hormone-like substances. An excess of these fats in the diet however, is believed to raise the cholesterol level in the bloodstream.
- Monounsaturated fats: These are composed mostly of monounsaturated fatty acids, meaning molecules with one double-bonded carbon, with all the others carbons being single-bonded. They are liquid at room temperature. Examples are olive, peanut and canola oil. They appear to protect against heart disease, in that they reduce blood cholesterol levels.
- Polyunsaturated fats: These fats are composed mostly of fatty acids such as linoleic or linolenic acids which have two or more double bonds in each molecule, as for example corn oil and safflower oil. They are also liquid at room temperature and can be further divided into the omega-6 and the omega-3 families. Polyunsaturated fats are thought to reduce the risk of coronary heart disease. The omega-3 forms are believed to have a positive impact on heart health and to play an important role in brain and eye function. Oily fish such as salmon, herring and mackerel are examples of omega-3s, and they are also found in walnuts and some oils like soybean and rapeseed.
- *Trans* fatty acids. Unsaturated fats come in different chemical structures: a bent *cis* form or a straight *trans* form. When they adopt the *trans* form, they are called *trans* fatty acids. They are produced by the partial hydrogenation of vegetable oils and present in hardened vegetable oils, most margarines, commercial baked foods, and many fried foods. An excess of these fats in the diet is thought to increase the risk of heart disease.

## Description

The three types of macronutrients do not have the same chemical composition. When compared with carbohydrates and fats, proteins are very different. Fats largely consist of hydrocarbon chains, containing 75–85% carbon. Carbohydrates are roughly 50% oxygen, and like fats, they usually have less than 5% nitrogen or none at all. Proteins, on the other hand, consist of 15–25% nitrogen and about an equal amount of oxygen. The three macronutrients are often found together in most foods, but in varying amounts, or alone in other foods. The Nutrition Facts labels provide a breakdown of the macronutrient composition of various foods.

### *Proteins*

According to RDI, between 10 and 35% of calories should come from protein.

Foods that are a source of protein include:

- Animal protein: Meat, poultry, fish, eggs, milk, cheese and yogurt provide high biological value proteins, because they contains all the essential amino acids.
- Plant proteins: Plants, legumes, grains, nuts, seeds and vegetables provide low biological value proteins. However, combining proteins from different plant sources in the same meal often results in a mixture of higher biological value. Examples of such combinations are: beans with rice, pasta or manioc, chickpeas with bread, lentils with potatoes, vegetables with cereals.

### *Carbohydrates*

According to the RDI, between 50 and 55% of calories should come from carbohydrates and 20–35 g dietary fiber per day should be taken by all those over two years of age.

Sources of dietary carbohydrates include:

- Monosaccharides: fruits, berries, vegetables and honey.
- Disaccharides: table sugar, sugar beet, sugar cane and fruits.
- Polyols: Isomalt
- Oligosaccharides: grains and vegetables
- Starch polysaccharides: cereals, whole grains, rice, pasta, potatoes, peas, corn and legumes.
- Non-starch polysaccharides: dietary fiber such as cellulose, hemicelluloses, pectins and gums.

### *Fats*

Overall fat intake should be no more than 30–35% of total calories, with no more than 10% of calories coming from saturated fats. This means that the remaining 20–25% of calories should come from mono and polyunsaturated sources. It is also recommended to

include more omega-3s polyunsaturated fats in the diet while keeping trans fats to a minimum.

Sources of dietary fats include:

- Saturated: Butter, cheese, meat, meat products (sausages, hamburgers), whole milk and yoghurt, pies, pastries, lard, dripping, hard margarines and baking fats, coconut and palm oil.
- Monounsaturated: Olives, rapeseed, nuts (pistachio, almonds, hazelnuts, macadamia, cashew, pecan), peanuts, avocados, and their oils.
- Omega-3 polyunsaturated: Salmon, mackerel, herring, trout (particularly rich in the long chain omega-3 fatty acids EPA or eicosapentaenoic acid and DHA or docosahexaenoic acid), walnuts, rapeseed, soybean flax seed, and their oils.
- Omega-6 polyunsaturated: Sunflower seeds, wheat germ, sesame, walnuts, soybean, corn and their oils. Certain margarines
- Trans fatty acids: Some frying and baking fats (hydrogenated vegetable oils) used in biscuits, cakes and pastries, dairy products, fatty meat from beef and sheep.

## Precautions

The main potential adverse effect associated with macronutrients is that if they are not consumed in the required amounts, a nutritional deficiency disorder may result, affecting body function more or less severely. Some precautions are also advisable concerning the excessive consumption of specific macronutrients. For example, foods containing sugars or starch are broken down by enzymes and bacteria in the mouth that produce acid, which attacks the enamel of the teeth. Saliva normally provides a natural repair process that rebuilds the enamel. But when carbohydrate-containing foods are consumed too frequently, the repair process is too challenged and tooth decay occurs. As for fats, their excessive consumption leads to overweight and **obesity**. Excess fat is not only stored subcutaneously but also in blood vessels and organs, where it blocks blood flow and damages organs such as the heart. Precautions are also required for people who avoid all foods of animal origin as they may have difficulty meeting their protein requirements.

## Interactions

Adequate intakes of protein, fat and carbohydrate are essential to normal growth, development and body maintenance but unlike micronutrients (**vitamins** and **minerals**) where a specific deficiency or excess can be related to a specific disease, the relationships between macronutrients and nutritional disease is much more difficult to understand. This is partly because macronutrients interact with each other and with substances in the body in a way that is very hard to describe accurately. They can also inter-convert, while all contribute to energy intake. Most people enjoy a wide variety of foods with no problems. But for some people however, the interactions of specific foods or their components with the body may cause adverse reactions ranging from a slight rash to a severe allergy.

## Aftercare

In the case of allergic reaction, the only way to treat sensitive individuals is to eliminate the food or food component from the diet. In the case of food intolerance, limiting the food to smaller servings may be sufficient to avoid symptoms. The number of calories required to correct or maintain weight depends on several factors, including age and activity level. This is why conditions such as nutritional deficiencies and obesity require professional care, that should be supervised by a physician working with a dietician.

## Complications

A common complication of unbalanced intake of macronutrients is diabetes, a metabolic disorder whereby the body cannot regulate blood glucose levels properly. There is no evidence that sugar consumption is linked to the development of any type of diabetes. However there is now good evidence that obesity and physical inactivity increase the likelihood of developing non-insulin dependent diabetes, which usually occurs in middle age. Weight reduction is usually necessary and is the primary dietary aim for people with non-insulin dependent diabetes. Consuming a wide range of carbohydrate foods is an acceptable part of the diet of all diabetics, and the inclusion of low glycaemic index foods is beneficial as they help regulate blood glucose control.

## Parental concerns

Today's lifestyles are vastly different from those of the past. The fast pace of modern lifestyles and the increase of households where both parents work have lead to marked changes in food preparation and consumption habits. A positive consequence has been the emergence of convenient foods and important advances in food technology that help ensure the safety and wholesomeness of the food supply. However, a negative consequence has also been a significant increase in ready-to-eat foods of low nutritional value (junk

food). Parents are accordingly concerned about their kids developing bad nutritional habits. Fortunately, there is a wealth of information about food, made available to help ensure that diets are nutritious, which parents can use to teach their kids to make informed decisions concerning which foods, and in what quantities, are best for good health.

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#### ORGANIZATIONS


American Dietetic Association (ADA). 120 South Riverside Plaza, Suite 2000, Chicago, IL 60606-6995. 1-800/877-1600. <http://www.eatright.org>.

American Society for Nutrition (ASN). 9650 Rockville Pike, Bethesda, MD 20814. (301) 634-7050. <http://www.nutrition.org>.

U.S. Department of Agriculture, Food and Nutrition Information Center. National Agricultural Library,10301 Baltimore Avenue, Room 105, Beltsville, MD 20705. (301) 504-5414. <http://www.nal.usda.gov>.

USDA Center for Nutrition Policy and Promotion (CNPP). 3101 Park Center Drive, 10th Floor, Alexandria, VA 22302-1594. (703) 305-7600. <http://www.cnpp.usda.org>.



Monique Laberge, Ph.D.


# Magnesium

## Definition

Magnesium (Mg) is an element belonging to the alkaline earth metal group. It participates in over 300 metabolic reactions, is crucial for life and health and is the fourth most common mineral in the body. In the body, it forms ions that have an electric charge of +2. Humans must meet their needs for magnesium from their diet. Magnesium is found mainly in plants and in some drinking **water**.

**Magnesium**

| Age | Recommended Dietary Allowance (mg) | Tolerable Upper Intake Level of Dietary Supplements (mg) |
|---|---|---|
| Children 0–6 mos. | 30 (AI) | Not established |
| Children 7–12 mos. | 75 (AI) | Not established |
| Children 1–3 yrs. | 80 | 65 |
| Children 4–8 yrs. | 130 | 110 |
| Children 9–13 yrs. | 240 | 350 |
| Boys 14–18 yrs. | 410 | 350 |
| Girls 14–18 yrs. | 360 | 350 |
| Men 19–30 yrs. | 400 | 350 |
| Women 19–30 yrs. | 310 | 350 |
| Men 31≥ yrs. | 420 | 350 |
| Women 31≥ yrs. | 320 | 350 |
| Pregnant women 18≤ yrs. | 400 | 350 |
| Pregnant women 19–30 yrs. | 350 | 350 |
| Pregnant women 31≥ yrs. | 360 | 350 |
| Breastfeeding women 18≤ yrs. | 360 | 350 |
| Breastfeeding women 19–30 yrs. | 310 | 350 |
| Breastfeeding women 31≥ yrs. | 320 | 350 |

| Food | Magnesium (mg) |
|---|---|
| Cereal, 100% bran, ½ cup | 129 |
| Oat bran, ½ cup, dry | 96 |
| Halibut, cooked, 3 oz. | 90 |
| Almonds, roasted, 1 oz. | 80 |
| Cashew nuts, roasted, 1 oz. | 75 |
| Spinach, cooked, ½ cup | 75 |
| Swiss chard, cooked, ½ cup | 75 |
| Beans, lima, cooked, ½ cup | 63 |
| Shredded wheat, 2 biscuits | 54 |
| Peanuts, roasted, 1 oz. | 50 |
| Black-eyed peas, cooked, ½ cup | 43 |
| Brown rice, cooked, ½ cup | 40 |
| Beans, pinto, cooked, ½ cup | 35 |

AI = Adequate Intake
mg = milligram

*(Illustration by GGS Information Services/Thomson Gale.)*

## Purpose

Magnesium is necessary for many cellular reactions critical to maintaining life. It plays a role in:

- strengthening bones
- synthesizing new deoxyribonucleic acid (DNA; genetic material)
- synthesizing proteins
- muscle contraction

## KEY TERMS

**Dietary supplement**—A product, such as a vitamin, mineral, herb, amino acid, or enzyme, that is intended to be consumed in addition to an individuals diet with the expectation that it will improve health

**Diuretic**—A substance that removes water from the body by increasing urine production

**Electrolyte**—Ions in the body that participate in metabolic reactions. The major human electrolytes are sodium (Na+), potassium (K+), calcium (Ca 2+), magnesium (Mg2+), chloride (Cl-), phosphate ($HPO_4$ 2-), bicarbonate ($HCO_3$-), and sulfate ($SO_4$ 2-).

**Glucose**—A simple sugar that results from the breakdown of carbohydrates. Glucose circulates in the blood and is the main source of energy for the body.

**Ion**—An atom or molecule that has an electric charge. In the body ions are collectively referred to as electrolytes.

**Mineral**—An inorganic substance found in the earth that is necessary in small quantities for the body to maintain health. Examples: zinc, copper, iron.

**Osteoporosis**—A condition found in older individuals in which bones decrease in density and become fragile and more likely to break. It can be caused by lack of vitamin D and/or calcium in the diet.

**Ribonucleic acid (RNA)**—A molecule that helps decode genetic information (DNA) and is necessary for protein synthesis

**Serum**—The clear fluid part of the blood that remains after clotting. Serum contains no blood cells or clotting proteins, but does contain electrolytes.

**Triglycerides**—A type of fat found in the blood. High levels of triglycerides can increase the risk of coronary artery disease

**Type 2 diabetes**—Sometimes called adult-onset diabetes, this disease prevents the body from properly using glucose (sugar).

- nerve impulse transmission
- conversion of nutrients into energy
- movement of ions across cell membranes
- regulation of blood glucose (sugar) levels
- regulation of blood pressure
- protecting the body against cardiovascular disease

## Description

Magnesium is in chlorophyll, the pigment that makes plants green. Humans absorb magnesium from food as it passes through the small intestine. The kidneys normally regulate how much magnesium is in the blood, and any excess magnesium is excreted in urine. Magnesium levels can be measured with a blood test.

When magnesium dissolves in body fluids, it becomes an electrolyte. **Electrolytes** are ions that have an electric charge. Magnesium is a cation, or positively charged ion, with an electric charge of +2, meaning it has lost two of its negatively charged elections. Other important electrolytes in the body are **sodium** (Na+), potassium (K+), **calcium** (Ca 2+), and the negatively charged ions chloride (Cl-), phosphate ($HPO_4$ 2-), bicarbonate ($HCO_3$-), and Sulfate ($SO_4$ 2-). Multiple electrolytes are involved in most metabolic reactions. These electrolytes are not evenly distributed within the body, and their electric charge and uneven distribution are what allow many chemical reactions to occur. About 50-60% of the 25 grams of magnesium in an adult's body, is in the bones. About 25% is in muscle cells, 6–7% in other cells, and less than 1% outside cells (e.g. in extracellular fluid or in blood serum).

Magnesium is involved in many reactions. One of the most important is in synthesizing adenosine triphosphate (ATP), the molecule that supplies most of the energy to drive cellular **metabolism**. Magnesium is also required to create new DNA, Ribonucleic acid (RNA), and proteins. The electrical charge of the magnesium ion is important in regulating the transmission of nerve impulses, muscle contraction, and the movement of nutrients and other electrolytes in and out of cells. Magnesium also has an effect on the way calcium is deposited in bones. It makes bone structurally more dense and stronger.

### *Normal magnesium requirements*

The United States Institute of Medicine (IOM) of the National Academy of Sciences has developed values called **Dietary Reference Intakes** (DRIs) for many **vitamins** and **minerals**. The DRIs consist of three sets of numbers. The Recommended Dietary Allowance (RDA) defines the average daily amount of the

nutrient needed to meet the health needs of 9,798 of the population. The Adequate Intake (AI) is an estimate set when there is not enough information to determine an RDA. The Tolerable Upper Intake Level (UL) is the average maximum amount that can be taken daily without risking negative side effects. The DRIs are calculated for children, adult men, adult women, pregnant women, and **breastfeeding** women.

The IOM has not set RDAs for magnesium in children under one year old because of incomplete scientific information. Instead, it has set AI levels for this age group. The RDAs for magnesium are the amount that has been determined to prevent deficiency. However, based on recent findings about the relationship between magnesium, diabetes, and cardiovascular disease, there is some debate over whether this represents the optimum amount for health. RDAs and ULs for magnesium are measured in milligrams (mg). There are no ULs for magnesium that is obtained from food and water. All magnesium ULs apply to **dietary supplements** only.

The following list gives the daily RDAs and IAs and ULs for magnesium for healthy individuals as established by the IOM.

- children birth–6 months: AI 30 mg; UL not established; All magnesium should come from breast milk, fortified formula, or food.
- children 7–12 months: AI 75 mg; UL not established; All magnesium should come from breast milk, fortified formula, or food.
- children 1–3 years: RDA 80 mg; UL 65 mg
- children 4–8 years: RDA 130 mg; UL 110 mg
- children 9–13 years: RDA 240 mg; UL 350 mg
- boys 14–18 years: RDA 410 mg; UL 350 mg
- girls 14–18 years: RDA 360 mg; UL 350 mg
- men 19–30 years: RDA 400 mg; UL 350 mg
- women 19–30 years: RDA 310 mg; UL 350 mg
- men age 31 and older: RDA 420 mg; UL 350 mg
- women age 31 and older: RDA 320 mg; UL 350 mg
- pregnant women 18 years and younger: RDA 400 mg; UL 350 mg
- pregnant women 19–30 years: RDA 350 mg; UL 350 mg
- pregnant women 31 years and older: RDA 360 mg; UL 350 mg
- breastfeeding women 18 years and younger: RDA 360 mg; UL 350 mg
- breastfeeding women 19–30 years: RDA 310 mg; UL 350 mg
- breastfeeding women 31 years and older: RDA 320 mg; UL 350 mg

### *Sources of magnesium*

Chlorophyll, the pigment that makes plants green, contains magnesium. Good natural sources of magnesium include dark green vegetables such as spinach and Swiss chard. Other vegetables high in magnesium are lima beans, black-eyed peas, almonds, cashew nuts, and peanuts. Whole grains contain a lot of magnesium, but processing removes most of it. Therefore brown rice is a good source of magnesium, but white rice is not. Whole wheat flour has more magnesium than white flour, and wheat bran and oat bran have more than either type of flour. Some water that is high in minerals (hard water) has a significant amount of magnesium; the amount varies widely depending on location. Magnesium is also found in many multivitamins and is available as a single-ingredient supplement. The amount of magnesium available to the body from dietary supplements varies depending on the molecule in which magnesium is found. Common forms of magnesium in dietary supplements include magn! esium oxide, magnesium gluconate, magnesium citrate, and magnesium aspartate. Some antacids contain a significant amount of magnesium hydroxide. The best way to get an adequate amount of magnesium is to eat a healthy diet high in green vegetables and whole grains.

The following list gives the approximate magnesium content for some common foods:

- 100% bran cereal, 1/2 cup: 129 mg
- oat bran, 1/2 cup dry: 96 mg
- shredded wheat, 2 biscuits: 54 mg
- halibut, cooked 3 ounces: 90 mg
- almonds, roasted, 1 ounce: 80 mg
- cashew nuts, roasted, 1 ounce:75 mg
- peanuts, roasted, 1 ounce: 50 mg
- spinach, cooked, 1/2 cup: 75 mg
- Swiss chard, cooked, 1/2 cup: 75 mg
- lima beans, cooked, 1/2 cup: 63 mg
- black-eyed peas, cooked, 1/2 cup: 43 mg
- pinto beans, cooked, 1/2 cup: 35 mg
- brown rice, cooked, 1/2 cup: 40 mg

### *Magnesium excess and deficiency*

Magnesium excess is called hypermagnesemia. This condition is rare. It occurs most often in people with severe kidney disease (end-stage renal failure), when the kidney can no longer remove magnesium ions from the blood. Another common cause is human error in calculating the amount of intravenous (IV) fluids containing magnesium to give to seriously

ill patients in the hospital. Abuse of antacids and laxatives containing magnesium hydroxide can also result in hypermagnesemia. Symptoms of hypermagnesemia (in increasing severity )include nausea, vomiting, lightheadedness, muscle weakness, loss of deep tendon reflexes, low blood pressure, irregular heart rhythms, coma, and death.

Hypomagnesemia, or low levels of magnesium are estimated to occur in about 2 of the American population, in 1,020 of hospitalized patients, and in up to 60 of patients in intensive care. Anywhere between 30 and 80 of people with alcoholism have hypomagnesemia, as do about one-fourth of people with diabetes.

Magnesium deficiency can be caused either by insufficient intake or excessive excretion of magnesium. Causes of insufficient intake include digestive disorders that interfere with the absorption of magnesium (e.g. Crohns disease, **celiac disease**, inflammatory bowel syndrome), malnutrition with a limited diet of green vegetables, alcoholism (alcohol is substituted for food), and **anorexia nervosa** (self-starvation). Some causes of excessive excretion of magnesium include kidney failure, diabetes, use of some diuretic drugs, and some hormone disorders of the parathyroid gland.

## Precautions

The kidneys are the main regulator of magnesium. People with kidney disease should not take magnesium supplements.

Pregnant women should discuss their magnesium needs with their healthcare provider. Many pregnant women have low levels of magnesium but should use supplements only under medical supervision. Low magnesium levels are thought to contribute to preeclampsia and eclampsia and possibly to increase the risk of early labor.

People undergoing surgery should tell their anesthesiologist if they are taking magnesium supplements, antacids, or laxatives because magnesium increases the muscle-relaxing effects of certain anesthetics.

## Interactions

Certain drugs and conditions can cause an excessive loss of magnesium. These include:

- cisplatin, a drug used in cancer treatment
- diuretics (water pills)
- fluoride poisoning

Certain drugs may be less effective when taken with magnesium supplements. These include some antibiotics, and digoxin, a heart medication. **Iron** may be absorbed more poorly in the presence of magnesium.

Some minerals decrease the absorption of magnesium. These include calcium, **manganese**, and phosphate. Boron appears to increase magnesium levels.

## Complications

No complications are expected from magnesium obtained from food and water. Potential complications related to excess use of magnesium supplements or from inadequate levels of magnesium are discussed above.

## Parental concerns

The safety of magnesium supplements in children has not been investigated. Breastfeeding women should avoid magnesium supplements and children should be encouraged to meet their magnesium requirements by eating a healthy diet high in green vegetables and whole grains and low in fat.

### Resources

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**ORGANIZATIONS**

American Heart Association. 7272 Greenville Avenue, Dallas, TX 75231. Telephone: (800) 242-8721. Website: http://www.americanheart.org

Linus Pauling Institute. Oregon State University, 571 Weniger Hall, Corvallis, OR 97331-6512. Telephone: (541) 717-5075. Fax: (541) 737-5077. Website: http://lpi.oregonstate.edu

Office of Dietary Supplements, National Institutes of Health. 6100 Executive Blvd., Room 3B01, MSC 7517, Bethesda, MD 20892-7517 Telephone: (301)435-2920. Fax: (301)480-1845. Website: http://dietary-supplements.info.nih.gov

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Helen Davidson

# Maker's diet

## Definition

The Maker's diet is a diet based on biblical dietary laws. It provides guidelines to help dieters to eat as they were created to eat. It encompasses aspects of physical, mental, spiritual and emotional health.

## Origins

The Maker's diet is the result of a personal journey by its creator, Jordan Rubin. Rubin was a healthy, happy athletic young man who had an athletic scholarship to college. Everything seemed fine, but then in 1994, when he was 19, he was diagnosed with **Crohn's disease**. Crohn's disease is a disease of the gastrointestinal system, and is a chronic **inflammatory bowel disease**. It affects about half a million people in the United States. There is no cure for this disease, although for most people it can be managed with prescription medications. This however, was not the case for Rubin.

Rubin reports that he had many symptoms of severe Crohn's disease including abdominal pain, chronic diarrhea, intestinal parasites, eye inflammation, arthritis, bladder infection, chronic fatigue, chronic depression, and many other debilitating problems. He could not find a treatment that helped him, and in a search for one he saw more than 70 doctors and other health professionals in seven countries. In all, he says that he tried more than 500 different treatments. The treatments he tried ranged from conventional medicine to natural remedies, but none of them worked for him.

According to Rubin, all that changed when his father tried one more person. Rubin refers to the person as an "eccentric nutritionist" because he was not a professional and had some very different ideas. What he told Rubin was that his problems all stemmed from not eating the way *The Bible* prescribes. Rubin began to look in *The Bible* for diet information, and combining what he found with what the eccentric nutritionist had told him, he started to change his diet. Rubin found that his symptoms began to clear up, and after a time, went away completely. Since this time he reports that his Crohn's disease has been in complete remission. The diet that he followed forms the basis of the Maker's diet.

Jordan Rubin earned a degree in Naturopathic Medicine from Peoples University of the Americas School of Natural Medicine, and a Ph.D. in Nutrition from the Academy of Natural Therapies, which is not accepted as qualification by the American Dietetic Association or other nutrition organizations. He is also a certified personal trainer and certified nutritional consultant. He has appeared on many different television programs and written several books including one titled *The Makers Diet*. He is also the founder and chief executive officer of Garden of Life, Inc. which he founded in 1998. The company produces supplements and other health products.

## Description

The Maker's diet was created by Jordan Rubin to follow the dietary laws set down by *The Bible*. He believes that following these laws, and by eating the way people ate 100 or more years ago, is the way that man was meant to eat. He believes that because man was not meant to eat the way he eats today these incorrect eating habits are to blame for many of the diseases and conditions that are so prevalent in industrialized society today.

## KEY TERMS

**Dietary supplement**—A product, such as a vitamin, mineral, herb, amino acid, or enzyme, that is intended to be consumed in addition to an individual's diet with the expectation that it will improve health.

**Mineral**—An inorganic substance found in the earth that is necessary in small quantities for the body to maintain a health. Examples: zinc, copper, iron.

**Obese**—More than 20% over the individual's ideal weight for their height and age or having a body mass index (BMI) of 30 or greater.

**Toxin**—A general term for something that harms or poisons the body.

**Vitamin**—A nutrient that the body needs in small amounts to remain healthy but that the body cannot manufacture for itself and must acquire through diet.

Rubin takes two of his main dietary laws from Leviticus, a book of *The Bible*. Leviticus (11:9-10) says to eat "whatsoever hath fins and scales in the waters" but not to eat "all that have not fins and scales in the seas." Rubin says that this means that fish with scales are intended to be eaten, such as salmon and trout, but smooth fish such as catfish and eels should not be eaten. It also means that crustaceans with hard shells such as lobster, crabs, and clams are not to be eaten. The other main dietary law taken from *The Bible* is also taken from Leviticus (11:3 and 11:7-8). Here *The Bible* says that man should eat "whatsoever parteth the hoof, and is clovenfooted, and cheweth the cud". Man should not eat "the swine, though he divide the hoof, and be cloven footed, yet he cheweth not the cud; he is unclean to you." This means that most animals can be eaten, such as cows, goats, and sheep because all these animals chew their cud. The main four-footed animal that cannot be eaten is pig because he does not chew his cud. This means that all forms of pork are forbidden. The dietary laws that Rubin derives from these passages are generally the same as the Kosher laws followed by Jewish people.

In addition to the dietary laws taken directly from *The Bible*, Rubin believes in eating a variety of whole foods that are processed little or none. This generally means choosing foods like brown rice, which have not been processed much, over white rice, which is significantly processed. He believes that eating many processed foods that have additives and preservatives goes against the diet man was meant to eat. He also believes that organic foods and meat from animals that were raised eating grass instead of wild grain is more in line with the foods man was intended to eat. The diet plan has three phases that last a total of 40 days and a maintenance stage intended to help the dieter follow the guidelines for the rest of his or her life.

Phase 1 is intended to correct harmful imbalances in the body, and lasts from day 1 to day 14. This phase has the most limited diet because it is intended to detoxify the body. The foods eliminated during this phase include **caffeine**, sugar, **artificial sweeteners**, and preservatives. Dieters may find themselves feeling mildly ill during the beginning of this phase, with headaches and flu-like symptoms. Rubin says this is because the body is coming back into balance and ridding itself of harmful toxins.

Phase 2 lasts from day 15 through day 28 of the diet, and is intend to return the dieter to optimal health. During this phase some of the foods restricted during phase 1 are reintroduced. Rubin says that by this time the dieter should feel better, have begun to lose weight, and see other positive changes. Phase 3 of the diet lasts from day 29 through day 40 of the diet. This is intended to help the dieter "claim health for life." During this phase more restricted foods are reintroduced into the diet. The foods allowed again during this phase include starchy foods such as bananas, potatoes, and bread.

After 40 days the three main phases of the diet end, and the dieter is supposed to be in optimal health and an increased state of wellness. The phase that occurs at this point is the maintenance phase of the diet, called "wellness for life." This phase is intended to last throughout the lifetime of the dieter.

Rubin provides many different tools for dieters to use including meal plans, shopping lists, and recipes. He also recommends getting plenty or exercise, especially outdoors in the sunshine, and taking one day a week off from doing any work. Rubin also makes recommendations for good hygiene such as regular hand washing. In addition to helping dieters achieve improved physical health, Rubin also says that his plan will help dieters achieve better mental, emotional, and spiritual health. Much of this comes in the form of fellowship with other dieters, spiritual community, and regular prayer.

### Function

The first 40 days of this diet is intended to detoxify the body and provide weight loss and overall better

physical health. It is also intended to improve the emotional and **mental health** of the dieter. Through its emphasis on prayer and Biblical understanding it is intended to provide better spiritual health. After the 40 days are over and the diet moves into its maintenance phase, the diet is intended to help the dieter maintain his or her improved physical, mental, emotional, and spiritual health for a lifetime. Although Jordan Rubin reports that following this diet caused his Crohn's disease to go into remission, it is not intended to treat or cure any disease or condition.

## Benefits

There are many benefits to following a diet that includes a variety of fresh fruits and vegetables and many whole grains. There is also significant benefit to losing weight and getting more exercise. People who get regular exercise are at a lower risk for heart disease and other cardiovascular diseases than people who do not get any exercise. Weight loss itself can have many positive health benefits. **Obesity** is strongly associated with many diseases and conditions, such as diabetes and cardiovascular disease. People who are extremely obese are at greater risk of these diseases and are likely to have more severe symptoms. Weight loss can reduce these risks and may even reduce the severity of symptoms experienced by people who have already have been affected.

Rubin reports that his diet will enable dieters to concentrate better, and will enhance their moods. He also says that it can reduce arthritis pain and inflammation, and can reduce the risk of **cancer** and heart disease. He also says that it can reverse the "accelerated aging" caused by the way people eat and live today.

## Precautions

Anyone thinking of beginning a new diet should consult a medical practitioner. Requirements of calories, fat, and nutrients can differ significantly from person to person, depending on gender, age, weight, and many other factors such as the presence of any diseases or conditions. Pregnant or **breastfeeding** women should be especially cautious because deficiencies of **vitamins** or **minerals** can have a significant negative impact on a baby. The Maker's diet requires the addition of supplements to the diet. Pregnant or breastfeeding women should be especially careful when taking a supplement because too much of certain vitamins or minerals can also be harmful to babies.

### QUESTIONS TO ASK THE DOCTOR

- Is the supplement suggested by this diet right for me? Is there another supplement or multivitamin that would be appropriate for me if I were to begin this diet?
- Is this diet appropriate for my entire family?
- Is it safe for me to follow this diet over a long period of time?
- Is this diet the best diet to meet my goals?
- Are there any sign or symptoms that might indicate a problem while on this diet?

## Risks

There are some risks with any diet. It is often difficult to get enough of some vitamins and minerals when eating a limited variety of foods. Usually taking a supplement or multi-vitamin can help reduce this risk. The Maker's requires and recommends various supplements. Supplements are not regulated by the Food and Drug Administration in the same way as prescription medicines. Taking any supplement carries its own set of risks.

## Research and general acceptance

Any diet that follows the United States Department of Agriculture's MyPyramid guide recommendations is generally accepted as a healthy diet for most adults. In 2007 the Center for Disease Control recommended that healthy adults get at least 30 minutes per day of light to moderate exercise. Following this diet will probably meet many of these recommendations for most people.

There are many scientific studies showing that weight loss can have positive effects on many aspects of general health. There are also many studies showing the positive effects of regular exercise on cardiovascular and general health. There are no significant peer reviewed journal articles on the Maker's Diet however. There is no significant scientific proof that the diet can relieve arthritis or inflammation. The diet also stresses organic foods, which it considers to be better and more healthful than non-organic foods. This is not necessarily always the case. The diet also emphasizes hand washing as an important part of hygiene. Regular hand washing is generally accepted to lower the chances of contracting and spreading disease.

There is also no scientific evidence to suggest that diet can detoxify the body.

There has been some concern about the supplements that are required or recommended for the Maker's diet program. These supplements are made by Rubin's company Garden of Life, Inc. In a letter dated May 11, 2004 the United States Food and Drug Administration ordered the company to stop making unsubstantiated claims about eight of its products and supplements. The claims were made in brochures, on labels, and in Rubin's book *Patient Heal Thyself*.

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#### ORGANIZATIONS

American Dietetic Association. 120 South Riverside Plaza, Suite 2000, Chicago, Illinois 60606-6995. Telephone: (800) 877-1600. Website: <http://www.eatright.org>

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Helen M. Davidson

# Manganese

## Definition

Manganese (Mn) is a mineral necessary in very tiny (trace) amounts for human health. In large quantities, manganese is poisonous. Manganese is used in some enzyme reactions and for the proper development of bones and cartilage. Humans must meet their needs for manganese from their diet. Manganese is found mainly in plants and in small quantities in some drinking **water**.

**Manganese**

| Age | Recommended Dietary Allowance (mg) | Tolerable Upper Intake Level (mg) |
|---|---|---|
| Children 0–6 mos. | 0.3 (AI) | Not established |
| Children 7–12 mos. | 0.6 (AI) | Not established |
| Children 1–3 yrs. | 1.2 | 2 |
| Children 4–8 yrs. | 1.5 | 3 |
| Boys 9–13 yrs. | 1.9 | 6 |
| Girls 9–13 yrs. | 1.6 | 6 |
| Boys 14–18 yrs. | 2.2 | 9 |
| Girls 14–18 yrs. | 1.6 | 9 |
| Men 19≥ yrs. | 2.3 | 11 |
| Women 19≥ yrs. | 1.8 | 11 |
| Pregnant women | 2.0 | 11 |
| Breastfeeding women | 2.6 | 11 |

| Food | Manganese (mg) |
|---|---|
| Tea, green, 1 cup | 1.58 |
| Pineapple, raw, ½ cup | 1.28 |
| Pecans, 1 oz. | 1.12 |
| Cereal, raisin bran, ½ cup | .94 |
| Brown rice, cooked, ½ cup | .88 |
| Spinach, cooked, ½ cup | .84 |
| Tea, black, 1 cup | .77 |
| Almonds, 1 oz. | .74 |
| Bread, whole wheat, 1 slice | .65 |
| Peanuts, 1 oz. | .59 |
| Sweet potato, mashed, ½ cup | .55 |
| Beans, navy, cooked, ½ cup | .51 |
| Beans, lima, cooked, ½ cup | .48 |
| Beans, pinto, cooked, ½ cup | .48 |

AI = Adequate Intake
mg = milligram

*(Illustration by GGS Information Services/Thomson Gale.)*

## Purpose

Researchers understand less about how manganese functions in the body than they do about many other **minerals**. Studies have shown that manganese is necessary for proper development of healthy bones and cartilage in animals. It is highly likely that manganese plays the same role in the development of human bones and connective tissue, although manganese deficiency is so rare in humans (and putting people on a prolonged manganese-free diet would be an unethical experiment) that this has not been proven experimentally.

Manganese is also necessary for the formation of an antioxidant enzyme in cellular mitochondria. Mitochondria, sometimes called the cell's power plant, are organelles that use large amounts of oxygen to produce energy. The production of energy by the mitochondria results in the formation of free radicals. Free

radicals are molecules that cause damage by reacting with **fats** and proteins in cell membranes and in genetic material. This process is called oxidation. **Antioxidants** are compounds that attach themselves to free radicals so that it is impossible for free radicals to react with, or oxidize, other molecules. In this way, antioxidants protect cells from damage. Although manganese is not by itself an antioxidant, it is a necessary part of the enzyme reaction that neutralizes free radicals produced by mitochondria. Manganese is also needed in some enzyme reactions that allow the body to process the use of amino acids, cholesterol, and **carbohydrates** in the body.

## Description

Manganese is acquired through diet. It is not evenly distributed in the body but is concentrated in the bones, liver, pancreas, and brain. Excess manganese is removed in bile, a digestive fluid made by the liver. The role of manganese in health is not well understood. Both manganese deficiency and manganese excess are rare. The few cases of dietary manganese excess that have been recorded have resulted from accidental exposure such as from drinking water contaminated with manganese-containing industrial waste. The United States Environmental Protection Agency (EPA) recommends a concentration of manganese no higher than .05 mg/L in drinking water. Side effects of high levels of manganese include loss of appetite, headaches, tremors, convulsions, and mental changes such a hallucinations. If manganese is inhaled in dust or vapor, it can cause severe damage to the nervous system. Some miners and industrial workers are at risk of being exposed to airborne manganese.

### *Normal manganese requirements*

The United States Institute of Medicine (IOM) of the National Academy of Sciences has developed values called **Dietary Reference Intakes** (DRIs) for many **vitamins** and minerals. The DRIs consist of three sets of numbers. The Recommended Dietary Allowance (RDA) defines the average daily amount of the nutrient needed to meet the health needs of 97–98% of the population. The Adequate Intake (AI) is an estimate set when there is not enough information to determine an RDA. The Tolerable Upper Intake Level (UL) is the average maximum amount that can be taken daily without risking negative side effects. The DRIs are calculated for children, adult men, adult women, pregnant women, and **breastfeeding** women.

The IOM has not set RDAs for manganese because not enough information is available about the need for manganese in humans. Instead, it has set AI levels for all age groups. Because high levels of manganese affect the nervous system, the ULs are very conservative. Some experts point out that vegans and vegetarians who eat large quantities of whole grains routinely take in manganese in amounts well above the established UL without any obvious adverse effects. IAs and ULs for manganese are measured in milligrams (mg).

The following list gives the daily IAs and ULs for manganese for healthy individuals as established by the IOM.

- children birth–6 months: AI 0.3 mg; UL not established; All manganese should come from food.
- children 7–12 months: AI 0.6 mg; UL not established; All manganese should come from food.
- children 1–3 years: RDA 1.2 mg; UL 2 mg
- children 4–8 years: RDA 1.5 mg; UL 3 mg
- boys 9–13 years: RDA 1.9 mg; UL 6 mg
- girls 9–13 years: RDA 1.6 mg; UL 6 mg
- boys 14–18 years: RDA 2.2 mg; UL 9 mg
- girls 14–18 years: RDA 1.6 mg; UL 9 mg
- children 4–8 years: RDA 1.5 mg; UL 3 mg
- boys 9–13 years: RDA 1.9 mg; UL 6 mg
- girls 9–13 years: RDA 1.6 mg; UL 6 mg
- boys 14–18 years: RDA 2.2 mg; UL 9 mg
- girls 14–18 years: RDA 1.6 mg; UL 9 mg
- men age 19 and older: RDA 2.3 mg; UL 11 mg
- women age 19 and older: RDA 1.8 mg; UL 11 mg
- pregnant women of all ages: RDA 2.0 mg; UL 11 mg
- breastfeeding women of all ages: RDA 2.6 mg; UL 11 mg

### *Sources of manganese*

Almost all people get enough manganese from their normal diet. Good sources of manganese include nuts, seeds, whole grains, leafy green vegetables, and tea. Some water that is high in minerals ("hard" water) may contain small amounts of manganese; the amount varies depending on location. Whole grains contain manganese, but processing removes most of it. Therefore brown rice is a good source of manganese, but white rice is not. Whole wheat flour has more manganese than white flour, and wheat bran has more than either type of flour. Manganese is also found in multivitamin/mineral supplements, and in single-ingredient supplements. Joint supplements that contain **glucosamine** and chrondroitin may also contain manganese. The best way to get an adequate amount of manganese

## KEY TERMS

**Alternative medicine**—A system of healing that rejects conventional, pharmaceutical-based medicine and replaces it with the use of dietary supplements and therapies such as herbs, vitamins, minerals, massage, and cleansing diets. Alternative medicine includes well-established treatment systems such as homeopathy, Traditional Chinese Medicine, and Ayurvedic medicine, as well as more-recent, fad-driven treatments.

**Amino acid**—Molecules that are the basic building blocks of proteins.

**Antioxidant**—A molecule that prevents oxidation. In the body antioxidants attach to other molecules called free radicals and prevent the free radicals from causing damage to cell walls, DNA, and other parts of the cell.

**Bile**—A greenish-yellow digestive fluid produced by the liver and stored in the gall bladder. It is released into the intestine where it helps digest fat, and then is removed from the body in feces.

**Conventional medicine**—Mainstream or Western pharmaceutical-based medicine practiced by medical doctors, doctors of osteopathy, and other licensed health care professionals.

**Dietary supplement**—A product, such as a vitamin, mineral, herb, amino acid, or enzyme, that is intended to be consumed in addition to an individual's diet with the expectation that it will improve health.

**Enzyme**—A protein that change the rate of a chemical reaction within the body without themselves being used up in the reaction.

**Free radical**—A molecule with an unpaired electron that has a strong tendency to react with other molecules in DNA (genetic material), proteins, and lipids (fats), resulting in damage to cells. Free radicals are neutralized by antioxidants.

**Glucose**—A simple sugar that results from the breakdown of carbohydrates. Glucose circulates in the blood and is the main source of energy for the body.

**Homeostasis**—The complex set of regulatory mechanisms that works to keep the body at optimal physiological and chemical stability in order for cellular reactions to occur.

**Hormone**—A chemical messenger that is produced by one type of cell and travels through the bloodstream to change the metabolism of a different type of cell.

**Mineral**—An inorganic substance found in the earth that is necessary in small quantities for the body to maintain a health. Examples: zinc, copper, iron.

**Osteoporosis**—A condition found in older individuals in which bones decrease in density and become fragile and more likely to break. It can be caused by lack of vitamin D and/or calcium in the diet.

**Serum**—The clear fluid part of the blood that remains after clotting. Serum contains no blood cells or clotting proteins, but does contain electrolytes.

is to eat a healthy diet high in green vegetables and whole grains.

The following list gives the approximate manganese content for some common foods:

- raisin bran cereal, 1/2 cup: 0.94 mg
- brown rice, cooked, 1/2 cup: 0.88 mg
- pinto beans, cooked, 1/2 cup: 0.48 mg
- lima beans, cooked, 1/2 cup: 0.48 mg
- navy beans, cooked, 1/2 cup: 0.51 mg
- whole wheat bread, 1 slice: 0.65 mg
- pineapple, raw, 1/2 cup: 1.28 mg
- pecans, 1ounce: 1.12 mg
- almonds, 1 ounce: 0.74 mg
- peanuts, 1 ounce: 0.59 mg
- spinach, cooked, 1/2 cup: 0.84 mg
- sweet potato, mashed, 1/2 cup: 0.55 mg
- tea, green, 1 cup (8 ounces): 0.40–1.58 mg
- tea, black, 1 cup (8 ounces): 0.18–0.77 mg

### *Controversial health claims for manganese*

Manganese supplements have not been proven effective in treating or preventing any specific disease or condition. However, based on a small number of laboratory and animal studies, practitioners of alternative medicine sometimes recommend supplemental manganese for the following conditions. These uses are considered speculative by practitioners of conventional medicine.

- prevention of osteoporosis
- treatment of rheumatoid arthritis
- treatment of premenstrual symptoms

- seizure prevention in individuals with epilepsy
- control of glucose levels in people with diabetes

### Precautions

Liver damage may reduce the rate at which **magnesium** is removed from the body. People with liver damage (e.g. cirrhosis) may be at higher risk of developing symptoms of manganese excess.

### Interactions

Antacids and laxatives that contain magnesium (e.g. milk of magnesia) may reduce the amount of manganese absorbed from food.

### Complications

No complications are expected from manganese acquired through food and water. Individuals who take multivitamin/mineral supplements containing manganese are unlikely to have any adverse effects. People who take manganese or joint supplements should be alert to how much manganese they are consuming, although overdose is extremely rare.

### Parental concerns

Parents should have few concerns about children getting either too much or too little manganese. Supplemental manganese should rarely be necessary. Parents should encourage their children to eat a diet high in fruits, vegetables, and whole grains.

### Resources

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Linus Pauling Institute. Oregon State University, 571 Weniger Hall, Corvallis, OR 97331-6512. Telephone: (541) 717-5075. Fax: (541) 737-5077. Website: <http://lpi.oregonstate.edu>

Office of Dietary Supplements, National Institutes of Health. 6100 Executive Blvd., Room 3B01, MSC 7517, Bethesda, MD 20892-7517 Telephone: (301)435-2920. Fax: (301)480-1845. Website: <http://dietary-supplements.info.nih.gov>

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Helen M. Davidson

## Maple syrup urine disease

### Definition

Maple syrup urine disease (MSUD), which is also known as branched-chain ketoaciduria, branched-chain alpha-keto acid dehydrogenase deficiency, or BCKD deficiency, is a rare but potentially fatal inherited metabolic disorder (IMD) passed down in an autosomal recessive pattern. The special diet associated with MSUD is a **low-protein diet** characterized by restriction of a specific amino acid known as leucine; the use of high-calorie liquid or gel formulas that are free of branched-chain amino acids (BCAAs); and frequent monitoring of the BCAA levels in the patient's blood plasma. Strict adherence to this diet is necessary to prevent developmental delays, mental retardation, and recurrent metabolic crises leading to respiratory failure and death.

### Origins

MSUD was first reported in 1954 by J. H. Menkes, a pediatrician, and his colleagues. The family in Menkes's case study had lost four infants within the first 3 months of life to a previously undescribed degenerative disorder of the nervous system. The urine of these infants smelled like maple syrup or burned sugar, whence the disease got its name of maple syrup urine disease or MSUD. An effective treatment, however, had to await further biochemical analysis of the metabolic dysfunction underlying the disease. In 1960, a researcher named Dancis established that the metabolic block in MSUD is caused by an insufficient supply of an enzyme that helps to

**Symptoms of Maple Syrup Urine Disease**

- Urine that smells like maple syrup
- Avoiding food
- Coma
- Feeding difficulties
- High-pitched crying
- Lethargy
- Poor weight gain
- Seizures
- Vomiting

*(Illustration by GGS Information Services/Thomson Gale.)*

break down three branched-chain amino acids—leucine, isoleucine, and valine—during the process of digestion. The deficient enzyme, now known as branched-chain alpha-keto acid dehydrogenase complex, or BCKD, was purified and defined in 1978.

Following Dancis's work, S. E. Snyderman and his colleagues reported on the first successful dietary therapy for MSUD in 1964, which they accomplished by restricting the patients' intake of foods containing high levels of branched-chain amino acids. Most protein-rich foods, such as meat, dairy products, and eggs, however, contain high levels of BCAAs. Dietary therapy of MSUD thus consists of a combination of **protein** substitutes containing amino acids without any BCAAs, and enough low-protein or protein-free foods to meet the patient's daily caloric requirements. The MSUD diet of the early 2000s as modified for different age groups is described in further detail below.

## Description

### *Maple syrup urine disease (MSUD)*

**GENERAL FEATURES.** MSUD is an inborn metabolic disorder (IMD), which means that it is a heritable disease characterized by the body's inability to process one or more specific substances essential to health. A person diagnosed with MSUD lacks the enzyme complex that is needed to break down the three BCAAs. The patient may lack the enzyme complex entirely, it may be inactivated, or it may be only partially active. In all three cases, the three BCAAs and their byproducts, which are called ketoacids, build up in the urine, blood, and other body tissues. In the classical (most severe) form of the disease, a baby born with MSUD develops a severe acidosis (abnormally high levels of acid in the blood) during the first week of life, followed by seizures and coma caused by swelling of the brain tissue, and finally death.

## KEY TERMS

**Amino acid**—One of 20 organic acids used as the building blocks of proteins in humans and other animals. The three amino acids involved in MSUD are called branched-chain amino acids or BCAAs because their chemical structures have side chains of carbon atoms that form a branch rather than a straight line.

**Autosomal recessive**—A term used to describe a pattern of genetic inheritance in which a child receives two copies of a defective gene, one from each parent, on an autosome (a nonsex chromosome). MSUD is an autosomal recessive disorder.

**Branched-chain alpha-keto acid dehydrogenase (BCKD)**—The chemical name of the enzyme that is missing or partially inactivated in patients with MSUD.

**Carrier**—A person who harbors an infectious agent or a defective gene without showing clinical signs of disease themselves and who can transmit the infection to others or the defective gene to their children.

**Cerumen**—The waxy substance secreted by glands in the external ear canal. It can be tested to screen newborns for MSUD.

**Dialysis**—A method of artificial kidney function used to remove waste products or other substances from the patient's body fluids. In the case of patients with MSUD, dialysis may be used to remove BCAAs from the patient's body during an acute episode requiring hospitalization.

**Leucine**—An essential amino acid and one of the three branched-chain amino acids implicated in MSUD. Leucine is the most toxic of the three and the one whose level is most closely monitored in dietary therapy for MSUD.

**CAUSES.** MSUD is caused by a mutation in any of four genes, known as BCKDHA, BCKDHB, DBT, and DLD respectively. These four genes code the proteins that form the BCKD complex, which is needed to break down BCAAs into smaller molecules. Mutations in any of the four genes will eliminate or reduce the function of the BCKD complex, thus allowing the levels of BCAAs and their byproducts in the patient's body to rise.

MSUD is an autosomal recessive disease, which means that a child with MSUD has inherited a

defective gene from both parents. The parents are said to be carriers of the disease because they can transmit it to their children without being affected by it themselves. With each pregnancy, the two carrier parents have a 1:4 chance that the baby will have MSUD. The chances are 2 in 4 that the child will be a carrier, and 1 in 4 that the child will neither have MSUD nor be a carrier. MSUD is a rare disorder in most ethnic groups, affecting one child in 180,000 in the general North American population and about one in 185,000 children worldwide. Among the Old Order Amish and the Mennonites in Pennsylvania, however, the rate is much higher, affecting one child in every 176 live births. As a result, Pennsylvania was the first state to mandate screening of newborns for MSUD.

**SYMPTOMS AND DIAGNOSIS.** The symptoms of MSUD vary in severity and time of onset, depending on the subtype of MSUD. As of 2007, researchers distinguish 5 subtypes, defined by the amount and type of enzyme activity present in the body:

- Classic MSUD: This is the most common subtype of the disease, with less than 2% of BCKD enzyme activity present. Newborns show symptoms within the first 4 to 7 days of life, including poor feeding, poor weight gain, recurrent vomiting, high-pitched crying, seizures caused by swelling of the brain, and alternating rigidity and softness of the muscles. The baby may make repetitious gestures resembling the movements of fencing or bicycling. The baby's urine develops a characteristic odor of maple syrup as soon as the other symptoms develop. If untreated, a child with classic MSUD will eventually stop breathing and die.
- Intermediate MSUD: A rare form of the disease that differs from the classic form chiefly in a slightly higher amount of BCKD enzyme activity in the patient's body, about 3 to 8 percent. Treatment and management is similar to that of classic MSUD. Only 20 patients have been reported with this subtype.
- Intermittent MSUD: The second most common form of MSUD, with enzyme activity between 8 and 15% of normal. Children with intermittent MSUD may not show any signs of the disorder until they are 12 to 24 months of age, usually in response to an illness or a rapid increase in protein intake. During episodes of illness or other metabolic stress, the child may develop seizures or other signs of metabolic stress. Children or adolescents with this form of MSUD are at risk of developmental delays, including mental retardation, as well as metabolic crises.
- Thiamine-responsive MSUD: A rare form of the disease, in which the level of enzyme activity in the child's body is increased by giving doses of thiamine hydrochloride.
- E3-deficient MSUD: A very rare variant of the disease, reported in only 10 patients as of 2007. These patients suffer from deficiencies in two other enzyme complexes as well as a lack of BCKD.

Early diagnosis of MSUD is essential to prevent neurological damage and death in infancy. Some states, but not all, have mandatory screening programs for MSUD. Classic MSUD can be diagnosed in many cases before the physical symptoms appear by swabbing the baby's ear canal within 12 to 24 hours of birth and testing the cerumen (ear wax) for the odor of maple syrup. A child suspected of having MSUD should be given a blood test without delay. The blood test used to confirm the diagnosis is the BCAA analysis, which examines the levels of the 20 amino acids in the baby's blood and their relationship to one another. The doctor can also order molecular genetic testing or tests that measure the levels of organic acids in the baby's urine. Prenatal diagnosis of MSUD can be performed by mutation analysis or by measuring the concentrations of BCAAs in the amniotic fluid that surrounds the baby inside the mother's womb.

**TREATMENT.** The first step in treatment of classic MSUD is prompt reduction of the levels of BCAAs in the body tissues of the affected child, particularly the level of leucine, which is the most toxic of the three BCAAs. In the 1960s and 1970s, dialysis was the method most commonly used to lower the BCAA levels rapidly. As of 2007, however, the preferred method involves administration of special intravenous solutions of amino acids that do not contain BCAAs, with glucose (sugar) added to meet the body's energy needs. In some cases insulin is added to the solution. These infusions lower the BCAA levels by enabling the child's body to use the excess BCAAs to synthesize proteins.

Lifelong therapy of MSUD has two mainstays: strict adherence to a diet based on restriction of the patient's leucine intake; and aggressive treatment of acute episodes, which can be triggered by surgery, infectious diseases, or emotional stress. These episodes are characterized by vomiting, diarrhea, sleepiness, irritability, staggering, slurred speech, hallucinations, and unusual breathing patterns. In many cases, putting the child on a "sick day" dietary regimen and immediate notification of the child's doctor will prevent the need for hospitalization. If the child cannot keep food down, hospitalization with intravenous feeding or dialysis may be necessary. Preventing

cerebral edema (swelling of the tissues of the brain) is the central concern in managing acute episodes of MSUD. Excess fluid accumulates in the brain as a result of the rise in the levels of amino acids and a loss of electrolyte balance. If untreated, cerebral edema puts pressure on the parts of the brain that control breathing and can lead to respiratory failure and death. It can, however, be treated by doctors familiar with the management of MSUD.

In extreme cases, MSUD can be treated by liver transplantation, but dietary therapy is a lower-risk form of treatment and has equally favorable results.

### *The MSUD special diet*

At all stages of the life cycle, the MSUD diet has the following characteristics:

- Careful evaluation of leucine intake on an individual basis. Leucine is an essential amino acid and cannot be excluded completely from the diet, even though it is the most toxic of the BCAAs and is present in foods in higher concentrations than either valine or isoleucine. The patient's tolerance of leucine must be calculated following measurement of BCAA levels and remeasured at appropriate intervals during the first 6 to 12 months of life.
- Intake of a protein substitute that provides BCAA-free amino acids.
- Inclusion of a supplement that provides necessary vitamins, minerals, and trace elements.
- Isoleucine and valine supplements, taken as needed. In some cases the patient's levels of these two BCAAs fall below desirable levels, or are too low in reference to the leucine level. The proportion of amino acids is important because isoleucine and valine levels drop more rapidly than leucine. When Levels of ioleucine and valine are too low, severe rashes may result. Also leucine may be restricted from further depletion. Supplementation is necessary at such times to lower the risk of an acute episode of MSUD.
- An adequate intake of calories from one of three sources: foods naturally low in or free from protein; specially formulated low-protein foods; and protein-free energy supplements containing glucose polymers and fats.

**INFANCY.** Infants diagnosed with MSUD are given a special MSUD formula supplemented with controlled amounts of infant formula. **Breastfeeding** is beneficial to some children with MSUD but does not remove the need for the special formula.

**CHILDHOOD TO AGE 10.** As children grow older, they must continue to take a protein substitute along with other foods that are weighed and measured at home to supply the correct amount of leucine. In 2003, Vitaflo, a company based in the United Kingdom, introduced a line of protein substitute products and isoleucine-valine supplements for children and adults with MSUD. *These products can be purchased only with a doctor's prescription*. The protein substitute formulation for children from 12 months to 10 years of age is an unflavored powder containing 8.4 g of protein equivalent, designed to be mixed with cold **water** to form either a gel or a drink. The formula includes all necessary **vitamins**, **minerals**, and trace elements as well as amino acids except for the 3 offending amino acids, and can be flavored with special packets in black currant, orange, lemon, raspberry, or tropical flavors. The product takes less than a minute to prepare and should be drunk at once; however, it can be stored in the refrigerator and used within 24 hours. The child must drink water or a permitted drink along with the MSUD Gel.

If needed, a packet of valine or isoleucine supplement, which also comes in powder form, is to be mixed in with the MSUD Gel and flavoring.

Vitaflo also makes a chocolate-flavored low-protein high-calorie supplement called VitaBite, which can be eaten like a candy bar, or used in permitted recipes as a filling for cakes or mixed into Rice Krispies treats.

The child should have leucine levels reevaluated every 6 to 12 months.

**ADOLESCENT AND ADULT.** The MSUD protein substitute for children over the age of 8, teenagers, and adults contains 15 g of protein equivalent and is intended to be taken as a low-volume drink. The powder, which contains the daily requirements of amino acids, vitamins, minerals, and trace elements, is mixed in a special shaker with 80 mL (about 1/3 cup) of cold water, shaken well, and drunk immediately along with water or a permitted beverage. Like the MSUD Gel, Express can be flavored and mixed with isoleucine or valine supplements. It can also be stored for no longer than 24 hours in a refrigerator if necessary.

As with children, adolescent and adult patients should have their leucine levels measured periodically.

**SICK DAY CARE.** In order to help prevent a child from requiring hospitalization during an acute attach of MSUD, he or she is placed on a diet with an even lower level than usual of leucine and a higher intake of special formula. The sick day diet is intended to provide enough calories and amino acids to meet the body's needs and to promote protein synthesis in order to use up the excess BCAAs in the blood. The

child may also be given more frequent blood tests during this period.

## Function

The function of the special dietary regimen and products for maple syrup urine disease is to prevent recurrent metabolic crises in the patient and associated damage to the central nervous system so that the patient can survive infancy, develop normally, and have a normal life expectancy.

## Benefits

The benefits of strict adherence to the MSUD diet are normal physical and intellectual development and a normal life span with no limitations on activity. Several patients diagnosed with MSUD as children have been able to complete their education, marry, and have children without complications. The longest-lived patient with MSUD as of 2007 has been followed for over 40 years and is still in good health.

## Precautions

Children with MSUD must be taught from an early age that strict adherence to their dietary regimen is critical to their health and growth, and that they must take responsibility for avoiding high-protein foods and otherwise controlling their diets.

Special care must be taken with even minor illnesses or infections, as the risk of an acute episode of MSUD is increased at these times.

Children and adolescents with MSUD may occasionally need psychotherapy or medications to cope with the anxiety and depression that often accompany diseases requiring careful attention to diet.

## Risks

Failure to comply with the MSUD diet puts the patient at risk of elevated blood levels of BCAAs, subsequent swelling of brain tissue, seizures, and death from respiratory failure.

## Research and general acceptance

Studies published since the late 1960s indicate that dietary restriction of branched-chain amino acids is an effective and low-risk approach to managing MSUD. A 2005 study of the new line of Vitaflo products found that the four patients in the study not only liked the taste, texture, and appearance of Vitaflo Express, but found it "very easy to prepare." In addition, the researchers found that leucine concentrations improved in all subjects; three of the four patients improved to the point that they could add more natural protein to their diets.

## Resources

### BOOKS

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funded by the National Institutes of Health and developed at the University of Washington in Seattle, WA.

**ORGANIZATIONS**

Cambrooke Foods, LLC. 2 Central Street, Framingham, MA 01701. Telephone: (866) 456-9776 or (508) 782-2300. Website: http://www.cambrookefoods.com/. Cambrooke Foods is a supplier of low-protein foods for people with phenylketonuria and MSUD; it is also a distributor of Vitaflo products within the United States.

Clinic for Special Children. 535 Bunker Hill Road, Strasburg, PA 17579. Telephone: (717) 687-9407. Website: http://www.clinicforspecialchildren.org/index.html. The clinic is a nonprofit medical and diagnostic service for children with MSUD and other inherited metabolic disorders, founded by one of the leading researchers of MSUD.

Maple Syrup Urine Disease (MSUD) Family Support Group. 82 Ravine Road, Powell, OH 43065. Telephone: (740) 548-4475. Website: http://www.msud-support.org.

National Institutes of Health (NIH) National Digestive Diseases Clearinghouse. 2 Information Way, Bethesda, MD 20892-3570. Telephone: (800) 891-5389 or (301) 654-3810. Website: http://www.niddk.nih.gov.

National Organization for Rare Disorders (NORD). 55 Kenosia Avenue, P.O. Box 1968, Danbury, CT 06813-1968. Telephone: (800) 999-6673 or (203) 744-0100. Website: http://www.rarediseases.org.

Vitaflo USA, LLC. 123 East Neck Road, Huntington, NY 11743. Telephone: (888) 848-2356. Website: http://www.vitaflousa.com. Vitaflo USA is the distributor of the MSUD protein substitutes developed by the parent company in the United Kingdom. The Canadian distributor is ParaMed Specialities, Inc., 995 Wellington Street, Suite 200, Montreal, Quebec H3C IV3. Telephone: (514) 395-2396. Website (French and English): http://www.paramedinc.com/

Rebecca J. Frey, PhD

# Mayo Clinic diet (fad diet)

## Definition

The Mayo Clinic diet (fad diet) is a popular diet that was neither created by nor endorsed by the Mayo Clinic, an internationally respected medical research facility headquartered in Rochester, Minnesota. The fad diet promises a weight loss of 10 pounds (4.5kilograms) for the person who follows the plan for 12 days. The dieter wanting to lose more weight takes two days off from the regimen and then starts the diet again. A person supposedly could lose more than 50 pounds (22.7 kilograms) within several months, according to the diet plan. The diet is low in **carbohydrates**, high in fat, and restricts the consumption of fruits, breads, and dairy products.

## Origins

Details are vague about how a grapefruit-based diet became known as the Mayo Clinic fad diet. Not even the Mayo Clinic knows how its name became associated with the popular diet, according to the medical facility's web site. The Mayo Clinic fad diet is believed to date back to the 1930s, when it was known as the **Hollywood diet**. It may be that the public thought that following the diet would quickly lead a dieter to have a slender figure like those of the movie stars. The Hollywood diet was a three-week plan that called for the dieter to eat grapefruit with every meal. Small amounts of other food were allowed, with the calories consumed each day totaling less than 800.

Grapefruit was eaten three times daily because the citrus fruit was said to contain enzymes that burned fat. Because of this special property, the weight-loss plan was also known as the "Grapefruit Diet" or the "Grapefruit and Egg Diet." The **grapefruit diet** was spoofed in the 1933 movie "Hard to Handle," a comedy starring actor James Cagney. He played a con man who promoted various money-making schemes during the Great Depression. While in prison, Cagney's character came up with a grapefruit diet that lasted 18 days.

Some Cagney fans said that the choice of fruit was a reference to "The Public Enemy," a 1931 movie where the actor smashed a grapefruit into actress Mae Clarke's face. However, grapefruit was a key element in various diets at the time. By the 1940s, one version of the fad diet was known as the Mayo Clinic Diet, according to dietitians at the Mayo Clinic.

It may be that promoters of the high-fat, low-carbohydrate diet thought that using the Mayo Clinic's name would lead dieters to believe that the food plan was medically sound. The Mayo Clinic disputes this label and refers to the fad weight-loss plan as a "diet myth."

Although the creator of the Mayo clinic fad diet is not known, the weight loss plan is known internationally. The bogus Mayo Clinic diet has been circulated by various methods over the decades. People typed copies of it for their friends during the 1950s. They duplicated it on office copiers during the 1970s, sent by it fax during the 1980s, and posted online versions of it that could be found on the Internet in 2007.

## KEY TERMS

**Calorie**—The nutritional term for a kilocalorie, the unit of energy needed to raise the temperature of one liter of water by one degree centigrade at sea level. A nutritional calorie equals 1,000 calories.

**Carbohydrate**—A nutrient that the body uses as an energy source. A carbohydrate provide 4 calories of energy per gram.

**Cholesterol**—A fatty substance found each cell of the human body and in animal foods.

**Fat**—A nutrient that the body uses as an energy source. Fats produce 9 calories per gram.

**Fiber**—A complex carbohydrate not digested by the human body. Plants are the source of fiber.

**Protein**—A nutrient that the body uses as an energy source. Proteins produce 4 calories per gram.

**Serum cholesterol**—Cholesterol that travels in the blood.

**Trans fats**—Short for trans fatty acids, they are also known as a partially hydrogenated oils. The acids are formed when hydrogen is added to liquid vegetable oils to make them more solid.

Over the years, variations of the fad diet have focused on grapefruit, meat, or eggs, according to the Mayo Clinic. Furthermore, the Mayo Clinic fad diet could be the inspiration for the **Atkins diet**. That plan named for cardiologist Robert Atkins was first described in his 1972 book, *Dr. Atkins' Diet Revolution*. Twenty years later, he updated the plan in his book, *Dr. Atkins' New Diet Revolution*. Atkins maintained that people could lose weight by eating meat and cheese, foods that are high in fat. The diet starts with a two-week ban on starchy items like potatoes, food made from white flour like pasta, fruit, and most vegetables.

While the Atkins diet remained popular in 2007, the Mayo Clinic continued to receive numerous calls about the Mayo Clinic fad diet. Most people phoned during the spring, according to the clinic web site. The callers may be motivated by the desire to quickly shed pounds before summer. The Mayo Clinic was not associated with a fad diet, and the medical facility developed a program of "healthy-eating principles." The program was detailed in the book *Mayo Clinic Healthy Weight for EveryBody*.

Published in 2005, the book provided information on developing a personalized weight-loss plan. The Mayo Clinic program called for a combination of nutritional eating and exercise. This regimen generally resulted in a weight loss of 1 to 2 pounds (0.45 to 0.90 kilograms) per week. The book also advised readers that maintaining a healthy weight was a lifelong process involving a nutritious diet and physical activity.

## Description

The fad Mayo Clinic diet is also referred to as the grapefruit diet because grapefruit or unsweetened grapefruit juice is consumed at every meal. Diet promoters claimed that grapefruit burned fat, resulting in weight loss. Some diets also called for the consumption of eggs, so the diet was referred to as the grapefruit and egg diet. Other elements of the diet included proteins like meat. The diet specified portion sizes for some foods. For other foods, dieters could eat as much as they wanted. Fried food was allowed in most plans.

The **fad diets** promised that the person could eat until full and would not experience hunger. For that to occur, the dieter had to follow diet instructions that included not eating between meals and avoiding all fruit except grapefruit. The diet also limited the consumption of vegetables. The Mayo Clinic fad diet is believed to have originated as the Hollywood Diet of the 1930s.

### *The Hollywood Diet*

The weight loss plan followed for three weeks consisted of the daily consumption of grapefruit. For 21 days, dieters followed a meal schedule of:

- A breakfast of half of a grapefruit and black coffee.
- A lunch of a half-grapefruit, an egg, cucumber, a piece of melba toast, and coffee or plain tea.
- A dinner of a half of a grapefruit, two eggs, half of a head of lettuce with a tomato, and coffee or tea.

In some versions of the plan, dieters could eat small portions of meat or fish. The daily calories consumed each day totaled less than 800.

### *The Mayo Clinic Diet*

The Hollywood Diet evolved into the weight-loss plan known as the Mayo Clinic diet or the grapefruit diet. The citrus fruit remained a key element of the numerous versions of the fad diet. Dieters could eat meat and **fats**, items that were said to produce the sensation of feeling full. Fruits and vegetables were restricted, and the diet was a temporary plan that generally lasted 12 days.

In one version of the diet, people followed this plan:

- Breakfast consisted of a half-grapefruit or 8 ounces (0.24 liters) of grapefruit juice, two eggs, two slices of bacon, and black coffee.
- Lunch was a grapefruit half or 8 ounces (0.24 liters) of grapefruit juice, salad and salad dressing, and as much meat as the person wanted to eat.
- Dinner consisted of a half-grapefruit or 8 ounces (0.24 liters) of grapefruit juice, salad or green and red vegetables, and unlimited meat.
- The evening snack consisted of 8 ounces (0.24 liters) of skim milk or 8 ounces of (0.24 liters) tomato juice.

Some diets allowed fish or poultry. In one version, the dieter ate eggs and grapefruit for every meal for several days. There was no limit on the amount of eggs eaten at lunch, a meal that included spinach. After several days, the dieter could eat pork chops or lamb chops. For some dieters in the 1950s and 1960s, the plan was a steady diet of grapefruit and steak.

Most versions of the Mayo Clinic fad diet are based on a 12-day cycle. For the dieter wanting to lose more weight, the person diets 12 days, takes two days off, and then starts the cycle again. Some plans recommended starting the plan on a Monday so the dieter would have the weekend off to indulge in forbidden items. Some dieters satisfied their **cravings** for pastries; others enjoyed alcoholic beverages.

### *The New Mayo Clinic fad diet*

The Internet in 2007 was among the sources of the New Mayo Clinic Diet, a plan that expanded on the original diet with more food choices. The new version contained the information that the diet was not created by the Mayo Clinic and was not approved by the medical facility. Some sites carried evaluations of the risks and benefits of the diet. Most advised the public to consult a doctor before starting a weight-loss program. Some versions advise people to exercise.

The dieter follows the plan for 12 days and is off the diet for two days. The weight-loss plan consists of:

- A breakfast of a half-grapefruit or 8 ounces (0.24 liters) of unsweetened grapefruit juice, two eggs prepared any way, two slices of bacon, and black coffee or tea.
- A lunch of a half-grapefruit or 8 ounces (0.24 liters) of unsweetened grapefruit juice, salad or raw vegetables from the allowed list, salad dressing that was not fat-free or low-fat, and meat that was prepared any way. Foods could be fried in butter.
- Dinner of a half-grapefruit or 8 ounces of (0.24 liters) unsweetened grapefruit juice, salad with dressing or allowed vegetables, and meat. Vegetables could be cooked in butter and meat could be cooked any way.
- An optional evening snack of 8 ounces (0.24 liters) of tomato juice or skim milk.

The vegetables allowed on the diet are red and green onions, red and green bell peppers, radishes, tomatoes, broccoli, cucumbers, spinach, cabbage, lettuce, green beans, chili peppers, cole slaw, and other green vegetables including dill or bread-and-butter pickles. Dieters may also eat cheese, hot dogs, and one tablespoon (28.3 grams) of nuts each day. Mayonnaise is also allowed.

Not allowed on the diet are white vegetables such as potatoes and white onions, corn, sweet potatoes, other starchy vegetables, breads, pasta, rice, and snack foods such as potato chips and pretzels. Also forbidden are fruit and desserts.

People are advised to follow the all of the diet rules because the combination of food supposedly burns fat. The diet regulations are:

- The amount of coffee or tea consumed should be restricted to one cup with the meal because drinking more could affect the fat-burning process.
- No foods should be eliminated, and dieters should eat the bacon at breakfast and salad during the other meals.
- The dieter must eat at least the minimum amount required for each meal. When no amount is specified, the person is may eat as much as needed until she or he feels full.
- The dieter should avoid eating between meals. If the diet is followed, the person is not supposed to experience hunger between meals.

Some versions of the plan advise dieters to drink 64 ounces (1.9 liters) of **water** each day. Diet soda is allowed on some plans. The dieter may not see a weight loss until the fifth day. At that time, the person may lose five pounds (2.27 kilograms). Furthermore, people may lose about one pound (0.45 kilograms) a day until reaching their goal weights. Supposedly, the diet works because it restricts the amount of sugar and starch that create fat.

## Function

People use the Mayo Clinic fad diet because they quickly shed pounds, and that loss affirms the diet's promise that certain foods burn fat. However, the loss of pounds is caused by a restriction on carbohydrates, which are found in breads, vegetables, and fruits.

Eliminating or limiting those foods results in fewer calories consumed. Cutting back on calories produces a weight loss. Additionally, eating more **protein**, foods that are high in fat, creates the sensation of feeling full.

## Benefits

The primary benefit of the Mayo Clinic fad diet is that a person quickly loses weight. For some people, a diet of several weeks is easier to follow than one that could last months or one described as a lifetime of healthy eating. On the fad plan, dieters do not have to count calories or track the fat and **fiber** of content of foods. People follow a plan consisting of several basic foods. The diet is more affordable than some weight-loss plans that require the purchase of meals.

Furthermore, dieters could feel that they aren't depriving themselves because they're allowed to eat as much as they want of meat and other high-fat proteins. People fond of fried foods will be happy that they don't have to give up those items.

The plan consists of a limited selection of food so it will be easy for dieters to shop and to know what to eat. While the repetitive nature of the diet may become monotonous, that sameness may help curb dieters' appetites. The monotony for some dieters is endured by the knowledge that the diet is short-term.

## Precautions

People taking certain medications should not prescribe to the Mayo Clinic fad diet because grapefruit and grapefruit juice could interact with those medications. Moreover, the general public should avoid the popular diet because it is not nutritionally balanced. According to the Mayo Clinic, the fad diet could be dangerous because some versions restrict calorie consumption to 800 per day.

Organizations including the clinic and the American Heart Association maintain that 1,200 calories per day is the minimum amount that should be consumed unless a dieter is following a medically supervised weight-loss plan.

Some versions of the diet are low calorie; others permit the dieter to eat unlimited amount of proteins. The fad diet severely restricts other food groups. Dieters miss out on the nutrients and fiber in fruits and vegetables, and the **calcium** found in dairy products. At the same time, they eat foods that often contain more calories, fat, and **sodium**.

The appeal of the Mayo Clinic fad diet is that it is a short-term plan. However, people often gain back more weight after they stop dieting.

## Risks

Risks associated with the fad diet range from the medication-grapefruit interaction to the potential for complications related to a **high-fat diet**. The Mayo Clinic in 2006 cautioned that cmicals in grapefruit and grapefruit juice interfere with the body's process of breaking down drugs in the digestive system.. The interference could produce excessively high levels of the drug in the blood. The interaction could occur with some medications to treat high blood pressure, HIV, high cholesterol, arrhythmia (abnormal heart rhythm), and erectile dysfunction. There is also a potential for interaction with some anti-depressants, anti-seizure medications, tranquilizers, immunosuppressant drugs and the pain relief drug Methadone.

The issue of this interaction was subject to some debate, with the Florida Department of Citrus in 2003 advising the public that the use of alternate medications would allow people to continue drinking grapefruit juice. In a related matter, the University of Florida served a key role in the establishment in 2003 of the Center for Food-Drug Interaction Research and Education. The center focuses on interactions with grapefruit. It is accessible to the public through a website.

People with concerns about grapefruit should ask their physician or pharmacist about possible drug interactions or alternative medications.

Furthermore, the combination of a **high-protein diet** with unlimited fat and the restriction on carbohydrates puts dieters at risk for conditions such as high blood pressure, heart disease, strokes, and diabetes. According to the American Heart Association, the risk is caused by increased cholesterol levels. This rise in cholesterol is brought on by the increase in fat and the decrease in fiber from fruits, vegetables, and whole-grain products. These foods are complex carbohydrates, and eliminating them causes the body to burn stored fat. While this process causes a weight loss, it triggers a reaction called the "starvation mode."

When the person ends the diet and again eats carbohydrates, the body responds by converting food into fat. This protection against starvation results in a weight gain.

## Research and general acceptance

Grapefruit is a source of **vitamin C** and fiber, but the citrus fruit does not have the capacity to burn calories. That's one of the misconceptions about the fad diet that the Mayo Clinic called a "hoax" because it limits the variety of food and promises a dramatic weight loss. Research by the clinic and organizations

## QUESTIONS TO ASK YOUR DOCTOR

- How much weight do I need to lose?
- Is it safe for me to go on the Mayo Clinic fad diet?
- Should I go back on the diet after the first two-week cycle?
- Should I avoid certain foods because of medications I'm taking or because of a health condition?
- What meats should I eat on this diet?
- Should I limit the amount of fried food that I eat?
- Will I gain the weight back after I stop dieting?
- What should I do to prevent a weight gain?

including the United States Department of Agriculture (USDA) concluded that a healthy weight loss is based on a nutritionally balanced diet with selections from the five food groups.

Furthermore, healthy selections for all people are recommended in the nutritional guidelines issued jointly by the USDA and Department of Health and Human Services. *Dietary Guidelines for Americans 2005* recommends a diet that emphasizes fruits, vegetables, whole grains, and fat free or low-fat milk and milk products. Selections from the protein food group should include lean meats, poultry, fish, beans, eggs, and nuts. In addition, the diet should be low in saturated fats, trans fats, cholesterol, salt, and added sugars.

Moreover, much of the Mayo Clinic fad diet conflicts with the American Heart Association's "2006 Diet and Lifestyle Recommendations." The nutritional guidelines for preventing cardiovascular disease include a diet of:

- Less than 300 milligrams of cholesterol each day. An egg yolk contains approximately 200 milligrams of cholesterol. Egg whites are cholesterol-free and rated by the association as a good source of protein.
- A variety of fruits and vegetables. These foods could help control weight and blood pressure.
- I Meats and poultry without skin. They should be prepared without added saturated fat.
- Less than 2,300 milligrams of sodium each day. This is the equivalent of 1 teaspoon of salt. High-sodium foods on the Mayo Clinic diet include: bacon, ham, sausage, hot dogs, lunch meat, and salad dressings.

The American Heart Association and other organizations recommend that people exercise regularly, usually from 30 to 60 minutes most days of the week.

### *General acceptance*

Versions of the Mayo Clinic fad diet have been in circulation since the 1930s. The weight loss plan's popularity was related to the fact that people rapidly lost weight by eating foods not ordinarily on a diet. The popularity of the diet seemed to lessen when the public discovered the Atkins diet, a weight-loss plan with some similarities.

## Resources

### BOOKS

Hensrud, Donald (ed.) *Mayo Clinic Healthy Weight for EveryBody*. Mayo Clinic, 2005.

### ORGANIZATIONS

American Dietetic Association, 120 South Riverside Plaza, Suite 2000, Chicago, IL 60606. (800) 877-1600. <http://eatright.org>.

American Heart Association National Center, 7272 Greenville Ave., Dallas, TX 75231. (800) 242-8721. <http://www.americanheart.org.>.

Center for Food-Drug Interaction Research and Education (grapefruit only), website. <http://www.druginteractioncenter.org/index.php>.

Mayo Clinic, 200 First St. S.W.,Rochester, MN 55905. (507) 284-2511. <http://www.mayoclinic.com>

### OTHER

Centers for Disease Control and Prevention National Center for Chronic Disease Prevention and Health Promotion. *Physical Activity and Good Nutrition: Essential Elements to Prevent Chronic Diseases and Obesity At A Glance 2007*. <http://www.cdc.gov/nccdphp/publications/aag/dnpa.htm> (April 9, 2007).

Mayo Clinic. *Grapefruit juice: Can it cause drug interactions?*< http://www.mayoclinic.com/health/food-and-nutrition/AN00413> (April 12, 2007).

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Liz Swain

# Mayo Clinic plan (endorsed by clinic)

## Definition

The **Mayo Clinic** plan is the weight-management program created by the Mayo Clinic, a respected medical facility headquartered in Rochester, Minnesota. Unlike the fad diet erroneously bearing the clinic's name, the actual Mayo plan concentrates on longterm health rather than a quick weight loss. While the Mayo Clinic fad diet is a temporary program that promises the dieter will shed 10 pounds (4.5 kilograms) in about two weeks, people following the 12-week Mayo Clinic Healthy Weight plan generally lose 1 to 2 pounds (0.45 to 0.90 kilograms) per week. The diet based on the clinic's Healthy Weight Pyramid allows unlimited consumption of fruits and vegetables. Exercise is also prescribed.

## Origins

The Mayo Clinic Healthy Weight Program was created by an organization with a long history of healthcare and research. The Mayo Clinic grew out of the medical practice of British doctor William Worrall Mayo and his sons, William James Mayo and Charles Horace Mayo. William W. Mayo came to the United States in 1846 and opened his first Minnesota medical practice in 1859. During the Civil War, he served as an examining surgeon for the Union Army. That work took him to Rochester, where he moved his family in 1864. Son William was 3 years old; Charles was born in 1865. Their father opened a medical clinic in Rochester that flourished. The brothers later practiced medicine with their father.

William W. Mayo died in 1911 at the age of 91, and his sons carried on the Mayo Clinic's medical and research programs. The clinic researched diabetes during the 1920s. In the following decade, clinical studies included the investigation of new long-acting insulins. The Mayo Clinic General Clinical Research Center's research after World War II included the 1950s studies of the use of low-cholesterol diets to reduce serum cholesterol.

The center's **obesity** research during the 1990s demonstrated that a person's body shape affected the risk for conditions like diabetes and heart attacks. The clinic defined the body types in terms of familiar shapes. The person with the majority of the body fat stored around the waist had an apple shape. The pear-shaped person's fat was stored lower in areas such as the hips and thighs. Research showed that the apple shape, with fat in the abdominal area, raised the risk of health problems.

**Mayo Clinic diet**

| Food group | Food sources | Daily servings | Calories per serving |
|---|---|---|---|
| Level 5 sweets | Candy and processed sweets | Up to 75 calories daily | |
| Level 4 fats | Heart-healthy olive oil, nuts, canola oil, and avocados | 3–5 | 45 |
| Level 3 protein/dairy | Legumes (beans, peas and lentils), fish, skinned white-meat poultry, fat-free dairy products and egg whites | 3–7 | 110 |
| Level 2 carbohydrates | Whole-wheat bread, whole-wheat pasta, oatmeal, brown rice and whole-grain cereal | 4–8 | 70 |
| Level 1 fruits/ vegetables | Whole fresh, frozen and canned fruits without added sugar; salad greens; asparagus; green beans; broccoli; and zucchini | Vegetables 4 (minimum) Fruit 3 (minimum) | Vegetables 25 Fruit 60 |

Physical activity: Aim for 30 to 60 minutes of moderately intense physical activity most days of the week

**Based on the Mayo Clinic diet pyramid.** *(Illustration by GGS Information Services/Thomson Gale.)*

Clinical research also revealed that fidgeting, movements such as shifting in a chair, burned calories. The process was labeled "non-exercise activity thermogenesis."

The Mayo Clinic in November of 2000 unveiled the first food pyramid targeted at people trying to lose weight and keep the pounds off. The Mayo Clinic Healthy Weight Pyramid was based on scientific principles and research at the clinic, as well as at Pennsylvania State University and the University of Alabama at Birmingham.

The universities studied the effect of low-energy-dense foods on weight loss. Energy density is related to the calories in food. Low-energy-dense foods have a small amount of calories in a large amount of a food such as a fruit or vegetable. High-energy-dense foods like a candy bar have a large number of calories in a small amount of food.

The universities' research demonstrated that people on low-energy dense food diets lost weight and kept the pounds off. Pennsylvania State University's

## KEY TERMS

**Body Mass Index**—Also known as BMI, the index determines whether a person is at a healthy weight, underweight, overweight, or obese. The BMI can be calculated by converting the person's height into inches. That amount is multiplied by itself and then divided by the person's weight. That number is then multiplied by 703. The metric formula for the BMI is the weight in kilograms divided by the square of height in meters

**Calorie**—The nutritional term for a kilocalorie, the unit of energy needed to raise the temperature of one liter of water by one degree centigrade at sea level. A nutritional calorie equals 1,000 calories.

**Carbohydrate**—A nutrient that the body uses as an energy source. A carbohydrate provide 4 calories of energy per gram.

**Cholesterol**—A fatty substance found each cell of the human body and in animal foods.

**Fat**—A nutrient that the body uses as an energy source. Fats produce 9 calories per gram.

**Fiber**—A complex carbohydrate not digested by the human body. Plants are the source of fiber.

**Morbidly obese**—Also known as extremely obese, the condition of someone with a BMI of more than 40.

**Obese**—A person with a high amount of body fat; someone with a Body Mass Index of 30 or higher.

**Overweight**—A person is too heavy for his or her height; someone with a Body Mass Index of from 25 to 30.

**Protein**—A nutrient that the body uses as an energy source. Proteins produce 4 calories per gram.

**Serum cholesterol**—Cholesterol that travels in the blood.

**Thermogenesis**—The generation of heat in the body.

research indicated that satiety, the sense of feeling full was connected to the volume and weight of food consumed. A person starting a low-energy-dense diet didn't have to eat less food in terms of the amount consumed. However, the type of food was changed, with high-energy foods restricted and the addition of more low-energy-dense foods. The person ate the same volume of food, but consumed fewer calories.

In addition the dieter would experience a sense of fullness earlier because low-energy-dense food frequently had high **fiber** and **water** contents. Those foods took longer to digest, causing satiety after the consumption of fewer calories.

Furthermore, the University of Alabama pioneered the use of an unlimited allowance of whole vegetables and fruits in diets. It proved a successful method for losing weight and not gaining it back.

The Mayo Clinic drew on that research and created the Health Weight Pyramid and the clinic's weight-loss program. The Mayo Clinic Healthy Weight Program is a low-calorie, plant-based diet. The emphasis is on the low-energy dense -foods in each food group. There is no limit on the amount of fresh fruits and vegetables allowed. Other low-energy dense-foods include whole-grain **carbohydrates** like pasta, brown rice, and baked potatoes.

Information about the Mayo Clinic Healthy Weight Program was available in the spring of 2007 on the Mayo Clinic website in the section titled "Mayo Clinic Diet: A weight-loss program for life." The 12-week program was also detailed in the 2005 book *Mayo Clinic Healthy Weight for EveryBody*.

### *The other Mayo Clinic diet*

During the 1940s, the dietitians at the Mayo Clinic began receiving questions from the public about the popular diet falsely attributed to the medical facility. The clinic had no connection to the fad weight-loss plan, and the origin of the Mayo Clinic fad diet was not known. The popular diet required the consumption of a half-grapefruit at each meal. Breakfast sometimes included two slices of bacon, and dieters ate meat during other meals. Missing from the weight-loss plan were other fruits, breads, and some vegetables. Since the 1940s, the Mayo Clinic has received calls about the fad diet. Most people inquire about it in the spring, according to a statement on the clinic web site in 2007.

## Description

The four cornerstones of the Mayo Clinic Healthy Weight Program are the Healthy Weight Pyramid, physical activity, setting goals, and motivation. Dieters use the pyramid to plan menus rich in healthy foods such as fruits and vegetables. The pyramid calls for moderate amounts of other foods. Physical activity should be increased, with the ultimate goal of a person doing moderate physical activity for 30 to 60 minutes each day for most days of the week.

Goal-setting is based on actions taken rather than pounds lost. Goals such as increasing the amount of fruit consumed or exercise performed could be set and

tracked on a weekly and monthly basis. Motivation provides the incentive to start a program that is essentially a lifetime plan.

### *The Healthy Weight Pyramid*

The Mayo Clinic Healthy Weight Pyramid is a nutrition guide that focuses on low-energy-dense foods. The clinic defined energy density as the process of feeling full while eating fewer calories. Low-energy-dense foods like fruits and vegetables provide a small number of calories in a large amount of food. Foods with a high-energy density have a large number of calories in a small amount of food. These foods like desserts and processed foods often contain large amounts of sugar.

The pyramid shows food groups in terms of amounts that should be consumed. At the bottom of the triangle are low-energy-dense foods; at the peak are high-energy dense sweets. The Mayo Clinic Healthy Weight Pyramid consists of five levels:

- Level 1 is comprised of unlimited amounts of vegetables and fruits. The dieter should consume at least four servings of vegetables and the same amount of fruit. A vegetable serving is 25 calories, which is 2 cups (453.6 grams) of shredded lettuce, 1 cup (226.8 grams) of whole mushrooms, or 10 small radishes. A fruit serving is 60 calories, which is one small banana, half of a large grapefruit, or about 12 grapes.
- Level 2 includes carbohydrates such as whole grains including pasta, bread, rice and cereals. A carbohydrate serving is 70 calories. One serving equals a slice of bread, one half-cup (113.4 grams) of whole-grain pasta, or 2 cups (453.6 grams) of popcorn.
- Level 3 consists of protein and dairy. This category includes plant-based food such as beans, fish, lean meat, and low-fat dairy products. A serving is 110 calories, and one serving. That is 1/3 cup (75.6 grams) of beans, 3 ounces (85 grams) of fish, 2 and one-half ounces (70.9 grams) of chicken, 1 cup (0.24 liters) of 2% milk, 2 ounces (56.7 grams ) of 1ow-fat cheddar cheese, or one half cup (113.4 grams) of fat-free ice cream.
- Level 4 consists of fats such as heart-healthy olive oil, nuts, canola oil, and avocados. One serving of fat is 45 calories. That is 1 teaspoon (4.9 milliliters) of oil, four walnut halves, 1/6 avocado, or 3 tablespoons (44.3 milliliters) of fat-free cream cheese.
- Level 5 is the sweets category. It includes candy and processed sweets. The daily allowance at this level is up to 75 calories. This amounts to one small slice of angel food cake, one half cup (113.4 grams) of gelatin dessert, or 1 tablespoon (14.8 milliliters) of honey.
- Physical activity is at the center of the pyramid. The placement represents the central role of regular physical activity.

**SERVING RECOMMENDATIONS.** The Mayo Clinic plan based most recommended food pyramid serving portions on daily calorie allowances. For the person trying to lose weight, the medically accepted calorie allowance is generally 1,200 calories per day for women and 1,400 calories for men. A diet of less than 1,200 calories per day could deprive a person of nutrients like **calcium**, **iron**, and **protein**. Because of that, diets of less than 1,200 calories should be medically supervised.

The Mayo Clinic program starts with a 1,200-calorie allowance, with higher amounts based on a person's weight. In addition, people who feel too hungry at one level or experience an extremely rapid weight gain are advised to follow the recommendations for the next level. In addition, the daily sweets allowance of 75 calories can be saved up so a treat with more calories is consumed on one day. However, the dieter must remember to budget the sweets in order to have a total weekly consumption of 525 calories.

The calorie allowances and serving recommendations from the Healthy Weight Pyramid are:

- 1,200 calories for women weighing 250 pounds (113.4 kilograms) or less. This consists of four or more servings of vegetables, three or more servings of fruit, four carbohydrate servings, three servings from the protein/dairy group, and three fats. A maximum of 75 calories of sweets may be consumed.
- 1,400 calories for men weighing 250 pounds (113.4 kilograms) or less and women weighing from 251 to 300 pounds (113.9 to 136.1 kilograms). The allowance is four or more servings of vegetables, four or more fruit servings, five servings of carbohydrates, four protein/dairy servings, and threes servings of fat. Up to 75 calories worth of sweets is allowed.
- 1,600 calories for men weighing from 251 to 300 pounds (113.9 to 136.1 kilograms) and women weighing 301 pounds (136.5 kilograms) or more. The allowance is five or more servings of vegetables, five or more fruit servings, six servings of carbohydrates, five protein/dairy servings, and three servings of fat. The sweets allowance is 75 calories.
- The 2,000-calorie allowance is a maintenance level or could be used while dieting. It consists of five or more vegetable servings, five or more servings of fruit, eight carbohydrate servings, seven protein/dairy servings, and five fat servings. Up to 75 calories worth of sweets is allowed.

### *Physical activity*

Physical activity is a key element of the Mayo Clinic Healthy Weight Program. The activity could be exercises like walking and swimming or actions involving movement such as gardening and housecleaning. Physical activity burns calories, which aids in weight loss. Even fidgeting is helpful in shedding pounds. Mayo Clinic studies indicated that the people who gained the least weight were those who fidgeted, moving around and doing activities like wiggling.

The goal of the Mayo Clinic program is for a person to do a moderately physical activity for 30 to 60 minutes on most days of the week. Moderately physical activities range from walking briskly to being constantly in motion while doing yard work. This type of exercise raises heart and breathing rates, according to the Mayo Clinic. The person may sweat lightly.

The calories burned during an hour of walking at a moderate intensity range from 250 to 340. The range is based on the person's weight and fitness level, according to the clinic. Gardening for an hour would burn 272 calories for someone who weighing 150 pounds (68 kilograms). In addition, a fidgety person could burn 350 calories a day. That was the conclusion of a 2005 Mayo Clinic study of the movements of 10 obese people and 10 thin subjects. The obese people sat 2 one half hours more than the thin people; they burned 350 fewer calories as a result.

The clinic advises people to begin an exercise program gradually so that their muscles and joints can adapt. An inactive person may need to exercise five to 10 minutes per day and then work up to a longer exercise session. Walking is a popular exercise, and the book *Mayo Clinic Healthy Weight for EveryBody* features a 12-week walking program. There is also information about a range of physical activities.

### *Goal setting*

While losing a specific amount of weight is the ultimate goal, the Mayo Clinic plan calls for setting gorals related to activities instead of pounds shed. Objectives should be specific, measurable and realistic such as increasing the servings of vegetables consumed or the distance walked. Weight-loss activity could be entered daily in a food and activity diary. The Mayo Clinic book has a daily food and activity record that could be copied and used to track progress on weekly and monthly goals.

### *Motivation*

Motivation is the incentive that helps a person begin the Healthy Weight Program and continue to follow the plan for life. The Mayo Clinic book contains strategies for each of the 12 weeks of the program. These include avoiding treats at work by going for a short walk at break time. Other methods of motivation include concentrating on the positive aspects of weight loss and exercising with a friend or relative.

### *Maintenance*

Once a goal weight is reached, the dieter's challenge is to avoid gaining back the pounds lost. The Mayo Clinic plan recommends that the person continue exercising regularly and use the Healthy Food Pyramid for meal planning. The Mayo Clinic set the average daily calorie allowances at:

- 2,000 for the average adult.
- 2,200 for older children, teenage girls, most men, and active women.
- 2,400 for teenage boys and active men.

## Function

The Mayo Clinic Healthy Weight Program was designed to produce a gradual weight loss through diet and exercise. The Healthy Weight Pyramid focuses on the consumption of foods with low-energy densities, foods that are generally low in calories. High-fiber foods such as fruits, vegetables, baked potatoes, and whole-grain products contain volume that causes a person to feel full. Also contributing to the sense of fullness is the fact that foods with fiber take longer to digest. Since the weight-loss plan places no limit on the amount of fruits and vegetables consumed, people satisfy hunger **cravings** with lower calorie-foods.

The Mayo Clinic program also emphasizes physical activity. The combination of regular exercise and nutritional eating could reduce the risk of conditions like diabetes, heart disease, and strokes.

Weight loss is just one aspect of the Mayo Clinic plan. The Healthy Weight Program also provides guidance about how to recognize and modify behaviors such as overeating to relieve stress. The program goal is for the dieter to make permanent changes in order to maintain a healthy weight.

## Benefits

The benefits of the Mayo Clinic Healthy Weight Program are illustrated by the tile of the book, *Mayo Clinic Healthy Weight for EveryBody*. The program shows people how to use the Healthy Weight Pyramid and exercise in order to achieve a lifetime of healthy living. People who follow the plan gradually lose

weight. Once a dieter reaches his or her goal weight, that person follows the plan to avoid gaining back those extra pounds.

The plan described in the Mayo Clinic book could be used to create a self-directed weight-loss program. By following the 12-week plan, the dieter learns about nutrition, portion control, and the importance of physical activity. Quizzes in the weekly units allow the dieter to understand issues such as eating habits.

Furthermore, direction is provided through weekly shopping lists and information about topics such as planning an effective and enjoyable exercise program. There are also tips from dietitians and recipes based on the Healthy Weight Pyramid.

## Precautions

The Mayo Clinic Healthy Weight Program does not pose an overall risk to people. However, some people may need to take their health conditions into account when making food choices. People with those conditions or those who take some medications need to make those food choices even if they don't follow the diet.

For example, pregnant women should not eat more than 12 ounces (0.34 ounces) of fish per week. Diabetics should monitor their blood sugar while following the program, and people with other conditions like food allergies should make adjustments when planning their menus. In addition, some fruits should be avoided by people taking certain medications. Grapefruit products, tangelos, and Spanish oranges should not be consumed by people using some anti-depressants, anti-seizure medications, tranquilizers, immunosuppressant drugs and the pain relief drug Methadone. In addition, those citrus fruits should be avoided by people taking some medications to treat high blood pressure, HIV, high cholesterol, arrhythmia (abnormal heart rhythm), and erectile dysfunction.

People who aren't sure if a health condition or medication will be affected by a food on the Mayo plan should discuss these concerns with their doctors. Healthcare professionals should also be consulted about what type of exercise is appropriate.

## Risks

There are no known risks for people who follow the Mayo Clinic Healthy Weight Program. However, people with questions about health conditions or drug interactions are advised to consult their physicians before starting any weight loss program.

### QUESTIONS TO ASK YOUR DOCTOR

- Would any health condition prevent me from starting the Mayo Clinic Healthy Weight Program?
- How much weight should I lose?
- Should I avoid certain foods because of medications I'm taking or because of a health condition?
- What is the minimum amount of calories that I should eat each day to lose weight?
- Am I physically able to begin an exercise program?
- What is the best type of exercise for me?
- How long should I do this exercise?
- How many times a week should I exercise?
- Are there any instructions I need to prevent injuries?

## Research and general acceptance

### *Research*

The Mayo Clinic Healthy Weight Program is the result of research by the clinic, the University of Alabama, and Pennsylvania State University. The clinic's Healthy Weight Pyramid is listed on the United States Department of Agriculture's list of sources of reliable weight loss information. In addition, the federal *Dietary Guidelines for Americans 2005* defined a healthy eating plan as one that:

- Emphasizes fruits, vegetables, whole grains, and fat free or low-fat milk and milk products.
- Includes lean meats, poultry, fish, beans, eggs, and nuts.
- Is low in saturated fats, trans fats, cholesterol, salt, and added sugars.

Both the Mayo Clinic and the federal guidelines recommended that people consume a variety of foods within each group. The USDA document is updated every five years, and the 2005 edition focused more on weight control than previous versions. The guidelines, like the Mayo Clinic program, contained food-serving recommendations for calorie levels ranging from 1,000 to 2,000 per day. While the Mayo program allowed unlimited fruits and vegetables, the federal plan designated serving amounts. The USDA also recommended a restriction on sweets and 30 to 60 minutes of moderate physical activity most days of the week.

The American Heart Association also recommended a half-hour to an hour of moderate physical activity on most days. Furthermore, the heart association's guidelines for weight loss are calorie allowances of 1,200 per day for women and 1,500 for men. This would produce a loss of one to two pounds per week. The association said that a weight loss program should include nutrition education so that people "embrace a lifetime of healthy eating habits." Those recommendations paralleled those of the Mayo Clinic Healthy Weight Program.

### *General acceptance*

The Mayo Clinic plan, with its emphasis on fruits and vegetables-, had not achieved the popularity of the Mayo Clinic fad diet as of the spring of 2007. Just one-fourth of American adults ate five or more servings of fruits and vegetables each day in 2005, according to "Physical Activity and Good Nutrition: Essential Elements to Prevent Chronic Diseases and Obesity At A Glance 2007," a report by the Centers for Disease Control and Prevention National Center for Chronic Disease Prevention and Health Promotion. The report also noted that 24% of adults were not physically active during their free time. In addition, more than 50% of adults did not do enough activity to gain health benefits from their efforts.

Some Americans have embraced parts of the Mayo Clinic plan, according to the 13 favorable customer reviews of *Mayo Clinic Healthy Weight for EveryBody* on the Amazon website in April of 2007. There were no negative reviews.

J.C. from Centennial, Colorado wrote a doctor recommended gastric bypass because of the reviewer's excess weight. J.C. followed the Mayo plan, felt full and "wasn't tempted to wander" from it. J.C. 's weight loss on the Mayo program led the doctor to report that the reviewer was in "very good health."

## Resources

### BOOKS

Hensrud, Donald (ed.) *Mayo Clinic Healthy Weight for EveryBody*. Mayo Clinic, 2005.

### ORGANIZATIONS

American Dietetic Association, 120 South Riverside Plaza, Suite 2000, Chicago, IL 60606. (800) 877-1600. <http://eatright.org>.

American Heart Association National Center, 7272 Greenville Ave., Dallas, TX 75231. (800) 242-8721. <http://www.americanheart.org.>.

Mayo Clinic, 200 First St. S.W.,Rochester, MN 55905. (507) 284-2511. <http://www.mayoclinic.com>

### OTHER

Centers for Disease Control and Prevention National Center for Chronic Disease Prevention and Health Promotion. *Physical Activity and Good Nutrition: Essential Elements to Prevent Chronic Diseases and Obesity At A Glance 2007*. <http://www.cdc.gov/nccdphp/publications/aag/dnpa.htm> (April 9, 2007).

Food and Nutrition Information Center National Agricultural Library/USDA *Weight Control and Obesity Resource List for Consumers* <http://www.nal.usda.gov/fnic/pubs/bibs/topics/weight/consumer.html> (April 11, 2007).

Mayo Clinic. *Mayo Clinic Diet: A weight-loss program for life* (2006). <http://www.mayoclinic.com/health/mayo-clinic-diet/WT00016> (April 7, 2007).

Rolls, Barbara, Ph.D. "Energy Density and Nutrition in Weight Control Management." *Permanente Journal*-Spring 2003.<http://xnet.kp.org/permanentejournal/spring03/energy.html> (April 11, 2007).

Neighmond, Patricia. *Wiggle While You Work: Fidgeting May Fight Fat*.National Public Radio: All Things Considered, Jan. 27, 2005. < http://www.npr.org/templates/story/story.php?storyId = 4468682> (April 11, 2007.)

U.S. Department of Agriculture and the Department of Health and Human Services. *Dietary Guidelines for Americans 2005* <http://www.health.gov/dietaryguidelines/dga2005/document > (April 9, 2007).

Liz Swain

# Meckel's diverticulum

## Definition

A Meckel's diverticulum is a small pouch about 2 inches long that develops near the junction of the small and large intestines. Meckel's diverticulum occurs due to an abnormality in early fetal development. It is the most common birth defect that occurs in the digestive system.

Fabricius Hildanus first described the birth defect in 1598, but the condition is named for Johann F. Meckel, a German anatomist who was the first to note that the condition occurred during the embryonic stage of development.

## Origins

After conception, small ducts and structures connect the intestines and the stomach. As fetal development progresses and the intestines begin to lengthen and narrow, the ducts smooth out and usually disappear

**A close-up image of a patient's small intestine with a protruding sac. This condition, call Meckel's diverticulum, is a congenital abnormality occurring in 2% of the population, usually males.** *(Custom Medical Stock Photo, Inc. Reproduced by permission.)*

by about seven weeks after conception. In the case of Meckel's diverticulum (and other intestinal abnormalities, including cysts and fistulas), however, the ducts fail to disappear into the intestinal tissue and instead form small pouches.

These pouches have their own blood supply and may contain tissue from the pancreas, jejunum, duodenum, colon, rectum, or endometrium. Most commonly, however, the pouch contains stomach tissue in about 80% of cases.

Meckel's diverticulum is estimated to occur in about 2% of the population. The condition occurs about equally in males and females, but males are two to three times more likely to develop complications.

Most people with Meckel's diverticulum do not experience symptoms and never know that they have the condition. Doctors may discover the condition when performing diagnostic tests for other abdominal conditions.

## Description

Symptoms of Meckel's diverticulum usually develop in children by 2 years of age, and people over the age of 10 years rarely have symptoms of the condition.

The most common symptoms associated with Meckel's diverticulum involve bleeding into the intestines, intestinal blockages, or inflammation. Newborns are more likely to experience intestinal blockage, whereas older infants and young children typically experience bleeding as the primary symptom. In adults, intestinal blockage is the most common complication associated with Meckel's diverticulum.

Bleeding from Meckel's diverticulum occurs when the stomach tissue in the lower intestine begins to secrete acid. Normally, stomach cells secrete acid to aid in food digestion, and the stomach's protective lining prevents the acid from damaging the digestive tract. However, when the stomach tissue in a Meckel's diverticulum begins secreting acid in the lower intestine, there is no protective lining. As a result, the acid ulcerates the intestinal walls, causing bleeding and pain.

A person with this condition may pass bloody stools, ranging in color from bright red, to maroon,

### KEY TERMS

**Anus**—The opening at the end of the intestines.

**Appendectomy**—The procedure to surgically remove an appendix.

**Appendicitis**—Inflammation of the appendix.

**Barium**—A thick liquid that coats the stomach after consumption, allowing the inside of the stomach to show up on an x-ray.

**Congenital**—Present at birth.

**Crohn's disease**—Disorder that causes inflammation of the digestive tract.

**Diverticula**—Small pouch in the colon.

**Diverticulitis**—Having diverticula that have become infected or inflamed.

**Diverticulosis**—Having diverticula.

**Esophageal atresia**—Disorder of the digestive system in which the esophagus does not develop properly.

**Omphalocele**—Birth defect that causes abdominal contents to protrude into the base of the umbilical cord.

**Rectum**—The last eight to ten inches of the colon, through which wastes are removed from the body. The anus is part of the rectum.

**Resection**—Surgical removal of a structure or organ.

**Volvulus**—A twisted loop of bowel that causes obstruction.

to black and tarry. Although bleeding may subside for a while, it tends to recurs intermittently. The bleeding associated with Meckel's diverticulum may be so copious that blood transfusions are required.

A person with intestinal blockage due to Meckel's diverticulum may also experience abdominal pain or discomfort that ranges from mild to severe.

In rare cases, food or other swallowed objects may become trapped in the diverticulum pouch, leading to pain and swelling.

Symptoms of inflammation due to Meckel's diverticulum may appear similar to symptoms of appendicitis, an inflammation of the appendix. A person with Meckel's diverticulum may have a distended abdomen, cramping pain, and vomiting, much like a person with appendicitis. If surgery for suspected appendicitis reveals a normal appendix, physicians should check for Meckel's diverticulum in the patient at the time of surgery.

If a person's symptoms are not yet severe, doctors may use a variety of tests to aid in the diagnosis:

- Blood tests. Blood tests, such as hematocrit and hemoglobin levels, to check for anemia (low number of red blood cells in the body) or stool smear tests to check for blood may be used. These test results cannot be used to directly diagnose Meckel's diverticulum, but they may point to bleeding that is indicative of the condition.
- Nuclear scans. In non-emergency situations, doctors can inject dye into the outer opening of the belly button while examining the intestinal tract with a nuclear scan. The injected dye collects at bleeding sites or in stomach tissue, so if the doctors see blood or stomach tissue in the lower intestines, they will be able to diagnose Meckel's diverticulum.
- Barium studies. Although barium studies are typically used in the diagnosis of digestive disorders, evidence suggests that using barium is unreliable in detecting Meckel's diverticulum.
- Rectosigmoidoscopy. Physicians may also use a small flexible tube with a camera on the end, called a sigmoidoscope, to evaluate the rectum and colon for blockages, bleeding, or other problems.

In most cases of symptomatic Meckel's diverticulum, surgical removal of the pouch is necessary. Surgery (physicians may refer to this as a resection) can restore blood supply to the intestines and eliminate symptoms of Meckel's diverticulum. If a person experiences heavy bleeding or severe abdominal pain, emergency surgery is usually required. Surgeons may actually diagnose the condition when the abdomen is cut open and can be inspected.

After surgery, a person with Meckel's diverticulum will receive intravenous fluids, pain medications, and sometimes antibiotics. Once the intestines begin making bowel sounds, which indicates that the gastrointestinal tract is working, a patient can usually begin taking food by mouth.

## Function

Unlike diverticulosis, a condition in which small pouches form in the large intestine, there are no special dietary changes associated with the treatment or prevention of Meckel's diverticulum.

Patients with diverticulosis are advised to eat a **high-fiber diet** to prevent or lessen the severity of the condition. **Fiber**, the parts of grains, fruit, and vegetables that the body cannot digest, helps soften stool. For people with diverticulosis, soft stools are necessary to prevent blockages and **constipation**. Doctors think these diverticular pouches occur when a person is constipated and the excess pressure from the hard stool in the colon causes weakened portions of the colon to bulge out, forming diverticula (plural of diverticulum).

However, because Meckel's diverticulum is a congenital condition and the small intestinal pouches are unrelated to fiber intake or constipation, eating a high-fiber diet - although recommended in general for good health - offers no particular beneficial advantage. Also, because most people without symptoms do not even know they have the condition, making dietary changes would be improbably anyway.

## Benefits

There are no benefits associated with Meckel's diverticulum. Special diets cannot alter the outcome or prevent the condition.

## Precautions

There are no precautions that can be taken to prevent this condition. Meckel's diverticulum is not a hereditary condition, and most people do not even know they have it unless they begin experiencing symptoms.

However, research has shown that people with certain congenital anomalies may be more likely to develop Meckel's diverticulum. An increased incidence of the condition is seen in people with esophageal atresia, anus and rectal malformations, omphalocele, Crohn's disease, and other neurological and cardiovascular abnormalities.

Rarely, intestinal **cancer** may develop in a person with Meckel's diverticulum, although this occurs more often in adults than children.

### Risks

The risk of complications in patients who have not experienced symptoms is nearly zero. Patients who are not experiencing symptoms usually do not require surgical treatment.

Without treatment, a symptomatic person with Meckel's diverticulum can lose enough blood that he or she goes into shock. In some cases, the intestine could rupture and leak waste into the abdomen, increasing the risk of serious infection. In rare cases, the complications associated with Meckel's diverticulum may be life-threatening.

According to the American Pediatric Surgical Association, there is a less than 2% risk of complications associated with surgical treatment of Meckel's diverticulum. Post-surgical intestinal blockage from scar tissue occurs in just 5% to 9% of patients.

Gastrointestinal functioning and nutrition remain unaffected after treatment for Meckel's diverticulum. After surgery to remove the pouch and any intestinal blockage, symptoms will not recur. The prognosis for someone with Meckel's diverticulum is excellent.

### Research and general acceptance

Treatment for a person with symptoms of Meckel's diverticulum is fairly straightforward and engenders little or no medical controversy.

When physicians are considering treatment options, determining whether to remove an asymptomatic Meckel's diverticulum may be controversial. Some research has indicated that age may play a role in the decision to remove a Meckel's diverticulum. A study in adults indicated that removal of asymptomatic diverticulum may benefit people under 50 years of age.

#### Resources

**PERIODICALS**

McKay R. High incidence of symptomatic Meckel's diverticulum in patients less than fifty years of age: an indication for resection. *American Surgeon,* 2007 Mar 73(3): 271-5.

Sagar J, Kumar V, Shah DK. Meckel's diverticulum: a systematic review. *Journal of the Royal Society of Medicine,* 2006 Oct;99(10):501-5.

**ORGANIZATIONS**

American Academy of Pediatrics. 141 Northwest Point Boulevard, Elk Grove Village, IL 60007-1098. (847) 434-4000. <http://www.aap.org>

American College of Gastroenterology. PO Box 3099, Alexandria, VA 22302. (800) HRT-BURN. <http://www.acg.gi.org>

American Gastroenterological Association. 7910 Woodmont Ave., 7th Floor, Bethesda, MD 20814. (310) 654-2055. <http://www.gastro.org>

American Pediatric Surgery Association. 60 Revere Drive, Suite 500, Northbrook, IL 60062. (847) 480-9576. <http://www.eapsa.org>

National Digestive Diseases Information Clearinghouse. 2 Information Way, Bethesda, MD 20892. (800) 891-5389. <http://digestive.niddk.nih.gov>

#### QUESTIONS TO ASK YOUR DOCTOR

- How serious is my condition?
- Will I need surgery to treat my condition?
- How long will it take me to recover after surgery, and what can I expect after recovery?
- What dietary changes will I need to make after treatment?
- Are there any long-term changes I need to make after surgery for Meckel's diverticulum?
- My child is undergoing surgery. Are there any complications associated with pediatric surgery for Meckel's diverticulum that I need to be concerned about?

Amy L. Sutton

## Medifast

### Definition

The Medifast diet is a portion-controlled, low-fat, low-carbohydrate, low-calorie diet plan that utilizes meal replacement foods that are obtained from the Medifast company. These meal replacement foods are nutrient-dense and low-calorie. As a low-calorie diet, the Medifast diet is intended to produce rapid weight loss at the start of a weight-loss program for persons who are moderately to extremely obese.

### Origins

The Medifast diet was created and is marketed by Jason Pharmaceuticals, based in Owings Mills, Maryland. Dr. William Vitale founded the company in

**Medifast®**

| Medifast® product | Calories per serving | Protein (g) | Carbohydrates (g) | Fat (g) | Cholesterol (mg) | Sodium (mg) | Potassium (mg) | Fiber (g) |
|---|---|---|---|---|---|---|---|---|
| 55 shakes | 90 | 11 | 13–14 | 0–1 | 0 | 250 | 420–440 | 3 |
| 70 shakes | 100–110 | 14 | 13–14 | 0.5–1 | 0 | 240–250 | 400–430 | 3 |
| Ready-to-drink shakes | 90 | 11 | 12 | 1–1.5 | 0 | 190–200 | 370–480 | 3 |
| Appetite suppression shakes | 100 | 15 | 12 | 0.5–1 | 0 | 210 | 400 | 4 |
| Diabetic shakes | 90 | 14 | 9–10 | 0.5–1 | 0 | 250 | 400 | 3 |
| Women's health shakes | 110 | 14 | 15 | 1 | 0 | 190 | 480 | 4 |
| Bars | 150–170 | 11 | 18–23 | 3.5 | 0 | 140–170 | 260–310 | 4–5 |
| Diabetic bars | 140 | 10–11 | 23–23 | 4–5.5 | 0 | 160–170 | 320–350 | 4 |
| Soups | 90–110 | 9–11 | 12–19 | 1 | 0 | 290–350 | 400–600 | 3–4 |

Amounts vary with product flavors

*(Illustration by GGS Information Services/Thomson Gale.)*

1980. Originally Medifast was primarily a medically-supervised weight loss program. Medifast still offers this option, but only about 10% of its customers now utilize the diet under mandatory medical supervision. Currently an individual can access the the Medifast diet program through Hi-Energy Weight Loss Centers, at home by telephone or through the web site (www.medifastdiet.com), through hospitals or clinics, or through the office of a health care provider (for example, a physician, nutritionist, or dietitian). Medifast is available in Asia (India, Hong Kong, and Singapore) as Dr. Diet.

## Description

Glucose is generally regarded as the preferred energy source for cells in the body, with ketosis being regarded as the crisis reaction of the body to a lack of **carbohydrates** in the diet. In a diet that does not substantially contribute to blood glucose, the body goes through a set of stages to enter ketosis. After about 48 hours the body starts using ketones produced from stored **fats** for energy, releasing free fatty acids, while reserving glucose for important needs, thus avoiding the depletion of the body's stored **protein** in the muscles. The burning of fat is thought to provide sufficient levels of energy while helping to eliminate physical hunger. Ketosis can be deliberately induced through the use of a low-calorie, low-carbohydrate diet, such as the Medifast diet, resulting in rapid weight loss due to the use of body fat for energy.

Specifically, the Medifast diet is a weight loss program that relies on meal replacement food products that are purchased from Jason Pharmaceuticals. Although medical supervision of the Medifast diet is not required, it is recommended. There are over 50 different meals that a dieter may choose as part of the diet, including shakes, bars, drinks, oatmeal, chili, soups, and puddings. The daily calorie intake on the plan is between 800 to 1,000 calories per day. During the weight loss phase of the diet, the dieter follows a 5 & 1 meal plan that consists of five portion-controlled, nutritionally-balanced Medifast meals plus one Lean & Green meal. The Lean portion of the Lean & Green meal consists of either:

- five ounces of cooked lean beef, pork, or lamb
- seven ounces of cooked chicken, turkey, fish, or seafood.

The Green portion of the Lean & Green meal consists of:

- Two cups of salad greens with 1/2 cup of raw vegetables (cabbage, spinach, sprouts, celery, radishes, cucumber, pepper, or tomato and 1-2 tablespoons of low-carb salad dressing, or
- One and one-half cups of low-carbohydrate cooked vegetables (Carrots, corn, peas, potatoes, and Brussels sprouts should be avoided during the weight loss phase of the Medifast diet).

A person who chooses to replace all meals with Medifast food products and to not incorporate the Lean & Green meal into their diet must do so only under a doctor's supervision.

During the Medifast 5 & 1 weight loss phase, the dieter eliminates fruits, dairy, and starches because of their high carbohydrate content. These foods can be reintroduced into the diet during the maintenance phase of the Medifast program. The dieter is also directed to drink at least 64 ounces of **water** per day and to limit the intake of other non-caloric liquids,

## KEY TERMS

**Acesulfame potassium** —A calorie-free artificial sweetener, also known as Acesulfame K or Ace K, and marketed under the trade names Sunett and Sweet One. Acesulfame potassium is 180-200 times sweeter than sucrose (table sugar), as sweet as aspartame, about half as sweet as saccharin, and one-quarter the sweetness of sucralose. Like saccharin, it has a slightly bitter aftertaste, especially at high concentrations. Kraft Foods has patented the use of sodium ferulate to mask acesulfame's aftertaste. Alternatively, acesulfame K is often blended with other sweeteners (usually sucralose or aspartame)

**Transient ischemic attack (TIA)** —A neurological event with the signs and symptoms of a stroke, but which go away within a short period of time. Also called a mini-stroke, a TIA is due to a temporary lack of adequate blood and oxygen (ischemia) to the brain. This is often caused by the narrowing (or, less often, ulceration) of the carotid arteries (the major arteries in the neck that supply blood to the brain). TIAs typically last 2 to 30 minutes and can produce problems with vision, dizziness, weakness or trouble speaking

**Deep vein thrombosis (DVT)**—Blockage of the deep veins; particularly common in the leg.

**Premenstrual syndrome (PMS)**—A syndrome that involves symptoms that occur in relation to the menstrual cycle and which interfere with the woman's life. The symptoms usually begin 5 to 11 days before the start of menstruation and usually stop when menstruation begins, or shortly thereafter. Symptoms may include headache, swelling of ankles, feet, and hands, backache, abdominal cramps or heaviness, abdominal pain, bloating, or fullness, muscle spasms, breast tenderness, weight gain, recurrent cold sores, acne flare-ups, nausea, constipation or diarrhea, decreased coordination, food cravings, less tolerance for noises and lights, and painful menstruation

**Pulmonary embolism**—Lodging of a blood clot in the lumen (open cavity) of a pulmonary artery, causing a severe dysfunction in respiratory function. Pulmonary emboli often originate in the deep leg veins and travel to the lungs through blood circulation. Symptoms include sudden shortness of breath, chest pain (worse with breathing), and rapid heart and respiratory rates

**Pycnogenol**—Trade name of a commercial mixture of bioflavonoids (catechins, phenolic acid, proan, thocyanidins) that exhibits antioxidative activity

**Type 1 Diabetes**—Previously known as insulin-dependent diabetes mellitus, (IDDM) or juvenile diabetes. Type 1 diabetes is a life-long condition in which the pancreas stops making insulin. Without insulin, the body is not able to use glucose (blood sugar) for energy. To treat the disease, a person must inject insulin, follow a diet plan, exercise daily, and test blood sugar several times a day. Type 1 diabetes usually begins before the age of 3.

**Type 2 Diabetes**—Previously known as noninsulin-dependent diabetes mellitus (NIDDM) or adult-onset diabetes. Type 2 diabetes is the most common form of diabetes mellitus. About 90 to 95% of people who have diabetes have type 2 diabetes. People with type 2 diabetes produce insulin, but either do not make enough insulin or their bodies do not use the insulin they make. Most of the people who have this type of diabetes are overweight

although additional non-caloric beverages are allowed. Coffee and caffeinated drinks are limited to three per day, as the low caloric level of the Medifast diet may increase sensitivity to **caffeine**, resulting in anxiety or shakiness. Alcoholic beverages are not recommended on the Medifast program, as they provide additional calories without nutritional value. Alcohol also stimulates the appetite as well as depletes the body of water.

The protein used in Medifast meal products is **soy** protein, which as a complete protein, provides all of the essential amino acids required for nutrition. The benefits of soy protein include:

- potential lowering of blood cholesterol levels, especially levels of LDL cholesterol
- potential increase in the mineral content and density of bones, which may protect against bone fractures and osteoporosis
- possible prevention of hormone-related cancers such as breast cancer, prostate cancer, and colon cancer
- possible reduction in triglycerides and increase in HDL cholesterol
- possible reduction in menopausal symptoms, including hot flashes or night sweats

Different formulations of the Medifast shakes, Medifast 55 and Medifast 70, are used for men and women. All of the low-lactose shakes contain proteins, **vitamins**, and **minerals**. However, Medifast 70 has a higher soy protein content and is more suitable for men or for women who are physically very active. In addition, there is a Medifast Plus Shake for Appetite Suppression available that contains an appetite suppresant in addition to protein, vitamins, and minerals. There are also a variety of lactose-free or low-lactose products available for persons who are lactose-intolerant.

The dieter is allowed one snack a day on the Medifast diet. These snacks may be Medifast snacks purchased through the program or such items as celery stalks, sugar-free gelatin, sugar-ree gum, sugar-free mints, bouillon, sugar-free popsicles, or dill pickle spears. Medifast products are sweetened with fructose or acesulfame potassium. Medifast diet products do not contain any stimulants, ephedrine, or herbs. Additional vitamin supplements are not required with the Medifast program, as the Medifast meals are fortified with vitamins. There are about 3-4 grams of **fiber** in most Medifast meal replacement products. Only one Medifast bar is allowed per day on the diet, as the bars are higher in calories than the other Medifast food products. Meals can be seasoned with herbs, seasonings, or spices, but the use of condiments such as ketchup, mustard, soy or teriyaki sauce, vinegar, horseradish is limited to small amounts of not more than 3-4 condiments a day. To accommodate eating at restaurants while still adhering to the Medifast diet, the dieter can have the daily Lean & Green meal.

For persons with various allergies, Medifast provides information on allergens present in specific Medifast food products. These allergens include whey, milk, soy, lactose, wheat, eggs, shellfish, tree nuts, peanuts, caffeine, and gluten.

All Medifast food products meet the standards imposed by the United States Food and Drug Administration for standards, labeling, and packaging requirements for the marketing and sale of medical foods, vitamins, and nutritional products. As part of the medical **food labeling** requirement, each product lists the name and quantity of each ingredient and is identified as a weight management/modified fasting or fasting supplement. The majority of Medifast products are certified kosher by The Orthodox Union of New York. In addition, there are a number of vegetarian meals and snacks available. A vegetarian can replace the meat portion of the Lean & Green meal with such items as low fat cheese, eggs or egg substitute, tofu, cottage cheese, or vegetable burgers.

There are several specialized Medifast food products and supplements that can be used in conjunction with the Medifast 5 & 1 diet program. However, individuals should not incorporate more than one kind of supplement into their Medifast meal plan.

Medifast Plus for Diabetics is designed to meet the nutritional needs of persons with Type 2 diabetes. This Medifast program can be used as a supplement in a weight-loss program for a person with Type 2 diabetes or as a supplement to a diabetes diet that has been designed to control blood sugar. The Medifast food products for diabetics contain less than 5 grams of sugar per serving, and many of the products have been certified as Low Glycemic by the Glycemic Research Institute. Blood sugar, oral diabetes medications, and insulin needs must be monitored periodically and adjusted as needed. Blood sugar should be checked at least two to three times a day, especially at the beginning of the Medifast program.

Medifast Plus for Joint Health is a meal-replacement supplement that was formulated to relieve the symptoms associated with arthritis and poor joint health. Medifast Joint Health Shakes contain both **glucosamine** and chondroitin. Three Joint Health Shakes are included daily as part of the Medifast 5 & 1 Meal plan. A person who is already taking medication for arthritis should consult with their health care provider before incorporating Joint Health shakes into their Medifast diet plan.

Medifast Plus for Women's Health is a meal-replacement supplement that was formulated to relieve and prevent the symptoms of menopause, such as hot flashes and night sweats. The Women's Health Shakes contain black cohosh, **echinacea**, and chaste tree berry. One to three Women's Health Shakes are included daily as part of the Medifast 5 & 1 meal plan. A women who is already on Hormone Replacement Therapy should consult with their health care provider before incorporating Joint Health shakes into their Medifast diet plan.

Medifast Plus for Coronary Health is a meal replacement supplement that was formulated to protect the heart against disease. Coronary Health Shakes include Coenzyme Q10, amino acids, and Pycnogenol. One to three Coronary Health Shakes are included daily as part of the Medifast 5 & 1 meal plan. The Coronary Health Shake was designed as a preventive measure, and persons with concerns about their heart health should talk to their health care provider before using this Medifast food product. It is especially important that persons who are already on heart medications consult with their health care provider

before incorporating Coronary Health shakes into their Medifast diet plan. In addition, dosage levels of blood pressure medications may need to be adjusted as a person loses weight.

Exercise is an integral part of losing weight and maintaining weight loss. However, a person who does not have an exercise program in place prior to starting the Medifast diet should wait 2-3 weeks before beginning an exercise program, in order to prevent **dehydration** and to protect muscle tissue. A person who does participate in an exercise program before starting the Medifast diet should cut the exercise program in half for the first several weeks, to allow the body to adjust to the lower calorie levels. As the body adjusts, the length and intensity of exercise can be increased.

A person stays on the Medifast 5 & 1 plan until:

- the target weight has been met
- weight loss has slowed to less than three pounds per month
- the dieter develops a contraindication to the program, such as pregnancy
- the health care provider recommends transitioning into the maintenance phase

If a person has significant weight to lose that necessitates staying on the weight loss phase for longer than sixteen weeks, the program should be monitored by a health care provider.

During the transition phase, after the weight loss phase of the Medifast diet, calories are slowly added back into the diet to give the body time to adjust to the new levels of calories and carbohydrates. Following the transition phase, an individual should develop a plan to maintain the weight loss. In some cases, a person may choses to continue to include Medifast food products in conjunction with other low calorie meals to maintain a healthy weight. Persons experiencing a a weight gain of five to ten pounds may go back on the Medifast 5 & 1 plan for a few weeks in order to return to their target weight.

As of 2007, the Medifast diet costs about $10/day, $70/week, or $275/month when purchasing food in packages. Costs are higher when purchasing on a per-product basis. There are no enrollment or membership fees associated with the program. The Medifast program has a web-based support program for customers that provides the dieter with tools, support, and information to assist with nutrition, exercise, and motivation. The program provides also behavior modification programs. In August 2002 Jason Pharmaceuticals set up a health network subsidiary, Take Shape for Life, that by 2007 had enrolled over 150 physicians and medical professionals to supervise a network of qualified health advisors who work with individuals to help them successfully implement their Medifast diet plan.

## Function

The purpose of the Medifast diet is create a calorie deficit that allows a person to burn fat and lose weight while maintaining muscle mass. The Medifast diet is most suited for those persons who need to lose a significant amount of weight and have had difficulty losing weight with other diets.

## Benefits

Many people on the Medifast diet lose an average of 2-5 pounds per week. Individual results vary based on initial weight when starting the program, targeted weight-loss goal, level of exercise, presence of medical conditions, use of medications, and compliance with the diet requirements.

## Precautions

Before starting the Medifast diet program, a person should consult with a health care provider. This is especially important if the person:

- has any serious medical conditions
- is on any medications, especially those for diabetes
- is age 65 or older
- is under the age of 18
- has 50 pounds or more to lose.

All individuals taking prescription medications should periodically meet with their health care provider while on the Medifast diet to make sure that medication dosages while on the diet. Persons over the age of 70 must be under the supervision of a health care provider when using the Medifast diet. These older people may need a higher caloric intake and may need to adjust their dosages of medications.

The Medifast meals should be eaten every two to three hours. If a meal is missed, the rest of the meals should be eaten closer together, for if a meal is skipped, the nutrients for the day will be inadequate.

There may be difficulties associated with transitioning from a diet based on shakes and soups to a regular diet. The transition phase should last about four to six weeks and can be started by introducing foods such as oatmeal for breakfast and fruits for snacks. Due to the low level of caloric intake during the weight loss phase of the Medifast diet, it is likely that some muscle loss will occur, so gradually

increasing strength training during the transition phase is recommended.

## Risks

Certain conditions absolutely prohibit the use of a low calorie diet such as Medifast. These conditions include:

- Mycocardial infarction/heart attack within previous three months, unstable angina
- Strokes or transient ischemic attacks
- Uncontrolled seizures
- Clotting disorders
- Type 1 diabetes (unless Medifast food products are used to improve nutrition or weight maintenance, but Medifast is not recommended as a weight loss program for Type 1 diabetics
- Severe liver or kidney diseases that require low-protein diets
- Active peptic ulcer disease
- Active cancers
- Active thrombophlebitis (or Deep Vein Thrombosis (DVT)/Pulmonary Embolism (PE) within three months
- Pregnancy or breast-feeding
- Eating disorders such as anorexia or bulimia
- Severe psychiatric illnesses, including history of major depression and/or suicide attempts
- Corticosteroid therapy of greater than 20 mg per day
- Chronic illicit drug use, addictions, alcoholism, and/or substance abuse.

Other conditions may limit the use of Medifast products and require the close supervision of a health care provider. These conditions include:

- Use of the medication Lithium (blood lithium levels should be monitored during the use of the Medifast diet)
- A history of seizures
- A history of peptic ulcer disease
- Use of anticoagulant medications such as coumadin (blood tests should be performed to determine the therapeutic level of coumadin required during the use of the Medifast diet)
- Over the age of 70 (it is recommended that persons use Medifast products in conjunction with a 1,200 calorie per day diet)
- Adolescent use (after puberty and under the age of 18, the Medifast diet should only be used under the care of a health care provider
- Hypothyroidism (the Medifast diet should only be used under the direct supervision of the health care provider. Blood tests should be conducted throughout the period of the diet and medication adjusted as required. Some health care providers suggest that a non-soy Medifast product be eaten at the time of day that the thyroid medication is taken. .
- Gastric by-pass surgery (the Medifast diet can be used in conjunction with gastric bypass surgery but calorie levels may be adjusted at the recommendation of the health care provider.

Many people do not experience physical discomfort on the Medifast program. However, some persons may become constipated, feel dizzy, lightheaded, fatigued, and/or cold, and may develop dry skin and hair. Other effects may include leg cramps, headaches, hair loss, rashes, gas, diarrhea, bad breath, and excessive feelings of hunger. For women, the rapid weight loss associated with the Medifast diet may cause an increase in levels of estrogen in the blood stream, which can affect the regularity of menstrual cycles, possibly increase symptoms of premenstrual syndrome (PMS), and can also increase fertility.

## Research and general acceptance

More than 15,000 physicians in the United States have recommended Medifast programs to their patients, and more than a million persons have used the Medifast diet since 1980. The Medifast diet is most suitable for persons who need to lose a significant amount of weight. The Medifast diet can be effective, but as with all diets, relapses are common. To maintain the weight loss, the use of a fitness routine is recommended to increase **metabolism** and lean muscle mass. The Medifast diet can also be expensive, especially when on-going medical oversight is included.

The Johns Hopkins Weight Management Center in Baltimore, Maryland uses Medifast food products for their very low calorie diets. In a clinical study, researchers at Johns Hopkins found that males lost an average of 67.41 pounds and females lost an average of 47.5 pounds after being on the Medifast program for six weeks.

In an 86-week weight loss study of persons with Type 2 diabetes, which was funded by Medifast, researchers from Johns Hopkins Bloomberg School of Public Health found that participants using Medifast lost twice as much weight and were twice as compliant as participants following a standard food diet based on the **dietary guidelines** of the American Diabetes Association (ADA). Twenty-four percent of the Medifast dieters were able to decrease or eliminate

## QUESTIONS TO ASK YOUR DOCTOR

- Is this type of low calorie diet appropriate for my weight-loss needs?
- What types of medical monitoring and oversight do I need?
- Where can I find support and information?
- What types of side effects should I watch out for?

their diabetes medication, compared to zero percent on the standard ADA food diet.

As of 2007, the National Institutes of Health is sponsoring a study on energy metabolism in the post-obese state at The University of Vermont. Medifast products are being used as the weight loss tool in the study. The study found that after 8 months, participants lost 45–65 pounds. Other users of the Medifast diet include the Shands Teaching Hospital, which is affiliated with the University of Florida, as part of their adolescent **obesity** treatment program and the Maine State Prison in their weight-loss program for obese prisoners.

### Resources

#### BOOKS

Davis, Lisa, and MacDonald, Bradley, T. *The Secret is Out: Medifast, What Physicians Have Always Known About Weight Loss*. Owings Mill, Maryland: Medifast, Inc., 2006.

#### ORGANIZATIONS

Medifast, Inc. Telephone: 800-209-0878. Website: [www.medifast1.com]

Tish Davidson, A.M.

# Mediterranean diet

## Definition

The Mediterranean diet is better described as a nutritional model or pattern of food consumption rather than a diet in the usual sense of the word. To begin with, there is more than one Mediterranean diet, if the phrase is understood to refer to the traditional foods and eating patterns found in the countries bordering the Mediterranean Sea. Francesco Visioli, a researcher who has edited two books on the subject, prefers the term "Mediterranean diets" in the plural to reflect the fact that "the populations in the Mediterranean area have different cultures, religions, economic prosperity, and [levels of] education, and all these factors have some influence on dietary habits and health." For example, Visioli notes that alcohol intake is very low in the Maghreb (coastal northwestern Africa) because most inhabitants of the region are Muslim, and consequently cereal grains figure more prominently in their diet than in most other Mediterranean countries. In addition, the differences among the various forms of the Mediterranean diet are important in understanding some of the research studies that have been done on it, as will be described more fully below.

## Origins

The origins of the pattern of food consumption found in Mediterranean countries go back several millennia into history; descriptions of meals in ancient Greek and Roman literature would not be out of place in contemporary Mediterranean diet cookbooks. The first description of the traditional Mediterranean diet as it was followed in the mid-twentieth century, however, was not in a cookbook; it was in a research study funded by the Rockefeller Foundation and published in 1953. The author was Leland Allbaugh, who carried out a study of the island of Crete as an underdeveloped area. Allbaugh noted the heavy use of olive oil, whole-grain foods, fruits, fish, and vegetables in cooking as well as the geography and other features of the island.

The Cretan version of the Mediterranean diet became the focus of medical research on the Mediterranean diet following the publication of Ancel Keys's Seven Country Study in 1980. Keys (1904–2004) was a professor of physiology at the University of Minnesota who had a varied background in biology and biochemistry before turning to nutrition almost by accident. Hired by the Army in 1941 to develop portable rations for troops in combat, Keys was responsible for creating what the Army then called K rations. His next wartime project was a starvation experiment, which he conducted in order to determine the food needs of starving civilians in war-torn Europe. American soldiers who were trying to re-feed refugees in the newly liberated countries found that there was no reliable medical information about treating starvation victims. Keys recruited 36 healthy male volunteers in 1944 who were conscientious objectors, most of them from the historic peace churches. For five months the subjects were given half the normal calorie requirement of an adult male and asked to exercise regularly on a treadmill. The average weight loss was 25% of body

**Mediterranean diet**

| Frequency | Food | Tips |
|---|---|---|
| Monthly | Red meats | No more than a few times month |
| Weekly | Sweets | Opt instead for naturally sweet fresh fruit |
| | Eggs | Less than 4 per week, including those in processed foods |
| | Poultry | A few times a week. Take the skin off and choose white meat to lower fat intake |
| | Fish | A few times a week |
| Daily | Cheese and yogurt | Cheese and yogurt are good sources of calcium. Choose low-fat varieties |
| | Olive oil | The beneficial health effects of olive oil are due to its high content of monounsaturated fats and antioxidants. Olive oil is high in calories, consume in moderation to reduce calorie intake |
| | Fruits | At least a serving at every meal. A serving of fruit is a healthy option for snacks |
| | Vegetables | At least a serving at every meal. Choose a variety of colors |
| | Beans, legumes, nuts | Beans are a healthy source of protein, and are loaded with soluble fiber, which has been shown to lower blood cholesterol levels by five percent or more. Most nuts contain monounsaturated (heart-healthy) fat. A handful of nuts is a healthy option for snacks |
| | Whole grains, including breads, pasta, rice, couscous, and polenta | A grain is considered whole when all three parts—bran, germ and endosperm—are present. Substitute whole wheat for white bread, brown rice for white rice and whole-wheat flour when baking. Mix pasta, rice, couscous, polenta and potatoes with vegetables and legumes |
| | Water | At least 6 glasses daily |
| | Wine (in moderation) | The U.S. Department of Agriculture defines moderation as no more than a five-ounce glass of wine daily for women and up to 2 glasses (10 ounces) daily for men |
| | Physical activity | Thirty minutes of cardiovascular activity a day is recommended to get in shape, burn calories and boost the metabolism |

**Based on the Mediterranean diet pyramid.** *(Illustration by GGS Information Services/Thomson Gale.)*

weight. Three months after the experiment ended, Keys found that none of the subjects had regained their weight or physical capacity. He learned that renutrition following starvation requires several months of above-average calorie intake, that vitamin supplements are needed, and that the proportion of **protein** in the diet must be increased. He wrote a booklet with this information for use by relief agencies after the war ended.

In the process of studying the effects of starvation in European men who survived the war, however, Keys noticed that the rate of heart attacks among them dropped markedly as food supplies decreased. He wondered whether dietary factors might be involved in heart disease. A study of Minnesota businessmen and professors in the mid-1950s showed him that the fat content of food—particularly the saturated **fats** found in the meat and dairy products consumed in large amounts by Midwesterners—was indeed a factor. After that experiment, Keys began to think in terms of diet as preventive medicine. He first encountered Mediterranean diets during visits to Italy and Spain to conduct research for the World Health Organization. His studies of food consumption patterns in those countries eventually led to the Seven Countries Study, which was a systematic comparison of diet, risk factors for heart disease, and disease experience in men between the ages of 40 and 59 in eighteen rural areas of Japan, Finland, Greece, Italy, the former Yugoslavia, the Netherlands, and the United States from 1958 to 1970. (Women were not included as subjects because of the rarity of heart attacks among them at that time and because the physical examinations were fairly invasive). In addition to asking the subjects to keep records of their food intake, the researchers performed chemical analyses of the foods the subjects ate. It was found that the men living on the island of Crete—the location of Leland Allbaugh's 1953 study—had the lowest rate of heart attacks of any group of subjects in the study.

Subsequent studies of Mediterranean diets have been conducted in subjects who have already suffered heart attacks and in women subjects. One consistent finding of recent research, however, is that subjects are less healthy in the early twenty-first century than the participants of the late 1950s because the traditional diets of the Mediterranean region have been increasingly abandoned in favor of fast foods and higher consumption of fatty meat products and sweets, as well as other staples of American and Northern European diets that are high in trans-fatty acids. In addition, changing agricultural practices around the Mediterranean have resulted in poultry and meat with higher fat content than was the case in the 1960s. As a result of concern about these trends, an association for the advancement of the Mediterranean diet was formed in Spain in 1995 and later funded the Foundation for the Advancement of the Mediterranean Diet, which is presently headquartered in Barcelona. The

## KEY TERMS

**Alpha-linolenic acid (ALA)**—A polyunsaturated omega-3 fatty acid found primarily in seed oils (canola oil, flaxseed oil, and walnut oil), purslane and other broad-leaved plants, and soybeans. ALA is thought to lower the risk of cardiovascular disease.

**Glycemic index (GI)**—A system devised at the University of Toronto in 1981 that ranks carbohydrates in individual foods on a gram-for-gram basis in regard to their effect on blood glucose levels in the first two hours after a meal. There are two commonly used GIs, one based on pure glucose as the reference standard and the other based on white bread.

**Metabolic syndrome**—A group of risk factors related to insulin resistance and associated with an increased risk of heart disease. Patients with any three of the following five factors are defined as having metabolic syndrome: waist circumference over 102 cm (41 in) for men and 88 cm (34.6 in) for women; high triglyceride levels in the blood; low levels of HDL cholesterol; high blood pressure or the use of blood pressure medications; and impaired levels of fasting blood glucose (higher than 110 mg/dL).

**Monoamine oxidase inhibitors (MAOIs)**—A group of antidepressant medications that may interact with foods used in Mediterranean diets, particularly red wines and aged cheeses.

**Monounsaturated fat**—A fat or fatty acid with only one double-bonded carbon atom in its molecule. The most common monounsaturated fats are palmitoleic acid and oleic acid. They are found naturally in such foods as nuts and avocados; oleic acid is the main component of olive oil.

**Purslane**—A broad-leafed plant native to India, commonly considered a weed in the United States. Purslane has the highest level of omega-3 fatty acids of any leafy vegetable, however, and is eaten fresh in salads or cooked like spinach as part of the Cretan diet.

**Trans-fatty acid**—A type of unsaturated fatty acid that takes its name from the fact that its alkyl chains are arranged in the so-called trans configuration (in which the carbon atoms that have double bonds form a long chain rather than a kinked shape). Trans-fatty acids occur naturally in small quantities in meat and dairy products; however, the largest single source of trans-fatty acids in the modern diet is partially hydrogenated plant oils, used in the processing of fast foods and many snack foods. Trans-fatty acids are not necessary for human health and increase the risk of coronary artery disease.

**Unsaturated fat**—A fat or fatty acid in which there are one or more double bonds between carbon atoms in the fatty acid chain, which means that the compound could absorb more hydrogen atoms. A saturated fat is one that has no room for more hydrogen atoms.

**Whole-diet approach**—The notion that the beneficial effects of any dietary regimen are produced by the diet as a whole rather than by one specific food or other factor.

Foundation's objectives include publication and dissemination of scientific findings about the diet and the promotion of its healthful use among different population groups.

## Description

### *Typical Mediterranean diet*

In general, Mediterranean diets have five major characteristics:

- High levels of fruits and vegetables, breads and other cereals, potatoes, beans, nuts, and seeds.
- Olive oil as the principal or only source of fat in the diet.
- Moderate amounts of dairy products, fish, and poultry; little use of red meat.
- Eggs used no more than 4 times weekly.
- Wine consumed in moderate amounts—two glasses per day for men, one glass for women.

Since wine and olive oil are obtained from their respective plant sources by physical (crushing or pressing) rather than chemical processes, their nutrients retain all the properties of their sources. Wine contains polyphenols, which are powerful **antioxidants** and also have a relaxing effect on blood vessels, thus lowering blood pressure.

The Mediterranean Diet Pyramid is an illustrated version of this typical dietary pattern. The base of the pyramid is labeled "Daily Physical Activity," with four layers of foods consumed on a daily basis above it. Fish, poultry, eggs, and sweets are in the next section of the pyramid—foods that may be eaten weekly. At the very top of the pyramid is red meat,

to be eaten no more than once a month. The pyramid may be found online at http://www.mediterraneandietinfo.com/Mediterranean-Food-Pyramid.htm and several other nutrition websites.

### *The Cretan diet*

The Cretan version of the Mediterranean diet as it was used on the island in the 1960s was distinctive in several respects because it contained:

- A higher proportion of total calories from fat (40% ), almost all of it from olive oil. It was low in animal fats (butter was rarely eaten) and saturated fats.
- A relatively low level of carbohydrate intake (45% of daily calories), with most of the carbohydrates coming from fruits (2 to 3 per day) and vegetables (2 to 3 cups per day)—many of them foods with a low glycemic index. Vegetables are an integral part of meals in the Cretan diet—they are not considered side dishes.
- Generous portions of whole-grain bread (8 slices per day). The bread was made from slowly fermented dough, however, and had a lower glycemic index than most contemporary breads.
- Moderate intake of fish (about 40 grams per day), which, however, is rich in omega-3 fatty acids.
- A higher intake of meat than in most versions of the Mediterranean diet, mostly as lamb, chicken, or pork.
- High intake of alpha-linolenic acid (ALA; an omega-3 fatty acid thought to lower the risk of heart disease) from nuts (particularly walnuts), seeds, wild greens (particularly purslane [*Portulaca oleracea*]), and legumes. Lamb is also a good source of ALA.

### *Online versions of the Mediterranean diet*

Two of the diets available through eDiets.com as of early 2007 are Mediterranean-type diets, the New Mediterranean Diet and the **Sonoma Diet**. Both plans are recipe-based, are customized to incorporate foods that the dieter enjoys, and provide personalized weekly meal plans. The New Mediterranean Diet costs $4.49 per week, with a minimum enrollment of 12 weeks, or $53.88 for the three-month trial period. The Sonoma Diet, which is an adaptation of the traditional Mediterranean diet to foods more commonly available in the United States, costs $5 per week for a minimum enrollment period of five weeks. The Sonoma Diet comes with a portion guide and wine guide as well as a customized weekly meal plan.

## Function

The function of Mediterranean diets as used in the United States and Western Europe is primarily preventive health care and only secondarily as a means to weight loss. There are several books available with weight-loss regimens based on Mediterranean diets, as well as cookbooks with recipes from a variety of Mediterranean countries.

## Benefits

### *Preventive health care*

Most of the scientific research that has been done on Mediterranean diets concerns their role in preventing or lowering the risk of various diseases.

**HEART DISEASE.** Mediterranean diets became popular in the 1980s largely because of their association with lowered risk of heart attacks and stroke, particularly in men, following the publication of the Seven Countries study. Mediterranean diets are thought to protect against heart disease because of their high levels of **omega-3 fatty acids** even though blood cholesterol levels are not lowered.

**ALZHEIMER'S DISEASE.** A study published in *Annals of Neurology* in 2006 reported that subjects in a group of 2000 participants averaging 76 years of age who followed a Mediterranean-type diet closely were less likely to develop Alzheimer's than those who did not. Further study is needed, however, to discover whether factors other than diet may have affected the outcome.

**ASTHMA AND ALLERGIES.** A group of researchers in Crete reported in 2007 that the low rate of wheezing and allergic rhinitis (runny nose) on the island may be related to the traditional Cretan diet. Children who had a high consumption of nuts, grapes, oranges, apples, and tomatoes (the main local products) were less likely to suffer from asthma or nasal allergies. Children who ate large amounts of margarine, however, were more likely to develop these conditions.

**METABOLIC SYNDROME.** Research conducted at a clinic in Naples, Italy, suggests that Mediterranean diets lower the risk of developing or reversing the effects of metabolic syndrome, a condition associated with insulin resistance and an increased risk of heart disease and type 2 diabetes. The results from this clinic were corroborated by a study done at Tufts University in Massachusetts, which found that the symptoms of metabolic syndrome were reduced even in patients who did not lose weight on the diet.

### *Weight loss*

Some population studies carried out in Mediterranean countries (particularly Italy and Spain) have found that close adherence to a traditional Mediterranean diet is associated with lower weight and a lower

**body mass index**. Although there are relatively few studies of Mediterranean diets as weight-reduction regimens, a research team at the Harvard School of Public Health reported in 2007 that a Mediterranean-style diet is an effective approach to weight loss for many people. A major reason for its effectiveness is the wide variety of enjoyable foods permitted on the diet combined with a rich tradition of ethnic recipes making use of these foods—which makes it easier and more pleasant for people to stay on the diet for long periods of time.

## Precautions

People who are making any major change in their dietary pattern in general should always consult their physician first. In addition, people who are taking monoamine oxidase inhibitors (MAOIs) for the treatment of depression should check with their doctor, as these drugs interact with a chemical called tyramine to cause sudden increases in blood pressure. Tyramine is found in red wines, particularly aged wines like Chianti, and in aged cheeses.

People using a Mediterranean diet for weight reduction should watch portion size and monitor their consumption of olive oil, cheese, and yogurt, which are high in calories. Dieters may wish to consider switching to low-fat cheeses and yogurts.

Because olive oil is a staple of Mediterranean diets, consumers should purchase it from reliable sources. The safety of olive oil is not ordinarily a concern in North America; however, samples of olive oils sold in Europe and North Africa are sometimes found to be contaminated by mycotoxins (toxins produced by molds and fungi that grow on olives and other fruits). Some mycotoxins do not have any known effects on humans, but aflatoxin, which has been found in olive oil, is a powerful carcinogen and has been implicated in liver **cancer**.

## Risks

There are no major risks associated with following a traditional Mediterranean diet for people who have consulted a physician beforehand if they intend to use the diet as a weight-loss regimen. Health crises caused by food interactions with MAOIs are uncommon but can be fatal (about 90 deaths over a 40-year period).

The risk of cancer or any other disease from aflatoxin-contaminated olive oil is minimal in the United States and Canada.

## Research and general acceptance

Mediterranean diets have been the subject of more medical research since the 1960s than any other regional or ethnic diet. Interest in Mediterranean diets has been high because nutritional research in general has moved away from curing deficiency diseases in the direction of preventive health care.

### QUESTIONS TO ASK YOUR DOCTOR

- Would you recommend a Mediterranean type of diet for general wellness as well as weight control?
- Have any of your other patients tried a Mediterranean diet? Did they enjoy it?
- Would you recommend the modified version of the Cretan diet used in the Lyon Diet Heart Study?

### *The Seven Countries Study*

The results from the Seven Countries study were published in book form in 1980. The research teams found that Japanese and Greek men had far lower rates of cardiovascular disease than men from the other five other countries, with the Greek subjects from the island of Crete having the lowest rate of all. Although the study and thirty years of follow-up reports showed that the relationship among heart disease, body mass, weight, and **obesity** is complex, the Seven Countries research also showed that the type of fat in the diet is more important than the amount, and that the use of monounsaturated fats—particularly olive oil—is correlated with a lower risk of heart attack and stroke. The twenty-year follow-up report indicated that 81% of the difference in coronary deaths among the seven countries could be explained by differences in the average intake of saturated fatty acids.

A detailed description of the Seven Countries study, the research that preceded it, and an overview of its findings can be found online on the website of the University of Minnesota School of Public Health, Division of Epidemiology and Community Health, at <http://www.epi.umn.edu/about/7countries/index.shtm>.

### *The Lyon Diet Heart Study*

The Lyon Diet Heart Study was the first clinical trial to demonstrate the beneficial effects of a Mediterranean-type diet. Begun in 1995, it was a major investigation of the effectiveness of a modified Cretan diet in preventing recurrent heart attacks. The subjects were a group of 605 Frenchmen under 70 years of age who had been treated in the previous 6 months for a

heart attack. They were recruited from several hospitals in the area of Lyon, a city in east-central France. Half the subjects were given an hour-long educational introduction to a modified version of the Cretan diet (canola oil was substituted for olive oil) and advised to follow this Mediterranean-style diet. The other half (the control group) were given a prudent diet recommended by the American Heart Association (AHA). At the end of 4 years, overall death rates were 56% lower in the group that followed the modified Cretan diet.

### *Ongoing research*

Mediterranean diets continue to be fruitful subjects for medical investigators, partly because the countries where they originated are changing so rapidly, and partly because discussion continues as to which of the components of these diets is the most important in disease prevention. Although olive oil has been the focus of many studies, recent research done in Greece seems to indicate that the combination of the various foods and food groups in Mediterranean diets is what makes them so healthful, rather than any one specific component. This position is sometimes called the whole-diet approach.

In addition, other researchers are studying lifestyle factors other than food that may well contribute to the beneficial effects of Mediterranean cooking. These include a generally more relaxed attitude toward life; higher levels of physical activity (made possible in part by the warm sunny climate of the region); and the fasting practices of Greek Orthodox Christians, which lower fat intake and restrict the believer to a vegetarian diet for about 110 days out of every year.

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Fundacin Dieta Mediterrnea. Website (Spanish only): http://www.dietamediterranea.com.

Linus Pauling Institute (LPI). Oregon State University, 571 Weniger Hall, Corvallis, OR 97331-6512. Telephone: (541) 737-5075. Website: http://lpi.oregonstate.edu/index.html.

University of Minnesota School of Public Health, Division of Epidemiology and Community Health (EpiCH). West Bank Office Building, 1300 South Second Street, Suite 300, Minneapolis, MN 55454-1015. Telephone: (612) 624-1818. Website of Seven Countries Study: http://www.epi.umn.edu/about/7countries/index.shtm.

Rebecca J. Frey, Ph.D.

Melanesian diet *see* **Pacific Islander diet**



# Menopause diet

## Definition

A menopause diet is a diet recommended for the special nutritional needs of women undergoing menopause and usually includes foods rich in **calcium** and **vitamin D**.

## Origins

Between the ages of 45 and 55 women experience changes to their body that are associated with menopause, the time in a woman's life when her period stops. It is a normal change in a woman's body and menopause is considered reached when a woman has not had a period for 12 months in a row. It marks the permanent end of fertility. Leading up to menopause, a woman's ovaries stop producing eggs, and her body slowly starts making less and less of the hormones estrogen and progesterone. As the ovaries become less functional and produce less of these hormones, the body responds accordingly. The density of the bone also begins to decrease in women during the fourth decade of life. However, that normal decline in bone density is accelerated during menopause. As a consequence, both age and menopause act together to decrease bone mass and bone density (**osteoporosis**). As a result, women are between 2 and 7 times more likely than men to suffer a bone fracture, the risk increasing with age and after menopause. Another consequence of getting older is that the digestive system becomes less efficient and digestion takes longer. After menopause, women are also more vulnerable to heart disease. Weight increases also seem to coincide with menopause. They are not believed to result from menopause itself, but rather to result from a slower **metabolism** and decreased energy expenditures due to lower activity levels. All of these changes that happen to women during menopause lead to different nutritional needs and nutrition for the changing female body during those years is accordingly focused on recommending foods that benefit the bones and the heart, while controlling weight. Overall, the American Dietetic Association (ADA) recommends that older

**Signs and symptoms of menopause**

- Changes in periods (they may be shorter or longer, heavier or lighter, or have more or less time in between)
- Hot flashes
- Night sweats
- Trouble sleeping through the night
- Vaginal dryness
- Mood changes
- Hair loss or thinning on the head, more hair growth on the face

**Although menopause itself is the time of a woman's last period, symptoms can begin several years before that in a stage called peri-menopause. Menopause and peri-menopause affect every woman differently.** *(Illustration by GGS Information Services/Thomson Gale.)*

women should have additional intake of nutrients such as calcium, **vitamins** D and $B_{12}$ while increasing consumption of dairy foods, especially skim or low-fat milk and yogurt, to help with these extra nutrient needs.

## Description

There is a consensus among health practitioners that a healthy diet containing a wide variety of foods will be good for women's health and well-being during menopause. It is also considered a time to lower fat and increase fruit and vegetable intake to help maintain weight, and to ensure a daily intake of low-fat dairy products to keep bones strong. Women who suffer from specific menopausal symptoms should consult a physician for personal dietary advice. For most women, a menopause diet is considered healthy if it follows these guidelines:

- Increase calcium. The way to reduce the loss of calcium from the bones is primarily to increase the intake of calcium from food. The recommended daily allowance (RDA) for calcium is 1200mg/day for women over 50. Eating and drinking 2 to 4 servings of dairy products and calcium-rich foods a day will help ensure that a woman is getting enough calcium in the daily diet. Calcium is found in dairy products, clams, sardines, broccoli and legumes.
- Increase iron intake. Eating at least 3 servings of iron-rich foods a day will help ensure that an adequate amount of iron is present in the daily diet. Iron is found in lean red meat, poultry, fish, eggs, leafy green vegetables, nuts and enriched grain products.
- Obtaining enough fiber. Foods high in fiber include whole-grain breads, cereals, pasta, rice, fresh fruits and vegetables.
- Eating fruits and vegetables. At least 2 to 4 servings of fruits and 3 to 5 servings of vegetables should be included in the daily diet.
- Include essential fatty acids (EFAs) in the diet. EFAs are found in nuts, seeds and oily fish. The best EFAs are those from the omega-3 and omega-6 families, which are found in pumpkin seeds, oily fish, walnuts, linseeds, dark green vegetables and oils such as sesame, walnut, soya and sunflower.
- Drinking plenty of water. At least eight 8-ounce glasses of water a day are recommended.
- Reducing high-fat foods. According to the National Academy of Sciences, the recommended daily calorie intake is 2,000 for women. Fat should provide 30% or less of this total. Saturated fat should be limited to less than 10% of the total daily calories because it raises blood cholesterol and increases the risk of heart disease. Saturated fat is found in fatty meats, whole milk, ice cream and cheese.
- Moderate use of sugar and salt. Too much sodium in the diet is linked to high blood pressure. Also, smoked, salt-cured and charbroiled foods contain high levels of nitrates, which have been linked to cancer.
- Limiting alcohol intake. Alcohol consumption should be limited to one or fewer drinks per day (3 to 5 drinks per week maximum) as alcohol can make hot flushes worse.

Since it has been shown that there is a direct relationship between the lack of estrogen after menopause and the development of osteoporosis, it is believed that the onset of osteoporosis can be delayed by taking supplements of calcium and vitamin D. The National Institute of Aging (NIA) recommends taking these two supplements if the diet can not provide them in sufficient amounts. Consultation with a health practitioner is highly recommended as excessive intake may cause adverse effects.

- Calcium: Some sources recommend 1500mg/day for postmenopausal women not taking hormone replacement therapy. Maximum dose to avoid adverse effects (kidney problems) is 2000mg/day.
- Vitamin D: The RDA for vitamin D is 10µg/day for women aged 51–69 and 15µg for women aged 70+. Vitamin D is present in fortified milk and cereals, salmon, cod liver oil, and other foods. Vitamin D deficiency is not uncommon in the elderly and those with little sun exposure. Maximum recommended is 50µg to avoid vitamin D toxicity.

In some cases, a physician may also recommend Vitamin $B_{12}$ and folic acid supplements. The RDA for vitamin $B_{12}$ is 2.4µg/day for women. Vitamin $B_{12}$ is present in liver, kidney, fish, poultry, eggs and milk, and in $B_{12}$-fortified foods. The RDA for folic acid is 180µg/day for women. It is found in juices spinach, asparagus, and green leafy vegetables.

## KEY TERMS

**Blood cholesterol**—Cholesterol is a molecule from which hormones, steroids and nerve cells are made. It is an essential molecule for the human body and circulates in the blood stream. Between 75 and 80% of the cholesterol that circulates in a person's bloodstream is made in that person's liver. The remainder is acquired from animal dietary sources. It is not found in plants. Normal blood cholesterol level is a number obtained from blood tests. A normal cholesterol level is defined as less than 200 mg of cholesterol per deciliter of blood.

**Bone mineral density (BMD)**—Test used to measure bone density and usually expressed as the amount of mineralized tissue in the area scanned (g/cm2). It is used for the diagnosis of osteoporosis.

**Calorie**—A unit of food energy. In nutrition terms, the word calorie is used instead of the scientific term kilocalorie that represents the amount of energy required to raise the temperature of one liter of water by one degree centigrade at sea level. In nutrition, a calorie of food energy refers to a kilocalorie and is therefore equal to 1000 true calories of energy.

**Estrogen**—A hormone produced by the ovaries and testes. It stimulates the development of secondary sexual characteristics and induces menstruation in women.

**Fat-soluble vitamins**—Vitamins, such as A, D, E and K that are found in fat or oil-containing foods, and which are stored in the liver, so that daily intake is not really essential.

**Fatty acid**—A chemical unit that occurs naturally, either singly or combined, and consists of strongly linked carbon and hydrogen atoms in a chain-like structure. The end of the chain contains a reactive acid group made up of carbon, hydrogen, and oxygen.

**Hormone replacement therapy (HRT)**—Use of the female hormones estrogen and progestin (a synthetic form of progesterone) to replace those the body no longer produces after menopause.

**Phytoestrogens**—Compounds that occur naturally in plants and under certain circumstances can have actions like human estrogen. When eaten they bind to estrogen receptors and may act in a similar way to oestrogen.

**Progesterone**—A female steroid hormone secreted by the ovary; it is produced by the placenta in large quantities during pregnancy.

**Water-soluble vitamins**—Vitamins that are soluble in water and which include the B-complex group and vitamin C. Whatever water-soluble vitamins are not used by the body are eliminated in urine, which means that a continuous supply is needed in food.

**Women's Health Initiative (WHI)**—Major 15-year research program sponsored by the National Heart, Lung, and Blood Institute (NHLBI) of the National Institutes of Health (NIH) to address the most common causes of death, disability and poor quality of life in postmenopausal women, namely cardiovascular disease, cancer, and osteoporosis. The WHI was launched in 1991 and consisted of a set of clinical trials and an observational study, which together involved 161,808 generally healthy postmenopausal women. The study results were published in the February 16, 2007 issue of *The New England Journal of Medicine*.

### Function

A menopause diet is a nutritious diet designed not only to minimize all the additional medical health risks of menopause and general aging, but also to lower both physical and mental symptoms of menopausal life. These commonly include hot flashes and skin flushing, night sweats, insomnia and mood swings and irritability.

### Benefits

The benefits of a healthy menopause diet include some relief of the unpleasant symptoms and the prevention of heart disease and severe osteoporosis. As for calcium and vitamin D, they have been shown in numerous studies to specifically prevent osteoporosis and help slow its progress. Vitamin D stimulate bone mineralization and the intestinal absorption of calcium and phosphate. Calcium also has numerous functions and is essential for bone formation and maintenance. Essential fatty acids are considered especially beneficial in the diet if the skin becomes dry or in case of joint pains. They have also been shown to help in the prevention of vaginal dryness and bladder infections, as well as increasing overall energy. Working together, vitamin $B_{12}$ and folic acid provide starting materials for the synthesis of serotonin and dopamine, two neurotransmitters associated with the body's ability to regulate mood. By supporting the

body's capacity to synthesize appropriate levels of these two neurotransmitters, folic acid and vitamin $B_{12}$ are thought to have mood stabilizing effects.

### Precautions

Supplements and prescription drugs have a lot in common. Both are used in an attempt to improve health. But "natural" remedies marketed as "dietary" supplements unfortunately do not have a Patient Package Insert, the document, required by the U.S. Food and Drug Administration (FDA) for all marketed prescription medications, that provides vital information on how to take a drug safely, identify its negative side effects, and avoid potentially dangerous interactions with other drugs. Before considering nutritional supplements for menopause, it is advised to proceed with caution and consult a healthcare provider prior to using any supplement.

In their 40s and 50s, women often gain weight, and they sometimes attribute this gain to menopause. Midlife weight gain appears to be mostly related to aging and lifestyle, but menopause also contributes to the problem. In general, fewer calories are needed after midlife because less energy is expended. Whether weight gain is linked to menopause itself and/or age, the available studies show that weight gain around menopause years can be prevented by exercise and diet, by minimizing fat gain and maintaining muscle, thus reducing body size and burning more calories.

### Risks

Nowadays, numerous menopause diets and supplements including mega vitamin supplements and medicinal creams are commercially advertised as the cure-all for menopause and its symptoms. While some may contribute to feeling good, there is a risk of adverse side effects associated with supplements taken above recommended level and a lot of uncertainty concerning their interactions with medications and hormone replacement therapy. This is why following a simple, well-balanced diet is presently considered the best way to reduce menopause symptoms and chances of developing some of the complications that go along with menopause, the two most serious being accelerated osteoporosis and heart disease. The advantage of following a varied diet that includes calcium and vitamin D is that there are no risks associated with it, provided that the general health of a woman is good.

### Research and general acceptance

There is broad consensus among women's health practitioners that a healthy diet combined with regular physical exercise really does make a difference to alleviate the symptoms and side-effects of menopause.

Calcium and vitamin D supplements in healthy postmenopausal women have been shown to provide a modest benefit in preserving bone mass and prevent hip fractures in certain groups including older women but do not prevent other types of fractures or colorectal **cancer**, according to the results of a major clinical trial, part of the Women's Health Initiative (WHI). While generally well tolerated, the supplements are associated with an increased risk of kidney stones.

Many women also believe that **soy** foods and the phytoestrogens they contain can alleviate menopausal symptoms but research has shown that their benefits are mild if they occur at all. When phytoestrogens act as estrogens, they are much weaker than the estrogen produced in humans. Published studies mostly indicate that increased consumption of phytoestrogens (soy, linseed) by postmenopausal women is no more effective than placebo (wheat diet) for reducing hot flushes. Despite conflicting study results, evidence strongly suggests that soy can help reduce total and LDL cholesterol levels.

### QUESTIONS TO ASK YOUR DOCTOR

- How will my body change with menopause?
- What kinds of dietary adjustments should I make?
- Can you recommend a menopause diet?
- Are there any specific foods that I should avoid?
- Is it safe to take dietary supplements to help my menopause symptoms?
- I'm finding it harder to lose weight now that I'm older. Does it have anything to do with menopause?
- As I go past menopause, how can my diet help me achieve the best possible health?
- I suffer from hot flashes at night that keep me from sleeping. Are there any dietary approaches that can help me have a good night's sleep?
- Are there certain foods that you could suggest to help with menopause symptoms?
- What foods are recommended to slow down osteoporosis?
- I really dislike dairy products. Is there a way to obtain calcium in other foods or as supplements?
- I use hormone replacement therapy. Should I have a special diet?

Agencies as diverse as the American Dietetic Association (ADA), the American College of Obstetricians and Gynecologists (ACOG), the American Academy of Family Physicians (AAFP) and the U.S. Food and Drug Administration (FDA) have issued findings on the following supplements and nutrients in the context of menopause:

- Glucosamine. Current evidence suggests that a potential benefit exists with little risk, even at doses of 1,500 mg/day in nondiabetic, nonpregnant women. The product should not be used by those at risk for shellfish allergy. Available evidence from randomized, controlled clinical trials supports the use for improving symptoms of osteoarthritis.
- Black cohosh. Black cohosh (known as both *Actaea racemosa* and *Cimicifuga racemosa*) is a member of the buttercup family, a perennial plant that is native to North America. It is an herb sold as a dietary supplement in the United States. The American College of Gynecology states that black cohosh supplementation may be helpful in short-term use (6 months or less) for the sweating and palpitations symptoms of menopause. Few adverse effects have been reported; however, long-term safety data are not available.
- Dehydroepiandrosterone (DHEA). DHEA has been studied extensively for the treatment of many diseases. Trials are inconsistent regarding the efficacy of DHEA supplements in the prevention of heart disease and the treatment of depressive symptoms. To date, no large-scale, controlled trial of DHEA has been conducted regarding the action of DHEA in the treatment of menopausal symptoms. It may have either additive or antagonistic effects with other hormone therapies.
- S-Adenosyl-L-Methionine (SAM-e). SAM-e is an amino acid produced naturally from methionine. It is an important molecule in cell function and survival, present in nearly every tissue in the body. To date, no controlled trials have been conducted on the efficacy of SAM-e in the treatment of depressed mood associated with menopause.
- Magnesium. Studies have suggested that magnesium supplementation may improve bone mineral density, but not that it decreases risk for fracture. Deficiency in magnesium may be a risk factor for postmenopausal osteoporosis. Some scientists believe more research is needed to establish the relationship between magnesium and bone density.

Other herbal supplements claim to alleviate menopausal symptoms, but there is little hard evidence to support the use of any of the following supplements: fish oil, **omega-3 fatty acids**, red clover, **ginseng**, rice bran oil, wild yam, calcium, gotu kola, licorice root, sage, sarsaparilla, passion flower, chaste berry, **ginkgo biloba** and valerian root.

## Resources

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### ORGANIZATIONS


American Dietetic Association. 216 W. Jackson Blvd, Chicago, IL 60606-6995. 1-800-877-1600 ext. 5000. <www.eatright.org>.

National Institute of Aging. Building 31, Room 5C27, 31 Center Drive, MSC 2292, Bethesda, MD 20892. 1-800-222-4225. < www.nia.nih.gov>.

The North American Menopause Society. 5900 Landerbrook Drive, Suite 390 Mayfield Heights, OH 44124. (440-442-7550). < www.menopause.org>.

U.S. Food and Drug Administration, Office of Women's Health (OWH), 5600 Fishers Lane,Rockville, MD 20857. 1-800-216-7331. <www.fda.gov/womens/default.htm>.

U.S. Department of Health and Human Services, 5600 Fishers Lane,Rockville, MD 20857. 1-800-994-9662. <www.4woman.gov>.


Monique Laberge, Ph.D.

# Men's nutrition

## Definition

While many diseases and health care issues affect both men and women, certain diseases and conditions exhibited in men may require distinct approaches regarding diagnosis and management. Some of the major issues associated with men's health are related to **cancer**, diabetes, heart disease, **hypertension**, impotence, and **prostate** health.

## Description

### *Cancer*

Cancer is characterized as aberrant and uncontrolled cell growth. Cells divide more rapidly than normal, and these growths may metastasize (spread to other organs). It affects people of all ages and can attack any organ or tissue of the body. Some cancers are more responsive to treatment and lend themselves to a cure, while others seem to appear suddenly and resist treatment.

Much of what we know from nutritional epidemiology supports the role of diet as a means of staving off cancer. Particularly, a mostly plant-based diet—one high in fruits, vegetables, and whole grains—is the key. Men should aim for five to nine servings of fruits and vegetables daily and eat breads, cereals, and grains that are high in **fiber**, such as whole wheat bread, bran flakes, brown rice, and quinoa.

Apart from diet, the most important thing a man can do to reduce his cancer risk is stop smoking and cease using all tobacco products. Smoking is the number one preventable cause of death in the United States, claiming 400,000 lives per year, and it increases the risk for developing cancer. Genetics and environmental sources (e.g., ultraviolet light) are also linked with cancer.

### *Diabetes Mellitus*

Carbohydrate intolerance—the inability to properly metabolize sugars—is known as diabetes mellitus, often just shortened to diabetes. The pancreas makes insulin, a hormone responsible for a cell's uptake of glucose (sugar) from blood for energy. People who have diabetes do not make enough insulin, or else the body cannot use what is made. Treatment includes achieving a healthy weight, engaging in exercise, and prescription medication. Sometimes people are able to cure their diabetes with diet and weight loss.

## KEY TERMS

**Etiology**—Origin and development of a disease.

**insulin**—Hormone released by the pancreas to regulate level of sugar in the blood.

**hormone**—Molecules produced by one set of cells that influence the function of another set of cells.

**glucose**—A simple sugar; the most commonly used fuel in cells.

**atherosclerosis**—Build-up of deposits within the blood vessels.

**phytochemical**—Chemical produced by plants.

**pH**—Level of acidity, with low numbers indicating high acidity.

A proper diet for people with diabetes is comparable to what the average healthy person should already be eating. Basic tenets include: eat three meals daily, incorporate healthful snacks, focus on foods high in fiber, combine protein and **carbohydrates** with moderate amounts of unsaturated fat, and avoid sugar-sweetened beverages to reduce overall caloric intake.

### *Heart Disease*

Heart disease, or coronary artery disease, is a result of improper function of the heart and blood vessels. There are many forms of heart disease. Atherosclerosis (hardening of the arteries) and hypertension (high blood pressure) are two of the most common. Fat deposits disrupt the flow of blood to the heart muscle, increasing the risk of myocardial infarction (heart attack).

Heart disease is the number one cause of death for men. According to the American Heart Association, 440,175 men died of heart disease in 2000. Apart from just being male, other risk factors are being forty-five years of age and older, low levels of high-density lipoprotein (HDL—the "good" cholesterol), high levels of low-density lipoprotein (LDL—the "bad" cholesterol), hypertension, smoking, excess body fat, diabetes, and a family history of heart disease.

The most important thing men should do to prevent heart disease is stop smoking and manage their weight. In terms of diet, dietitians recommend that men include more lean and healthier **protein** foods in their diets—such as white meat chicken and turkey, and sirloin instead of filet mignon. Additionally, eating fatty fish (e.g., salmon or mackerel) twice a week

may have a cardioprotective effect. Baking and broiling are preferred over deep fat frying.

### *Hypertension*

The Centers for Disease Control and Prevention (CDC) reports that 64% of men seventy-five and older have hypertension (high blood pressure), and African Americans are at a greater risk. Termed the "silent killer," hypertension often has no physical symptoms. Men often feel well enough to function normally in their day-to-day lives, and they do not view the risk as a serious one.

Being obese is associated with hypertension. Losing weight helps to control blood pressure, and sometimes men are able to decrease or discontinue their medication if their physicians determine it is no longer needed. Getting men to move away from large portions of fatty meat and potatoes and more toward three ounces of meat on a plate of overflowing vegetables is one sure method to help prevent overweight and manage hypertension. Additionally, some men are sensitive to dietary salt (**sodium** chloride). Eating too much salt can cause the body to retain **water**, resulting in increased blood pressure. Processed foods tend to be high in salt.

### *Impotence*

Impotence, also known as erectile dysfunction, occurs when a man cannot maintain an erection to achieve orgasm in sexual intercourse. The National Institutes of Health report that 15 to 30 million American men have erectile dysfunction. Many things can prevent normal erection, including psychological interference, neurological problems, abnormal blood flow, and prescription medications. Certain health conditions, such as diabetes and heart disease, cause men to experience impotence as well. Treatment may consist of psychotherapy, prescription medication, and surgery.

### *Prostate Health*

A small gland surrounding the urethra, the prostate supplies fluid that transports semen. The CDC reports that 31,078 men died of prostate cancer in 2000. Signs of prostate trouble are hesitant urination, weak urine flow and dribbling, and incontinence (inability to control urinary bladder). Nutrition may play a role in prostate health. Besides eating a varied diet focused on overall moderation, researchers have shown benefits from lycopene, a phytochemical (plant chemical) that gives plants a red color. Foods containing lycopene include processed tomato products, watermelon, and pink or red grapefruit.

## Benefits

Nutrition impacts health. Eating a good diet promotes wellness and disease prevention for healthy men, and sound nutrition helps manage chronic diseases as well. Men often fall short of achieving a healthful diet due to busy work schedules, fear of or disinterest in cooking, and the stresses of daily living. Simple steps to improve time management and a willingness for experimentation in the kitchen are both reasonable suggestions to help men eat more healthful meals.

Apart from nutritious meals, men should visit their physicians regularly, both for checkups and to discuss the health implications of nutritional supplements (protein powder, **vitamin E**, etc.). Routine physical exams, including blood tests for cholesterol, blood pressure measurements, and cancer screenings, help identify problems early, which can dramatically improve outcomes. In addition, sixty minutes of exercise daily helps weight management.

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D. Milton Stokes

Mental health *see* **Nutrition and mental health**

# Metabolism

Metabolism refers to the physical and chemical processes that occur inside the cells of the body and that maintain life. Metabolism consists of anabolism (the constructive phase) and catabolism (the destructive phase, in which complex materials are broken down). The transformation of the **macronutrients**, **carbohydrates**, **fats**, and proteins in food to energy, and other physiological processes are parts of the metabolic process. ATP (adinosene triphosphate) is the major form of energy used for cellular metabolism.

## Carbohydrate Metabolism

Carbohydrates made up of carbon, hydrogen, and oxygen atoms are classified as mono-, di-, and polysaccharides, depending on the number of sugar units they contain. The monosaccharides—glucose, galactose, and fructose—obtained from the digestion of food are transported from the intestinal mucosa via the portal vein to the liver. They may be utilized directly for energy by all tissues; temporarily stored as glycogen in the liver or in muscle; or converted to fat, amino acids, and other biological compounds.

Carbohydrate metabolism plays an important role in both types of **diabetes mellitus**. The entry of glucose into most tissues—including heart, muscle, and adipose tissue—is dependent upon the presence of the hormone insulin. Insulin controls the uptake and metabolism of glucose in these cells and plays a major role in regulating the blood glucose concentration. The reactions of carbohydrate metabolism cannot take place without the presence of the B **vitamins**, which function as coenzymes. Phosphorous, **magnesium**, **iron**, copper, **manganese**, **zinc**, and chromium are also necessary as cofactors.

Carbohydrate metabolism begins with ***glycolysis***, which releases energy from glucose or glycogen to form two molecules of pyruvate, which enter the Krebs cycle (or citric acid cycle), an oxygen-requiring process, through which they are completely oxidized. Before the Krebs cycle can begin, pyruvate loses a carbon dioxide group to form acetyl coenzyme A (acetyl-CoA). This reaction is irreversible and has important metabolic consequences. The conversion of pyruvate to acetyl-CoA requires the B vitamins.

The hydrogen in carbohydrate is carried to the electron transport chain, where the energy is conserved in ATP molecules. Metabolism of one molecule of glucose yields thirty-one molecules of ATP. The energy released from ATP through hydrolysis (a chemical reaction with **water**) can then be used for biological work.

## KEY TERMS

**Adipose tissue**—Tissue containing fat deposits.

**Anaerobic**—Without air, or oxygen.

**Deamination**—Removal of an NH2 group from a molecule.

**Galactosemia**—Inherited disorder preventing digestion of milk sugar, galactose.

**Glucose**—A simple sugar; the most commonly used fuel in cells.

**Glycogen**—Storage form of sugar.

**Glycolysis**—Cellular reaction that begins the breakdown of sugars.

**Ketones**—Chemicals produced by fat breakdown; molecule containing a double-bonded oxygen linked to two carbons.

**Ketosis**—Build-up of ketone bodies in the blood, due to fat breakdown.

**Krebs cycle**—Cellular reaction that breaks down numerous nutrients and provides building blocks for other molecules.

**Lipoprotein**—Blood protein that carries fats.

**Mitochondria**—Small bodies within a cell that harvest energy for use by the cell.

**Oxidative**—Related to chemical reaction with oxygen or oxygen-containing compounds.

**phenylketonuria**—Inherited disease marked by the inability to process the amino acid phenylalanine, causing mental retardation.

**Phospholipid**—A type of fat used to build cell membranes.

**Sterol**—Building blocks of steroid hormones; a type of lipid.

**Triglyceride**—A type of fat.

Only a few cells, such as liver and kidney cells, can produce their own glucose from amino acids, and only liver and muscle cells store glucose in the form of glycogen. Other body cells must obtain glucose from the bloodstream.

Under anerobic conditions, lactate is formed from pyruvate. This reaction is important in the muscle when energy demands exceed oxygen supply. Glycolysis occurs in the cytosol (fluid portion) of a cell and has a dual role. It degrades monosaccharides to generate energy, and it provides glycerol for triglyceride synthesis. The Krebs cycle and the electron transport

chain occur in the mitochondria. Most of the energy derived from carbohydrate, **protein**, and fat is produced via the Krebs cycle and the electron transport system.

*Glycogenesis* is the conversion of excess glucose to glycogen. *Glycogenolysis* is the conversion of glycogen to glucose (which could occur several hours after a meal or overnight) in the liver or, in the absence of glucose-6-phosphate in the muscle, to lactate. *Gluconeogenesis* is the formation of glucose from noncarbohydrate sources, such as certain amino acids and the glycerol fraction of fats when carbohydrate intake is limited. Liver is the main site for gluconeogenesis, except during starvation, when the kidney becomes important in the process. Disorders of carbohydrate metabolism include diabetes mellitus, lactose intolerance, and galactosemia.

## Protein Metabolism

Proteins contain carbon, hydrogen, oxygen, nitrogen, and sometimes other atoms. They form the cellular structural elements, are biochemical catalysts, and are important regulators of gene expression. Nitrogen is essential to the formation of twenty different amino acids, the building blocks of all body cells. Amino acids are characterized by the presence of a terminal carboxyl group and an amino group in the alpha position, and they are connected by peptide bonds.

Digestion breaks protein down to amino acids. If amino acids are in excess of the body's biological requirements, they are metabolized to glycogen or fat and subsequently used for energy metabolism. If amino acids are to be used for energy their carbon skeletons are converted to acetyl CoA, which enters the Krebs cycle for oxidation, producing ATP. The final products of protein catabolism include carbon dioxide, water, ATP, urea, and ammonia.

**Vitamin $B_6$** is involved in the metabolism (especially catabolism) of amino acids, as a cofactor in transamination reactions that transfer the nitrogen from one keto acid (an acid containing a keto group '-CO-' in addition to the acid group) to another. This is the last step in the synthesis of nonessential amino acids and the first step in amino acid catabolism. Transamination converts amino acids to L-glutamate, which undergoes oxidative deamination to form ammonia, used for the synthesis of urea. Urea is transferred through the blood to the kidneys and excreted in the urine.

The glucose-alanine cycle is the main pathway by which amino groups from muscle amino acids are transported to the liver for conversion to glucose. The liver is the main site of catabolism for all essential amino acids, except the branched-chain amino acids, which are catabolized mainly by muscle and the kidneys. Plasma amino-acid levels are affected by dietary carbohydrate through the action of insulin, which lowers plasma amino-acid levels (particularly the branched-chain amino acids) by promoting their entry into the muscle.

Body proteins are broken down when dietary supply of energy is inadequate during illness or prolonged starvation. The proteins in the liver are utilized in preference to those of other tissues such as the brain. The gluconeogenesis pathway is present only in liver cells and in certain kidney cells.

Disorders of amino acid metabolism include phenylketonuria, albinism, alkaptonuria, type 1 tyrosinaemia, nonketotic hyperglycinaemia, histidinaemia, homocystinuria, and maple syrup urine disease.

## Fat (Lipid) Metabolism

Fats contain mostly carbon and hydrogen, some oxygen, and sometimes other atoms. The three main forms of fat found in food are glycerides (principally triacylglycerol 'triglyceride', the form in which fat is stored for fuel), the phospholipids, and the sterols (principally cholesterol). Fats provide 9 kilocalories per gram (kcal/g), compared with 4 kcal/g for carbohydrate and protein. Triacylglycerol, whether in the form of chylomicrons (microscopic lipid particles) or other lipoproteins, is not taken up directly by any tissue, but must be hydrolyzed outside the cell to fatty acids and glycerol, which can then enter the cell.

Fatty acids come from the diet, adipocytes (fat cells), carbohydrate, and some amino acids. After digestion, most of the fats are carried in the blood as chylomicrons. The main pathways of lipid metabolism are lipolysis, betaoxidation, ketosis, and lipogenesis.

Lipolysis (fat breakdown) and beta-oxidation occurs in the mitochondria. It is a cyclical process in which two carbons are removed from the fatty acid per cycle in the form of acetyl CoA, which proceeds through the Krebs cycle to produce ATP, $CO_2$, and water.

Ketosis occurs when the rate of formation of ketones by the liver is greater than the ability of tissues to oxidize them. It occurs during prolonged starvation and when large amounts of fat are eaten in the absence of carbohydrate.

Lipogenesis occurs in the cytosol. The main sites of triglyceride synthesis are the liver, adipose tissue, and intestinal mucosa. The fatty acids are derived

from the hydrolysis of fats, as well as from the synthesis of acetyl CoA through the oxidation of fats, glucose, and some amino acids. Lipogenesis from acetyl CoA also occurs in steps of two carbon atoms. NADPH produced by the pentose-phosphate shunt is required for this process. Phospholipids form the interior and exterior cell membranes and are essential for cell regulatory signals.

### Cholesterol Metabolism

Cholesterol is either obtained from the diet or synthesized in a variety of tissues, including the liver, adrenal cortex, skin, intestine, testes, and aorta. High **dietary cholesterol** suppresses synthesis in the liver but not in other tissues.

Carbohydrate is converted to triglyceride utilizing glycerol phosphate and acetyl CoA obtained from glycolysis. Ketogenic amino acids, which are metabolized to acetyl CoA, may be used for synthesis of **triglycerides**. The fatty acids cannot fully prevent protein breakdown, because only the glycerol portion of the triglycerides can contribute to gluconeogenesis. Glycerol is only 5% of the triglyceride carbon.

Most of the major tissues (e.g., muscle, liver, kidney) are able to convert glucose, fatty acids, and amino acids to acetyl-CoA. However, brain and nervous tissue—in the fed state and in the early stages of starvation—depend almost exclusively on glucose. Not all tissues obtain the major part of their ATP requirements from the Krebs cycle. Red blood cells, tissues of the eye, and the kidney medulla gain most of their energy from the anaerobic conversion of glucose to lactate.

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Gita Patel


Mexican diet *see* **Central American and Mexican diet**

Micronesian diet *see* **Pacific Islander diet**

Middle Eastern diet *see* **Greek and Middle Eastern diet**


## Minerals

### Definition

Minerals are inorganic elements that originate in the earth and cannot be made in the body. They play important roles in various bodily functions and are necessary to sustain life and maintain optimal health, and thus are essential nutrients. Most of the minerals in the human diet come directly from plants and **water**, or indirectly from animal foods. However, the mineral content of water and plant foods varies geographically because of variations in the mineral content of soil from region to region.

### Description

The amount of minerals present in the body, and their metabolic roles, varies considerably. Minerals provide structure to bones and teeth and participate in energy production, the building of **protein**, blood formation, and several other metabolic processes. Minerals are categorized into major and trace minerals, depending on the amount needed per day. Major minerals are those that are required in the amounts of 100 mg (milligrams) or more, while trace minerals are required in amounts less than 100 mg per day. The terms *major* and *trace*, however, do not reflect the importance of a mineral in maintaining health, as a deficiency of either can be harmful.

Some body processes require several minerals to work together. For example, **calcium**, **magnesium**,

**Trace minerals that can be found in commercial preparations of colloidal minerals**

| | |
|---|---|
| Aluminum | Molybdenum |
| Antimony | Neodymium |
| Arsenic | Nickel |
| Barium | Niobium |
| Beryllium | Nitrogen |
| Bismuth | Osmium |
| Boron | Oxygen |
| Bromine | Phosphorus |
| Cadmium | Platinum |
| Calcium | Potassium |
| Carbon | Praseodymium |
| Cerium | Ralladium |
| Cesium | Rhodium |
| Chloride | Rubidium |
| Chromium | Ruthenium |
| Cobalt | Samarium |
| Copper | Scandium |
| Dyprosium | Selenium |
| Erbium | Silicon |
| Europium | Silver |
| Fluoride | Sodium |
| Gadolinium | Strontium |
| Gallium | Sulfur |
| Germanium | Tantalum |
| Gold | Tellurium |
| Hafnium | Terbium |
| Holmium | Thalium |
| Hydrogen | Thenium |
| Indium | Thorium |
| Iodine | Thulim |
| Iridium | Tin |
| Iron | Titanium |
| Lanthanum | Tungsten |
| Lead | Vanadium |
| Lithium | Ytterbium |
| Lutetium | Yttrium |
| Magnesium | Zinc |
| Manganese | Zirconium |
| Mercury | |

**Colloidal mineral supplements are usually liquid extracts of minerals mainly derived from humic shale deposits or from aluminosilicate-containing clays.** *(Illustration by GGS Information Services/Thomson Gale.)*

and phosphorus are all important for the formation and maintenance of healthy bones. Some minerals compete with each other for absorption, and they interact with other nutrients as well, which can affect their bioavailability.

### *Mineral Bioavailability*

The degree to which the amount of an ingested nutrient is absorbed and available to the body is called bioavailability. Mineral bioavailability depends on several factors. Higher absorption occurs among individuals who are deficient in a mineral, while some elements in the diet (e.g., oxalic acid or oxalate in spinach) can decrease mineral availability by chemically binding to the mineral. In addition, excess intake of one mineral can influence the absorption and **metabolism** of other minerals. For example, the presence of a large amount of **zinc** in the diet decreases the absorption of **iron** and copper. On the other hand, the presence of **vitamins** in a meal enhances the absorption of minerals in the meal. For example, **vitamin C** improves iron absorption, and **vitamin D** aids in the absorption of calcium, phosphorous, and magnesium.

In general, minerals from animal sources are absorbed better than those from plant sources as minerals are present in forms that are readily absorbed and binders that inhibit absorption, such as phytates, are absent. Vegans (those who restrict their diets to plant foods) need to be aware of the factors affecting mineral bioavailability. Careful meal planning is necessary to include foods rich in minerals and absorption-enhancing factors.

### *Supplementation*

It is generally recommended that people eat a well-balanced diet to meet their mineral requirements, while avoiding deficiencies and chemical excesses or imbalances. However, supplements may be useful to meet dietary requirements for some minerals when dietary patterns fall short of Recommended Daily Allowances(RDAs) or Adequate Intakes(AIs) for normal healthy people.

The Food and Nutrition Board currently recommends that supplements or fortified foods be used to obtain desirable amounts of some nutrients, such as calcium and iron. The recommendations for calcium are higher than the average intake in the United States. Women, who generally consume lower energy diets than men, and individuals who do not consume dairy products can particularly benefit from calcium supplements. Because of the increased need for iron in women of childbearing age, as well as the many negative consequences of iron-deficiency anemia, iron supplementation is recommended for vulnerable groups in the United States, as well as in developing countries.

Mineral supplementation may also be appropriate for people with prolonged illnesses or extensive injuries, for those undergoing surgery, or for those being treated for alcoholism. However, extra caution must be taken to avoid intakes greater than the RDA or AI for specific nutrients because of problems related to nutrient excesses, imbalances, or adverse interactions with medical treatments. Although toxic symptoms or adverse effects from excess supplementation have been reported for various minerals (e.g., calcium, magnesium, iron, zinc, copper, and **selenium**) and tolerable

## KEY TERMS

**Absorption**—Uptake by the digestive tract.

**Bioavailability**—Availability to living organisms, based on chemical form.

**Caries**—Cavities in the teeth.

**Cretinism**—Arrested mental and physical development.

**Fortified**—Altered by addition of vitamins or minerals.

**Myoglobin**—Oxygen storage protein in muscle.

**Neurotransmitter**—Molecule released by one nerve cell to stimulate or inhibit another.

**Phytate**—Plant compound that binds minerals, reducing their ability to be absorbed.

upper limits set, the amounts of nutrients in supplements are not regulated by the Food and Drug Administration (FDA). Therefore, supplement users must be aware of the potential adverse effects and choose supplements with moderate amounts of nutrients.

### *Major Minerals*

The major minerals present in the body include **sodium**, potassium, chloride, calcium, magnesium, phosphorus, and sulfur.

Functions. The fluid balance in the body, vital for all life processes, is maintained largely by sodium, potassium, and chloride. Fluid balance is regulated by charged sodium and chloride ions in the extracellular fluid (outside the cell) and potassium in the intracellular fluid (inside the cell), and by some other **electrolytes** across cell membranes. Tight control is critical for normal muscle contraction, nerve impulse transmission, heart function, and blood pressure. Sodium plays an important role in the absorption of other nutrients, such as glucose, amino acids, and water. Chloride is a component of hydrochloric acid, an important part of gastric juice (an acidic liquid secreted by glands in the stomach lining) and aids in food digestion. Potassium and sodium act as cofactors for certain enzymes.

Calcium, magnesium, and phosphorus are known for their structural roles, as they are essential for the development and maintenance of bones and teeth. They are also needed for maintaining cell membranes and connective tissue. Several enzymes, hormones, and proteins that regulate energy and fat metabolism require calcium, magnesium and/or phosphorus to become active. Calcium also aids in blood clotting. Sulfur is a key component of various proteins and vitamins and participates in drug-detoxifying pathways in the body.

Disease prevention and treatment. Sodium, chloride, and potassium are linked to high blood pressure (**hypertension**) due to their role in the body's fluid balance. High salt or sodium chloride intake has been linked to cardiovascular disease as well. High potassium intakes, on the other hand, have been associated with a lower risk of stroke, particularly in people with hypertension. Research also suggests a preventive role for magnesium in hypertension and cardiovascular disease, as well as a beneficial effect in the treatment of diabetes, **osteoporosis**, and migraine headaches.

Osteoporosis is a bone disorder in which bone strength is compromised, leading to an increased risk of fracture. Along with other lifestyle factors, intake of calcium and vitamin D plays an important role in the maintenance of bone health and the prevention and treatment of osteoporosis. Good calcium nutrition, along with low salt and high potassium intake, has been linked to prevention of hypertension and kidney stones.

Deficiency. Dietary deficiency is unlikely for most major minerals, except in starving people or those with protein-energy malnutrition in developing countries, or people on poor diets for an extended period, such as those suffering from alcoholism, anorexia, or bulimia. Most people in the world consume a lot of salt, and it is recommended that they moderate their intake to prevent chronic diseases (high salt intake has been associated with an increased risk of death from stroke and cardiovascular disease). However, certain conditions, such as severe or prolonged vomiting or diarrhea, the use of **diuretics**, and some forms of kidney disease, lead to an increased loss of minerals, particularly sodium, chloride, potassium, and magnesium. Calcium intakes tend to be lower in women and vegans who do not consume dairy products. Elderly people with suboptimal diets are also at risk of mineral deficiencies because of decreased absorption and increased excretion of minerals in the urine.

Toxicity. Toxicity from excessive dietary intake of major minerals rarely occurs in healthy individuals. Kidneys that are functioning normally can regulate mineral concentrations in the body by excreting the excess amounts in urine. Toxicity symptoms from excess intakes are more likely to appear with acute or chronic kidney failure.

Sodium and chloride toxicity can develop due to low intake or excess loss of water. Accumulation of

excess potassium in plasma may result from the use of potassium-sparing diuretics (medications used to treat high blood pressure, which increase urine production, excreting sodium but not potassium), insufficient aldosterone secretion (a hormone that acts on the kidney to decrease sodium secretion and increase potassium secretion), or tissue damage (e.g., from severe burns). Magnesium intake from foods has no adverse effects, but a high intake from supplements when kidney function is limited increases the risk of toxicity. The most serious complication of potassium or magnesium toxicity is cardiac arrest. Adverse effects from excess calcium have been reported only with consumption of large quantities of supplements. Phosphate toxicity can occur due to absorption from phosphate salts taken by mouth or in enemas.

## Trace Minerals

Trace minerals are present (and required) in very small amounts in the body. An understanding of the important roles and requirements of trace minerals in the human body is fairly recent, and research is still ongoing. The most important trace minerals are iron, zinc, copper, chromium, **fluoride**, **iodine**, selenium, **manganese**, and **molybdenum**. Some others, such as arsenic, boron, cobalt, nickel, silicon, and vanadium, are recognized as essential for some animals, while others, such as barium, bromine, cadmium, gold, silver, and aluminum, are found in the body, though little is known about their role in health.

Functions. Trace minerals have specific biological functions. They are essential in the absorption and utilization of many nutrients and aid enzymes and hormones in activities that are vital to life. Iron plays a major role in oxygen transport and storage and is a component of hemoglobin in red blood cells and myoglobin in muscle cells. Cellular energy production requires many trace minerals, including iron, copper, and zinc, which act as enzyme cofactors in the synthesis of many proteins, hormones, neurotransmitters, and genetic material.

Iron and zinc support immune function, while chromium and zinc aid insulin action. Zinc is also essential for many other bodily functions, such as growth, development of sexual organs, and reproduction. Zinc, copper and selenium prevent oxidative damage to cells. Fluoride stabilizes bone mineral and hardens tooth enamel, thus increasing resistance to tooth decay. Iodine is essential for normal thyroid function, which is critical for many aspects of growth and development, particularly brain development. Thus, trace minerals contribute to physical growth and mental development.

### Benefits

In addition to clinical deficiency diseases such as anemia and goiter, research indicates that trace minerals play a role in the development, prevention, and treatment of chronic diseases. A marginal status of several trace minerals has been found to be associated with infectious diseases, disorders of the stomach, intestine, bone, heart, and liver, and **cancer**, although further research is necessary in many cases to understand the effect of supplementation. Iron, zinc, copper, and selenium have been associated with immune response conditions. Copper, chromium and selenium have been linked to the prevention of cardiovascular disease. Excess iron in the body, on the other hand, can increase the risk of cardiovascular disease, liver and colorectal cancer, and neurodegenerative diseases such as Alzheimer's disease. Chromium supplementation has been found to be beneficial in many studies of impaired glucose tolerance, a metabolic state between normal glucose regulation and diabetes. Fluoride has been known to prevent dental caries and osteoporosis, while potassium iodide supplements taken immediately before or after exposure to radiation can decrease the risk of radiation-induced thyroid cancer.

### Risks

With the exception of iron, dietary deficiencies are rare in the United States and other developed nations. However, malnutrition in developing countries increases the risk for trace-mineral deficiencies among children and other vulnerable groups. In overzealous supplement users, interactions among nutrients can inhibit absorption of some minerals leading to deficiencies. Patients on intravenous feedings without mineral supplements are at risk of developing deficiencies as well.

Although severe deficiencies of better-understood trace minerals are easy to recognize, diagnosis is difficult for less-understood minerals and for mild deficiencies. Even mild deficiencies of trace minerals however, can result in poor growth and development in children.

Iron deficiency is the most common nutrient deficiency worldwide, including in the United States. Iron-deficiency anemia affects hundreds of millions of people, with highest prevalence in developing countries. Infants, young children, adolescents, and pregnant and lactating women are especially vulnerable due to their high demand for iron. Menstruating women are also vulnerable due to blood loss. Vegetarians are another vulnerable group, as iron from plant foods is less bioavailable than that from animal sources.

Zinc deficiency, marked by severe growth retardation and arrested sexual development, was first reported in children and adolescent boys in Egypt, Iran, and Turkey. Diets in Middle Eastern countries are typically high in **fiber** and phytates, which inhibit zinc absorption. Mild zinc deficiency has been found in vulnerable groups in the United States. Copper deficiency is rare, but can be caused by excess zinc from supplementation.

Deficiencies of fluoride, iodine, and selenium mainly occur due to a low mineral content in either the water or soil in some areas of the world. Fluoride deficiency is marked by a high prevalence of dental caries and is common in geographic regions with low water-fluoride concentration, which has led to the fluoridation of water in the United States and many other parts of the world. Goiter and cretinism (a condition in which body growth and mental development are stunted) have been eliminated by iodization of salt in the United States, but still occur in parts of the world where salt manufacture and distribution are not regulated. Selenium deficiency due to low levels of the mineral in soil is found in northeast China, and it has been associated with Keshan disease, a heart disorder prevalent among people of that area.

Toxicity. Trace minerals can be toxic at higher intakes, especially for those minerals whose absorption is not regulated in the body (e.g., selenium and iodine). Thus, it is important not to habitually exceed the recommended intake levels. Although toxicity from dietary sources is unlikely, certain genetic disorders can make people vulnerable to overloads from food or supplements. One such disorder, hereditary hemochromatosis, is characterized by iron deposition in the liver and other tissues due to increased intestinal iron absorption over many years.

Chronic exposure to trace minerals through cooking or storage containers can result in overloads of iron, zinc, and copper. Fluorosis, a discoloration of the teeth, has been reported in regions where the natural content of fluoride in drinking water is high. Inhalation of manganese dust over long periods of time has been found to cause brain damage among miners and steelworkers in many parts of the world.

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Sunitha Jasti

# Molybdenum

## Definition

Molybdenum is a trace element considered a micronutrient, meaning a nutrient needed in very small amounts. It is required by almost all living organisms and works as a cofactor for enzymes that carry out important chemical transformations in the global carbon, nitrogen, and sulfur cycles. Thus, molybdenum–dependent enzymes are not only required for the health of people, but also for the health of ecosystems.

## Purpose

Molybdenum is an essential trace mineral considered essential in human nutrition. This is because, as tiny as the required amounts are, the consequences of their absence (deficiency) are severe. The active biological form of molybdenum is known as the molybdenum cofactor. It is found in several tissues of the human body and is required for the activity of enzymes that are involved in eliminating toxic substances, including the catabolism of purines, which produces uric acid, formed primarily in the liver and excreted by the kidney into the urine. In addition to being a cofactor of enzymes involved in purine and pyrimidine detoxification, molybdenum also has therapeutic uses, being used in the treatment of:

- Molybdenum deficiency
- Molybdenum cofactor deficiency, a disease in which deficiency of the molybdenum cofactor causes severe neurological abnormalities, and mental retardation.
- Copper poisoning.
- Improper carbohydrate metabolism.

Recent research findings suggest that molybdenum may also have a role in stabilizing the unoccupied

**Molybdenum**

| Age | Recommended Dietary Allowance (mcg) |
|---|---|
| Children 0–6 mos. | 2 |
| Children 7–12 mos. | 3 |
| Children 1–3 yrs. | 17 |
| Children 4–8 yrs. | 22 |
| Children 9–13 yrs. | 34 |
| Adolescents 14–18 yrs. | 43 |
| Adults 19≥ yrs. | 45 |
| Pregnant women | 50 |
| Breastfeeding women | 50 |

| Food | Molybdenum (mcg) |
|---|---|
| Beans, navy, 1 cup | 196 |
| Black-eye peas, 1 cup | 180 |
| Lentils, 1 cup | 148 |
| Split peas, 1 cup | 148 |
| Beans, lima, 1 cup | 142 |
| Beans, kidney, 1 cup | 132 |
| Beans, black, 1 cup | 130 |
| Almonds, 1 cup | 46.4 |
| Chestnuts, 1 cup | 42.4 |
| Peanuts, 1 cup | 42.4 |
| Cashews, 1 cup | 38 |
| Soybeans, green, 1 cup | 12.8 |
| Yogurt, 1 cup | 11.3 |
| Cottage cheese, 1 cup | 10.4 |
| Egg, cooked, 1 cup | 9 |
| Tomatoes, fresh, 1 cup | 9 |
| Veal liver, 3.5 oz. | 8.9 |
| Milk, 1 cup | 4.9 |

mcg=microgram

*(Illustration by GGS Information Services/Thomson Gale.)*

glucocorticoid receptor. Glucocorticoids are naturally–produced steroid hormones, that inhibit the process of inflammation. Their shape permits them to move across the membrane that surrounds cells in the body, and to be recognized by molecules inside the cell called glucocorticoid receptors.

## Description

The body absorbs molybdenum quickly in the stomach and in the small intestine. The mechanism of absorption is uncertain. Following absorption, molybdenum is transported by the blood to the liver and to other tissues of the body. In the molybdate form, it is carried in the blood bound to alpha–macroglobulin and by adsorption to red blood cells. The liver and kidney store the highest amounts of molybdenum. The molybdenum cofactor is made in cells and consists of a molybdenum atom bound to tricyclic pyranopterin molecules, the simplest of which is known as molybdopterin. The cofactor is a component of four main enzymes:

- Sulfite oxidase. This enzyme catalyzes the transformation of sulfite to sulfate, a reaction that is necessary for the metabolism of sulfur–containing amino acids, such as cysteine.
- Xanthine oxidase. This enzyme catalyzes the breakdown of nucleotides (precursors of DNA and RNA) to form uric acid, which contributes to the antioxidant capacity of the blood.
- Aldehyde oxidase. This enzyme is involved in several reactions, including the catabolism of pyrimidines.
- Xanthine dehydrogenase. This enzyme catalyzes the conversion of hypoxanthine to xanthine, and xanthine to uric acid.

Aldehyde oxidase and xanthine oxidase catalyze hydroxylation reactions involving a number of different molecules with similar structures. Xanthine oxidase and aldehyde oxidase also play a role in the **metabolism** of drugs and toxins. However, according to the Micronutrient Information Center of the Linus Pauling Institute of Oregon State University, only sulfite oxidase is known to be crucial for human health.

Sources of dietary molybdenum include milk, dried beans, peas, nuts and seeds, eggs, liver tomatoes, carrots and meats. The molybdenum contents are per cup:

- Navy beans: 196 µg
- Black–eye peas: 180 µg
- Lentils: 148 µg
- Split peas: 148 µg
- Lima beans: 142 µg
- Kidney beans: 132 µg
- Black beans: 130 µg
- Almonds: 46.4 µg
- Peanuts: 42.4 µg
- Chestnuts: 42.4 µg
- Cashews: 38 µg
- Yogurt: 11.3 µg
- cooked egg: 9 µg
- Green soybeans: 12.8 µg
- Cottage cheese: 10.4 µg
- Milk: 4.9 µg
- Fresh tomatoes: 9 µg
- Veal liver: 8.9 µg per 3.5 oz–serving

The recommended dietary allowance (RDA) for molybdenum was most recently revised in January 2001:

- Infants: (0–6 months): 2 µg.
- Infants: (7–12 months): 3 µg.
- Children (1–3 y): 17 µg

## KEY TERMS

**Acetaminophen**—An aspirin substitute that works as a pain killer and fever reducer, but does not have anti–inflammatory properties and does not produce the side effects associated with aspirin, such as stomach irritation.

**Amino acid**—Organic (carbon–containing) molecules that serve as the building blocks of proteins.

**Antioxidant**—Any substance that prevents or reduces damage caused by reactive oxygen species (ROS) or reactive nitrogen species (RNS).

**Antioxidant enzyme**—An enzyme that can counteract the damaging effects of oxygen in tissues.

**Catabolism**—The metabolic breakdown of large molecules in living organism, with accompanying release of energy.

**Chelation therapy**—The use of a ring–shaped compound called a chelating agent, that can form complexes with a circulating metal and assisting in its removal from the body.

**Cofactor**—A compound that is essential for the activity of an enzyme.

**Blood brain barrier**—A physiological mechanism that alters the permeability of brain capillaries, so that some substances, such as certain drugs, are prevented from entering brain tissue, while other substances are allowed to enter freely.

**Detoxification**—The process of detoxifying, meaning the removal of toxic substances.

**Enzyme**—A biological catalyst, meaning a substance that increases the speed of a chemical reaction without being changed in the overall process. Enzymes are proteins and vitally important to the regulation of the chemistry of cells and organisms.

**Gout**—Painful inflammation of the big toe and foot caused by an abnormal uric acid catabolism resulting in deposits of the acid and its salts in the blood and joints.

**Hyperuricemia**—Abnormally elevated blood level of uric acid, the breakdown product of purines that are part of many foods we eat.

**Inflammation**—A response of body tissues to injury or irritation characterized by pain and swelling and redness and heat.

**Macro minerals**—Minerals that are needed by the body in relatively large amounts. They include sodium, potassium, chlorine, calcium, phosphorus, magnesium.

**Macronutrients**—Nutrients needed by the body in large amounts. They include proteins, carbohydrates and fats.

**Metabolism**—The sum of the processes (reactions) by which a substance is assimilated and incorporated

- Children (4–8 y): 22 µg
- Children (9–13 y): 34 µg
- Adolescents (14–18): 43 µg
- Adults: 45 µg
- Pregnancy: 50 µg
- Lactation: 50 µg

Molybdenum in nutritional supplements is available in the form of **sodium** molybdate or ammonium molybdate. Molybdenum in food is principally in the form of the organic molybdenum cofactors. The efficiency of absorption of nutritional molybdenum in supplements ranges from 88–93%, and the efficiency of absorption of molybdenum from foods ranges from 57–88%.

### Precautions

Pregnant women and nursing mothers should be careful not to use supplemental molybdenum in amounts greater than RDA amounts. Those with excess build–up of uric acid in the blood (hyperuricemia) or gout should also exercise caution in the use of supplements. Overall, it is believed that the toxicity of molybdenum compounds appears to be relatively low in humans. The Food and Nutrition Board (FNB) of the Institute of Medicine found little evidence that molybdenum excess was associated with adverse health effects in healthy people. Hyperuricemia and gout–like symptoms have only been reported in occupationally exposed workers in a copper–molybdenum plant and in an Armenian population consuming 10–15 mg of molybdenum from food daily. Other studies report that blood and urinary uric acid levels were not elevated by molybdenum intakes of up to 1.5 mg/day.

Dietary molybdenum deficiency has never been observed in healthy people. Molybdenum cofactor deficiency and isolated sulfite oxidase deficiency are the only two disorders associated with this trace

into the body or detoxified and excreted from the body.

**Micronutrients**—Nutrients needed by the body in small amounts. They include vitamins and miberals.

**Molybdenum cofactor deficiency**—An inherited disorder in which deficiency of the molybdenum cofactor causes deficiency of a variety of enzymes, resulting in severe neurological abnormalities, dislocated ocular lenses, mental retardation, xanthinuria, and early death.

**Molybdopterin**—The chemical group associated with the molybdenum atom of the molybdenum cofactor found in molybdenum–containing enzymes.

**Nucleotide**—A subunit of DNA or RNA consisting of a nitrogenous base (adenine, guanine, thymine, or cytosine in DNA; adenine, guanine, uracil, or cytosine in RNA), a phosphate molecule, and a sugar molecule (deoxyribose in DNA and ribose in RNA).

**Plasma**—The liquid part of the blood and lymphatic fluid, which makes up about half of its volume. It is 92% water, 7% protein and 1% minerals.

**Protein**—Biological molecules that consist of strings of smaller units called amino acids, the "building blocks" of proteins. In proteins, amino acids are linked together in sequence as polypeptide chains that fold into compact shapes of various sizes. Proteins are required for the structure, function, and regulation of the body's cells, tissues, and organs, and each protein has unique functions.

**Purines**—Components of certain foods that are transformed into uric acid in the body.

**Pyrimidine**—A nitrogen–containing, double–ring, basic compound that occurs in nucleic acids.

**Recommended dietary allowance (RDA)**—The levels of intake of essential nutrients judged on the basis of scientific knowledge to be adequate to meet the nutrient needs of healthy persons by the Food and Nutrition Board of the National Research Council/National Academy of Sciences. The RDA is updated periodically to reflect new knowledge. It is popularly called the Recommended Daily Allowance.

**Toxic**—Harmful or poisonous substance.

**Toxin**—A poisonous substance, especially a protein, that is produced by living cells or organisms and is capable of causing disease.

**Trace minerals**—Minerals needed by the body in small amounts. They include: selenium, iron, zinc, copper, manganese, molybdenum, chromium, arsenic, germanium, lithium, rubidium, tin.

**Vitamin E**—A fat–soluble vitamin essential for good health found chiefly in plant leaves, and wheat.

element. Molybdenum cofactor deficiency disorder is severe and usually results in premature death in early childhood since all of the molybdenum cofactor–dependent enzymes are affected. Isolated sulfite oxidase deficiency only affcets sulfite oxidase activity. Together, molybdenum cofactor deficiency and isolated sulfite oxidase deficiency have been diagnosed in more than 100 individuals worldwide. They are, however, both inherited disorders and there are no documented cases of their ever occurring as a result of dietary molybdenum deficiency.

## Interactions

Studies have shown that high doses of molybdate inhibit the metabolism of acetaminophen in rats. However, it is not known whether this occurs at clinically relevant doses in humans. High doses of molybdate may also lower the absorption of copper. Likewise, high doses of copper may lower the absorption of molybdenum and decrease overall molybdenum levels.

## Aftercare

There is only one report of acute poisoning resulting from intake of a dietary molybdenum supplement. The person consumed a total dose of 13.5 mg of molybdenum over a period of 18 days, at an intake rate of 300–800 µg daily, resulting in visual and auditory hallucinations, several petit mal seizures and one grand mal seizure. The subject was treated with chelation therapy to remove the molybdenum from his body and his symptoms disappeared after several hours.

## Complications

With molybdenum deficiency being extremely unlikely, molybdenum–related complications are only

possible with molybdenum toxicity that may result in gout. High molybdenum levels in people with low copper levels may cause copper deficiency symptoms, but are easily treated with diet readjustments.

## Parental concerns

The RDA for molybdenum (17–22 µg for children) is sufficient to prevent deficiency. Although the precise amount of molybdenum required to most likely promote optimum health is not known, there is presently no evidence that intakes higher than the RDA are beneficial. Most people in the United States consume more than sufficient molybdenum in their diets, making supplementation unnecessary. If required, it should be noted that the amount of molybdenum presently found in most multivitamin/mineral supplements is higher than the RDA. It is however well below the tolerable upper intake level of 2,000 µg/day and is generally considered safe.

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### ORGANIZATIONS


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American Society for Nutrition (ASN). 9650 Rockville Pike, Bethesda, MD 20814. (301) 634-7050. <www.nutrition.org>.

Office of Dietary Supplements, National Institutes of Health. National Institutes of Health, Bethesda, Maryland 20892 USA. <ods.od.nih.gov>.

U.S. Department of Agriculture, Food and Nutrition Information Center. National Agricultural Library,10301 Baltimore Avenue, Room 105, Beltsville, MD 20705. (301) 504-5414. <www.nal.usda.gov>.


Monique Laberge, Ph.D.

MSUD *see* **Maple syrup urine disease**

MyPyramid *see* **USDA Food Guide Pyramid (MyPyramid)**

# N

Naphthoquinones *see* **Vitamin K**

## Native American diet

### Origins

When Christopher Columbus dropped anchor on the shores of San Salvador in the Caribbean Sea, he believed he reached India. Because he believed he was in India, Columbus named the inhabitants *Indians*, a term that was soon used to refer to all the native inhabitants of North America. Today, the term *Native American* is more commonly used.

#### *The Hardships of Settlement*

New settlers in North America had a difficult time learning how to grow food and harvest crops to sustain their colonies through the land's harsh winters. The Native Americans, on the other hand, were accustomed to the climate and the land's nuances, and were familiar with what types of food were available to them during the different times of the year. They did not go hungry as the settlers did. The Native Americans were skilled agriculturists, nomadic hunters, and food gatherers who lived in relatively egalitarian communities where both the women and men had equal responsibilities.

The portal that Columbus opened when he first stepped foot on the soil of the New World in 1492 triggered a steady influx of European settlers, indelibly affecting the lives of Native Americans. However, it was Thomas Jefferson's purchase of the Louisiana Territory from France in 1803 that fundamentally changed the course of Native Americans' future in North America. Hoping to expand the nation's size, Jefferson urged the Creek and Cherokee nations of Georgia to relocate to the newly acquired land. This began an era of devastating wars over land. The many years of struggle between Native American tribes and the U.S. government resulted in the near extinction of many Native American tribes.

#### *General Diet before the Colonial Period*

The Native American population, including American Indians and Alaska Natives, once totaled nearly 24 million, with over 500 tribes. The diets of Native Americans varied by geographic region and climate. They lived in territories marked by specific natural boundaries, such as mountains, oceans, rivers, and plains. Hunting, fishing, and farming supplied the major food resources. Native Americans survived largely on meat, fish, plants, berries, and nuts.

The most widely grown and consumed plant foods were maize (or corn) in the mild climate regions and wild rice in the Great Lakes region. A process called *nixtamalizacion* (soaking dry corn in lime **water**) was used to soften the corn into dough, called *nixtamal* or *masa*. This was prepared in a variety of ways to make porridges and breads. Many tribes grew beans and enjoyed them as *succotash*, a dish made of beans, corn, dog meat, and bear fat. Tubers (roots), also widely eaten, were cooked slowly in underground pits until the hard tough root became a highly digestible gelatin-like soup. It is estimated that 60% of modern agricultural production in the United States involves crops domesticated by Native Americans.

Maple sugar comprised 12% of the Native American diet. The Native American name for maple sugar is *Sinzibuckwud* (drawn from the wood). Sugar was a basic seasoning for grains and breads, stews, teas, berries, vegetables. In the Southwest, the Native Americans chewed the sweet heart of the agave plant.

Many tribes preferred broth and herbed beverages to water. The Chippewa boiled water and added leaves or twigs before drinking it. Sassafras was a favorite ingredient in teas and medicinal drinks. Broth was flavored and thickened with corn silk and

## KEY TERMS

**Cholesterol**—Multi-ringed molecule found in animal cell membranes; a type of lipid

**Diabetes**—Inability to regulate level of sugar in the blood

**Type II diabetes**—Inability to regulate the level of sugar in the blood due to a reduction in the number of insulin receptors on the body's cells

dried pumpkin blossoms. Native Americans in California added lemonade berries to water to make a pleasantly sour drink.

Sacred and Ceremonial Foods. Sacred foods included bear, organ meats, and *blood soup*. The Horns Society, a militant group of the Blackfoot Nation, used *pemmican*, made with berries, for its sacred communion meal. Boiled buffalo tongue was a delicacy and was served as the food of communion at the Sun Dance, a Lakota and Plains Indian courtship dance that also celebrated the renewal of spiritual life. Blood soup, made from a mixture of blood and corn flour cooked in broth, was used as a sacred meal during the nighttime Holy Smoke ceremony of the Sioux, a celebration of Mother Earth that involved the use of the "peace pipe." Wolves and coyotes were the only animals that were not hunted for food, because they were regarded as teachers or pathfinders and held as sacred by all tribes.

At marriage ceremonies, the bride and groom exchanged food instead of rings. The groom brought venison or some other meat to indicate his intention to provide for the household. The bride provided corn or bean bread to symbolize her willingness to care for and provide nourishment for her household.

## Description

### *Current Food Practices*

Native American diets and food practices have possibly changed more than any other ethnic group in the United States. Although the current diet of Native Americans may vary by tribe, and by personal traits such as age (e.g., young versus old), it closely resembles that of the U.S. white population. Their diet, however, is poorer in quality than that of the general U.S. population. A recent study found that only 10% of Native Americans have a healthful diet, while 90% have a poor quality that needs improvement. The majority of Native Americans have diets that are too high in fat (62%). Only 21% eat the recommended amount of fruit on any given day, while 34% eat the recommended amount of vegetables, 24% eat the recommended amount of grains, and 27% consume the recommended amount of dairy products. Native Americans are also four times more likely to report not having enough to eat than other U.S. households.

## Risks

### *Diet-Related Health Issues*

Heart disease is the leading cause of death among Native Americans. Risk factors, such as high blood pressure, cigarette smoking, high blood cholesterol, **obesity**, and diabetes, are health conditions that increase a person's chance for having heart disease. The more risk factors a person has, the greater chance a person may have for developing heart disease. Sixty-four percent of Native American men and 61% of women have one or more of these risk factors.

Diabetes. Type II diabetes is one of the most serious health problems for Native Americans in the United States. It is estimated that 12.3% of Native Americans over nineteen years of age have type II diabetes, compared to about 6% of the general U.S. population—a statistic that has caused health experts to say diabetes has reached widespread proportions. On average, Native Americans are 2.8 times more likely to be diagnosed with diabetes than whites of a similar age. Diabetes is a major cause of health problems and deaths in most Native American populations. Diabetes rates for Native Americans vary by tribal group.

Obesity. Obesity is a major risk factor for both type II diabetes and heart disease. On average, 30% of all adult Native Americans are obese. Both males and females are consistently more overweight and obese than the total U.S. population. Among the Pima of Arizona and Mexico, for example, 95% of those with diabetes are also overweight. In addition to the increase in obesity among adults, obesity in children has also become a serious health problem. For both adults and children, the increasingly high rates of obesity have been associated with a **high-fat diet** and decreased levels of physical activity.

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# Neanderthin

## Definition

The neanderthin diet is a high-protein low-carbohydrate diet that is based on the foods eaten by early humans of the paleolithic era, from about one million years ago to 10,000–14,000 years ago when agriculture developed. Since this was the period of rapid evolution of the human species, modern humans are presumed to be genetically adapted to a paleolithic diet.

Neanderthin is the same as or very similar to a:

- paleolithic diet
- 'paleo' diet
- paleothin diet
- caveman diet
- Pangaian diet
- stone-age diet
- pre-agricultural diet
- hunter-gatherer diet.

## Origins

### *Paleolithic foods*

For 96.6% of our evolutionary history, all human beings were hunter/gatherers. Isolated pockets of hunter/gatherers have survived into the twenty-first century. Early humans hunted animals, fished, and gathered plants for food. There were no crops, such as rice or wheat, and no milk products except for breast milk, although babies were probably breastfed until they were several years old. Although the paleolithic diet varied greatly depending on the geographical location and season, it is likely that early humans used a far greater variety of plants and animals than do modern humans and, perhaps for this reason, may have consumed more **vitamins**, **minerals**, and healthy factors such as **antioxidants**.

Based on the foods that would have been available during the paleolithic and on the foods consumed by modern hunter/gatherers, many experts believe that early humans had a diet that was very high in **protein** derived from meat—perhaps up to twice as much as modern westerners. Since the meat was from wild animals it was low in fat. Early humans living near oceans, lakes, and rivers would have eaten fish and seafood such as oysters, mussels, and prawns that are also low in fat, particularly saturated **fats**. However since early humans ate far more of the animal carcass than modern humans, including offal that is now considered inedible, as well as brains and other organs, the paleolithic diet may have been even higher in fat than modern diets. However the fats would have been monounsaturated and polyunsaturated rather than saturated.

The paleolithic diet probably also included large amounts of:

- leafy vegetables
- root vegetables
- fruits and berries
- grass seeds
- nuts
- honey.

Root vegetables are high in nutrients and **fiber** and may have provided a large portion of early humans' energy requirements. Wild berries have more nutrients and antioxidants than modern commercial berries, as well as far less sugar. Salt intake was probably about one-fifth of what the average westerner consumes today.

About 72% of the food consumed by modern humans was unavailable to early humans. The paleolithic diet did not include:

- dairy products
- cereal grains such as wheat, barley, oats, or rice
- legumes, including beans, soy, peas, or peanuts
- corn
- yeast
- processed foods such as sugar, bread, or pastries
- alcohol.

## KEY TERMS

**Antigen**—A substance that is foreign to the body and invokes an immune response.

**Antioxidant**—A substance such as vitamin C or beta-carotene that inhibits oxidation—reactions promoted by oxygen and peroxides—and that may help protect the body against the damaging effects of free radicals.

**Autoimmune disease**—A disease caused by the body's own immune system.

**Diabetes mellitus**—A disorder of carbohydrate metabolism caused by a combination of hereditary and environmental factors and characterized by the inadequate secretion or utilization of insulin, leading to excessive sugar in the blood.

**Glycemic index**—GI; a measure of the rate at which an ingested carbohydrate raises the glucose level in the blood.

**HDL cholesterol**—High-density lipoprotein; 'good' cholesterol that helps protect against heart disease.

**Homocysteine**—An amino acid product of animal metabolism that at high blood levels is associated with an increased risk of cardiovascular disease.

**LDL cholesterol**—Low-density lipoprotein; 'bad' cholesterol that can clog arteries.

**Lectins**—Plant proteins that bind to carbohydrate-containing receptors on cell surfaces.

**Omega-3 fatty acids**—A type of polyunsaturated fatty acids that appear to be beneficial for the heart.

**Paleolithic**—Human cultures of the Pleistocene epoch, from about one million to 10,000 years ago.

**Pemmican**—Dried meat pounded into a powder and mixed with hot fats and dried fruits or berries to make a loaf or small cakes.

**Phytate**—Phytic acid; an acid in cereal grains that interferes with the intestinal absorption of minerals such as calcium and magnesium.

**Phytochemicals**—Compounds in plants such as carotenoids and phytosterols.

**Rheumatoid arthritis**—A chronic autoimmune disease that is characterized by pain, stiffness, inflammation, and possible destruction of joints.

**Saturated fats**—Fats found in animal products and in coconut and palm oils that are a major dietary cause of high LDL.

**Triglycerides**—Neutral fat; lipids formed from one glycerol molecule and three fatty acids that are widespread in adipose tissue and circulate in the blood as lipoproteins.

**Unsaturated fats**—Fats that help to lower blood cholesterol; olive and canola oils are monounsaturated fats; fish, safflower, sunflower, corn, and soybean oils are polyunsaturated fats.

### *Neanderthin*

As a young man Ray Audette was stricken first with rheumatoid arthritis and then with diabetes—autoimmune diseases that are prevalent only in agricultural societies. A non-scientist, Audette spent 15 years researching and experimenting with diets that would improve his health. He self-published *Neander-thin: A Caveman's Guide to Nutrition* in 1996.

While Audette helped to popularize the paleo diet, his ideas were not new. Herodotus espoused the benefits of a paleo diet in the fifth century B.C. The concept was revived during the nineteenth century by William Banting and James Salisbury, who ground up cheap beef cuts with fat to make 'Salisbury steak.' In the early twentieth century the Arctic explorer Vilhjalmur Stefansson lived with the Inuit and adopted and publicized their all-meat diet. Buckminster Fuller adopted a low-carbohydrate diet on the theory that nature utilizes energy most efficiently and that vegetables and animal protein are the most concentrated sources of food energy.

In 1985 S. B. Eaton and Melvin Konner published an article in the *New England Journal of Medicine* reporting that, compared to our modern diet, the paleo diet had far more:

- fiber
- iron
- calcium
- folate
- essential fatty acids;

and far less:

- sugar
- salt
- saturated fats.

They concluded: 'The diet of our remote ancestors may be a reference standard for modern human nutrition and a model for defense against certain 'diseases of civilization.'' Although initially met with ridicule, this work opened up new avenues of nutrition

research. Since 1987 Dr. Loren Cordain, professor of exercise physiology at Colorado State University, has used research and scholarship to promote a paleo diet.

## Description

### *General principles*

Paleo diets are based on the theory that, since the human genome has changed very little in the past 40,000 years, modern human nutritional requirements should be identical to those of paleolithic humans. However neanderthin is not just a diet—it is a hunter/gatherer way of life. Audette wrote: 'It's the most natural way to eat. It's the way to become most in tune with nature. As I've been doing this, I've been becoming more and more of an uncivilized man. I'm no longer a spectator of nature, I'm a participant. Philosophically, you become one with the hunter-gatherer within you.

In general paleo diets consist of:

- high protein—about 29% compared with 15% in the typical modern diet
- medium fat—38% compared with 34% in the modern diet
- low-to-medium carbohydrate—33% compared with 48% in the modern diet
- no alcohol compared with an average of 3% in a modern diet
- high levels of omega-3 fats
- healthy monounsaturated fats from canola, walnut, and olive oils
- carbohydrates with a low glycemic index (GI) from fruits and vegetables
- high soluble fiber
- small amounts of honey or maple syrup
- high amounts of essential vitamins, minerals, antioxidants, and phytochemicals.

Paleo diets include little or no:

- saturated or trans fats
- refined sugars
- grains
- high-GI carbohydrates
- salt
- processed foods.
- Audette concluded that obesity and various diseases are immune responses to foods introduced via technology. Thus neanderthin is defined by its non-reliance on technology. Audette wrote: 'A natural diet is what is edible when you are naked with a sharp stick.' Food in the neanderthin diet must be edible without cooking, although it does not have to be eaten raw.

### *Allowable foods*

Neanderthin is a diet of:

- lean meat with low levels of saturated fats
- fish and other seafood with high levels of omega-3 fats
- eggs
- vegetables, especially root vegetables but not potatoes
- nuts
- berries
- fruit.

**ANIMAL PRODUCTS** Meats, seafood, and eggs are the most important components of paleo diets. Ideally these come from animals fed on natural **organic food** and from free-range chickens. Pasture-fed beef and lamb are lower in fat than grain-fed animals. Wild game is the lowest in fat and is the preferred meat. Because of the dangers of bacterial and parasitic contamination, Audette does not suggest eating meat, poultry, eggs, or seafood raw unless it has been irradiated. Meat should be lightly cooked or cooked by paleolithic methods—slow cooking over low heat—a with a crock pot rather than a microwave. Processed meats should be without preservatives or additives such as corn, corn products, **soy**, starch, or sugars.

Paleo diets include unlimited quantities of unprocessed meat such as:

- grass-fed bison and beef
- chicken
- lamb
- pork
- turkey
- antelope
- caribou
- elk
- kangaroo
- ostrich
- quail
- rabbit
- venison
- fish
- shellfish.

**VEGETABLES** Most vegetables are allowed, raw or cooked, fresh or frozen, including:

- artichokes
- asparagus
- broccoli
- Brussels sprouts

- cabbage
- carrots
- celery
- cucumbers
- eggplant
- garlic
- lettuce
- mushrooms
- onions
- peppers
- rhubarb
- spinach
- turnips
- watercress.

Potatoes and legumes are prohibited because they require cooking or processing to be edible.

**FRUIT, NUTS, AND SEEDS** All fruit and nuts should be consumed fresh and raw. The neanderthin diet calls for very little fruit to achieve maximum weight loss. Canned fruits, preserves, jams, and jellies are prohibited because of their high sugar content and the loss of nutrients during processing. The neanderthin diet allows only limited amounts of juice with pulp and without additives.

Most fruits are permitted including:

- apples
- apricots
- avocadoes
- ripened bananas
- berries
- cherries
- citrus fruits
- coconuts
- dates
- grapes
- olives
- peaches
- pears
- tomatoes
- tropical fruits.

Most nuts and seeds are allowed including:

- almonds
- Brazil nuts
- chestnuts
- filberts
- pecans
- walnuts.

Raw cashews contain a toxin and are therefore prohibited.

In general paleo diets allow olive, nut, coconut, and **flaxseed** oils. Neanderthin beverages are limited to **water**, tea, and lemon and lime juice. Lard and mustard are permitted.

### *Forbidden foods*

Forbidden foods include:

- all grains including cereals, breads, corn, pasta, wheat, wheat germ, barley, oats, rye, rice, buckwheat
- all legumes including beans and bean products, lentils, soybeans, peanuts, and coffee
- all dairy products
- sugars including sucrose, fructose, and molasses
- starchy foods including potatoes, yams, parsnips, sweet potatoes, cassava, manioc
- processed meats made with nitrites and additives, including hot dogs, bacon, sausage, and lunch meat
- cashews and mixed nuts
- margarine
- corn, cottonseed, peanut, soybean, rice-bran, and wheat-germ oils
- ice cream
- candy
- chocolate
- carob
- commercial mayonnaise and ketchup
- whey powder
- baking powder
- salt and foods containing added salt
- soy sauce, vinegar, and all pickled foods
- seaweed byproducts such as agar and carrageenen
- alcohol

### *A neanderthin menu*

A typical neanderthin menu consists of:

- for breakfast, a 12-oz (340-g) steak with two eggs, a small glass of orange juice, and hot tea with lemon
- for lunch, a double-meat hamburger with lettuce, onion, and tomato, and a medium iced tea
- an afternoon snack of one apple, one small bag of almonds, and one bottle of mineral water
- for dinner, six medium poached shrimp, six raw oysters with lemon, and a 12-oz (340-g) grilled tuna steak
- an evening snack of one cup of Brazil nuts and one-half cup of pemmican—dried meat mixed with fat.

### *Modifications*

Various paleo diets differ in their specifics. Cordain's diet recommends canola oil but not coconut or palm oils which are high in saturated fats. For weight loss, nuts and seeds should be limited to 4 oz (110 g) per day. Cordain allows diet soda, coffee, tea, beer, wine, and other alcohol in moderation. He advises easing into the diet in three phases and allows 'open meals' with loosened rules, starting out with three open meals per week. Cordain and others believe that paleo diets are beneficial even if the rules are only partially followed. Some paleo diets merely restrict the amount dairy products and grains. At the very least cereal grains should be restricted to two–three servings daily.

## Function

Although neanderthin and other paleo diets are used for weight loss, they are primarily designed to promote good health by providing the foods for which the human body is best adapted. Cordain argues that proteins in agricultural foods such as cereal grains are foreign to the human immune system, since humans did not eat grains during their evolution as a species. Therefore these foods can disrupt the immune system and cause autoimmune diseases such as lupus and rheumatoid arthritis.

In today's world most people do not have access to game meat and the world's food supply is completely dependent on cereal grains. Thus neanderthin and other paleo diets are only appropriate for those who can afford to eliminate grains from their diets and are willing to eat large quantities of meat.

## Benefits

Proponents of neanderthin and other paleo diets claim that they:

- cause weight loss
- reduce hypertension (high blood pressure)
- lower 'bad' cholesterol
- reduce food sensitivities by eliminating sugar, dairy, grains, and legumes
- reduce the risks for high blood pressure, heart disease, type 2 diabetes, and cancer
- alleviate symptoms of diabetes and arthritis.

Many people on low-calorie high-carbohydrate diets suffer from hunger pangs and regain any weight lost on the diet. In contrast people usually feel satiated on high-protein diets. Cordain claims that protein also speeds up the **metabolism**, thereby accelerating weight loss.

The allowable **carbohydrates** in the neanderthin diet have low GIs that help stabilize blood sugar and insulin levels. The over-consumption of carbohydrates has been linked to numerous health problems including:

- insulin resistance
- hormone imbalances
- heart disease
- obesity
- diabetes
- hypertension
- gastrointestinal disorders
- dental caries
- cancer.

Neanderthin eliminates legumes which can be:

- poisonous if eaten raw
- high in lectins, which bind carbohydrates, can be inflammatory and toxic, and have been linked to autoimmune diseases
- high in phytate (phytic acid) that can inhibit the absorption of minerals such as zinc, calcium, magnesium, and iron in the digestive tract
- high in protease inhibitors, which can interfere with the breakdown of proteins into amino acids.

## Precautions

Precautions concerning neanderthin and other paleo diets include:

- They are probably more expensive than eating grains such as bread and pasta.
- Some obese people, particularly women, may fail to lose weight.
- People with low blood pressure may not be able to limit their salt intake.
- Chronic diabetics will probably not experience a reversal in symptoms.
- These diets must be adjusted for use by children and pregnant women.

## Risks

Risks associated with neanderthin and other paleo diets include:

- possible adverse effects from the high amounts of meat and fat
- possible adverse effects on the kidneys from the high protein
- possible difficulty in consuming adequate amounts of carbohydrates.

## Research and general acceptance

### *Research*

**FOSSIL AND ETHNOGRAPHIC EVIDENCE** Although there have been no large trials of neanderthin or other paleo diets, there is an increasing volume of scientific evidence to support the benefits of at least some components of these diets. Cordain's paleolithic diet was based on evidence from the fossil record and ethnographic studies of 181 hunter/gatherer groups around the world. This evidence suggests that the pre-agricultural diet was primarily animal-based, with 65% of energy from animal sources and 35% from plant sources—a diet high in protein and low-to-moderate in carbohydrates and fat. Studies indicate that early humans rarely if ever ate cereal grains or diets that were high in carbohydrates. Cereal grains are virtually indigestible by humans without milling (grinding) and cooking. The first grinding stones do not appear in the archeological record until about 10,000–15,000 years ago. Modern hunter/gatherers, such as African Bushmen, Amazonian Indians, and Australian Aborigines, have little heart disease, **osteoporosis**, **obesity**, **cancer**, rheumatoid arthritis, or other diseases until they adopt a modern western diet.

Fossil studies have shown that the density and robustness of paleolithic bones were equal to or greater than those of most modern humans, despite a low-calcium **high-protein diet** without dairy products. This has been attributed to their physical activity, with a daily energy expenditure of twice that of modern humans, **vitamin D** from working outdoors in the sun, and improved **calcium** balance due to improved acid-base status from the 35% of energy coming from fruits and vegetables.

The fossil record indicates that, in comparison to their paleolithic ancestors, early farmers had:

- smaller skeletons
- increased infant mortality
- shorter life-spans
- more infectious diseases
- more iron-deficient anemia
- more bone disorders
- more dental caries and tooth enamel defects.

**NUTRITIONAL EVIDENCE** There is little scientific evidence to support the prevailing view that healthy diets should be high in complex carbohydrates such as are found in breads, cereals, rice, and pasta. According to Cordain:

- Although individual tolerances for cereal grains vary tremendously, health deteriorates when cereal constitutes 70% or more of the caloric intake.
- Diets high in cereal and dairy lower the pH of the body, making it more acidic and leading to urinary calcium excretion and increased depletion of skeletal calcium.
- The high phytate content of wholegrain cereals can interfere with iron and calcium metabolism.
- The high phytate levels in unleavened wholegrain breads can cause zinc deficiency.
- Components of cereals can interact with the gastrointestinal tract and perhaps with the immune system.
- The high lectin content of whole grains can cause dietary and pathogenic antigens to enter the circulation.
- Whole-cereal grains lack vitamin C and beta-carotene and their vitamin $B_6$ is poorly absorbed.
- Epidemiological studies have shown that diets high in unleavened wholegrain breads can result in vitamin D deficiency and rickets.
- Whole grains have low levels of essential fats and high ratios of omega-6/omega-3 fatty acids.

Cordain believes that the modern western diet is not only too high in saturated fats, but that the polyunsaturated fats are out of balance. Cordain's research suggests that prior to the development of agriculture, the ratio of omega-6 to **omega-3 fatty acids** was about 1:1–3:1, whereas in the modern diet the average ratio is 12:1.

**CLINICAL STUDIES** A 2003 German study found that a diet high in lean meat and relatively low in carbohydrates increased HDL ('good') cholesterol and lowered LDL ('bad') cholesterol, **triglycerides**, and homocysteine levels. They concluded that their results might warrant a reevaluation of high-carbohydrate, low-fat nutrition guidelines. Clinical studies also have shown that people eat fewer calories with high-protein meals than with high-carbohydrate or high-fat meals, probably because protein is more satiating.

**OPPOSITION** While most scientists and nutritionists agree that increased consumption of fruits and vegetables, reduced saturated fats, and increased activity levels are beneficial, many of them consider paleo diets to be eccentric, if not outright dangerous. Their concerns include:

- the elimination of entire food groups
- increased consumption of saturated fats that could raise cholesterol
- excess wasted protein
- possible weight gain.

## QUESTIONS TO ASK YOUR DOCTOR

- Are neanderthin or other paleo diets appropriate for me?
- Could this type of diet exacerbate my medical conditions?
- Have you treated other patients on these types of diets?
- Would I be expected to lose weight on neanderthin?
- Is it appropriate for me to completely eliminate grains, legumes, and dairy from my diet?

The majority of nutritionists believe that reduced- or low-fat milk and milk products, cereal foods such as wheat, rice, and pasta, and beans are appropriate foods.

Many scientists question whether a paleo diet would have much affect on modern health, since modern health problems occur primarily in middle age and beyond. It is unlikely that many paleolithic peoples survived to an age at which problems such as heart disease, cancer, arthritis, or osteoporosis begin to develop.

### *General acceptance*

The majority of nutritionists and the general public view neanderthin as a quirky fad diet, unsuitable for most people. However paleo diets are gaining popularity among athletes. Nevertheless, although few people have or could adopt neanderthin, there is increased skepticism concerning the overwhelming reliance on grains in typical diets.

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**ORGANIZATIONS**

Price-Pottenger Nutrition Foundation. 7890 Broadway, Lemon Grove, CA 91945. (800) 366-3748. <http://www.price-pottenger.org>.
The Weston A. Price Foundation. PMB 106-380, 4200 Wisconsin Ave., NW, Washington DC 20016. (202) 363-4394. <http://www.westonaprice.org>.

Margaret Alic, PhD

# Negative calorie diet

## Definition

The Negative Calorie diet is based on the theory that some foods use more calories to digest than are contained in the foods and that this can be used to produce weight loss.

## Origins

The origins of the idea of negative calorie foods are not clear. For many years some people have speculated that if a dieter were to eat foods that were hard for the body to break down, but did not contain very many calories, that it would take more energy for the body to process the food than were acquired through the breakdown of the food.

As of 2007, the Negative Calorie diet is available as an 80 page downloadable e-book from the website www.negativecaloriediet.com. It is put out by The Equilibria Group, and is not available as a traditional book. Dieters must purchase the right to download the book to their personal computer and then can view the book on the computer or print it out if they choose. According to the website the diet has been available since 1997 and has been followed by thousands of dieters around the world.

## Description

The Negative Calorie diet is based on the idea that some foods are negative calorie foods. The diet does not claim that the foods actually contain negative calories, instead the idea is that some foods take more calories for the body to process and digest than are contained in the foods themselves.

When a person eats a piece of food the first thing that happens is chewing and this action consumes energy. Foods that are higher in stringy fibers, such as celery, generally require more chewing, and hence more energy expenditure, than other foods such as cake which do not require as much chewing. After chewing, the food is moved down the esophagus and into the stomach, where it begins to be broken down as it mixes with stomach acid. Then it is moved into the small intestine where it is liquefied and absorption into the body begins. Then the mass moves into the large intestine where fluids are absorbed and then the residual mass is excreted.

The Negative Calorie diet believes that this entire process of digestion uses many calories, and so by eating foods that are low in calories, and take longer to digest, the body will actually be using more calories than are taken by processing the foods. The diet claims that these extra calories required for digestion are taken from fat stores in the body, and that the more of these negative calorie foods the dieter eats, the more weight will be lost.

The Negative Calorie diet gives, as an example, the net calorie consumption from eating broccoli. It says that if you eat a serving of 100 grams of broccoli, which contains 25 calories, it will take the body 80 calories worth of energy to digest it. This results in a negative net calorie use of 55 calories which are supposed to be taken from fat stores on the body. As a counter example the diet says that if a dieter eats a piece of cake that contains 400 calories, it will take the

## KEY TERMS

**Calorie**—A measurement of the energy content of food, also known as a large calorie, equal to 1000 scientific calories.

**Diabetes mellitus**—A condition in which the body either does not make or cannot respond to the hormone insulin. As a result, the body cannot use glucose (sugar). There are two types, type 1 or juvenile onset and type 2 or adult onset.

**Dietary supplement**—A product, such as a vitamin, mineral, herb, amino acid, or enzyme, that is intended to be consumed in addition to an individual's diet with the expectation that it will improve health.

**Mineral**—An inorganic substance found in the earth that is necessary in small quantities for the body to maintain a health. Examples: zinc, copper, iron.

**Vitamin**—A nutrient that the body needs in small amounts to remain healthy but that the body cannot manufacture for itself and must acquire through diet.

body 150 calories to digest it, and the net 250 calories taken into the body will be stored as fat.

The Negative Calorie diet contains more than 100 foods which are considered negative calorie. These are mostly fruits and vegetables that are high in **fiber**. Some of the vegetables include: asparagus, beets, broccoli, cabbage, celery, chilies, garlic, lettuce, spinach, and zucchini. Some fruits considered negative calorie include: apples, grapefruits, lemons, oranges, and pineapple.

There are 3 diet plans that a dieter can select from, depending on how fast the dieter wants to lose weight. Also provided are a variety of recipes and suggestions for how to continue to include negative calorie foods in the diet once the desired weight loss has been achieved.

The diet says that eating these negative calorie foods can actually increase the body's **metabolism**. The e-book also includes other suggestions for how the dieter can increase his or her metabolism. One suggestion is breathing better and more deeply. The diet says that this will increase metabolism and let the body rid itself of toxins. The diet also provides a set of exercises. It claims that the three exercises provided will tone 85% of the body's muscles. These exercises are recommended to be done for 15 minutes, three times a week.

### Function

The Negative Calorie diet is intended to help dieters lose a lot of weight very quickly. It says that dieters can lose up to 14 pounds in 7 days by following the diet strictly. It also includes exercise recommendations that are intended to help the dieter tone their body. After the dieter has reached their desired weight the Negative Calorie diet suggests that it be repeated as needed to help maintain weight loss. It also says that during this period the negative calorie food should be included into the dieters usual diet to help promote continued health and ensure that the weight is not regained.

### Benefits

The Negative Calorie diet claims that dieters can lose up to 14 pounds in 7 days. Although this has not been proven, there are many benefits to a diet that includes many of the foods on the negative calorie list. Eating a diet that includes many different fruits and vegetables will provide a dieter with many **vitamins** and **minerals** that are important to good health.

Including many of the foods listed as negative calorie foods may be able to help promote weight loss if part of an otherwise balanced and healthy diet. This is because foods that are low in calories, but full of fiber, can make the dieter feel fuller after eating fewer calories, and because fibrous foods may take longer for the stomach to break down, they may help the dieter to feel full longer. There are many benefits to losing weight if it is done at a moderate pace through healthy eating and increased exercise. **Obesity** is associated with an increased risk of type II diabetes, cardiovascular disease, and many other diseases and conditions. Losing weight can reduce the risks of these and other obesity-related diseases as well as may be able reduce the severity of the symptoms if the diseases have already occurred.

### Precautions

Anyone thinking of beginning a new diet should consult a medical practitioner. Requirements of calories, fat, and nutrients can differ significantly from person to person, depending on gender, age, weight, and many other factors such as the presence of any diseases or conditions. Pregnant or **breastfeeding** women should be especially cautious, because deficiencies of vitamins or minerals can have a significant negative impact on a baby. Women beginning the

Negative Calorie diet should be especially careful if they are pregnant or breastfeeding because the very limited nature of the diet means that it will be difficult to get daily requirements of fat, **protein**, and other nutrients. Because the recommended foods are very low in calories, this diet may be a very low calorie diet (a diet involving fewer than 800 calories a day). Very low calorie diets can have serious side effects and should be undertaken under the supervision of a medical professional.

### Risks

There are some risks with any diet, and these risks are often especially great when the diet severely limits the foods that can be eaten. It is often difficult to get enough of some vitamins and minerals when eating a limited variety of foods. The Negative Calorie diet limits the dieter mainly to the list of foods that are believed to be negative calorie. Although these foods are fruits and vegetables, which are good sources of many important vitamins and minerals, they are not enough to maintain good health.

The Negative Calorie diet limits dairy products, as they are not considered to be negative calorie. Because these foods are excellent sources of **calcium**, it is possible that people who do not eat any of these foods may not get enough calcium in their diet. Lack of calcium can lead to many different disease and conditions such as **osteoporosis** and rickets. Anyone considering this diet might want to consider taking a supplement or vitamin to help reduce the risk of this and other similar deficiencies.

Protein and fat are also not included in any of the foods that are considered to be negative calorie. Although too much fat in the diet can be harmful, some is required to maintain good health. Protein is also necessary for good health. Not getting enough protein can have many negative effects on the body and people considering this diet should closely monitor their intake to make sure that they are getting enough.

### Research and general acceptance

There have been no scientific studies of the Negative Calorie diet. Although it is generally accepted that food does require energy for the body to digest, the amount of energy expended depends very heavily on the body's metabolism, and there is no way for dieters to accurately measure how much energy their body is expending to digest any given food. The diet also claims that these foods will increase the dieter's metabolism, which has not been scientifically proven.

### QUESTIONS TO ASK THE DOCTOR

- Do I have any special dietary needs that this diet might not meet?
- Is this diet safe for me?
- Is this diet safe for my entire family?
- Is it safe for me to follow this diet over a long period of time?
- Are there any sign or symptoms that might indicate a problem while on this diet?

Following the diet's recommendations for breathing has not been scientifically proven to increase metabolism, or rid the body of toxins.

The United States Department of Agriculture's MyPyramid, the updated version of the Food Guide Pyramid, recommends that healthy adults eat the equivalent of 2 to 3 cups of vegetables each day. The Negative Calorie diet would more than adequately meet these requirements for most people because the majority of the foods considered to be negative calorie are vegetables.

MyPyramid recommends that healthy adults eat the equivalent of 1 1/2 to 2 cups of fruit per day. 1 cup of fruit is equivalent to 1 small apple, 1 large orange, or 1 cup of pineapple cubes. Because these and many other fruits are considered to be negative calorie, it is likely that a person following the negative calorie diet would consume the recommended daily amount of fruit.

The Negative Calorie diet severely limits the intake of dairy products for dieters. Dairy products are generally considered to be part of a healthy diet. MyPyramid recommends the equivalent of 3 cups of low-fat or non-fat dairy per day for healthy adults. Following the Negative Calorie diet would generally not meet this recommendation.

Starches and grains are also severely restricted on the Negative Calorie diet. Whole grains are generally considered a necessary and important part of any healthy diet. MyPyramid recommends that healthy adults eat the equivalent of 3 to 4 ounces of grains each day, of which at least half should be whole grains. The Negative Calorie diet would not generally meet this recommendation.

The Negative Calorie diet does not provide many options for getting enough protein. MyPyramid recommends that healthy adults eat between 5 and 6 one

half ounces of food from the meat and beans group each day. Because negative calorie foods tend to be fruits and vegetables, not meat or beans, this daily requirement for healthy living would probably not be met for most people following the negative calorie diet.

As of 2007, the Center for Disease Control recommends 30 minutes of light to moderate exercise each day for healthy adults. Because this diet includes exercise recommendations that are only require performing the exercises three times a week, for 15 minutes each workout, following this diet alone without additional exercise does not meet these minimum recommendations. Regular exercise is generally accepted as an excellent way of improving health, reducing the risk of disease, and managing weight.

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Helen M. Davidson

# Niacin

## Definition

Niacin is a general term that refers to two forms of vitamin $B_3$, nicotinic acid and niacinamide. Humans need niacin to remain healthy, and although the liver can slowly make very small amounts of niacin, most niacin must come from foods or **dietary supplements**.

Niacin deficiency is called pellagra. Pellagra affects the skin, digestive tract and brain. The best-known symptom is a rash that becomes darker when exposed to light. In later stages, the digestive system may become inflamed, and finally the nervous system is affected.

**Niacin**

| Age | Recommended Dietary Allowance (mg) | Tolerable Upper Intake Level (mg) |
|---|---|---|
| Children 0–6 mos. | 2 (AI) | Not established |
| Children 7–12 mos. | 4 (AI) | Not established |
| Children 1–3 yrs. | 6 | 10 |
| Children 4–8 yrs. | 8 | 15 |
| Children 9–13 yrs. | 12 | 20 |
| Boys 14–18 yrs. | 16 | 30 |
| Girls 14–18 yrs. | 14 | 30 |
| Men 19≥ yrs. | 16 | 35 |
| Women 19≥ yrs. | 14 | 35 |
| Pregnant women | 18 | 35 |
| Breastfeeding women | 17 | 35 |

| Food | Niacin (mg) |
|---|---|
| Cereal, fortified, 1 cup | 20–27 |
| Tuna, light, packed in water, 3 oz. | 11.3 |
| Chicken, light meat, 3 oz. | 10.6 |
| Salmon, 3 oz. | 8.5 |
| Cereal, unfortified, 1 cup | 5–7 |
| Turkey, light meat, 3 oz. | 5.8 |
| Beef, lean, 3 oz. | 3.1 |
| Pasta, enriched, 1 cup cooked | 2.3 |
| Bread, whole wheat, 1 slice | 1.1 |
| Asparagus, cooked, ½ cup | 1 |
| Carrots, raw, ½ cup | 0.6 |
| Coffee, brewed, 1 cup | 0.5 |

AI = Adequate Intake
mg = milligram

*(Illustration by GGS Information Services/Thomson Gale.)*

## Purpose

Niacin is a necessary part of the cycle in which the body breaks down **carbohydrates**, **fats**, and proteins and converts them into energy. Niacin also plays a role in the production of certain hormones in the adrenal glands and in helping the liver remove harmful chemicals from the body.

## Description

Niacin belongs to the B-complex group of water-soluble **vitamins**. Scientists working with extracts of nicotine from tobacco first discovered nicotinic acid in the 1930s. Because nicotinic acid turned out to be a vitamin essential to health, scientists created the name niacin by using the first two letters of "nicotinic" and "acid" and the last two letters of "vitamin". They did not want a health-promoting vitamin to be associated with nicotine and tobacco.

### *Normal niacin requirements*

The United States Institute of Medicine (IOM) of the National Academy of Sciences has developed values called **Dietary Reference Intakes** (DRIs) for vitamins and **minerals**. The DRIs consist of three sets of numbers. The Recommended Dietary Allowance (RDA) defines the average daily amount of the nutrient needed to meet the health needs of 97–98% of the population. The Adequate Intake (AI) is an estimate set when there is not enough information to determine an RDA. The Tolerable Upper Intake Level (UL) is the average maximum amount that can be taken daily without risking negative side effects. The DRIs are calculated for children, adult men, adult women, pregnant women, and **breastfeeding** women.

The IOM has not set RDAs or ULs for niacin in children under one year old because of incomplete scientific information. Instead, it has set AI levels for this age group. RDAs and ULs for niacin are measured in micrograms (mg) of niacin equivalent (NE). One mg NE equals 1 mg niacin or 60 mg tryptophan, an amino acid that the liver can convert into niacin. Unlike the UL for many vitamins, the UL for niacin acid refers only to niacin that comes from fortified food or that is in dietary supplements such as multivitamins. There is no UL for niacin found in natural plant and animal foods. The UL for niacin also does not apply to individuals who are taking large doses of niacin under the supervision of a medical professional for the treatment of cardiovascular disease.

The following are the daily RDAs and IAs and ULs for niacin for healthy individuals:

- children birth–6 months: AI 2 mg; UL not established. All niacin should come from breast milk, fortified formula, or food.
- children 7–12 months: AI 4 mg; UL not established. All niacin should come from breast milk, fortified formula, or food.
- children 1–3 years: RDA 6 mg; UL 10 mg
- children 4–8 years: RDA 8 mg; UL 15 mg
- children 9–13 years: RDA 12 mg; UL 20 mg
- boys 14–18 years: 16 RDA mg; UL 30 mg
- girls 14–18 years: 14 RDA mg; UL 30 mg
- men age 19 and older: RDA 16 mg; UL 35 mg
- women age 19 and older: RDA 14 mg; UL 35 mg
- pregnant women: RDA 18 mg; UL 35 mg
- breastfeeding women: RDA 17 mg; 35 mg

## KEY TERMS

**Alzheimer's disease**—An incurable disease of older individuals that results in the destruction of nerve cells in the brain and causes gradual loss of mental and physical functions.

**Amino acid**—Molecules that are the basic building blocks of proteins.

**B-complex vitamins**—A group of water-soluble vitamins that often work together in the body. These include thiamine ($B_1$), riboflavin ($B_2$), niacin ($B_3$), pantothenic acid ($B_5$), pyridoxine ($B_6$), biotin ($B_7$ or vitamin H), niacin/folic acid ($B_9$), and cobalamin ($B_{12}$).

**Dietary supplement**—A product, such as a vitamin, mineral, herb, amino acid, or enzyme, that is intended to be consumed in addition to an individual's diet with the expectation that it will improve health.

**Enzyme**—A protein that change the rate of a chemical reaction within the body without themselves being used up in the reaction.

**Osteoporosis**—A condition found in older individuals in which bones decrease in density and become fragile and more likely to break. It can be caused by lack of vitamin D and/or calcium in the diet.

**Steroid**—A family of compounds that share a similar chemical structure. This family includes the estrogen and testosterone, vitamin D, cholesterol, and the drugs cortisone and prendisone.

**Vitamin**—A nutrient that the body needs in small amounts to remain healthy but that the body cannot manufacture for itself and must acquire through diet.

**Water-soluble vitamin**—A vitamin that dissolves in water and can be removed from the body in urine.

### *Sources of niacin*

Good sources of niacin include red meat, poultry, fish, and fortified cereals. A niacin fortification program began in the United States in 1938 when supplemental niacin was added to bread. Today niacin is routinely added to flour, cereals, bread, and pasta. These products can be labeled "fortified" or "enriched." Because of niacin fortification, most healthy Americans get enough niacin from their diet without taking a dietary supplement. Niacin is also found in multivitamins, B-complex vitamins, and as a single-ingredient supplement.

Niacin is one of the more stable B vitamins and is not degraded or lost by exposure to heat, light, or air. The following list gives the approximate niacin content for some common foods:

- chicken, light meat, 3 ounces: 10.6 mg
- turkey, light meat, 3 ounces: 5.8 mg
- beef, lean, 3 ounces: 3.1 mg
- salmon, 3 ounces: 8.5 mg
- tuna, light, packed in water, 3 ounces: 11.3 mg
- asparagus, cooked, 1/2 cup: 1 mg
- carrots, raw, 1/2 cup: 0.6 mg
- cereal, unfortified 1 cup: 5–7 mg
- cereal, fortified, 1 cup: 20–27 mg
- pasta, enriched 1 cup cooked: 2.3 mg
- bread, whole wheat 1 slice: 1.1 mg
- coffee, brewed 1 cup: 0.5 mg

### *Niacin deficiency*

Niacin, like other B-complex vitamins, is used in enzyme reactions that break down fats, carbohydrates, proteins, and alcohol into smaller molecules that can be used to produce energy or to build up different molecules necessary to create new cells. Most of the niacin a person needs must come from food. The liver does synthesize small amounts of niacin from tryptophan, an amino acid found in **protein**. However, this process is very slow, and it takes 60 mg of tryptophan to create 1 mg of niacin. Therefore, for humans to get enough niacin to maintain health, they must eat niacin-rich foods or take a dietary supplement containing niacin.

Diets that contain little or no niacin over time will result in a disorder called pellagra. Symptoms of pellagra include cracked, dry, scaly skin (pellagra means "rough skin" in Italian), swollen tongue, sore mouth, diarrhea, and mental changes. Left untreated, pellagra is fatal. Symptoms of less severe niacin deficiency include fatigue, mouth sores, vomiting, headache, depression, and memory loss.

Pellagra was common in the United States 1940s, particularly among poor people living in the South whose diet consisted mostly of corn and cornmeal. Corn contains niacin, but the niacin is bound to other molecules in a way that make it unavailable for use in the body. Many people in Mexico and Central America survive mainly on a diet of corn products. However, the tradition of soaking corn in solution containing alkaline lime before cooking releases the bound niacin so that it is available to the body. This explains why people living in Mexico and Central American rarely develop pellagra despite corn being a staple in their diet.

In 1938, the United States began a program to add niacin to bread. The fortification program resulted in a dramatic drop in the number of people developing pellagra. Today in the United States, those at highest risk of developing niacin deficiency are people with alcoholism, people with **anorexia nervosa** (self-starvation), and people with Hartnup's disease, rare genetic disorders that affect the ability of the body to absorb tryptophan.

### *Niacin and cardiovascular disease*

Niacin in the form of nicotinic acid when taken in quantities as large as 2 grams three times a day has proved successful in rigorous clinical trials in lowering cholesterol levels in the blood and slowing the development of atherosclerosis (hardening of the arteries). When niacin is taken in these quantities, which are far beyond the established UL, it should be treated as a drug, not a dietary supplement, and taken only under the supervision of a physician. Sometimes niacin is prescribed along with statin (cholesterol lowering) drugs. This combination is often more successful in lowering cholesterol than either medication alone.

Over-the-counter niacin dietary supplements can be used to treat cardiovascular disease, but many physicians prefer high-dose prescription niacin. When sold as a prescription drug, the manufacturing process is more strictly controlled than it is for niacin sold as a dietary supplement. Niacin is available in a variety of immediate-, slow- or extended-release tablets or capsules and as a liquid. It is sold under many brand names including Niacor, Niaspan, Nicolar, Nicotinex Elixir, Slo-niacin, and Novo-Niacin.

### *Niacin and other diseases*

Several studies have examined the effect of large doses of niacin on preventing the development of type 1 (insulin-dependent) diabetes in high-risk individuals. Nicotinic acid was found to have no effect, but the results of studies using niacinamide were mixed. Research continues in this area. Research is also being done on whether niacin supplementation can decrease the risk of developing certain cancers. Again, the results are not clear. The same is true for studies looking at niacin supplementation as a way of preventing or delaying **osteoporosis**. Clinical trials are underway to determine safety and effectiveness of niacin both alone and in combination with other vitamins and drugs in preventing or treating **cancer**, cardiovascular disease, and dementias such as Alzheimer's disease. Individuals

interested in participating in a clinical trial at no charge can find a list of open trials at <http://www.clinicaltrials.gov>.

## Precautions

It must be emphasized that people who take high doses of niacin to lower cholesterol and improve cardiovascular health must treat niacin like a prescription drug and take it only under the direction of a physician. When high doses of niacin are prescribed, the dosage is increased gradually until the desired amount is reached in order to reduce unpleasant of side effects. Niacin should not be stopped suddenly without consulting a physician. Individuals who take large doses of niacin may need regular blood tests to determine the effectiveness of the treatment.

Studies on the safety of high doses of niacin during pregnancy have not been done. Niacin passes into breast milk and may cause unwanted side effects in breastfed babies. Pregnant and nursing women should consult their physician about whether to reduce or discontinue high-dose niacin supplements.

## Interactions

Niacin, especially at high doses, may interact with other drugs. Before starting niacin supplementation, patients should review with their physician all the prescription, over-the-counter, and herbal medications that they are taking. Some common drug interactions are:

- When niacin and cholesterol-lowering statin drugs such as lovastatin (Mevacor) or atorvastatin (Lipator) are taken together, cholesterol is lowered more than when these drugs are taken alone.
- Niacin may increase blood glucose (sugar) levels, requiring adjustments in insulin or diabetes drugs.
- Oral contraceptives may increase the amount of niacin produced by the liver.
- Niacin may increase the effect of nitrates (nitroglycerine, isosorbide) used to treat heart conditions.

## Complications

When niacin is consumed within the established DRI range, complications are rare. However, when niacin is taken in therapeutic doses to treat disease, serious side effects may develop. The most common side effect is burning, tingling, or hot sensation in the face and chest along with flushed skin. This occurs most often at doses of 75 mg or higher. Building up slowly to large doses of niacin may reduce the sensation, as may taking aspirin 30 minutes before taking niacin. Other side effects include abdominal pain, dizziness, diarrhea, faintness, itchy skin, vomiting, unusual thirst, and irregular heartbeat. Liver damage may also occur at high doses.

## Parental concerns

Niacin deficiency almost never occurs in children, and niacin is not taken in large doses by children to prevent disease. When taken within established DRI ranges, parents should have few concerns about niacin.

## Resources

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### ORGANIZATIONS


American Dietetic Association. 120 South Riverside Plaza, Suite 2000, Chicago, Illinois 60606-6995. Telephone: (800) 877-1600. Website: <http://www.eatright.org>

American Heart Association. 7272 Greenville Avenue, Dallas, TX 75231. Telephone: (800) 242-8721. Website: <http://www.americanheart.org>

Linus Pauling Institute. Oregon State University, 571 Weniger Hall, Corvallis, OR 97331-6512. Telephone: (541) 717-5075. Fax: (541) 737-5077. Website: <http://lpi.oregonstate.edu>


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Tish Davidson, A.M.

North African diet *see* **African diet**

# Northern European diet

## Definition

The countries of northern Europe include the United Kingdom of Great Britain (England, Scotland, Wales, Northern Ireland), the Republic of Ireland (now a sovereign country), and France. (Although southern France is generally considered to be part of southern Europe, it will be included in this discussion.) These countries are all part of the European Union. England and France have a very diverse population due to the large number of immigrants from former colonies and current dependent territories. Catholicism and Protestantism are the dominant religions.

## Description

### *Eating Habits and Meal Patterns*

The northern European diet generally consists of a large serving of meat, poultry, or fish, accompanied by small side dishes of vegetables and starch. The traditional diet is high in **protein**, primarily from meat and dairy products. The diet tends to be low in whole grains, fruits, and vegetables. Immigrants from this region of the world brought this eating pattern to North America and it still influences the "meat and potatoes" American meal. The influence of each country's food habits on each other is also extensive.

### *England*

English cuisine was primarily shaped during the Victorian era. The diet relies heavily on meats, dairy products, wheat, and root vegetables. The English are famous for their flower gardens, but they are also known for their kitchen gardens, which yield an abundance of herbs and vegetables. Breakfast is very hearty and generally consists of bacon, eggs, grilled tomato, and fried bread. Kippers (smoked herring) are also popular at breakfast. Many Britons still partake in afternoon tea, which consists of tiny sandwiches (no crust) filled with cucumber or watercress, scones or crumpets with jam or clotted cream, cakes or tarts, and a pot of hot tea. Tea shops abound in England, Wales, and Scotland, and Britons drink about four cups of tea a day. Coffee is also very popular with the younger generation.

The pub (short for "public house") is a central part of life and culture in the United Kingdom (Britain has over 61,000 pubs). British pubs are very cozy and homey, and they are famous for their beers, which are very strong. Pubs also serve food. The most common British pub meal is the "ploughman's lunch," named for traditional farmworkers. It consists of a large chunk of cheese, a hunk of homemade bread, pickled onion, and ale. Other popular menu items are shepherd's pie, Cornish pastry, Stargazy pie, and Lancashire hot pot. Britain's most famous dish is fish and chips, traditionally made with cod or pollack. There are some 8,500 fish-and-chip shops across the United Kingdom—they outnumber McDonald's eight to one.

**Traditional dishes of England, Scotland, Wales, Ireland and France**

| Dish | Main ingredients | Country |
|---|---|---|
| Cornish pastry | Steak, potatoes, turnips, onions | England |
| Fish and chips | Cod or pollack, potatoes | England |
| Ploughman's lunch | Cheese, bread, pickled onions, and ale | England |
| Shepard's pie | Meat, potatoes, vegetables | England |
| Stargazy pie | Fish | England |
| Steak and kidney pie | Beef steak, lamb's kidneys | England |
| Bangers and mash | Sausage, mashed potatoes | Scotland |
| Haggis | Sheep's offal | Scotland |
| Faggots | Pig liver | Wales |
| Glamorgan sausage | Cheese, bread crumbs, onions, eggs (meatless) | Wales |
| Poacher's pie | Venison, wild boar, rabbit, pheasant, smoked bacon, mushrooms | Wales |
| Welsh rarebit (or rabbit) | Melted cheese | Wales |
| Welsh salt duck | Duck, salt | Wales |
| Colcannon | Mashed potatoes, onions, cabbage | Ireland |
| Corned beef and cabbage | Corned beef, cabbage, carrots, onions | Ireland |
| Bouillabaisse | Fish stock, fish, shellfish | France |
| Chocolate mousse | Chocolate, eggs, cream | France |
| Foie gras | Goose or duck liver | France |
| Quiche Lorraine | Egg, bacon, cheese, pie crust | France |
| Ratatouille | Eggplant, zucchini, onions, tomatoes | France |
| Salade Niçoise | Tuna, green beans, hard-boiled eggs, olives | France |

*(Illustration by GGS Information Services/Thomson Gale.)*

## KEY TERMS

**Saturated fat**—A fat with the maximum possible number of hydrogens; more difficult to break down than unsaturated fats.

### *Scotland*

Scottish cuisine is centered on fresh raw ingredients such as seafood, beef, game, fruits, and vegetables. Porridge, or boiled oatmeal, is usually eaten for breakfast. It is cooked with salt and milk—Scots do not usually eat their oatmeal with sugar or syrup.

The Aberdeen-Angus breed of beef cattle is widely reared across the world and is famous for rich and tasty steaks. Scottish lamb also has an excellent international reputation. Game such as rabbit, deer, woodcock, and grouse also plays an important role in the Scottish diet. Fish and seafood are abundant due to the numerous seas, rivers, and lochs (lakes). Scottish kippers and smoked salmon are international delicacies. As in other parts of the United Kingdom, there are numerous tea shops. Scotland is also known for its excellent whiskey and cheeses.

Scotland's national dish is haggis, which is made from sheep's offal. The windpipe, lungs, heart, and liver of the sheep are boiled and then minced. The mixture is then combined with beef suet and oatmeal. The mixture is placed inside the sheep's stomach, which is then sewn shut and boiled.

### *Wales*

The food in Wales is pretty much the same as in Britain or Scotland, but there are a number of specialties. The leek (a vegetable) is a national emblem and is used in a number of dishes. St. David is the patron saint of Wales and the leek is worn on St. David's Day, March 1, a national holiday. Potato is a dietary staple. Fish and seafood are abundant, especially trout and salmon. Popular dishes in Wales include Welsh rarebit (or rabbit), poacher's pie, faggots (made from pig liver), Glamorgan sausage (which is actually meatless), and Welsh salt duck.

### *Ireland*

The island of Ireland consists of Northern Ireland and the Republic of Ireland. The Republic of Ireland is a state that covers approximately five-sixths of the island, while the remaining sixth of the island is known as Northern Ireland and is part of the United Kingdom of Great Britain and Northern Ireland. Northern Ireland is predominantly Protestant and the Republic of Ireland is predominantly Catholic.

Milk, cheese, meat, cereals, and some vegetables formed the main part of the Irish diet before the potato was introduced to Ireland in the seventeenth century. The Irish were the first Europeans to use the potato as a staple food. The potato, more than anything else, contributed to the population growth on the island, which had less than 1 million inhabitants in the 1590s but had 8.2 million in 1840. However, the dependency on the potato eventually led to two major famines and a series of smaller famines.

The potato is still the staple food in Ireland, though other root vegetables, such as carrots, turnips, and onions, are eaten when in season. A traditional Irish dish is *colcannon*, made of mashed potatoes, onions, and cabbage. It came to the United States in the 1800s with the huge wave of Irish immigration, and is often served on St. Patrick's Day (March 17). Corned beef and cabbage are also eaten on St. Patrick's Day.

Breakfast is a large meal, usually consisting of oatmeal porridge, eggs, bacon, homemade bread, butter, and preserves. Strong black tea with milk and sugar is served with all meals. Lunch is the main meal of the day and is usually eaten at home with the whole family. Lunch is often a hearty soup, followed by meat, potatoes, vegetable, bread, and dessert. Afternoon tea is still common. A light supper is served later in the evening. Irish pubs are known throughout the world for their vibrant and friendly atmosphere. There are many different types of pubs, including dining pubs, music pubs, and pubs with accommodations (room and board). Irish whiskey and ale are also world-renowned.

### *France*

One of modern France's greatest treasures is its rich cuisine. The French have an ongoing love affair with food. Families still gather together for the Sunday midday feast, which is eaten leisurely through a number of appetizers and main courses. Most French meals are accompanied by wine.

French cuisine is divided into classic French cuisine (*haute* cuisine) and provincial or regional cuisine. Classic French cuisine is elegant and formal and is mostly prepared in restaurants and catered at parties. More simple meals are usually prepared at home. Buttery, creamy sauces characterize classic French cuisine in the west, northwest, and north-central regions. The area surrounding Paris in the north-

central region is the home of classic French cuisine. The area produces great wine, cheese, beef, and veal. Fish and seafood are abundant in the northern region, and the famous Belon oysters are shipped throughout France. Apples are grown in this region and apple brandy and apple cider are widely exported. Normandy is known for its rich dairy products, and its butter and cheeses are among the best in the world. The Champagne district is located in the northernmost region, bordering Belgium and the English Channel, and is world-renowned for its sparkling wines. Only those produced in this region can be legally called "champagne" in France.

German cuisine has influenced French cuisine in the east and northeast parts of the country. Beer, sausage, sauerkraut, and goose are very popular, for example (goose fat is used for cooking). Famous dishes from these regions include *quiche Lorraine* and goose liver pâté (*pâté de fois gras*). The south of France borders the Mediterranean Sea, and the cuisine in this region is similar to that of Spain and Italy. Olive oil, tomatoes, garlic, herbs, and fresh vegetables are all widely used. Famous dishes from this region are black truffeles, *ratatouille, salade Niçoise*, and *bouillabaisse*.

The French eat three meals a day and rarely eat snacks. They usually eat a light continental breakfast consisting of a baguette (French bread) or croissant with butter or jam. Strong coffee with hot milk accompanies breakfast (sometimes hot chocolate). Lunch is the largest meal of the day. Wine is drunk with lunch and dinner, and coffee is served after both meals. France is also known for its exquisite desserts such as *crème brûlée* and *chocolate mousse*.

### Risks

#### *Nutritional Status*

Cardiovascular disease (e.g., **coronary heart disease**, stroke, **hypertension**) is the most common cause of death in these countries, and smoking rates are high. **Obesity** is the fastest growing chronic disease, especially among children. Alcoholism is high, especially among the Irish.

France's low rate of heart disease has been termed the "French Paradox." The theory is that France's low rate of heart disease is due to the regular consumption of wine, despite the high intake of saturated **fats**. However, recent evidence suggests that the rate of heart disease in France may have been underestimated and underreported, for while the rate of heart disease is lower in France than most countries, it is still the number one cause of death in France. In addition, the consumption of saturated fat has increased, which will eventually result in increased risk for coronary heart disease (CHD), regardless of wine intake.

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Norwegian diet *see* **Scandinavian diet**

## Nutrigenomics

### Definition

Nutrigenomics can be defined as the study of the relationships between dietary factors and individual genes. Nutrigenomics is sometimes referred to as:

- nutritional genomics
- nutrigenetics
- nutritional genetics
- the DNA diet

Definitions of nutrigenomics often include the determination of individual nutritional requirements based on the genetic makeup of the person, as well as the association between diet and chronic disease. Nutrigenomics is part of a broader movement toward personalized medicine, focusing on a personalized diet.

Some scientists distinguish between nutrigenomics and nutrigenetics. They define nutrigenomics as the identification of genes that are involved in physiological responses to diet and the genes in which small changes, called polymorphisms, may have significant nutritional consequences. Nutrigenetics is then defined as the study of these individual genetic variations or polymorphisms, their interaction with nutritional factors, and their association with health and disease. Others define nutrigenetics as the study of the functional interactions between food and the genome at the molecular, cellular, and organismic levels, and the ways in which individuals respond differently to diets depending on their genetic makeup.

**Known interactions between food and inherited genes**

| Genetic condition | Foods to avoid |
|---|---|
| Phenylketonuria (PKU) | Food containing the amino acid phenylalanine, including high protein foods such as fish, chicken, eggs, milk, cheese, dried beans, nuts, and tofu |
| Defective aldehyde dehydrogenase enzyme | Alcohol |
| Galactosemia (lack of a liver enzyme to digest galactose) | Diets which contain no lactose or galactose, including all milk and milk products |
| Lactose intolerance (shortage of the enzyme lactase) | Milk and milk products |

*(Illustration by GGS Information Services/Thomson Gale.)*

Jose M. Ordovas, a pioneer researcher in the field, uses the following definition: 'Nutritional genomics covers nutrigenomics, which explores the effects of nutrients on the genome, proteome and metabolome, and nutrigenetics, the major goal of which is to elucidate the effect of genetic variation on the interaction between diet and disease.' The genome is the DNA that makes up an individual's genes. The proteome consists of all of the proteins—the products of gene expression—that are produced under specific conditions. The metabolome is comprised of all of the metabolites in the body under specific dietary and physiological conditions. However many authors do not distinguish between the terms nutritional genomics, nutrigenomics, and nutrigenetics.

## Origins

The concept that diet influences health is an ancient one. In 400 B.C. Hippocrates advised physicians: 'Leave your drugs in the chemist's pot if you can heal your patient with food.' Likewise it has long been known that individuals can differ in their requirements for a given nutrient.

Nutrigenomics includes known interactions between food and inherited genes, called 'inborn errors of metabolism,' that have long been treated by manipulating the diet:

- Phenylketonuria (PKU) is caused by a change (mutation) in a single gene. Affected individuals must avoid food containing the amino acid phenylalanine.
- Many Asians have a defective aldehyde dehydrogenase enzyme, which is involved in ethanol metabolism. Alcohol consumption has unpleasant effects on these individuals.
- Galactosemia—caused by an inherited defect in one of three enzymes involved in the metabolism of the sugar galactose—is controlled with a milk-free diet, since galactose is a metabolite or breakdown product of lactose or milk sugar.
- The majority of adults in the world are lactose intolerant, meaning that they cannot digest milk products, because the gene encoding lactase, the enzyme that breaks down lactose, is normally 'turned off' after weaning. However some 10,000–12,000 years ago a polymorphism in a single DNA nucleotide appeared among northern Europeans. This single nucleotide polymorphism—a SNP—resulted in the continued expression of the lactase gene into adulthood. This was advantageous because people with this SNP could utilize nutritionally-rich dairy products in regions with short growing seasons.

With the revolution in molecular genetics in the late twentieth century, scientists set out to identify other genes that interact with dietary components. By the 1980s companies were commercializing nutrigenomics. The Human Genome Project of the 1990s, which sequenced all of the DNA in the human genome, jump-started the science of nutrigenomics. By 2007 scientists were discovering numerous interrelationships between genes, nutrition, and disease.

## Description

### *Principles of nutrigenomics*

Nutrigenomics draws from various scientific disciplines including:

- genetics
- molecular biology
- bioinformatics
- biocomputation
- physiology
- pathology
- nutrition
- sociology
- ethics.

There are five principles of nutrigenomics:

- Diet can be a serious risk factor for a number of diseases for some individuals under certain circumstances.
- Substances in the diet can act on the human genome, either directly or indirectly, to alter gene structure or expression.
- Individual genetic makeup or genotype can influence the balance between health and disease.
- Genes that are regulated by dietary factors can play a role in the onset, incidence, progression, and/or severity of chronic diseases.

## KEY TERMS

**APO**—Apolipoprotein; proteins that combine with lipids to form lipoproteins; APOA1 is one of the class A apoliproteins; APOE is a class E apolipoprotein.

**DNA methylation**—The enzymatically controlled addition of a methyl group (CH3) to the nucleotide base cytosine in DNA; methylation is involved in suppressing gene expression or turning off genes.

**Epigenetic**—A modification of gene expression that is independent of the DNA sequence of the gene.

**Folic acid**—Folate; a B-complex vitamin that is required for normal production of red blood cells and other physiological processes; abundant in green, leafy vegetables, liver, kidney, dried beans, and mushrooms.

**Galactosemia**—An inherited metabolic disorder in which galactose accumulates in the blood due to a deficiency in an enzyme that catalyzes its conversion to glucose.

**Genome**—A single haploid set of chromosomes and their genes.

**Genotype**—All or part of the genetic constitution of an individual or group.

**HDL cholesterol**—High-density lipoprotein; 'good' cholesterol that helps protect against heart disease.

**Homocysteine**—An amino-acid product of animal metabolism that at high blood levels is associated with an increased risk of cardiovascular disease (CVD).

**Kinase**—An enzyme that catalyzes the transfer of phosphate groups from high-energy phosphate-containing molecules, such as ATP, to another molecule.

**Lactose**—Milk sugar; a disaccharide sugar present in milk that is made up of one glucose molecule and one galactose molecule.

**LDL cholesterol**—Low-density lipoprotein; 'bad' cholesterol that can clog arteries.

**Metabolome**—All of the metabolites found in the cells and fluids of the body under specific dietary and physiological conditions.

**MTHFR**—Methylene tetrahydrofolate reductase; an enzyme that regulates folic acid and maintains blood levels of homocysteine.

**Phenylketonuria**—PKU; an inherited metabolic disorder caused by an enzyme deficiency that results in the accumulation of the amino acid phenylalanine and its metabolites in the blood.

**Polymorphism**—A gene that exists in variant or allelic forms.

**Polyunsaturated fatty acid**—PUFA; fats that usually help to lower blood cholesterol; found in fish, safflower, sunflower, corn, and soybean oils.

**Proteome**—All of the proteins expressed in a cell, tissue, or organism.

**SNP**—Single nucleotide polymorphism; a variant DNA sequence in which the base of a single nucleotide has been replaced by a different base.

**Triglycerides**—Neutral fat; lipids formed from one glycerol molecule and three fatty acids that are widespread in adipose tissue and circulate in the blood as lipoproteins.

- Dietary intervention based on individual nutritional status and requirements and genotype can prevent, mitigate, or cure chronic disease.

Nutrigenomics is in sharp contrast to the traditional food pyramid and recommended daily allowances (RDAs) that are intended to prevent nutritional deficiencies in the general population. Nutrigenomics also contrasts with foods and supplements that are claimed to be beneficial for everyone. Rather genetic variations among individuals can result in very different responses to general diets and specific foods. Nutrigenomics can be applied to populations, subpopulations, and ethnic groups that share genetic similarities, as well as to individuals.

### *Nutrigenomic diseases*

Diseases and conditions that are known to have genetic and/or nutritional components are candidates for nutrigenomic studies to determine whether dietary intervention can affect the outcome. Differences in genetic makeup or genotype are factors in:

- gastrointestinal cancers
- other gastrointestinal conditions or digestive diseases
- inflammatory diseases
- osteoporosis.

Nutrient imbalances are factors in:

- aging
- alcoholism/substance abuse
- behavioral disorders
- cancer
- cardiovascular disease (CVD)
- chronic fatigue
- deafness
- diabetes
- immune disorders
- macular degeneration
- multiple sclerosis
- neurological disorders
- osteoporosis
- Parkinson's disease
- stroke.

Diseases that are known to involve interactions between multiple genetic and environmental factors such as diet include:

- many cancers
- diabetes
- heart disease
- obesity
- some psychiatric disorders.

Inherited mutations in genes can increase one's susceptibility for **cancer**. The risk of developing cancer can be markedly increased if there is a gene-diet interaction. Studies of twins show that the likelihood of identical twins developing the same cancer is less than 10%, indicating that the environment plays an important role in cancer susceptibility. There are various examples of the effects of diet on cancer risk:

- High consumption of red meat has been shown to increase the risk of colorectal cancer.
- The incidence of colon cancer among Japanese increased dramatically after the 1960s as the Japanese diet became westernized.
- Dietary fiber has a protective effect against bowel cancer.
- Some studies have shown a relationship between dietary fat and breast cancer.

Among people with high blood pressure only about 15% have sodium-sensitive **hypertension**. For the other 85%, eliminating salt from the diet has no effect on their blood pressure. Nutrigenomics is addressing why some people can control their hypertension with diet, whereas others require drugs.

### *SNPs*

The DNA sequence of the human genome varies by only 0.1% between individuals. However that small variation is very important for disease susceptibility. These variations in the DNA sequences of genes are called polymorphisms. Some polymorphisms affect the functioning of the proteins encoded by the genes. The most common type of variation is a change in just one nucleotide or unit of the DNA sequence, called a single nucleotide polymorphism or SNP. Some of the differences in individual responses to components of food are due to SNPs, which may change the way a **protein** interacts with metabolites in the body.

**MTHFR** One of the best-known examples of a gene-nutrient interaction is the MTHFR gene that encodes the enzyme methylene tetrahydrofolate reductase. MTHFR regulates folic acid and maintains blood levels of homocysteine. A specific SNP in the MTHFR gene is found in 10% of northern Europeans and 15% of southern Europeans. People with this SNP in both copies of their MTHFR gene have elevated levels of homocysteine in their blood, particularly if their intake of folic acid is low. This condition is associated with CVD. However it is not yet known whether folic-acid supplementation will prevent CVD in these individuals a recent study in the *British Medical Journal* supported the use of folic acid supplements for those with elevated homocysteine levels. This SNP in MTHFR is also associated with a reduced risk for colon cancer, but only if folic-acid intake is normal. However there is no evidence that treatment with folic acid, or eating foods such as beans, peas, green leafy vegetables, and fortified grains that provide folic acid, will prevent colon cancer. There are numerous genes associated with the development of CVD and a multitude of dietary nutrients that interact with these genes. Researchers have also found genetic differences in folic-acid **metabolism** among black American and Mexican women and MTHFR SNPs have been associated with other disorders including severe migraines and depression.

**LIPID METABOLISM** One of the first applications of nutrigenomics was to examine the differences among individuals and populations in the blood levels of lipids—triglycerides and HDL ('good') and LDL ('bad') cholesterol—and the effect of high-fat diets on these levels. High levels of HDL cholesterol are associated with a reduced risk for CVD. Dietary changes have a modest beneficial effect on blood-lipid levels in the majority of people. However some people experience no effect and others experience the opposite effect from the same dietary modifications. SNPs in genes that are directly or indirectly involved in

lipoprotein metabolism may be responsible for these differences. Therefore typical healthy diet recommendations may actually harm people who have a specific genotype.

In women who have a particular SNP in the gene encoding apolipoproteinA-1 (APOA1), an enzyme involved in lipid metabolism, high levels of HDL cholesterol are correlated with high consumption of polyunsaturated fatty acids (PUFA). In contrast women who have the more common form of APOA1 have low levels of HDL cholesterol with high consumption of PUFA. Thus this SNP may be associated with a large change in the risk for CVD. The relationship between HDL cholesterol and PUFA is not seen in men. Thus increased PUFA consumption—from foods such as fish, vegetable oils, and nuts—would be expected to benefit one group of women, harm another group of women, and have little effect on men, although this has not yet been scientifically demonstrated.

Similarly people carrying a particular SNP in the gene encoding hepatic lipase respond to high-fat diets with increased HDL cholesterol. People with variations in a gene called APOE, which is involved in cholesterol balance, respond differently to low-fat diets. One variant of the APOE gene is associated with an increased risk for Alzheimer's disease, but only in Caucasians and Japanese. Black Africans with the same variant do not have an increased risk.

### *Alterations in gene expression*

SNPs can cause changes in gene-food interactions by changing the way a protein encoded by the SNP-containing gene interacts with a metabolite. SNPs can also change the expression of a gene, causing the gene to produce more or less protein. Chemicals in foods can also directly or indirectly affect the expression of a gene. Plant chemicals called **phytonutrients** can alter the cell-signaling pathways that regulate gene expression. Small plant proteins called peptides can also alter the regulation of gene expression. Lunasin is a substance in **soy** that has been associated with reduced risks for heart disease and several cancers including **prostate** cancer. Lunasin appears to increase the expression of genes that monitor damage to DNA and suppress the proliferation of tumor cells.

Nutritional factors can act as signaling molecules that interact with a complex system of more than 540 enzymes called kinases. Kinases transmit signals from the environment, including food, to the genome, turning on and off the expression of genes that produce the proteins involved in metabolism. Two kinase pathways are known to be involved in:

- satiety
- insulin signaling
- muscle energy reserves
- lipid metabolism
- inflammation.

These processes are associated with **obesity**, type 2 diabetes, and atherosclerosis. There are specific phytonutrients that are known to affect these two kinase pathways.

Epigenetic modifications are changes in gene expression that do not affect the DNA sequence of the gene. One of these modifications is DNA methylation, which attaches small molecules to the DNA. During early development DNA methylation is highly susceptible to nutritional and other environmental influences.

Dietary components such as retinoic acid and **zinc** can bind to DNA and affect gene expression. Zinc, which is abundant in red meat and some seafoods, turns on some genes and turns off others. For example zinc activates genes associated with the production of white blood cells that fight infection. Dietary fatty acids can also directly modify gene expression.

### *Commercial nutrigenomics*

A number of companies offer genetic profiling or genotyping of DNA that is obtained from a swab of the inside of the cheek. The DNA analysis, along with a detailed nutritional and lifestyle questionnaire, is used to recommend individualized nutritional changes for improving health and preventing disease. However as of 2007 less than 20 genes were being tested for variations that have nutrigenomic implications. These include:

- MTHFR
- genes affecting cholesterol levels
- genes affecting insulin sensitivity
- a specific genetic variation that makes it more difficult to absorb calcium in the presence of caffeine.

The report, which costs $250–$1,500, may include an estimate of **folate** levels in the body based on the questionnaire. Some companies then sell the client supplements or products that are claimed to be nutrigenomic.

For the majority of people a nutrigenomic diet will not differ significantly from a standard diet that includes plenty of fruits and vegetables. The client may be told to get more exercise and to avoid:

- alcohol
- processed bread

- preservatives
- bacon and sausage
- dairy
- junk food.

Nutrigenomics is almost certainly the wave of the future. As more gene-diet associations are discovered, genetic profiling and nutritional prescriptions are expected to become commonplace. For this reason major food corporations are investing large amounts of money in nutrigenomics and in the development of new products to meet the demands of personalized diets. Nutrigenomics is also being applied to the development of pet foods and animal feed stocks.

## Function

Although it is widely believed that nutrigenomics will have a tremendous impact on diets in the not-too-distant future, as of 2007 it was not particularly relevant to the average consumer. Most people who buy commercial nutrigenomic products:

- are middle-to-upper class
- have a family history of chronic disease or weight problems
- are worried about aging and age-related diseases
- have a strong commitment maintaining good health.

Nutrigenomics may be most relevant for the approximately 20% of the population for whom diet has little affect on health and for the approximately 20% for whom a conventional diet is unhealthy. The former group may want to feel free to eat whatever they choose and the latter group may need professional advice in designing an appropriate diet. However some experts believe that the future of nutrigenomics is as a population—rather than an individual—nutritional program, with the development of foods that meet the nutritional requirements for the majority of genotypes, thus maximizing the benefits.

## Benefits

The mission of the National Center for Minority Health and Health Disparities (NCMHD) Center of Excellence for Nutritional Genomics, a major nutrigenomics initiative at the University of California at Davis, is: 'to reduce and ultimately eliminate racial and ethnic health disparities' that result from interactions between genes and the environment, particularly dietary factors. Its goal is to devise 'genome-based nutritional interventions to prevent, delay, and treat diseases such asthma, obesity, Type 2 diabetes, cardiovascular disease, and prostate cancer.'

However current benefits from nutrigenomics are limited:

- Obtaining a personalized dietary regimen may encourage people to become more health conscious.
- People are more likely to heed advice that they pay for.
- Discovering genetic susceptibilities can be a strong motivator for making dietary and lifestyle changes.

The potential future benefits from nutrigenomics are tremendous:

- The safe upper and lower limits for essential macronutrients—proteins, carbohydrates, and fats—and micronutrients such as vitamins and minerals will be better defined and understood.
- Diseases may be avoided or ameliorated.
- Unnecessary vitamins and other dietary supplements can be avoided.
- People whose health is relatively unaffected by diet can continue to eat foods that they enjoy.
- Lifespan may be extended.

## Precautions

Far more research is needed before nutrigenomic diets become a reality. There are very few diet-gene interactions for which there is enough information to yield specific useful advice and even fewer genetic variants that can be screened for. Nutrigenomic prescriptions will probably differ depending on age and other physiological conditions including pregnancy.

At present there is no evidence that nutritional changes made on the recommendations of commercial analysis will reduce an individual's risk of developing a particular disease. John Erdman, professor of food sciences and human nutrition at the University of Illinois at Urbana-Champaign, told *U.S. News & World Report* in 2006: 'Identifying a handful of genes from a snippet of hair or a mouth swab and returning with a diet plan and a bill for several hundred dollars is a waste of money and is way premature.'

Nutrigenomics companies have been accused of making false claims. The U.S. Government Accounting Office concluded in 2006 that nutrigenomic tests lacked scientific accountability and could be misleading to consumers. As of 2007 many of the products marketed by these companies were supplements that had no basis in nutrigenomics.

Nutrigenomic testing raises numerous ethical questions, such as whether genetic profiling should remain restricted to wealthy clients or whether it should be available as standard healthcare coverage.

## QUESTIONS TO ASK YOUR DOCTOR

- Are you familiar with nutrigenomics and genetic profiling?
- Do I have symptoms that might be explained by interactions between genes and food?
- Am I a candidate for genetic testing?
- Would you be able to make nutritional and lifestyle recommendations based on the results of my tests?
- Are there other types of medical tests that would give me the same or better information?

## Risks

Nutrigenomics risks include:

- The knowledge of a disease susceptibility may cause high levels of anxiety and stress.
- Genetic testing raises privacy concerns—some companies already sell the results of their genetic profiling to other companies.
- Those with known genetic susceptibilities may be discriminated against in employment or health insurance.
- Physicians may not be qualified to interpret nutrigenomic reports and make appropriate decisions based on them.
- The demand for nutrigenomic evaluations may eventually overtax the healthcare system. As with any new technology, nutrigenomics also may pose as-yet-unrecognized risks.

The nutrigenomics industry remains unregulated. It is unclear whether any future regulation will treat nutrigenomics as medicine or as nutrition.

## Research and general acceptance

### *Research*

Nutrigenomics is a very active field of research in both the United States and Europe and clinical studies are ongoing. Evidence is accumulating that the nutrients in food and supplements may affect the expression and even the structure of specific genes. However the science of nutrigenomics is extremely complex. The elucidation of the APOA1 gene variants was possible only because of a very large decades-long epidemiological study called the Framingham Heart Study. Although most experts believe that any clinical applications of nutrigenomics are premature, some scientists believe that reliable diet recommendations based on individual genetic profiles may be available as early as 2010.

Many scientists believe that nutrigenomics has tremendous potential for improving public health. In the future it will probably be possible to analyze DNA to precisely determine individual nutritional guidelines, with diets designed to fit a specific genetic profile. Specific products may be available to meet the health requirements of individuals. Technological developments may enable doctors to perform nutrigenomic tests in their offices. Children may be tested at a young age so that diet can be used as preventative medicine. The development of nutrigenomics is expected to revolutionize the dietetics profession.

### *General acceptance*

Very few consumers have as yet made use of nutrigenomics. However the food industry, healthcare providers, and consumers have vested interests in the development of the science. Studies have shown that 85–93% of people believe that diet is an important part of health and of the management of aging and conditions such as arthritis. However it is also possible that nutrigenomics will suffer a consumer backlash, similar to the European backlash against genetically-modified foods.

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**ORGANIZATIONS**

American Dietetic Association. 120 South Riverside Plaza, Suite 2000, Chicago, IL 60606-6995. Telephone: (800) 877-1600. <http://www.eatright.org>.

Center for Emerging Issues in Science. Life Sciences Research Office, Inc. 9650 Rockville Pike, Bethesda, MD 20814. (301) 634-7030. <http://www.LSRO.org>.

European Nutrigenomics Organisation (NuGO). Nutrigenomics Society. <http://www.nugo.org>.

Institute for the Future. 124 University Avenue, 2nd Floor, Palo Alto, CA 94301. (650) 854-6322. <http://www.iftf.org/>.

National Center for Minority Health and Health Disparities (NCMHD) Center of Excellence for Nutrigenomics. Section of Molecular and Cellular Biology, University of California, 1 Shields Avenue, Davis, CA 95616. (530) 752-3263. <http://nutrigenomics.ucdavis.edu>.

National Human Genome Research Institute. National Institutes of Health. Building 31, Room 4B09, 31 Center Drive, MSC 2152, 9000 Rockville Pike, Bethesda, MD 20892-2152. (301) 402-0911. <http://www.genome.gov>.

Margaret Alic, PhD

# NutriSystem

## Definition

NutriSystem is a commercial weight loss program based in the Philadelphia area that delivers heat-and-eat foods directly to the customer's home in 28-day packages. Its products have been described as "fast food for weight loss." Customers select one of six specialized subprograms, each of which offers a prepackaged assortment of food items called "Favorites Package" or a completely customized selection. As of 2007 NutriSystem has about 800,000 customers in the United States and Canada. In addition to its meal delivery programs, the company offers **dietary supplements**, including a multivitamin called Nutrihance. It has also recently formed a business partnership with a network of franchised fitness centers called Slim and Tone. In early 2007, NutriSystem combined its direct online marketing of diet foods with its network division of franchised consultants. The company's market value was estimated at $2 billion as of early 2007.

## Origins

NutriSystem began in 1972 as a producer of a liquid **protein** diet, which it abandoned in 1978 as a result of competition from **Slim-Fast**, Carnation weight loss products, and other over-the-counter liquid diet drinks. NutriSystem then started a chain of 1,200 bricks-and-mortar weight loss centers roughly similar to **Weight Watchers**; dieters came to the centers in person to weigh in and then purchased prepackaged portion-controlled meals to take home. The company went bankrupt in the early 1990s but reinvented itself in 1999 as an online meal delivery service. As of the early 2000s, customers may order their monthly food assortments by telephone as well as online. Although a free weight loss counseling service is available by telephone or online chat, fewer than 20% of customers make use of it.

NutriSystem conducted a survey in 2005 to gather information about customer demographics, in the course of which the company discovered that most of its customers were women between the ages of 20 and 50. In 2006 it began to target men as customers, using endorsements from such well-known professional athletes as John Kruk, Don Shula, and Dan Martino. Of

the estimated 70 million adult Americans on a diet at any one time, 20 million are men. To attract male customers, NutriSystem emphasizes the inclusion of pizza, hamburgers, pasta, and other "guy foods" among the choices available on the two subprograms designed for men. It also emphasizes sex in its advertising, using such testimonials as one from a man who claims that his "sex life is excellent" since he began using NutriSystem and shedding 62 pounds. Last, the company stresses the benefits of privacy in dieting at home in its male-oriented advertising, as its focus groups indicated that many men are embarrassed to admit that they want to lose weight and regard dieters' support groups as an indication of weakness.

Interestingly, the company's advertising that is aimed at women differs from that of its competitors in *not* hiring celebrities. The company president has been quoted as saying, "Celebrities are risky. If they don't lose the weight, it can work against you."

The next demographic that NutriSystem is seeking to attract is older customers. Two of the company's six subprograms are designed for people over 60, and offer such options for health-conscious seniors as **green tea** and gingko biloba supplements to improve memory.

## KEY TERMS

**Gingko biloba**—A deciduous tree native to northern China whose leaves are used to make an extract thought to improve memory and relieve depression.

**Glycemic index (GI)**—A system devised at the University of Toronto in 1981 that ranks carbohydrates in individual foods on a gram-for-gram basis in regard to their effect on blood glucose levels in the first two hours after a meal. There are two commonly used GIs, one based on pure glucose as the reference standard and the other based on white bread.

**Saturated fat**—A fat that has no room for additional hydrogen atoms in its chain-like structure. High levels of saturated fats in the diet are thought to increase the risk of heart disease.

**Trans fat**—A type of unsaturated fatty acid that takes its name from the fact that its alkyl chains are arranged in the so-called trans configuration (in which the carbon atoms that have double bonds form a long chain rather than a kinked shape). Trans fats occur naturally in small quantities in meat and dairy products; however, the largest single source of these fatty acids in the modern diet is partially hydrogenated plant oils, used in the processing of fast foods and many snack foods. Trans fats are not necessary for human health and increase the risk of coronary artery disease.

**Very low-calorie diet (VLCD)**—A term used by nutritionists to classify weight-reduction diets that allow around 800 calories or fewer a day. None of the NutriSystem meal plans are VLCDs.

## Description

NutriSystem does not ask customers to sign a contract. To begin the program, the client either chooses one of the six programs online and continues to fill out the order form for their 28-day supply of prepackaged foods, or calls the company's toll-free number to order over the phone. As of early 2007, the six subprograms are:

- Women's Program.
- Silver for Women (women over 60). This program includes a free multivitamin supplement.
- Men's Program.
- Silver for Men (men over 60). This program also includes a free multivitamin supplement.
- Type II Diabetic Program.
- All-Vegetarian Program.

To complete the first order, the dieter selects one breakfast, one lunch, one dinner item, and one dessert (dessert choices include non-sweet snacks like pretzels or nacho chips) for each day of the 28-day package. The total meal plan is designed around eating five times a day—three meals and two snacks. The NutriSystem foods do not require refrigeration; they are prepared by a "soft canning" process and can be stored at room temperature. Some items, such as the snack bars and nacho chips, are ready to eat; the others are prepared on the stovetop or in a microwave oven. Some require the addition of hot **water**. There are at least 120 different items for the dieter to choose among in each program, with new items added from time to time. In addition to such predictable standbys as cinnamon oatmeal, chocolate pudding, and tuna casserole, the food choices include thin crust pizza with cheese, pot roast, vegetarian chili, chicken cacciatore, fettucine Alfredo, and almond biscotti.

The prepackaged foods, however, constitute only about 40% of the dieter's total intake; he or she is expected to add yogurt, skim milk, salads, breads, fresh fruit, and similar items to the base meal. The company recommends an intake of 4 1/2 cups of

fresh vegetables and fruits per day. The nutrient ratios in NutriSystem's prepackaged foods are about 55% **carbohydrates**, 25% protein, and 20% **fats**. About 5% of the calories come from trans fats or saturated fats. The **sodium** content is kept below the recommended daily limit for adults. None of the six programs are very low-calorie diets (VLCDs); they allow a total intake of about 1200 calories per day for women and 1500 for men. Most dieters will lose one to two pounds per week if they stick to the plan.

NutriSystem claims that its food selections are based on the glycemic index (GI), which measures foods by their effect on a person's blood sugar level within two hours after a meal. Foods ranked low on the GI index raise blood sugar levels slowly and gradually, thus allowing a dieter to feel satisfied for longer periods of time. The company advertises this aspect of the program as the "Glycemic Advantage."

The dieter's first order arrives with a "Welcome Kit" containing a meal planner, which outlines the meals and snacks and includes a daily food diary for keeping track of the dieter's consumption of fresh foods as well as the prepackaged items. The Welcome Kit also explains the support services available, including online chat groups, classes, newsletters, and the "Daily Dose Motivational Message" as well as the option of one-on-one telephone contact with a counselor.

The daily cost of the three prepackaged meals and dessert is about $10, which means that the dieter must allow close to $300 per month for the NutriSystem program in addition to the cost of fresh dairy products and produce. As of early 2007, the company is offering 7 days' worth of meals with the first 28-day package. In addition, customers who choose the auto-delivery option for their second and subsequent deliveries get a 10-percent discount for each month they remain in the program.

## Function

NutriSystem is intended as a moderately paced weight reduction program for people who prefer the convenience of prepackaged portion-controlled entrees, whose schedules do not fit well with weigh-ins or group meetings, who do not have time to cook or plan diet menus, or who simply prefer to diet at home. It is not a rapid weight loss program, detoxification diet, or total lifestyle regimen.

## Benefits

Some people who have tried NutriSystem are pleased with the range of food choices available as well as liking the taste of the foods. One customer said on a general diet weblog (not one sponsored by NutriSystem), "I find the food very good and actually good value considering all—I am never hungry and enjoy this diet very much." Another benefit mentioned by some customers is that the food choices are well within mainstream tastes; those who would feel intimidated by a diet designed for "upscale" clients like the familiarity of the NutriSystem options. One customer remarked, "I do not have a sophisticated palate. . . . I am a happy camper, and I can afford [NutriSystem]."

Many customers state that the convenience of the prepackaged foods is what appeals to them most. One person acknowledged, "I am lazy. . . I love the box arriving; the prep without thinking; the learning to eat small portions." The NutriSystem items can be easily taken to work and consumed during lunch hour, since they don't require refrigeration. People who cook only for themselves also mention the convenience of not having a refrigerator full of leftovers, since the NutriSystem items are one-meal portions.

## Precautions

A common criticism of the NutriSystem program is that dieters do not learn to plan meals, gauge portion size, or cook for themselves after they have lost the desired amount of weight on the program. To counter this criticism, the company published a book in 2004 that contains recipes, tips for sizing portions, and other advice about maintaining weight loss for NutriSystem clients who are making the transition to their own cooking and calorie counting.

The program also does not place much emphasis on exercise; in fact, some of the advertising copy for the men's program contains such remarks as "Whenever you get low on NutriSystem meals and snacks, another batch arrives at your door. You don't even have to leave that comfortable chair in your living room."—hardly an incentive to physical activity.

Another difficulty some clients have with the NutriSystem program is that it does not fit well into family meals unless everyone in the household is using the program. Many customers report that they must prepare a second meal for the rest of the family—a common source of temptation to go off the diet.

## Risks

The NutriSystem program seems safe from a nutritional standpoint for most dieters who have had a medical checkup for previously undiagnosed conditions or food allergies. It does not depend on appetite suppressants, fasting, or other practices that may be dangerous to health.

## Research and general acceptance

NutriSystem does not appear to have been used in any clinical trials reported in the medical literature, most likely because of its heavily commercial emphasis as well as the number of different subprograms it markets. Its chief dietitian, Jay Satz, has apparently never published a research article in a professional medical or nutritional journal. NutriSystem has not yet been rated or evaluated by the American Dietetic Association. Existing feedback about this diet program is informal as of early 2007, consisting solely of testimonials in television commercials and the website itself, and comments or reviews on various Internet diet websites and online chat groups.

The only nutritional information that NutriSystem supplies is that its meal plan "meets, and in many cases, exceeds the government standards for healthy eating," the government standards in question being the United States Department of Agriculture (USDA) *Dietary Guidelines for Americans 2005*. There are no endorsements by physicians, dietitians, or other health care professionals on the website, although a physician is listed as the second author of the 2004 book on the NutriSystem program.

General acceptance of the NutriSystem program is mixed. Some people who have tried the system report that the meals vary considerably in tastiness and overall quality. A 2005 article in *Business Week* reported that the company's own chief dietitian acknowledges that some of the items are less than delectable. The reporter continued, "The meals and snacks, all packaged to keep without refrigeration, are not unlike offerings from competitors and have a mushy nursing-home quality when heated. . . . [No visiting] Frenchman would stomach the beef Burgundy with rice. And the Thai noodles with peanut sauce and tofu, left on my desk for two days, sent a vegetarian colleague fleeing." One unhappy customer said, "I couldn't stand NutriSystem but was able to get a partial refund . . . . They were really quite nice about everything, considering I told them I didn't like their food's taste and consistency."

The company maintains a blog called *NutriSystem Food Reviews and Recipes Blog* at http://www.nsfoodreviews.com, where people can leave reviews of the various food choices available. Dieters who are unhappy with their selections may return unused food items within 30 days of receipt for refunds with no questions asked. In addition to the poor quality of some of the foods, another customer complaint is the occasional unavailability of popular items around holiday seasons. The average customer stays on the plan for about 9 weeks and loses an average of 20 pounds; about a third will return to the plan within a year. Most, however, regain the lost weight; in fact, the company's business strategy is based on this fact. The president has been quoted in print as saying, "It's a sad thing from the consumer's standpoint; but it makes a very attractive business model."

### QUESTIONS TO ASK YOUR DOCTOR

- What is your professional opinion of NutriSystem?
- Do you know of any published clinical studies of this program?
- Have any of your other patients tried it?
- Which of the six subprograms did they use?
- Did they like the foods available?
- Were they able to lose weight and keep it off?

## Resources


### BOOKS

NutriSystem and Dr. James Rouse *NutriSystem Nourish: The Revolutionary New Weight-Loss Program*. Hoboken, NJ: John Wiley and Sons, 2004.

Scales, Mary Josephine. *Diets in a Nutshell: A Definitive Guide on Diets from A to Z*. Clifton, VA: Apex Publishers, 2005.

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U.S. Department of Agriculture (USDA). *Dietary Standards for Americans 2005*. Available online in PDF format at http://www.health.gov/dietaryguidelines/dga2005/document/.

**ORGANIZATIONS**

NutriSystem, Inc. 200 Welsh Road, Horsham, PA 19044. Telephone: (215) 706-5300. Website: http://www.nutrisystem.com.

Slim and Tone. 300 Welsh Road, Bldg 1, Suite 225, Horsham, PA 19044. Telephone: (877) 453-SLIM. Website: http://www.slimandtone.com.

Rebecca J. Frey, PhD

# Nutrition and mental health

## Definition/Description

Mental health problems are believed to be the result of a combination of factors that appear to play a role in predisposing individuals to developing a mental health difficulty. These include genetics, age and environmental factors. More recently, however, there is a growing wealth of evidence, which highlights the ever-increasing role that food and nutrition plays in our emotional status. The evidence suggests that may food play an important contributing role in the prevention, progression and management of mental health problems including, Depression, Anxiety, Schizophrenia, Attention Deficit **Hyperactivity** Disorder (ADHD), and Alzheimers Disease. Research is ongoing in this area and the role of nutrition in mental health has yet to be fully understood and embraced. Much of the proposed benefits require further research before we can equivocally relate specific mental health problems to our nutritional status.

## Demographics

There appears to be a growing burden of mental ill-health worldwide which ultimately poses an ongoing financial burden on healthcare systems. Demographics vary from one country to the next with some countries statistics suggesting that one in four people are likely to experience a mental health problem at some point in their lifetime. Most studies indicate that there appears to be no respite in the pace and impact of the growing burden of mental ill-health.

## Causes and symptoms

There is a plethora of anecdotal, clinical and controlled studies that highlight the importance of nutrition as one part of the jigsaw in the prevention and management of positive mental health. Other causative factors include genetics and environmental factors

## Diagnosis

Diagnosis of a mental health problem is usually made by a trained clinician, for example, a Psychiatrist or a General Practitioner (GP). Confirmation of a diagnosis is usually made following completion of standardised assessment tools and a full psychiatric assessment.

## Treatment

Treatment varies depending on the type of mental health problem. However, more and more, lifestyle factors including exercise are seen as a first-line treatment for people suffering with symptoms of Depression. If required, this may then be followed by a talking therapy, for example, Cognitive Behaviour Therapy (CBT) or a guided self-help approach with evidence-based books, called 'Bibliotherapy'. Medication may also be required as an adjunct to the aforementioned therapies, for example, Selective Serotonin-reuptake inhibitors (SSRIs). Where individuals do not respond to these treatments, Electro convulsive therapy (ECT) may be explored. For other types of mental health problems, medication may be commenced on diagnosis, subject to the symptoms the individual is experiencing. In cases where the individual is deemed as requiring support and intervention on a more intensive basis, inpatient treatment may be necessary. This is usually considered if the individual is thought to present a risk either to themselves or others as a consequence of their mental health difficulty.

## Nutrition/Dietetic concerns

The food we eat plays an important role in our physical and emotional wellbeing at every stage of our lives from the preconceptive nutrition of a mother planning her pregnancy through to weaning, adolescence, adult and older adulthood. The benefits to babies of breast versus formula milks in terms of brain function is well documented. These benefits are thought to be as a consequence of increased levels of Essential fatty Acids (EFAs) in breastmilk. Many studies have reviewed research over the past number of years, which clearly support the notion that the inclusion of breakfast improves daily and long-term academic performance in children. Similarly, research studies suggest that when children are hungry, behaviour is worsened. Conversely, the provision of nutritious meals helps decrease fighting and absence whilst simultaneously increasing attention. A number of studies suggest that supplementation of the diet can impact on the behaviour of offenders and have a

**Diet-mood connection**

| Nutrient | Food sources | Neurotransmitter/mechanism | Proposed effect |
|---|---|---|---|
| Protein | Meat, milk, eggs, cheese, fish, beans | Dopamine, Norepinephrine | Increased alertness, concentration |
| Carbohydrate (CHO) | Grains, fruits, sugars | Serotonin | Increased calmness, relaxation |
| Calories | All foods | Reduced blood flow to the brain | Excess calories in a meal is associated with decreased alertness and concentration after the meal |

*(Illustration by GGS Information Services/Thomson Gale.)*

## KEY TERMS

**Amino acids**—These are the building blocks of protein

**Carbohydrates**—carbohydrates are a major source of energy. Carbohydrates in the diet are principally made up of starches, sugars and dietary fibre.

**Fats**—Fat is a concentrated source of energy. Foods that are high in fat provide a lot of energy and are good sources of vitamins, A, D, E, and K and provide essential fatty acids.

**Minerals**—These are elements which are essential for the body's normal function including calcium, iron, phosphorous, magnesium, sodium, chloride, iodine, manganese, copper, and zinc

**Proteins**—These are large molecules which are made up of thousands of amino acids. The primary function of protein is grwth and repair of body tissues.

**Serotonin**—A neurotransmitter and a hormone. As a neurotransmitter is acts like a chemical in the brain which help transmit signals in the brain

**Tryptophan**—This is an amino acid which plays a role in the manufacture of serotonin

**Vitamins**—These are compounds required by the body in small amounts to assist in energy production and in cell growth and maintenance. They are essential for life and with the exception of vitamin D, cannot be made in the body. They should ideally be consumed from food. However, individuals who struggle to eat can obtain their vitamin requirements from dietary supplements.

positive impact on reduction of antisocial behaviour (Gesch, 2002). However, further studies are necessary to replicate these findings amongst the general population.

Most people have a good understanding of the effects of nutrition on our physical health. The ongoing health-promotion messages both in the media and in health-care settings appear to have reached the general public. People now accept the effects that a diet high in saturated fat, salt and sugar plus a diet low in fibre, fresh fruit and vegetables can have on our long-term health. The public are aware that a unhealthy dietary intake increases the risk of **Coronary Heart Disease** (CHD), Type 2 Diabetes, **Hypertension** and some types of **Cancer**. Less awareness appears to be evident in terms of how the diet can impact on our emotional status and mental health. However, anyone who has ever drank alcohol, tea or coffee or eaten chocolate recognises how certain fluids or foods can influence our mood. Perhaps one of the reasons why we do not associate food with mood is due to the delay in seeing an immediate effect, for example, eating some foods which are raw or undercooked can cause people to become very ill and consequently develop an immediate association between a particular food and physical discomfort. However, the impact of what we eat on our mood is usually a slower less tangible process.

Arguably, the contribution of diet to mental health status is complex and affected by many other complex issues. Nonetheless, we do know that diet affects our physical health, which in turn can impact on our emotional status and wellbeing. A restrictive dietary intake, which is low in essential nutrients, is unlikely to meet the daily recommended nutritional requirements to help minimise the risk of development of nutrition-related illnesses, including, iron-deficiency anaemia, low energy levels and poor concentration. Similarly, dietary intakes high in fat or sugar, can frequently be low in essential **vitamins** and **minerals** despite meeting our energy or calorie requirements. Therefore, our brain like the heart or liver is sensitive to the foods we eat on a daily basis. To remain healthy the brain needs different amounts of the following nutrients; complex **carbohydrates**, EFA's, amino acids, vitamins and minerals and **water.**

## Therapy

In order to understand the role individual nutrients play in the body it is important to briefly look at the structure of the brain and how it functions.

### *Structure of the Brain and Neurotransmitters*

The brain contains billions of nerve cells, which allow the brain to communicate with itself and other parts of the body. These nerve cells are made up of fat primarily, which is derived from the diet. Chemicals, called neurotransmitters help the nerve cells communicate with each other and they are made from amino acids, which are often derived from the diet. Amino acids are the building blocks of **Protein**. The most widely known neurotransmitter is called Serotonin and is derived from an amino acid called Tryptophan. Other transmitters include Acetylcholine, Dopamine, Adrenaline, Noradrenaline and 4-aminobutyrate (GABA). A sufficient balance of these neurotransmitters is essential for good mental health and they play an important role in feelings of anxiety, memory and cognitive status. The frequent consumption of certain foods can hinder and decrease the effectiveness of these chemicals in the brain, for example, foods high in saturated and trans-fats. Conversely, certain foods can help nourish the brain by helping it to release an efficient balance of neurotransmitters. Similarly, foods, which are high in **antioxidants**, can help protect the cells in the brain from becoming damaged.

In addition, to feeding the brain with foods that will help regulate neurotransmitter activity and protect the brain from damage, mood can also be improved by ensuring that the diet contains adequate amounts of complex carbohydrates, essential **fats**, amino acids, vitamins and minerals and water.

### *Carbohydrates*

**FACTS ABOUT CARBOHYDRATES AND WEIGHT LOSS** There is much confusion amongst the public about carbohydrates and their role as part of a healthy diet. Starchy carbohydrates have wrongly been at the receiving end of misleading messages in the media which suggest that 'low-carb' and 'carb-free' options are the way to go if you are trying to lose weight. There is little evidence to support these theories.

- When energy intake equals energy expenditure, weight remains unchanged.
- When energy intake exceeds expenditure, weight increases.
- When energy intake is less than expenditure, weight will decrease.

Therefore, if someone hypothetically requires 3000 calories per day and they eat 3500 calories worth of carrots daily, they may still gain weight as their energy intake is greater than their expenditure, even though what they are eating is low in calories.

In summary, the message is; daily calorie intake should be made up of calories from carbohydrates, proteins, fats, vitamins and minerals, from a variety of foods. There should not be a need for people to completely exclude a major food group such as starchy carbohydrates to support weight loss and in fact this would not be recommended as part of a healthy diet.

**CARBOHYDRATES AND THE BRAIN** The brain runs on a fuel called glucose and it is the largest user of glucose within the body. Glucose is the breakdown product of carbohydrates. However, some carbohydrates are more preferable than others in terms of fuelling the brain, because they release the glucose at a slower and more efficient rate. These more efficient fuels for the brain are derived from starchy carbohydrates. However, please note that there are different types of carbohydrates, complex (also known as starchy), sugary and fiber-type foods.

**COMPLEX CARBOHYDRATES** Sometimes referred to as 'starchy' or 'slow release' carbohydrates. Foods from this group should be included at each mealtime because they are broken down slowly in the body and therefore give us a slow release of energy over a long period of time. These fuels help us to feel full for longer after we eat meals high in starchy carbohydrates. They therefore help prevent or reduce the need for snacking. Starchy foods which contain fiber enhance this effect further and therefore work even more efficiently. Starchy foods tend to be high in nutrients, for example, B vitamins. These foods are essential for maintaining and sustaining energy levels. Choosing foods that take longer to be broken down helps ensure that the brain receives a relatively constant source of fuel. These foods also play a vital role in helping to support an efficient **metabolism**. If the brain does not receive the correct fuels on a regular basis or energy intake is inadequate the metabolic rate may slow down, thereby making the body more prone to weight gain.

Sources of starchy carbohydrates: Breads, potatoes, pasta, rice, cereals, oats, cous cous, bulgar wheat, yams, sweet potatoes, green banana, plantain, noodles. Fibre-rich options include, brown rice, wholemeal pasta and wholemeal cereals.

**SUGARY OR 'SIMPLE' CARBOHYDRATES** These carbohydrates are broken down and release energy very quickly into the body. They boost energy levels artificially for short periods of time, but are not an efficient

source of energy. The reason why they give us energy quickly is because they contain sugar. Energy levels drop quickly following consumption of these foods, as they are unable to keep us going for long periods of time. Therefore, people are likely to feel hungry shortly after eating foods rich is simple or refined sugars and are more likely to feel the need to snack if meals are based on foods from this group. Finally, these foods also tend to be poor sources of nutrients and are sometimes high in refined sugar and fat

Sources of sugary carbohydrates: Chocolate, cakes, sweets biscuits and alcohol.

### *Fats*

**EFA'S** Despite current recommendations to watch our fat intake, fat is essential for life. From a physical health perspective fat provides us with essential fat-soluble vitamins A, D, E and K. From a mental health perspective, the brain is composed of a high percentage of fat and a high percentage of this fat comes from EFAs, omega-3 and omega-6. These are called 'essential' as they cannot be made in the body and need to be obtained from the diet. These EFAs are a vital part of the structure of the brain cells and for promoting communicating between the cells in the brain.

Much research has been conducted on omega-3 oils to date, which indicates that these fatty acids can have positive protective benefits in terms of heart disease. More recently researchers have become interested in the potential benefits of omega-3 in behaviour and positive mental health. However, there is wide variation in outcomes of studies with some researchers who have reviewed the evidence suggesting positive benefits on mood whilst other studies discount this. Interestingly, a study from 2003, suggested that the levels of depression amongst people lining in the Artic and Subartic regions was rising at the same time that traditional diets, which were high in EFAs were being replaced by more processed foods.

Other mental health problems have been researched to investigate if there is a relationship between diet and Alzheimer's disease and Schizophrenia. Much research is still required in these areas before any definitive associations can be made. Nonetheless, as at 2007, many studies have indicated that there is a relationship between higher intakes of fat with increased incidence of Alzheimer's disease. Other research suggests a link between lower levels of poly-unsaturated fatty acids (PUFAs) and Schizophrenia (Peet et al., 1995).

Sources of omega-3 include oily fish, for example, mackerel, pilchards, sardines, fresh tuna, salmon, herring, anchovies, kippers, whitebait and trout. Vegetable oils including linseed, **flaxseed**, rapeseed and walnut also contain omega 3.

### *Amino Acids*

Amino acids are the building blocks of protein and neurotransmitters are made from amino acids. Some amino acids are 'essential', meaning we need to obtain them from our diet, whilst the body itself can make 'non-essential' amino acids. Therefore, inadequate intake of certain amino acids may contribute to insufficient levels of neurotransmitters in the brain.

The most widely researched amino acid is tryptophan and its relationship with the neurotransmitter serotonin. Serotonin can play a role in mood, eating and sleep patterns. One of the features of depression is a reduction in the amount of serotonin in the brain. As Tryptophan is a precursor to serotonin it has recently been the focus of much research attention. Tryptophan is found in many foods including eggs, lean meat and beans. However, to produce serotonin, the body also requires the availability of other enzymes, vitamins and minerals. Absence of any of these essential components may impact on the ability of the body to manufacture serotonin.

### *Vitamins*

A number of different B vitamins play a role in positive mental health, for example, a deficiency of the B vitamin (**niacin**) can lead to sleeplessness, fatigue, depression and memory loss whilst a deficiency of **riboflavin** can lead to insomnia and weakness. Numerous physical signs and symptoms are also associated with B vitamin deficiency. Some studies suggest that there may be a correlation between **folate** or folic acid and Depression and that those with low intakes were more likely to be diagnosed with Depression than those with higher intakes.

Sources of B vitamins include some meats and offal, fortified cereals, eggs, milk and some vegetables.

### *Minerals*

**IRON** **Iron** is an essential mineral for the blood. Iron deficiency can lead to the development of anaemia, which means that the ability of the body to transport oxygen around the body for energy is compromised. This can result in people feeling tired, lethargic and low in mood. The iron we get from food

plays an important role in the levels of iron in the blood. Good sources of iron are found in red meat, meat products and offal. The type of iron in these foods are easily absorbed by the body. Iron is also found in lesser quantities in eggs, baked beans, white meat, spinach, some dried fruits and fortified cereals, but the body does not absorb this type of iron as easily. Other foods can either inhibit or enhance the absorption of iron, for example, **vitamin C** can enhance whilst tannins (found in tea and coffee) can inhibit iron absorption.

**SELENIUM** **Selenium** plays an important role in our immune system functioning, reproduction and thyroid hormone metabolism. There are some research studies, which suggests that selenium plays a positive role in mood and energy levels and that people with a low selenium intake are more likely to be anxious, depressed and tired. Sources include; walnuts and brazil nuts, seafood, chicken, beef, bran, broccoli, mushrooms, onions, wheat germ and whole-grain products.

### *Antioxidants*

Studies into the causes of Schizophrenia suggest lower levels of antioxidant enzymes in the brains of people with Schizophrenia thus indicating that their brain cells may be more vulnerable to oxidation. However, further research is required in this area before any conclusive correlations can be made. Similar research into the role of antioxidants in the prevention of Alzheimers Disease is also ongoing.

### *Water*

Water makes up more than three-quarters of the brain and is therefore an essential element in ensuring the chemical processes in our bodies work efficiently. We lose water daily through waste, sweat and bodily fluids. When we sweat excessively through exercise or in warm temperatures we lose large volumes of fluid. It is essential that we replace these fluids. Average fluid requirements for adults are approximately 35ml/kg/day. Signs of **dehydration** include tiredness, restlessness, irritable behaviour, weakness, **constipation**, loss of concentration and headaches. More severe symptoms, can include low blood pressure, fainting and on occasions heart failure.

Sources of fluids: water is one of the best sources of fluid for the body. Other fluids including squash, fruit juice and milk. Tea and coffee can also contribute to your daily fluid intake, however, non-caffeinated drinks are preferable as **caffeine** (and alcohol) can have a diuretic effect and exacerbate dehydration.

**HOW MUCH FLUID DO I NEED PER DAY?** An average adult should aim for 35 mls of fluid per kilogram of body weight. Therefore, a 70 kg individual requiring 35 mls per kg per day would in total need;

- 70kg x 35 mls = 2450 mls per day
- Weight x 35 mls = minimum fluid requirements for the day

## Prevention

Whilst the above information provides some details in relation to the role of nutrition and mental health they are by no means a sole cure for depressive symptoms for the majority of individuals. Some foods can help lift your mood, but if there is an underlying medical cause for the symptoms it is important that this is dealt with properly. Medical advice should be sought when individuals experience signs and symptoms of Depression before starting any new dietary regime. If unsure please request a referral via your GP to a Registered Dietitian

## Resources


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**ORGANIZATIONS**

<http://www.mentalhealth.org.uk>.
<http://www.nice.org.uk>.
<http://www.bda.uk.com>.
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# Nutrition literacy

## Definition

Nutrition literacy refers to the set of abilities needed to understand the importance of good nutrition in maintaining health.

## Purpose

The first purpose of nutrition literacy is to understand food so that people improve their ability to make informed decisions concerning which foods, and in what quantities, are required to maintain health. This also includes an awareness of which foods to avoid and why. Today's consumers benefit from an unprecedented diversity of food products. Information about food is also widely available to help ensure that diets are nutritious. Nutrition literacy is accordingly based on being informed on several issues that include:

- Food and health: People require energy and certain essential nutrients. Energy is provided by food that contains macronutrients, required in large amounts (protein, carbohydrate, fats). Essential nutrients are essential because the body cannot make them on its own and must obtain them from food. They include micronutients such as vitamins, minerals, required in small amounts and certain amino acids and fatty acids. Foods also contain fiber and other components that are important for health. Nutrition literacy provides an understanding of the basic nutrient classes and explains their respective roles in maintaining health as well as their dietary sources. This is often commonly referred to as the "Food Pyramid".
- Food interactions: Many food nutrients have a specific function in the body but most need to interact with each other for maximum health benefits. For example, people need calcium for strong bones, but

**Nutrient content claims**

| Claim | Definition | Nutrient |
|---|---|---|
| "Free" or "Fat free" | No amount of or only trivial amounts. | Fat<br>Saturated fat<br>Cholesterol<br>Sodium<br>Sugars<br>Calories |
| "Very Low"<br>"Low" | Not an overall definition.<br>May be used on foods that can be eaten frequently without exceeding dietary guidelines.<br>Amount varies depending on the nutrient. | Sodium<br>Fat<br>Saturated fat<br>Sodium<br><br>Cholesterol<br>Calorie |
| "Lean" and "Extra Lean" | Used to describe fat in meat, poultry, seafood, and game meats. | Fat |
| "High" | May be used if the food contains 20% or more of the Daily Value per serving. | Vitamins and minerals<br>Dietary fiber<br>Protein |
| "Good Source" | May be used if the food contains 10% to 19% of the Daily Value per serving. | Vitamins and minerals<br>Dietary fiber<br>Protein |
| "Reduced" | Nutritionally altered to contain at least 25% less of a nutrient, or of calories, than the reference food. Reduced claim cannot be made if it is already labeled low. | Fat<br>Saturated fat<br>Sodium<br>Cholesterol<br>Calorie |
| "Less" | Contains 25% less of a nutrient, or of calories, than the reference food. | Fat<br>Saturated fat<br>Sodium<br>Cholesterol<br>Calorie |
| "Light" or "Lite" | One-third fewer calories, or half the fat, of the reference food. If the food derives 50% or more of calories from fat, the reduction must be 50%. | Calories<br>Fat |
| "Light in Sodium" | Sodium has been reduced by at least 50%. | Sodium |
| "More" | Contains at least 10% of the Daily Value of the nutrient present in reference food. "Fortified," "enriched," "added," "extra," and "plus" are all synonyms of "more." | Vitamins and minerals<br>Dietary fiber<br>Protein |

*(Illustration by GGS Information Services/Thomson Gale.)*

many other nutrients also take part in building and maintaining bones, such as proteins, phosphorus, magnesium and vitamin D. Tannins in tea can inhibit the absorption of iron. Zinc supplements, an essential trace mineral, should not be taken at the same time as certain antibiotics, such as tetracyclines and quinolones, as it may decrease the action of the antibiotic. Nutrition literacy seeks to explain the interactions of nutrients with each other and also with medications.

- Food and disease: Good food choices can help to prevent diseases, such as heart disease, certain cancers, diabetes, stroke and osteoporosis, that are leading causes of death and disability in the United States. Many genetic, environmental, behavioral and cultural factors can affect health. Understanding the family history of disease and risk factors, such as body weight and fat distribution, blood pressure and blood cholesterol, can help people make more informed decisions about how to improve health. Nutrition literacy promotes good food choices and diets that lead to improving health while also reducing major risk factors for chronic diseases, such as obesity, high blood pressure and high blood cholesterol. By explaining how food is chemically converted into nutrients that can be absorbed and used by the body (digestion), it also promotes digestive system health.
- Understanding fast foods: Today's lifestyles are very different from those of the past. The fast pace of modern lifestyles and the increase of single-parent households or families where both parents work have significantly changed food consumption habits. This has led to the emergence of convenient foods and important advances in food technology. There are more than 300,000 fast food outlets in the United States and fast food has now become common in the busy American lifestyle. However, a negative consequence has also been a significant increase in ready-to-eat foods of low nutritional value (junk food), because it is often high in calories, sodium, fat and cholesterol. Nutritional literacy provides information on fast foods and how they can be part of a balanced, healthy diet in small quantities.
- Understanding food supplements: Nutrition literacy also provides information on food supplements, such as vitamins, minerals, fiber and phytonutrients that may be required in some instances to meet nutritional needs. However, supplements do not supply the balance of important nutrients present in whole foods, and they can be harmful if taken regularly in excessive amounts. Daily vitamin and mineral supplements at or below the Recommended Dietary Allowances are considered safe but are rarely needed by people who eat the variety of foods recommended for example by the Food Pyramid. Supplements are usually needed only to meet specific nutrient requirements. For example, older people with little exposure to sunlight may need a vitamin D supplement. And pregnant women may benefit from folic acid and iron supplements.
- Eating disorders awareness: Nutrition literacy also includes providing information on eating disorders, that include anorexia nervosa, bulimia, and binge eating disorder. They are illnesses with a biological basis that are influenced by emotional and cultural factors.

## Description

Nutrition literacy extends beyond the basic skills of reading, writing, speaking and listening to include skills required by a person to understand and interpret the often complex information about foods and their nutrients. Nowadays, these skills must necessarily include information-processing literacy because nutrition information is now widely and increasingly distributed on the Internet.

The social and technological developments of the past decades have also significantly influenced the variety of food available, and also our understanding of how food provides nutrients to the body. It is now agreed that one of the most fundamental principles of healthy nutrition is variety: the need to consume a wide range of different foods on a regular basis. Provided that a person is eating normal quantities of food, it is now recognized that a varied diet is likely to provide enough of all nutrients required by the body. In the last decades of the twentieth century, nutrition literacy was highly focused on concerns about dietary excesses of **macronutrients** such as **fats** and on the relationship between diet and specific diseases such as heart disease and **cancer**. This resulted in an overall perception that nutrition was the most effective way of maintaining health. However, many of the diseases associated with dietary excess are now understood to also have a major genetic component. Additionally, non-dietary lifestyle factors have been shown to be very important, leading to a realization that diets which may be helpful to some people may only be part of the solution for others. The prevailing view of good nutrition is now that each person should consume the most appropriate balance of nutrients for maintenance of individual good health, and this requires a higher level of literacy than in the past.

## Nutrition literacy resources

There are many resources available to achieve nutrition literacy. The most useful include:

- Nutrition Facts labels: These are the labels found on the packaging of some fresh foods and most processed foods. They provide detailed information on specific nutritional content. People can learn a lot about the composition of foods from reading these labels. The labels can also be useful for learning to predict what the composition of restaurant or takeout food might be. For example, the label of a frozen supermarket pizza can be used as a guide to the calories and nutrients that a restaurant pizza is likely to contain.
- Nutrition handouts: Health care practitioners usually have handy sheet material concerning nutritional advice in their waiting rooms. Dentists commonly provide people with dietary tips on how to avoid tooth decay and maintain oral hygiene. Supermarkets also regularly distribute nutritional information on foods at checkouts and in special displays.
- Nutrition classes and lectures: Medical foundations, community colleges, and consumer groups organize lectures that are open to the general public in many communities across the United States. Online nutrition classes and webcasts are also available on the Internet.
- Patient handouts: These contain detailed dietary information for specific health conditions as well as recommendations on foods that may help recovery and foods that should be avoided.
- Recommended Dietary Allowances (RDAs): RDAs recommend the average daily level of a nutrient that is sufficient to provide its adequate requirement for nearly all individuals in a life stage and gender group. RDAs are widely provided in almost all diets and nutrition advice material.
- Food Guide Pyramid: The Food Guide Pyramid is provided and updated by the United Stated Department of Agriculture (USDA) and represents a popular way for people to understand how to eat healthy. It was designed to help kids and parents understand dietary guidelines. A rainbow of colored stripes represents the five food groups to make it easy to select the foods providing the nutrients and other substances needed for good health. Most of the daily servings of food should be selected from the food groups that are the largest in the picture and closest to the base of the pyramid. The pyramid shows that foods from the grain group, along with vegetables and fruits, are the basis of healthful diets.
- Expanded Food and Nutrition Education Program (EFNEP): The USDA Expanded Food and Nutrition Education Program (EFNEP) is designed to assist limited resource audiences in acquiring the knowledge, skills, attitudes, and behavior necessary for nutritionally sound diets, and to contribute to their personal development and the improvement of the total family diet and nutritional well-being. It provides reputable sources of scientific and consumer nutrition information for consumers and professionals in the form of newsletters, publications, and Internet links.
- Family nutrition programs (FNP). Often sponsored by the USDA Food Stamp Program, these programs provide nutrition education to limited resource individuals and families in almost all states. They are managed by departments of Human Nutrition or of Social Services and by health associations and foundations.

## Distributors of nutrition education materials

There are several organizations and agencies that distribute nutrition information as printed matter (books, booklets, brochures, fact sheets) or on their websites. They also organize conferences and lectures. Some of the most trusted are listed below.

### *United Stated Department of Agriculture (USDA)*

Through its Food and Nutrition Information Center (FNIC), the USDA distributes a wealth of food and human nutrition information since 1971. It provides credible, accurate, as well as practical resources for nutrition and health professionals, educators, government personnel and consumers. It also maintains a popular website called *MyPyramid.gov* for people of all age groups to help them make smart choices from every food group, balance food and physical activity, and to stay within recommended daily calorie needs.

### *American Dietetic Association*

The association has the goal of linking nutrition and health. It is the largest organization of food and nutrition professionals in the United States. It offers numerous food and nutrition information distributed in many forms. Examples are:

- Nutrition fact sheets (Nutrition for Everyone, Weight Management, Kid's Nutrition Needs)
- The good nutrition reading list (365 Days of Healthy Eating from the American Dietetic Association, The College Student's Guide to Eating Well on Campus, A Healthier You: Based on the Dietary Guidelines for Americans)

## KEY TERMS

**Amino acid**—There are 20 amino acids. The body can synthesize 11 from components within the body, but the nine called essential amino acids must be consumed in the diet.

**Binge eating disorder (BED)**—Eating disorder characterized by recurrent binge eating without the regular use of compensatory measures to counter the binge eating.

**Blood cholesterol**—Cholesterol is a molecule from which hormones, steroids and nerve cells are made. It is an essential molecule for the human body and circulates in the blood stream. Between 75 and 80% of the cholesterol that circulates in a person's bloodstream is made in that person's liver. The remainder is acquired from animal dietary sources. It is not found in plants. Normal blood cholesterol level is a number obtained from blood tests. A normal cholesterol level is defined as less than 200 mg of cholesterol per deciliter of blood.

**Calorie**—A unit of food energy. In nutrition terms, the word calorie is used instead of the scientific term kilocalorie which represents the amount of energy required to raise the temperature of one liter of water by one degree centigrade at sea level. In nutrition, a calorie of food energy refers to a kilocalorie and is therefore equal to 1000 true calories of energy.

**Cloze tests**—Tests of language proficiency and what they measure.

**Fatty acid**—A chemical unit that occurs naturally, either singly or combined, and consists of strongly linked carbon and hydrogen atoms in a chain-like structure. The end of the chain contains a reactive acid group made up of carbon, hydrogen, and oxygen.

**Food Stamp Program (FSP)**—The Food Stamp Program provides a basic safety net to millions of people. The program was born in the late 1930s, with a limited program in effect from 1939 to 1943. It was revived as a pilot program in 1961 and was extended nationwide in 1974. The current program was implemented in 1977 with the goal of alleviating hunger and malnutrition by permitting low-income households to obtain a more nutritious diet through normal channels of trade.

**Language Experience Approach**—An approach to reading instruction based on activities and stories developed from personal experiences of the learner.

**Nutrition Facts label**—Labels affixed to foods sold throughout the United States. Usually on the back or the side of the bottle, package, or bag, the label specifies the amount of calories provided by the contents as well as the amount of nutrients, vitamins and supplements.

**Phytochemicals**—Chemicals extracted from plants that have health-enhancing effects.

**Stroke**—The sudden death of some brain cells due to a lack of oxygen when the blood flow to the brain is impaired by blockage or rupture of an artery.

**Trace minerals**—Minerals needed by the body in small amounts. They include: selenium, iron, zinc, copper, manganese, molybdenum, chromium, arsenic, germanium, lithium, rubidium, tin.

**Webcast**—The delivery of live or delayed sound or video broadcasts using web technologies. The sound or video is captured by conventional video or audio systems. It is then digitized and streamed on a web server.

- Daily nutrition tips (A Variety of Options with Chicken, Add more Calcium to your Daily Routine)
- Consumer nutrition brochures (Healthy Habits for Healthy Kids - a Nutrition and Activity Guide for Parents, Start Healthy: the Guide to Teaching Your Little One Good Eating Habits, From the Surgeon General: Improving Bone Health.
- Popular diets reviews. Every year brings a new popular diet that quickly becomes a best-selling book. The ADA reviews them for consumers.
- Home food safety. This is a national public education initiative called "Home Food Safety . . . It's in Your Hands". It raises consumer awareness on the importance of practicing food safety at home, while communicating easy solutions so people can take control and handle food safely in their own kitchens.

### *United States Food and Drug Administration (FDA)*

The FDA is responsible for protecting public health by regulating the safety, efficacy, and security of human and veterinary drugs, biological products, medical devices, the nation's food supply, cosmetics, and products that emit radiation. The FDA is also responsible for advancing the public health by helping the public get the accurate, science-based information they need to use medicines and foods to improve

their health. It regularly issues and updates food information on product safety, recalls, warnings and approvals. This information is made public in almost all media:

- FDA Consumer. This is the official magazine of the FDA. It is a good source for the latest information on FDA-related issues, gathered from FDA news releases and other sources.
- Consumer print publications. Almost 100 short brochures on nutrition-related issues are available on request or downloadable from the FDA website.
- FDA & You. An electronic newsletter for teens, parents, and educators with current information on many of the FDA medical product and health topics.
- Quick Information for Your Health. Easy-to-read health information. Some titles are available as printable forms from the FDA website or as printed brochures for ordering.

#### *American Diabetes Association*

The association distributes nutritional information related to diabetes and health. Its bookstore has award-winning books on nutrition, recipes, weight loss, meal planning and more. Examples are:

- Diabetes Meal Planning Made Easy
- The Complete Guide to Carb Counting
- Healthy Calendar Diabetic Cooking

## Nutrition literacy issues

There are presently two major issues affecting nutrition literacy. The most serious is illiteracy, followed by the difficult readability of some nutrition information:

- Illiteracy: Estimates of the prevalence of illiteracy in the United States vary according to the sources and criteria used to define it. But it is generally agreed that economic, social and cultural factors all contribute to higher rates of illiteracy in some population groups. Results from the 2003 National Assessment of Adult Literacy (NAAL) included health literacy results. The results were based on assessment tasks designed specifically to measure the health literacy of adults living in the United States. Health literacy was reported using four performance levels: Below Basic, Basic, Intermediate, and Proficient. The majority of adults (53%) were found to have Intermediate health literacy. Some 22% had Basic and 14% had Below Basic health literacy. The relationship between health literacy and factors such as educational level, age, race and ethnicity, sources of information about health issues were also examined. It was found that adults with Below Basic or Basic health literacy were less likely than adults with higher health literacy to obtain information about health issues from written sources (newspapers, magazines, books, brochures, or the Internet) and more likely than adults with higher health literacy to get information about health issues from radio and television.
- Readability of nutrition information: Since important nutrition materials are often written at levels that are too difficult for low-literate readers, efforts are now directed at presenting nutrition information that can match the reading abilities and learning styles of the intended audience. Increasing research is being performed on the overall readability nutrition information. Techniques such as Cloze tests and the Language Experience Approach have been adapted to help develop materials for specific low-literate target groups. Low-literacy materials and guides for educators are also becoming increasingly available. Professionals that survey nutrition education have recommended materials that are low-cost, and of the type mostly used in patient education. A recent study reported that 68% of a group of nutrition publications representative of material commonly distributed to the public were written at ninth grade level or higher. 11% were at the sixth grade level or below and only two publications were written at the third grade level. The conclusion is that many nutrition publications can be read and understood by literate Americans, but very few can be understood by the millions that have limited literacy skills. Another study reviewed the readability of books recommended to consumers by professional nutrition and dietetic organizations. The grade level required to read the recommended books was the tenth grade and more than 40% required a reading level that exceeds that of popular magazines. Only one recommended book was written at a level that was understandable by adults with low-literacy skills.

## Parental concerns

Nutrition literacy is important for parents so that they may first of all understand how food helps maintain health and prevent disease. It is also important so that they can teach their kids how to use nutritional information to develop good eating habits. Fortunately, as a result of our living in the "information age", resources are increasingly available to help parents develop nutrition literacy in their children. Major federal agencies such as the FDA and the USDA maintain websites that now have pages specifically designed to develop health and nutrition literacy

in kids. Two examples are the *FDA Kids Page* and the USDA *MyPyramid* page. These are very useful tools to help kids learn how to vary the foods they eat, while obtaining sound nutrition and health-related knowledge. There is now an unprecedented amount of information about food, to help ensure that diets are nutritious so that consumers understand the nutritional content of the foods they purchase. While many options exist about the relative merits of various foods, there is increasing evidence that the traditional concept of a balanced diet containing a wide variety of foods should be a guiding nutrition principle. At the same time, however, with the growing number of fast food products widely available, it is becoming increasingly important for consumers to have nutrition literacy. Only with this information can people make intelligent judgments about the food they eat.

## Resources

### BOOKS


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### ORGANIZATIONS


American Diabetes Association. 1701 North Beauregard St., Alexandria, VA 22311. 1-800-342-2383. www.diabetes.org.

American Dietetic Association. 216 W. Jackson Blvd, Chicago, IL 60606-6995. 1-800-877-1600 ext. 5000.www.eatright.org.

American Society for Nutrition (ASN). 9650 Rockville Pike, Bethesda, MD 20814. (301) 634-7050. www.nutrition.org.

Food and Drug Administration, Center for Food Safety and Applied Nutrition. 5100 Paint Branch Parkway, College Park, MD 20740-3835. 1-888-723-3663. vm.cfsan.fda.gov.

Food and Nutrition Information Center. 10301 Baltimore Avenue, Beltsville, MD 20705-2351. www.nutrition.gov.

USDA Center for Nutrition Policy and Promotion (CNPP). 3101 Park Center Drive, 10th Floor, Alexandria, VA 22302-1594.<> (703) 305-7600. www.cnpp.usda.org.


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# O

## Obesity

### Definition

Obesity is an abnormal accumulation of body fat, usually 20% or more over an individual's ideal body weight. Obesity is associated with increased risk of illness, disability, and death.

The branch of medicine that deals with the study and treatment of obesity is known as bariatrics. As obesity has become a major health problem in the United States, bariatrics has become a separate medical and surgical specialty.

### Description

Obesity traditionally has been defined as a weight at least 20% above the weight corresponding to the lowest death rate for individuals of a specific height, gender, and age (ideal weight). Twenty to forty percent over ideal weight is considered mildly obese; 40–100% over ideal weight is considered moderately obese; and 100% over ideal weight is considered severely, or morbidly, obese. More recent guidelines for obesity use a measurement called BMI (**body mass index**) which is the individual's weight multiplied by 703 and then divided by twice the height in inches. BMI of 25.9–29 is considered overweight; BMI over 30 is considered obese. Measurements and comparisons of waist and hip circumference can also provide some information regarding risk factors associated with weight. The higher the ratio, the greater the chance for weight-associated complications. Calipers can be used to measure skin-fold thickness to determine whether tissue is muscle (lean) or adipose tissue (fat).

Much concern has been generated about the increasing incidence of obesity among Americans. Some studies have noted an increase from 12% to 18% occurring between 1991 and 1998. Other studies have actually estimated that a full 50% of all Americans are overweight. The World Health Organization terms obesity a worldwide epidemic, and the diseases which can occur due to obesity are becoming increasingly prevalent.

Excessive weight can result in many serious, potentially life-threatening health problems, including **hypertension**, Type II **diabetes mellitus** (non-insulin dependent diabetes), increased risk for coronary disease, increased unexplained heart attack, **hyperlipidemia**, infertility, and a higher prevalence of colon, **prostate**, endometrial, and, possibly, breast **cancer**. Approximately 300,000 deaths a year are attributed to obesity, prompting leaders in public health, such as former Surgeon General C. Everett Koop, M.D., to label obesity "the second leading cause of preventable deaths in the United States."

### Causes and symptoms

The mechanism for excessive weight gain is clear—more calories are consumed than the body burns, and the excess calories are stored as fat (adipose) tissue. However, the exact cause is not as clear and likely arises from a complex combination of factors. Genetic factors significantly influence how the body regulates the appetite and the rate at which it turns food into energy (metabolic rate). Studies of adoptees confirm this relationship—the majority of adoptees followed a pattern of weight gain that more closely resembled that of their birth parents than their adoptive parents. A genetic predisposition to weight gain, however, does not automatically mean that a person will be obese. Eating habits and patterns of physical activity also play a significant role in the amount of weight a person gains. Recent studies have indicated that the amount of fat in a person's diet may have a greater impact on weight than the number of calories it contains. **Carbohydrates** like cereals, breads, fruits, and vegetables and **protein** (fish, lean meat, turkey breast, skim milk) are converted to fuel almost as soon as they are consumed.

**Height and weight goals**

**Men**

| Height | Small frame | Medium frame | Large frame |
|---|---|---|---|
| 5'2" | 128–134 lbs. | 131–141 lbs. | 138–150 lbs. |
| 5'3" | 130–136 | 133–143 | 140–153 |
| 5'4" | 132–138 | 135–145 | 142–153 |
| 5'5" | 134–140 | 137–148 | 144–160 |
| 5'6" | 136–142 | 139–151 | 146–164 |
| 5'7" | 138–145 | 142–154 | 149–168 |
| 5'8" | 140–148 | 145–157 | 152–172 |
| 5'9" | 142–151 | 148–160 | 155–176 |
| 5'10" | 144–154 | 151–163 | 158–180 |
| 5'11" | 146–157 | 154–166 | 161–184 |
| 6'0" | 149–160 | 157–170 | 164–188 |
| 6'1" | 152–164 | 160–174 | 168–192 |
| 6'2" | 155–168 | 164–178 | 172–197 |
| 6'3" | 158–172 | 167–182 | 176–202 |
| 6'4" | 162–176 | 171–187 | 181–207 |

**Women**

| Height | Small frame | Medium frame | Large frame |
|---|---|---|---|
| 4'10" | 102–111 lbs. | 109–121 lbs. | 118–131 lbs. |
| 4'11" | 103–113 | 111–123 | 120–134 |
| 5'0" | 104–115 | 113–126 | 112–137 |
| 5'1" | 106–118 | 115–129 | 125–140 |
| 5'2" | 108–121 | 118–132 | 128–143 |
| 5'3" | 111–124 | 121–135 | 131–147 |
| 5'4" | 114–127 | 124–141 | 137–151 |
| 5'5" | 117–130 | 127–141 | 137–155 |
| 5'6" | 120–133 | 130–144 | 140–159 |
| 5'7" | 123–136 | 133–147 | 143–163 |
| 5'8" | 126–139 | 136–150 | 146–167 |
| 5'9" | 129–142 | 139–153 | 149–170 |
| 5'10" | 132–145 | 142–156 | 152–176 |
| 5'11" | 135–148 | 145–159 | 155–176 |
| 6'0" | 138–151 | 148–162 | 158–179 |

SOURCE: Doctors On-Line, Inc. "Height and Weight Goals as Determined by the Metropolitan Life Insurance Company."

## KEY TERMS

**Adipose tissue**—Fat tissue.

**Appetite suppressant**—Drug that decreases feelings of hunger. Most work by increasing levels of serotonin or catecholamine, chemicals in the brain that control appetite.

**Bariatrics**—The branch of medicine that deals with the prevention and treatment of obesity and related disorders.

**Ghrelin**—A recently discovered peptide hormone secreted by cells in the lining of the stomach. Ghrelin is important in appetite regulation and maintaining the body's energy balance.

**Hyperlipidemia**—Abnormally high levels of lipids in blood plasma.

**Hyperplastic obesity**—Excessive weight gain in childhood, characterized by the creation of new fat cells.

**Hypertension**—High blood pressure.

**Hypertrophic obesity**—Excessive weight gain in adulthood, characterized by expansion of already existing fat cells.

**Ideal weight**—Weight corresponding to the lowest death rate for individuals of a specific height, gender, and age.

**Leptin**—A protein hormone that affects feeding behavior and hunger in humans. At present it is thought that obesity in humans may result in part from insensitivity to leptin.

Most fat calories are immediately stored in fat cells, which add to the body's weight and girth as they expand and multiply. A sedentary lifestyle, particularly prevalent in affluent societies, such as in the United States, can contribute to weight gain. Psychological factors, such as depression and low self-esteem may, in some cases, also play a role in weight gain.

At what stage of life a person becomes obese can affect his or her ability to lose weight. In childhood, excess calories are converted into new fat cells (hyperplastic obesity), while excess calories consumed in adulthood only serve to expand existing fat cells (hypertrophic obesity). Since dieting and exercise can only reduce the size of fat cells, not eliminate them, persons who were obese as children can have great difficulty losing weight, since they may have up to five times as many fat cells as someone who became overweight as an adult.

Obesity can also be a side effect of certain disorders and conditions, including:

- Cushing's syndrome, a disorder involving the excessive release of the hormone cortisol
- hypothyroidism, a condition caused by an underactive thyroid gland
- neurologic disturbances, such as damage to the hypothalamus, a structure located deep within the brain that helps regulate appetite
- consumption of such drugs as steroids, antipsychotic medications, or antidepressants

The major symptoms of obesity are excessive weight gain and the presence of large amounts of

fatty tissue. Obesity can also give rise to several secondary conditions, including:

- arthritis and other orthopedic problems, such as lower back pain
- hernias
- heartburn
- adult-onset asthma
- gum disease
- high cholesterol levels
- gallstones
- high blood pressure
- menstrual irregularities or cessation of menstruation (amenorhhea)
- decreased fertility, and pregnancy complications
- shortness of breath that can be incapacitating
- sleep apnea and sleeping disorders
- skin disorders arising from the bacterial breakdown of sweat and cellular material in thick folds of skin or from increased friction between folds
- emotional and social problems

## Diagnosis

Diagnosis of obesity is made by observation and by comparing the patient's weight to ideal weight charts. Many doctors and obesity researchers refer to the body mass index (BMI), which uses a height-weight relationship to calculate an individual's ideal weight and personal risk of developing obesity-related health problems. Physicians may also obtain direct measurements of an individual's body fat content by using calipers to measure skin-fold thickness at the back of the upper arm and other sites. The most accurate means of measuring body fat content involves immersing a person in **water** and measuring relative displacement; however, this method is very impractical and is usually only used in scientific studies requiring very specific assessments. Women whose body fat exceeds 30% and men whose body fat exceeds 25% are generally considered obese.

Doctors may also note how a person carries excess weight on his or her body. Studies have shown that this factor may indicate whether or not an individual has a predisposition to develop certain diseases or conditions that may accompany obesity. "Apple-shaped" individuals who store most of their weight around the waist and abdomen are at greater risk for cancer, heart disease, stroke, and diabetes than "pear-shaped" people whose extra pounds settle primarily in their hips and thighs.

## Treatment

Treatment of obesity depends primarily on how overweight a person is and his or her overall health. However, to be successful, any treatment must affect life-long behavioral changes rather than short-term weight loss. "Yo-yo" dieting, in which weight is repeatedly lost and regained, has been shown to increase a person's likelihood of developing fatal health problems than if the weight had been lost gradually or not lost at all. Behavior-focused treatment should concentrate on:

- What and how much a person eats. This aspect may involve keeping a food diary and developing a better understanding of the nutritional value and fat content of foods. It may also involve changing grocery-shopping habits (e.g., buying only what is on a prepared list and only going on a certain day), timing of meals (to prevent feelings of hunger, a person may plan frequent, small meals), and actually slowing down the rate at which a person eats.
- How a person responds to food. This may involve understanding what psychological issues underlie a person's eating habits. For example, one person may binge eat when under stress, while another may always use food as a reward. In recognizing these psychological triggers, an individual can develop alternate coping mechanisms that do not focus on food.
- How they spend their time. Making activity and exercise an integrated part of everyday life is a key to achieving and maintaining weight loss. Starting slowly and building endurance keeps individuals from becoming discouraged. Varying routines and trying new activities also keeps interest high.

For most individuals who are mildly obese, these behavior modifications entail life-style changes they can make independently while being supervised by a family physician. Other mildly obese persons may seek the help of a commercial weight-loss program (e.g., **Weight Watchers**). The effectiveness of these programs is difficult to assess, since programs vary widely, drop-out rates are high, and few employ members of the medical community. However, programs that emphasize realistic goals, gradual progress, sensible eating, and exercise can be very helpful and are recommended by many doctors. Programs that promise instant weight loss or feature severely restricted diets are not effective and, in some cases, can be dangerous.

For individuals who are moderately obese, medically supervised behavior modification and weight loss are required. While doctors will put most moderately obese patients on a balanced, low-calorie diet

(1200–1500 calories a day), they may recommend that certain individuals follow a very-low-calorie liquid protein diet (400–700 calories) for as long as three months. This therapy, however, should not be confused with commercial liquid protein diets or commercial weight-loss shakes and drinks. Doctors tailor these diets to specific patients, monitor patients carefully, and use them for only a short period of time. In addition to reducing the amount and type of calories consumed by the patient, doctors will recommend professional therapists or psychiatrists who can help the individual effectively change his or her behavior in regard to eating.

For individuals who are severely obese, dietary changes and behavior modification may be accompanied by surgery to reduce or bypass portions of the stomach or small intestine. Although obesity surgery is less risky as of 2003 because of recent innovations in equipment and surgical technique, it is still performed only on patients for whom other strategies have failed and whose obesity seriously threatens their health. Other surgical procedures are not recommended, including liposuction, a purely cosmetic procedure in which a suction device is used to remove fat from beneath the skin, and jaw wiring, which can damage gums and teeth and cause painful muscle spasms.

Appetite-suppressant drugs are sometimes prescribed to aid in weight loss. These drugs work by increasing levels of serotonin or catecholamine, which are brain chemicals that control feelings of fullness. Appetite suppressants, though, are not considered truly effective, since most of the weight lost while taking them is usually regained after stopping them. Also, suppressants containing amphetamines can be potentially abused by patients. While most of the immediate side-effects of these drugs are harmless, the long-term effects of these drugs, in many cases, are unknown. Two drugs, dexfenfluramine hydrochloride (Redux) and fenfluramine (Pondimin) as well as a combination fenfluramine-phentermine (Fen/Phen) drug, were taken off the market when they were shown to cause potentially fatal heart defects. In November 1997, the United States Food and Drug Administration (FDA) approved a new weight-loss drug, sibutramine (Meridia). Available only with a doctor's prescription, Meridia can significantly elevate blood pressure and cause dry mouth, headache, **constipation**, and insomnia. This medication should not be used by patients with a history of congestive heart failure, heart disease, stroke, or uncontrolled high blood pressure.

Other weight-loss medications available with a doctor's prescription include:

- diethylpropion (Tenuate, Tenuate dospan)
- mazindol (Mazanor, Sanorex)
- phendimetrazine (Bontril, Plegine, Prelu-2, X-Trozine)
- phentermine (Adipex-P, Fastin, Ionamin, Oby-trim)

Phenylpropanolamine (Acutrim, Dextarim) is the only nonprescription weight-loss drug approved by the FDA These over-the-counter diet aids can boost weight loss by 5%. Combined with diet and exercise and used only with a doctor's approval, prescription anti-obesity medications enable some patients to lose 10% more weight than they otherwise would. Most patients regain lost weight after discontinuing use of either prescription medications or nonprescription weight-loss products.

Prescription medications or over-the-counter weight-loss products can cause:

- constipation
- dry mouth
- headache
- irritability
- nausea
- nervousness
- sweating

None of them should be used by patients taking monoamine oxidase inhibitors (MAO inhibitors).

Doctors sometimes prescribe fluoxetine (Prozac), an antidepressant that can increase weight loss by about 10%. Weight loss may be temporary and side effects of this medication include diarrhea, fatigue, insomnia, nausea, and thirst. Weight-loss drugs currently being developed or tested include ones that can prevent fat absorption or digestion; reduce the desire for food and prompt the body to burn calories more quickly; and regulate the activity of substances that control eating habits and stimulate overeating.

## Alternative treatment

Diuretic herbs, which increase urine production, can cause short-term weight loss but cannot help patients achieve lasting weight control. The body responds to heightened urine output by increasing thirst to replace lost fluids, and patients who use **diuretics** for an extended period of time eventually start retaining water again anyway. In moderate doses, psyllium, a mucilaginous herb available in bulk-forming laxatives like Metamucil, absorbs fluid and makes patients feel as if they have eaten enough. Red peppers and mustard help patients lose weight more quickly by accelerating the metabolic rate. They also make people more thirsty,

so they crave water instead of food. Walnuts contain serotonin, the brain chemical that tells the body it has eaten enough. Dandelion (*Taraxacum officinale*) can raise **metabolism** and counter a desire for sugary foods.

Acupressure and acupuncture can also suppress food **cravings**. Visualization and meditation can create and reinforce a positive self-image that enhances the patient's determination to lose weight. By improving physical strength, mental concentration, and emotional serenity, yoga can provide the same benefits. Also, patients who play soft, slow music during meals often find that they eat less food but enjoy it more.

Getting the correct ratios of protein, carbohydrates, and good-quality **fats** can help in weight loss via enhancement of the metabolism. Support groups that are informed about healthy, nutritious, and balanced diets can offer an individual the support he or she needs to maintain this type of eating regimen.

## Prognosis

As many as 85% of dieters who do not exercise on a regular basis regain their lost weight within two years. In five years, the figure rises to 90%. Repeatedly losing and regaining weight (yo yo dieting) encourages the body to store fat and may increase a patient's risk of developing heart disease. The primary factor in achieving and maintaining weight loss is a life-long commitment to regular exercise and sensible eating habits.

## Prevention

Obesity experts suggest that a key to preventing excess weight gain is monitoring fat consumption rather than counting calories, and the National Cholesterol Education Program maintains that only 30% of calories should be derived from fat. Only one-third of those calories should be contained in saturated fats (the kind of fat found in high concentrations in meat, poultry, and dairy products). Because most people eat more than they think they do, keeping a detailed food diary is a useful way to assess eating habits. Eating three balanced, moderate-portion meals a day—with the main meal at mid-day—is a more effective way to prevent obesity than fasting or crash diets. Exercise increases the metabolic rate by creating muscle, which burns more calories than fat. When regular exercise is combined with regular, healthful meals, calories continue to burn at an accelerated rate for several hours. Finally, encouraging healthful habits in children is a key to preventing **childhood obesity** and the health problems that follow in adulthood.

## New directions in obesity treatment

The rapid rise in the incidence of obesity in the United States since 1990 has prompted researchers to look for new treatments. One approach involves the application of antidiabetes drugs to the treatment of obesity. Metformin (Glucophage), a drug that was approved by the Food and Dug Administration (FDA) in 1994 for the treatment of type 2 diabetes, shows promise in treating obesity associated with insulin resistance.

Another field of obesity research is the study of hormones, particularly leptin, which is produced by fat cells in the body, and ghrelin, which is secreted by cells in the lining of the stomach. Both hormones are known to affect appetite and the body's energy balance. Leptin is also related to reproductive function, while ghrelin stimulates the pituitary gland to release growth hormone. Further studies of these two hormones may lead to the development of new medications to control appetite and food intake.

A third approach to obesity treatment involves research into the social factors that encourage or reinforce weight gain in humans. Researchers are looking at such issues as the advertising and marketing of food products; media stereotypes of obesity; the development of **eating disorders** in adolescents and adults; and similar questions.

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**ORGANIZATIONS**

American Dietetic Association. (800) 877-1600. www.eatright.org.

American Obesity Association (AOA). 1250 24th Street NW, Suite 300, Washington, DC 20037. (202) 776-7711 or (800) 98-OBESE. www.obesity.org.

American Society for Bariatric Surgery. 7328 West University Avenue, Suite F, Gainesville, FL 32607. (352) 331-4900. www.asbs.org.

American Society of Bariatric Physicians. 5453 East Evans Place, Denver, CO 80222-5234. (303) 770-2526. www.asbp.org.

HCF Nutrition Research Foundation, Inc. P.O. Box 22124, Lexington, KY 40522. (606) 276-3119.

National Institute of Diabetes and Digestive and Kidney Diseases. 31 Center Drive, USC2560, Building 31, Room 9A-04, Bethesda, MD 20892-2560. (301) 496-3583. www.niddk.nih/gov.

National Obesity Research Foundation. Temple University, Weiss Hall 867, Philadelphia, PA 19122.

Weight-Control Information Network. 1 Win Way, Bethesda, MD 20896-3665. (301) 951-1120. www.navigator.tufts.edu/special/win.html.

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# Omega-3 fatty acids

## Definition

Essential to human health, omega-3 fatty acids are a form of polyunsaturated **fats** that are not made by the body and must be obtained from a person's food.

## Purpose

Eating foods rich in omega-3 fatty acids is part of a healthy diet and helps people maintain their health.

## Description

In recent years, a great deal of attention has been placed on the value of eating a **low fat diet**. In some cases, people have taken this advice to the extreme by adopting a diet that is far too low in fat or, worse yet, a diet that has no fat at all. But the truth is that not all fat is bad. Although it is true that trans and saturated fats, which are found in high amounts in red meat, butter, whole milk, and some prepackaged foods, have been shown to raise a person's total cholesterol, polyunsaturated fats can actually play a part in keeping cholesterol low. Two especially good fats are the omega-3

**Mercury in fish**

| Least mercury | Moderate mercury (eat 3 servings or less per month) | Highest level (Avoid eating) |
|---|---|---|
| Anchovies | Bluefish | Mackerel (king) |
| Catfish | Grouper | Marlin |
| Clams | Mackerel (Spanish, Gulf) | Orange Roughy |
| Crab (domestic) | Sea Bass (Chilean) | Shark |
| Flounder | Tuna (canned albacore) | Swordfish |
| Haddock (Atlantic) | Tuna (yellowfin) | Tilefish |
| Herring | | |
| Mackerel (N. Atlantic, chub) | | |
| Oysters | | |
| Perch (ocean) | | |
| Pollock | | |
| Salmon (canned) | | |
| Salmon (fresh) | | |
| Sardines | | |
| Scallops | | |
| Shad (American) | | |
| Shrimp | | |
| Sole (Pacific) | | |
| Squid (calamari) | | |
| Tilapia | | |
| Trout (freshwater) | | |
| Whitefish | | |
| Whiting | | |

SOURCE: National Resources Defense Council

*(Illustration by GGS Information Services/Thomson Gale.)*

**Sources of Omega 6-Fatty Acids**

- Baked goods
- Brazil nuts
- Cereals
- Corn oil
- Cottonseed oil
- Eggs
- Hemp oil
- Meats from grass-fed animals
- Pecans
- Pine nuts
- Pumpkin oil
- Safflower oil
- Sesame oil
- Soybean oil
- Sunflower oil
- Sunflower seeds
- Wheat germ oil
- Whole grains

*(Illustration by GGS Information Services/Thomson Gale.)*

fatty acids and the omega-6 fatty acids, which are polyunsaturated.

Two types of omega-3 fatty acids are eicosapentaenoic acid (EPA) and docosahexanoic acid (DHA), which are found mainly in oily cold-water fish, such as tuna, salmon, trout, herring, sardines, bass, swordfish, and mackerel. With the exception of seaweed, most plants do not contain EPA or DHA. However, alpha-linolenic acid (ALA), which is another kind of omega-3 fatty acid, is found in dark green leafy vegetables, **flaxseed** oil, fish oil, and canola oil, as well as nuts and beans, such as walnuts and soybeans. Enzymes in a person's body can convert ALA to EPA and DHA, which are the two kinds of omega-3 fatty acids easily utilized by the body.

Many experts agree that it is important to maintain a healthy balance between omega-3 fatty acids and omega-6 fatty acids. As Dr. Penny Kris-Etherton and her colleagues reported in their article published in the *American Journal of Nutrition* an over consumption of omega-6 fatty acids has resulted in an unhealthy dietary shift in the American diet. The authors point out that what used to be a 1:1 ratio between omega-3 and omega-6 fatty acids is now estimated to be a 10:1 ratio. This poses a problem, researchers say, because consuming some of the beneficial effects gained from omega-3 fatty acids are negated by an over consumption of omega-6 fatty acids. For example, omega-3 fatty acids have anti-inflammatory properties, whereas omega-6 fatty acids tend to promote inflammation. Cereals, whole grain bread, margarine, and vegetable oils, such as corn, peanut, and sunflower oil, are examples of omega-6 fatty acids. In addition, people consume a lot of omega-6 fatty acid simply by eating the meat of animals that were fed grain rich in omega-6. Some experts suggest that eating one to four times more omega-6 fatty acids than omega-3 fatty acids is a reasonable ratio. In other words, as dietitians often say, the key to a healthy diet is moderation and balance.

### *The health benefits of omega-3 fatty acids*

There is strong evidence that omega-3 fatty acids protect a person against atherosclerosis and therefore against heart disease and stroke, as well as abnormal heart rhythms that cause sudden cardiac death, and possibly autoimmune disorders, such as lupus and rheumatoid arthritis. In fact, Drs. Dean Ornish and Mehmet Oz, renowned heart physicians, said in a 2002 article published in *O Magazine* that the benefits derived from consuming the proper daily dose of omega-3 fatty acids may help to reduce sudden cardiac death by as much as 50%. In fact, in an article published by *American Family Physician*, Dr. Maggie Covington, a clinical assistant professor at the University of Maryland, also emphasized the value of omega-3 fatty acids with regard to cardiovascular health and referred to one of the largest clinical trials to date, the GISSI-Prevenzione Trial, to illustrate her point. In the study, 11,324 patients with **coronary heart disease** were divided into four groups: one group received 300 mg of **vitamin E**, one group received 850 mg of omega-3 fatty acids, one group received the vitamin E and fatty acids, and one group served as the control group. After a little more than three years, "the group given omega-3 fatty acids only had a 45% reduction in sudden death and a 20% reduction in all-cause mortality," as stated by Dr. Covington.

According to the American Heart Association (AHA), the ways in which omega-3 fatty acids may reduce cardiovascular disease are still being studied. However, the AHA indicates that research as shown that omega-3 fatty acids:

- decrease the risk of arrthythmias, which can lead to sudden cardiac death
- decrease triglyceride levels
- decrease the growth rate of atherosclerotic plaque
- lower blood pressure slightly

In fact, numerous studies show that a diet rich in omega-3 fatty acids not only lowers bad cholesterol, known as LDL, but also lowers **triglycerides**, the fatty material that circulates in the blood. Interestingly, researchers have found that the cholesterol levels of Inuit Eskimos tend to be quite good, despite the fact that they have a high fat diet. The reason for this, research has found, is that their diet is high in fatty fish, which is loaded with omega-3 fatty acids.

The same has often been said about the typical Mediterranean-style diet.

Said to reduce joint inflammation, omega-3 fatty acid supplements have been the focus of many studies attempting to validate its effectiveness in treating rheumatoid arthritis. According to a large body of research in the area, omega-3 fatty acid supplements are clearly effective in reducing the symptoms associated with rheumatoid arthritis, such as joint tenderness and stiffness. In some cases, a reduction in the amount of medication needed by rheumatoid arthritis patients has been noted.

More research needs to be done to substantiate the effectiveness of omega-3 fatty acids in treating **eating disorders**, attention deficit disorder, and depression. Some studies have indicated, for example, that children with behavioral problems and attention deficit disorder have lower than normal amounts of omega-3 fatty acids in their bodies. However, until there is more data in these very important areas of research, a conservative approach should be taken, especially when making changes to a child's diet. Parents should to talk to their child's pediatrician to ascertain if adding more omega-3 fatty acids to their child's diet is appropriate. In addition, parents should take special care to avoid feeding their children fish high in mercury. A food list containing items rich in omega-3 fatty acids can be obtained from a licensed dietitian.

### *Mercury levels and concerns about safety*

A great deal of media attention has been focused on the high mercury levels found in some types of fish. People concerned about fish consumption and mercury levels can review public releases on the subject issued by the U. S. Food and Drug Administration and the Environmental Protection Agency. Special precautions exist for children and pregnant or **breastfeeding** women. They are advised to avoid shark, mackerel, swordfish, and tilefish. However, both the U.S. Food and Drug Administration and the Environmental Protection Agency emphasis the importance of dietary fish. Fish, they caution, should not be eliminated from the diet. In fact, Robert Oh, M.D., stated in his 2005 article, which was published in *The Journal of the American Board of Family Practice* "with the potential health benefits of fish, women of childbearing age should be encouraged to eat 1 to 2 low-mercury fish meals per week."

### *Contaminants and concerns about safety*

Other concerns regarding fish safety have also been reported. In 2004, Hites and colleagues assessed organic contaminants in salmon in an article published in *Science*. Their conclusion that farmed salmon had higher concentrations of polychlorinated biphenyls than wild salmon prompted public concerns and a response from the American **Cancer** Society. Farmed fish in Europe was found to have higher levels of mercury than farmed salmon in North and South America; however, the American Cancer Society reminded the public that the "levels of toxins Hites and his colleagues found in the farmed salmon were still below what the U.S. Food and Drug Administration, which regulates food, considers hazardous." The American Cancer Society still continues to promote a healthy, varied diet, which includes fish as a food source.

## Recommended dosage

The AHA recommends that people eat two servings of fish, such as tuna or salmon, at least twice a week. A person with coronary heart disease, according to the AHA, should consume 1 gram of omega-3 fatty acids daily through food intake, most preferably through the consumption of fatty fish. The AHA also states that "people with elevated triglycerides may need 2 to 4 grams of EPA and DHA per day provided as a supplement," which is available in liquid or capsule form. Ground or cracked flaxseed can easily be incorporated into a person's diet by sprinkling it over salads, soup, and cereal.

Sources differ, but here are some general examples:

- 3 ounces of pickled herring = 1.2 grams of omega-3 fatty acids
- 3 ounces of salmon = 1.3 grams of omega-3 fatty acids
- 3 ounces of halibut = 1.0 grams of omega-3 fatty acids
- 3 ounces of mackerel = 1.6 grams of omega-3 fatty acids
- 1 1/2 teaspoons of flaxseeds = 3 grams of omega-3 fatty acids

## Precautions

In early 2004, the U.S. Food and Drug Administration along with the the Environmental Protection Agency issued a statement that women who are or may be pregnant, as well as breastfeeding mothers and children, should avoid eating some types of fish thought to contain high levels of mercury. Fish that typically contain high levels of mercury are shark, swordfish, and mackerel, whereas shrimp, canned light tuna, salmon, and catfish are generally thought to have low levels of mercury. Because many people engage in fishing as a hobby, women should be sure

before they eat any fish caught by friends and family that the local stream or lake is considered low in mercury.

Conflicting information exists whether it is safe for patients with macular degeneration to take omega-3 fatty acids in supplement form. Until more data becomes available, it is better for people with macular degeneration to receive their omega-3 fatty acids from the food they eat.

### Side effects

Fish oil supplements can cause diarrhea and gas. Also, the fish oil capsules tend to have a fishy aftertaste.

### Interactions

Although there are no significant drug interactions associated with eating foods containing omega-3 fatty acids, patients who are being treated with blood-thinning medications should not take omega-3 fatty acid supplements without seeking the advice of their physicians. Excessive bleeding could result. For the same reason, some patients who plan to take more than 3 grams of omega-3 fatty acids in supplement form should first seek the approval of their physicians.

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Lee Ann Paradise

## Optifast

### Definition

Optifast is an all liquid diet. It is intended for significant weight loss in a short period of time, is intended only for the extremely obese, and must be completed under the supervision of a trained physician.

### Origins

Optifast is a line of products and an associated diet plan produced by the Novartis Medical Nutrition Corporation. The company is headquartered in Basel, Switzerland and produces many different pharmaceutical and general nutrition products including Gerber baby food. According to Novartis, since the company introduced Optifast in 1974, more than one million people have used the diet. It was the first all liquid very-low calorie physician monitored diet to be available commercially. Although the Optifast line began with pre-made drinks, it has grown to include soup mixes and nutrition bars. The company has also branched out to produce products and associated diet

**Optifast®**

| Optifast® product | Calories per serving | Protein (g) | Carbohydrates (g) | Fat (g) | Sodium (mg) | Potassium (mg) | Fiber (g) | % of DV vitamins and minerals |
|---|---|---|---|---|---|---|---|---|
| 800 ready to drink | 160 | 14 | 20 | 3 | 220 | 460 | 0 | 20–30 |
| 800 powder | 160 | 14 | 20 | 3 | 230 | 470 | 0 | 20–30 |
| HP powder | 200 | 26 | 10 | 6 | 480 | 800 | 0 | 35 |
| Nutrition bars | 160–70 | 8 | 23 | 4–5 | 150 | 230 | 4 | 40 |

Amounts vary with product flavors

*(Illustration by GGS Information Services/Thomson Gale.)*

plans intended for adolescent patients and patients undergoing gastric bypass surgery.

## Description

The Optifast diet generally consists of four phases: screening, active weight loss, transition, and maintenance. Novartis provides training for physicians and other healthcare professionals who are going to be involved in monitoring and providing support to patients on the Optifast diet. Novartis provides general guidelines for administering the diet, but each clinic or physician may offer whatever specific program they chose. Therefore, no two experiences with Optifast will necessarily be the same. The following is a general overview of what many clinics offer.

The first phase of the Optifast diet is screening. Optifast is only appropriate for massively obese people, generally those who have at least 50 pounds to lose or are experiencing obesity-related complications. In most cases the diet is only recommended for patients between the ages of 20 and 50. The physician will do a general health screening and various lab tests to determine if Optifast is likely to pose any special risks to the patient. During this time the patient may be able to meet the various support staff that he or she will be working with while on the diet, including the physician, nurses, lab technicians, psychologists, counselors, nutritionists, and anyone else who is going to be on the medical team.

After screening has been completed and it has been determined that the patient is a good match for the Optifast diet, the diet itself begins. This is the active weight loss phase and generally lasts from 4 to 6 weeks. During this phase the patient is on a fluid-only diet using Optifast products. These are nutritional drinks that come in a variety of flavors, and generally provide a total of fewer than 800 calories per day. This means that the Optifast diet is considered a very-low calorie diet (a diet providing fewer than 800 calories a day). Generally 5 Optifast drinks are consumed throughout the course of a day, and doing so provides the recommended daily allowance of **vitamins**, nutrients, proteins, and other substances necessary for good health.

During the active weight loss phase the patient meets with a physician once or more weekly to monitor progress and health. Lab tests may be repeated to check various levels such as cholesterol or blood glucose. As weight loss increases medication dosages may be altered, and the amount of Optifast consumed each day may be altered to fit changing caloric needs. Also during this time the patient will meet, usually in a group, with a trained psychologist or therapist to discuss any problems or obstacles he or she is facing. During these group meetings patients will begin to learn new behaviors and eating patterns to help them maintain their weight when they begin eating self-prepared foods again.

After the active weight loss phase is finished the transition phase begins. During this time the patient begins to replace the Optifast drinks with solid foods. Patients work with a nutritionist to help them learn to choose meals high in fruits, vegetables, and whole grains and low in **fats** and simple **carbohydrates**. During this period the patient continues to meet with the physician regularly and attend group classes. This phase usually lasts 4 to 6 weeks.

Once the transition to solid foods is complete the maintenance phase begins. During this phase the patient begins to practice the good eating and healthy living habits learned during the program. Exercise is emphasized as a way to help prevent the re-gaining of weight lost. Many clinics offer classes and meetings that patients can attend to help them as they try to keep the weight off.

Although the very-low calorie diet was the original Optifast product, the line has begun to branch out and now offers a variety of diets. One diet is used for patients who are going to undergo **bariatric surgery**, and can be administered both before and after the

## KEY TERMS

**Dietary supplement**—A product, such as a vitamin, mineral, herb, amino acid, or enzyme, that is intended to be consumed in addition to an individual's diet with the expectation that it will improve health.

**Gallstone**—Stones that form in the gallbladder or bile duct from excess cholesterol or salts.

**Laparoscopic**—Pertaining to a surgical procedure which uses an instrument which can be inserted into the body to view structures within the abdomen and pelvis.

**Mineral**—An inorganic substance found in the earth that is necessary in small quantities for the body to maintain a health. Examples: zinc, copper, iron.

**Type 2 diabetes**—Sometime called adult-onset diabetes, this disease prevents the body from properly using glucose (sugar).

**Very-low calorie diet**—A diet of 800 calories or fewer per day.

**Vitamin**—A nutrient that the body needs in small amounts to remain healthy but that the body cannot manufacture for itself and must acquire through diet.

surgery. This can help reduce complications and smooth the transition into a fluid-only diet after the surgery. Another diet is an Optifast diet intended for very obese adolescents. Optifast also offers bars and other products, which are not associated with its original fluid-only diet. In addition to the very-low calorie diet, diet plans with a more moderate quantity of calories per day are also available.

### Function

The Optifast diet is intended for significant weight loss by the extremely overweight. It is especially aimed at those people who have health problems related to **obesity** and who need to lose significant weight quickly to avoid serious health complications. The Optifast diet must be administered by a physician who is trained in using the Optifast system. Although the eligibility requirements for the Optifast program vary from clinic to clinic, generally a person must be at least 50 pounds overweight to be eligible for the Optifast diet. It is not intended for people interested in losing 10 or 20 pounds that are more a cosmetic problem than a serious medical issue.

### Benefits

There are many possible benefits to significant weight loss for the obese. These benefits can include both looking and feeling better, as well as having more energy. In addition to these general benefits there are many specific health benefits to weight-loss. These benefits tend to be even greater for people who are moderately or severely obese because a greater degree of obesity is generally associated with greater health risks.

Novartis Medical Nutrition, the makers of Optifast, reports that in 20,000 people studied who had completed 22 weeks of the Optifast diet, on average there was a weight loss of 52 pounds. This was a loss of 22% of body weight. They also report an average decrease of 29% in blood glucose levels, a 15% average decrease in total cholesterol, and an average decrease in blood pressure of 10%. Reductions in cholesterol and blood pressure can be especially significant in overall health gains from weight loss because they are important risk factors for heart disease.

Another possible benefit of the Optifast diet is an opportunity for the dieter to re-learn food habits and behaviors while on the all-liquid phase of the diet. During this time no food choices have to be made, the program is firmly outlined. Therefore it may provide an opportunity for the dieter to take a more objective look at some negative eating habits, and come up with positive ways of dealing with potential problems, before going back to eating self-prepared foods.

Some people also believe that Optifast may provide psychological benefits to dieters who have very significant amounts of weight to lose. It can be frustrating to lose one to two pounds a week if the eventual goal is weight loss of 100 pounds or more. A program like Optifast that allows a large quantity of weight loss in a short period of time may allow dieters to be encouraged by seeing results more quickly, possibly providing positive psychological benefits.

### Precautions

The Optifast diet is intended to be followed only under the supervision of a physician trained in administering the Optifast system. No very-low calorie diet should be undertaken without close medical supervision. It is also only intended for people who have large amounts of weight to lose, generally more than 50

pounds, or are experiencing significant complications from obesity. The Optifast diet can present significant health risks for people for whom it is not indented. The Optifast diet is not appropriate for pregnant or **breast-feeding** women.

### Risks

There are possible risks for any diet, but the risks associated with a very-low calorie diet can be more serious. Optifast is designed to be a complete replacement for all meals, so it contains the daily recommended amounts of vitamins and **minerals**. However, because these recommendations are made for the average, healthy adult, they are not necessarily right for everyone. Because severe obesity has many common complications, daily requirements of vitamins and nutrients should be considered carefully for each person thinking of beginning the Optifast diet.

Another risk of following a very-low calorie diet is an increased risk of gallstone formation. **Gallstones** are more likely to occur in women than men, and are more likely to occur during rapid weight loss or when following a very-low calorie diet such as Optifast. Other side effects of a very-low calorie diet can include nausea, fatigue, **constipation**, or diarrhea. In most cases these problems resolve in a few weeks and are not very severe.

Whenever a person loses a very large amount of weight in a very short time there are certain risks. Many medication dosages are prescribed based on a person's weight. Therefore what might be the right amount of medication when beginning the Optifast diet may be too much only a few weeks later when weight has been lost. In some cases this may cause an overdose. This is one of many reasons that it is critical to be under medical supervision during the Optifast diet, so medications can be adjusted appropriately as weight is lost.

### Research and general acceptance

Optifast has been used in many studies investigating the impact of very-low calorie diets. It has not been studied intensely in relation to other similar very-low calorie diets. It has been shown to have many positive outcomes, such as lowered cholesterol levels and reduced risks of cardiovascular disease. It has also been shown that in patients who are going to undergo laparoscopic adjustable gastric banding (a procedure in which a band is placed around the upper part of the stomach causing patients to feel full with less food) following the Optifast diet for 6 weeks prior to the procedure can reduce liver size and fat content, allowing surgeons better access and reducing the possibility of complications.

Although there are many documented benefits to the Optifast diet, there are some people who suggest there may be other, more beneficial diets with fewer possible negative side effects. It has been shown that very-low calorie diets such as Optifast are not any more effective at keeping weight off in the long run than more traditional diets. This suggests that for some people the risks and benefits of a very-low calorie diet should be assessed in regard to the long term effects, and not just the speed of original weight loss. Another reason that some people may prefer more traditional diets is that the Optifast diet can be prohibitively expensive. The diet can cost upwards of $2,000, depending on the clinic at which it is administered and how long the active weight loss and transition phases last.

### QUESTIONS TO ASK THE DOCTOR

- Do the possible benefits of this diet outweigh the possible risks?
- Is a very-low calorie diet right for me?
- What kind of support is available to help me maintain my weight loss?
- What kind of psychological support is available to me while on this diet?
- Do I have any special dietary needs that this diet might not meet?
- Does this diet pose any special risks for me?
- Are there any sign or symptoms that might indicate a problem while on this diet?

### Resources

#### BOOKS

Shannon, Joyce Brennfleck ed. *Diet and Nutrition Sourcebook*. Detroit, MI: Omnigraphics, 2006.

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**ORGANIZATIONS**

American Dietetic Association. 120 South Riverside Plaza, Suite 2000, Chicago, Illinois 60606-6995. Telephone: (800) 877-1600. Website: <http://www.eatright.org>

Novartis Medical Nutrition, US. 445 State Street, Fremont, MI 49412. Telephone: (800) 333-3785. Website: <http://www.novartisnutrition.com>

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Helen Davidson

# Optimum health plan

## Definition

The Optimum Health Plan is a program created by Andrew Weil, M.D. that uses ideas from integrative medicine to improve a dieter's physical and emotional health.

## Origins

Dr. Andrew Weil developed the Optimum Health Plan. He attended Harvard University, from which he received a bachelor's degree in biology in 1964. He then attended Harvard Medical School, from which he received his medical degree in 1968. Dr. Weil believes strongly in integrative medicine. Integrative medicine is described as choosing among the best of both conventional and alternative medicine. Conventional medicine is the scientific and technological medicine that most people think of when they think of going to a doctor or hospital. Alternative medicine encompasses techniques that are more natural, such as using herbs to try to heal patients. Integrative medicine attempts to choose the least invasive alternatives when attempting to help a patient and does not use all methods used in alternative medicine. Instead, it makes use of the ideas in alternative medicine that have been scientifically proven. In this way, doctors who practice integrative medicine try to treat the entire patient, including both physical and emotional components, using the best of alternative and conventional medicine.

Dr. Weil released his book *8 Weeks to Optimum Health: A Proven Program For Taking Full Advantage of Your Body's Natural Healing Power* in 1997. He released a revised and updated version of the book in 2006. He has also written a number of other books designed to go with his program including *;Maximizing the 8 Weeks to Optimum Health Plan*. He has released both a compact disc version on the program and a video version. He has authored a recipe book and many books on other topics in integrative medicine.

## Description

The Optimum Health Plan is available in a number of different formats. It is available in Dr. Weil's book *8 Weeks to Optimal Health,* in his 72 minute educational video of the same title, and online through the "My Optimum Health Plan" program on his Web site, <http://www.MyOptimumHealthPlan.com>. The idea behind the various Optimum Health Plan products is that for best results change should be accomplished slowly, one step at a time.

Dr. Weil lays out an eight week long plan that makes changes slowly over that time period, so that by the end of the program the dieter has made significant diet, exercise, and lifestyle changes, all accomplished little by little. Dr. Weil uses ideas behind integrative medicine, such as the idea that there is a tie between **mental health** and physical health, to make health and well-being recommendations for the whole person. This means that, according to integrative medicine, it is important to treat the entire person, even if the complaint or problem seems to be just medical, because the physical body and the mind and emotional aspects of a person are all interconnected. Dr. Weil believes in the uses of various aspects of both alternative medicine and conventional medicine, and his plan reflects this.

The Optimum Health Plan makes recommendations for diet, exercise, and emotional and spiritual well being. Dr. Weil advocates a diet that does not contain very much meat or other animal products. Instead, he advocates getting most **protein** from healthier sources such as **soy**. He also recommends a diet that includes a wide variety of fresh fruits and vegetables. He suggests that dieters stay away from most processed foods, especially fast foods, and instead prepare healthy, nutritious meals from fresh ingredients.

Dr. Weil makes recommendations about exercise, as well as many other aspects of health. He suggests **vitamins** and supplements, herbs, breathing exercises, relaxation, stress-reduction techniques, and other ideas to help make the dieter healthier in every respect. There are various changes to the plan suggested to help personalize it for people who have different

## KEY TERMS

**Alternative medicine**—a system of healing that rejects conventional, pharmaceutical-based medicine and replaces it with the use of dietary supplements and therapies such as herbs, vitamins, minerals, massage, and cleansing diets. Alternative medicine includes well-established treatment systems such as homeopathy, Traditional Chinese Medicine, and Ayurvedic medicine, as well as more-recent, fad-driven treatments.

**Conventional medicine**—mainstream or Western pharmaceutical-based medicine practiced by medical doctors, doctors of osteopathy, and other licensed health care professionals

**Dietary supplement**—a product, such as a vitamin, mineral, herb, amino acid, or enzyme, that is intended to be consumed in addition to an individual's diet with the expectation that it will improve health

**Integrative Medicine**—A medical outlook combining aspects of conventional and alternative medicines.

**Mineral**—An inorganic substance found in the earth that is necessary in small quantities for the body to maintain a health. Examples: zinc, copper, iron.

**Vitamin**—A nutrient that the body needs in small amounts to remain healthy but that the body cannot manufacture for itself and must acquire through diet.

concerns, such as seniors, pregnant women, people with diabetes, and others.

My Optimum Health Plan, the online version of Dr. Weil's program, allows dieters to customize their plans even further. Dieters can choose meal plans based on preferences, allergies, and dietary needs. The Web site also gives dieters access to recipes that go along with the meal plan, and the site will produce a shopping list for dieters to make grocery shopping easier.

The Website also provides dieters with an online diary where they can record their feelings and successes or frustrations as they follow the program. There is a mood tracker that lets dieters record their mood each time they log into the site so that they can observe any change in their mood over the course of the program.

Emotional support and increased emotional and spiritual well being is very important to all versions of the program. In addition to recommendations about meditation, deep breathing, and other ideas designed to reduce stress and foster a sense of peace and well-being, the online version of the program allows dieters to interact with other people trying to improve their lives through Dr. Weil's program. It provides message boards, tips, inspirational messages, and videos from Dr. Weil himself.

### Function

Dr. Weil believes that his Optimum Health Plan can help dieters in many ways. In addition to helping people lose weight, it is intended to lead to overall better health. He also says that his plan can help people age gracefully and can reduce the risk of many diseases. It can help dieters achieve a better quality of sleep at night, leading to more energy during the day. Overall he believes his plan can improve the health of dieters, physically, emotionally, and spiritually.

The Optimum Health Plan is intended to be a lifestyle-changing plan. It is intended to produce more than weight loss, although that is one of its benefits. The dieter is expected to continue to follow the recommendations of the plan well after the eight weeks are over. The plan is intended to have a lasting impact on all aspects of a dieter's daily life.

### Benefits

There are many benefits to losing weight if it is done at a moderate pace through healthy eating and increased exercise. The Optimum Health Plan would generally be considered appropriate for moderate weight loss through healthy living. **Obesity** is a risk factor for type 2 diabetes, cardiovascular disease, **hypertension**, and many other diseases and conditions. People who are the most obese are generally at the greatest risk for developing these diseases, and for having the most severe symptoms if the diseases do develop. Weight loss can reduce the risk of these and other obesity-related conditions, and can help reduce the severity of associated symptoms.

This plan may be of special benefit to dieters who have specific problems or concerns, such as seniors, people with diabetes, or pregnant women. The online version of the plan allows for customization of the meal plans to meet the needs of those who are trying to follow a **low sodium diet**, a diabetic-friendly diet, or have other health concerns. The book also provides recommendations that are targeted to these and other

groups. This may make the program easier to follow for these groups, and dieters may appreciate the special attention given to their particular needs and concerns.

Dieters may find the slow, step-by-step process encouraged by Dr. Weil to be a significant benefit of this plan. For many people, making huge lifestyle changes rapidly can be very difficult. Focusing on making small changes in one area of life at a time can make change seem more manageable. The eight-week time period of the plan is longer than that for many plans, but this may also benefit dieters because good habits take time to become ingrained, so by the end of the diet, dieters may find that they have many good habits already internalized. This may make it easier to continue with the recommendations of the plan after the eight weeks are over.

## QUESTIONS TO ASK THE DOCTOR

- Is this diet the best diet or lifestyle plan to meet my goals?
- Would a multivitamin or other dietary supplement be appropriate for me if I were to begin this diet?
- What kind of exercise might be appropriate for my lifestyle and fitness level?
- Is this diet appropriate for my entire family?
- Is it safe for me to follow this diet over a long period of time?
- Is this diet the best diet to meet my goals?

### Precautions

Anyone thinking of beginning a new diet should consult a physician or other medical professional. Each person is different, and daily requirements of calories, vitamins, **minerals**, and other nutrients can differ from person to person depending on age, weight, sex, activity level, the presence of certain diseases and conditions. A doctor can help a dieter determine if a diet is likely to be safe and effective for that dieter, and if is the best diet to meet the dieter's personal goals. Pregnant or **breastfeeding** women should be especially cautious because when a baby receives all of its nutrients from its mother what the mother eats can affect the baby's health and well-being.

When a diet or lifestyle plan recommends vitamins and mineral supplements or herbal supplements, it is especially important that the dieter discuss beginning such a regimen with his or her doctor. Although many therapies embraced by alternative medicine have scientific support, it is crucial that dieters discuss these therapies with their personal physician and do not attempt to undertake them without proper medical supervision.

### Risks

There are some risks to any diet. Anytime a dieter begins to eat a restricted diet there is some risk that not all the vitamins and minerals needed for good health will be consumed each day. A dietary supplement or multivitamin may help reduce these risks. Because supplements and vitamins have their own risks, and are not regulated by the Food and Drug Administration in the same way as prescription medicine, dieters should be cautious about which supplements they choose. Talking to a doctor can help dieters choose a multivitamin or supplement that is right for their individual needs.

### Research and general acceptance

There have not been any significant scientific studies done to determine the effectiveness of Dr. Weil's program. However, it is generally accepted that a healthy diet is one that contains many different fruits and vegetables, stress reduction, and exercise, as these all have positive effects on the body.

The United States Department of Agriculture makes recommendations for how many servings of each food group should be consumed each day for good health. This recommendations are in the MyPyramid food guidelines, and can be found at <http://www.MyPyramid.gov>. Any healthy diet should generally follow the guidelines as laid out in the MyPyramid guide. The Optimum Health Plan would meet these requirements for most people, but because of the recommendations against meat, dieters may want to ensure that they are getting enough servings from the meat and beans group. MyPyramid recommends that healthy adults eat the equivalent of 5–6.5 ounces from this food group each day.

Studies have shown that diet and exercise are more effective at producing long-term, sustainable weight loss when done in combination than either diet or exercise is, when done alone. The Optimum Health Plan advocates making changes in both of these areas slowly, which may add up to large positive outcomes in the long term.

### Resources

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#### ORGANIZATIONS

American Dietetic Association. 120 South Riverside Plaza, Suite 2000, Chicago, Illinois 60606-6995. Telephone: (800) 877-1600. Website: <http://www.eatright.org>

#### OTHER

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Tish Davidson, M.A.

# Oral health and nutrition

## Definition

Oral tissues, such as the gingiva (gums), teeth, and muscles of mastication (chewing muscles), are living tissues, and they have the same nutritional requirements as any other living tissue in the body.

## Description

When adequate, nutritious food is not available, oral health may be compromised by nutrient-deficiency diseases, such as scurvy. In contrast, when food is freely available, as in many industrialized societies, oral health may be compromised by both the continual exposure of the oral environment to food and the presence of chronic diseases, such as diabetes. The diet not only affects the number and kinds of carious lesions (cavities), but also is an important factor in the development of periodontal disease (gum disease).

According to the U.S. Surgeon General's report, *Healthy People 2010*, dental caries have significantly declined in the United States since the early 1970s. However, it remains an important concern, especially in specific subgroups in the U.S. population. For example, 80% of dental caries in children's permanent teeth are concentrated in 25% of the child and adolescent population, particularly in individuals from low socioeconomic backgrounds.

### *Factors Affecting Nutrition and Oral Health*

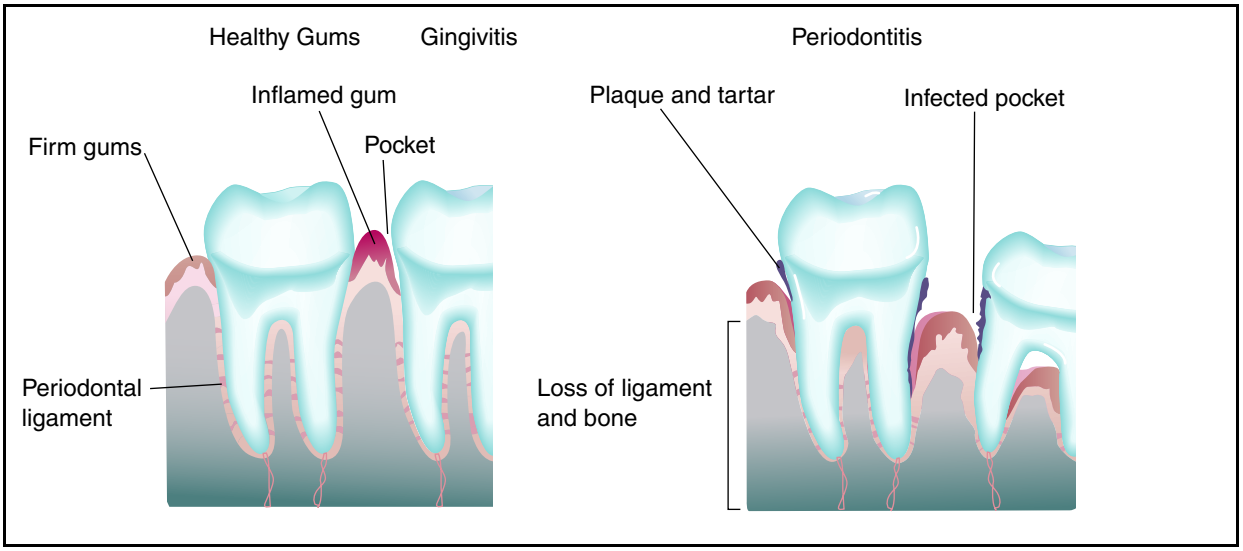
Sugar, particularly the frequent ingestion of sweets (cakes, cookies, candy), is related to both dental caries and periodontal disease. For example,populations with a frequent exposure to sugar, such as agricultural workers in sugar-cane fields (who may chew on sugar cane while they work), have a greater number of decayed, missing, and restored teeth. Sugar (sucrose), has a unique relationship to oral health. Sucrose can supply both the substrate (building blocks) and the energy required for the creation of dental plaque (the mesh-like scaffold of molecules that harbor bacteria on tooth surfaces). Sucrose also releases glucose during digestion, and oral bacteria can metabolize the glucose to produce organic acids. However, oral bacteria can also produce organic acids from foods other than sugar.

Oral health may be related to many nutritional factors other than sugar,including the number of times a day a person eats or drinks, the frequent ingestion of drinks with low acidity (such as fruit juices and both regular and diet soft drinks), whether a person is exposed to **fluoride** (through fluoridated **water**, fluoridated toothpaste, or fluoride supplements), and whether an eating disorder is present. Not only can the diet affect oral health, but also oral health can affect eating patterns. This is particularly true in individuals with very poor oral health, who may not be able to chew without pain or discomfort. Older,*edentulous* (having no teeth) patients who have had a stroke with the accompanying chewing and swallowing problems may be at significant nutritional risk, particularly if they are living alone and on a limited income. Finally, malnutrition (both undernutrition and overnutrition) have specific effects on oral health.

### *Undernutrition and Oral Health*

Although oral diseases associated with vitamin deficiencies are rare in the United States and other industrialized countries, they may be common in emerging "third-world" nations. In these countries, the limited supply of nutrient-dense foods or the lack of specific nutrients in the diet (**vitamin C**, **niacin**, etc.) may produce characteristic oral manifestations. In addition, unusual food practices, such as chewing sugar cane throughout the day or other regional or cultural nutritional practices, may decrease the oral health of specific populations.

Vitamin-deficiency diseases may produce characteristic signs and symptoms in the oral cavity (mouth). For example, in a typical B-vitamin deficiency, a person may complain that the tongue is red and swollen




**Healthy gums support the teeth. When gingivitis goes untreated, the gums become weak and pockets form aroun the teeth. Plaque and tartar build up in the pockets, the gum recedes, and periodontitis occurs.** *(Illustration by Argosy, Inc./Thomson Gale.)*

and "burns" (*glossitis*), that changes in taste have occurred, and that cracks have appeared on the lips and at the corners of the mouth (angular cheilosis). In a vitamin C deficiency, petechiae (small, hemorrhaging red spots) may appear in the oral cavity, as well as on other parts of the body, especially after pressure has been exerted on the tissue. In addition, the gums may bleed upon probing with a dental instrument.

In humans, **calcium** deficiency rarely, if ever, causes the production of hypoplastic enamel (poorly mineralized enamel) similar to the **osteoporosis** produced in bone. Teeth appear to have a biological priority over bone when calcium is limited in the diet.

Oral health problems associated with nutritional deficiencies occur not only in populations with a limited food supply. Individuals whose chewing and swallowing abilities have been compromised by oral **cancer**, radiation treatment, or AIDS may also exhibit signs and symptoms of nutritional deficiencies.

### *Overnutrition and Oral Health*

The proliferation of foods high in calories,fat, sugar, and salt, and low in nutritional content—such as that found in fast-food restaurants and vending machines—has created a "toxic" food environment in many industrialized countries, and this has had an important impact on oral health. Oral bacteria have the ability to synthesize the acids that dissolve tooth enamel from many different types of foods, not just sugar. Frequency of eating is a major factor related to poor oral health in infants, as well as children and adults. *Baby bottle tooth decay*, also called *nursing bottle caries*, is a term that refers to the caries formed when an infant is routinely put to sleep with a bottle. *Breastfeeding caries* is a condition associated with the constant exposure of an infant's oral environment to breast milk, while *pacifier caries* occurs when a pacifier is dipped in honey prior to inserting the pacifier into an infant's mouth.

Both childhood and adult **obesity** are on the rise, and they have reached epidemic proportions in some countries. Obesity is traditionally associated with increased rates of non-insulin-dependent diabetes; elevations in blood pressure; and elevated serum glucose, blood cholesterol, and triglycerides (blood fat)—but it is also associated with decreased oral health status. For example, the number of servings of fruit juice and soft drinks ingested each day is correlated not only with obesity in children, but also with increased caries. The American Academy of Pediatrics has warned parents on the overuse of fruit juices in **children's diets**.

Although diet soft drinks do not contain sugar, they do contain both carbonic and phosphoric acids and can directly destroy tooth enamel, particularly if the teeth are periodically exposed to a diet drink throughout the day. The direct demineralization of tooth enamel by regular and diet soft drinks has similarities to the demineralization of tooth enamel common in **anorexia nervosa**, in which forced regurgitation of food exposes lingual tooth surfaces (the side of the tooth facing the tongue) to stomach acids. In the case of enamel erosion produced by soft drinks and juices, effects are usually seen on all the tooth surfaces.

## KEY TERMS

**scurvy**—a syndrome characterized by weakness, anemia, and spongy gums, due to vitamin C deficiency.

**caries**—cavities in the teeth.

**sucrose**—table sugar.

**plaque**—material forming deposits on the surface of the teeth, which may promote bacterial growth and decay.

**glucose**—a simple sugar; the most commonly used fuel in cells.

**acidity**—measure of the tendency of a molecule to lose hydrogen ions, thus behaving as an acid.

**malnutrition**—chronic lack of sufficient nutrients to maintain health.

**undernutrition**—food intake too low to maintain adequate energy expenditure without weight loss.

**serum**—non-cellular portion of the blood.

### *Fluoride and Oral Health*

No discussion of nutrition and oral health would be complete without mentioning the role of the micronutrient fluoride. The addition of fluoride to the public drinking water supply is rated as one of the most effective preventive public health measures ever undertaken. Fluoride reduces dental caries by several different mechanisms. The fluoride ion may be integrated into enamel, making it more resistant to decay. In addition, fluoride may inhibit oral microbial **metabolism**, lowering the production of organic acids.

The relationship of nutrition to oral health includes much more than a simple focus on sugar's relationship to caries. It includes factors such as an individual's overall dietary patterns, exposure to fluoride, and a person's systemic health.

### Resources

#### OTHER

American Dental Association. "Oral Health Topics." Available from <http://www.ada.org>

American Dietetic Association. "Position of the American Dietetic Assoication: Oral Health and Nutrition." Available from < http://www.eatright.com>

U.S. Department of Health and Human Services. "Healthy People 2010." Available from <http://www.health.gov/healthypeople>

Warren B. Karp

# Organic food

## Definition

Organic foods are not specific foods, but are any foods that are grown and handled after harvesting in a particular way. In the United States, organic foods are crops that are raised without using synthetic pesticides, synthetic fertilizers, or sewage sludge fertilizer, and they have not been altered by genetic engineering. Organic animal products come from animals that have been fed 100% organic feed and raised without the use of growth hormones or antibiotics in an environment where they have access to the outdoors. Standards for organic foods vary from country to country. The requirements in Canada and Western Europe are similar to those in the United States. Many developing countries have no standards for certifying food as "organic."

## Purpose

The organic food movement has the following goals:

- improve human health by decreasing the level of chemical toxins in food
- decrease the level of agricultural chemicals in the environment, especially in groundwater
- promote sustainable agriculture
- promote biodiversity
- promote genetic diversity among plants and animals by rejecting genetically modified organisms (GMOs)
- provide fresh, healthy, safe food at competitive prices

## Description

Organic farming is the oldest method of farming. Before the 1940s, what is today called organic farming was the standard method of raising crops and animals. World War II accelerated research into new chemicals that could be used either in fighting the war or as replacements for resources that were in short supply because of their usefulness to the military. After the war ended, many of the new technological discoveries were applied to civilian uses and synthetic fertilizers, new insecticides, and herbicides became available. Fertilizers increased the yield per acre and pesticides encouraged the development of single-crop mega-farms, resulting in the consolidation of agricultural land and the decline of the family farm.

Organic farming, although only a tiny part of American agriculture, originally offered a niche

**Pesticides in fruits and vegetables**

| Highest level | Lowest level |
|---|---|
| Peaches | Onions |
| Apples | Avocados |
| Sweet bell peppers | Corn, sweet, frozen |
| Celery | Pineapples |
| Nectarines | Mango |
| Strawberries | Peas, sweet, frozen |
| Cherries | Kiwi |
| Pears | Bananas |
| Grapes, imported | Cabbage |
| Spinach | Broccoli |
| Lettuce | Papaya |
| Potatoes | Blueberries |

SOURCE: Developed by the Environmental Working Group

*(Illustration by GGS Information Services/Thomson Gale.)*

market for smaller, family-style farms. In the early 1980s this method of food production began to gain popularity, especially in California, Oregon, and Washington. The first commercial organic crops were vegetables that were usually sold locally at farmers' markets and health food stores.

By the late 1980s interest in organic food had reached a level of public awareness high enough that the United States Congress took action and passed the Organic Food Production Act of 1990. This act established the National Organic Standards Board (NOSB) under the United States Department of Agriculture (USDA). NOSB has developed regulations and enforcement procedures for the growing and handling of all agricultural products that are labeled "organic." These regulations went into effect on October 21, 2002.

Since the 1990s, the market for organic food has expanded from primarily fruits and vegetables to eggs, dairy products, meat, poultry, and commercially processed frozen and canned foods. In 2000, for the first time, more organic food was purchased in mainstream supermarkets than in specialty food outlets. By 2005, every state had some farmland that was certified organic, and some supermarket chains had begun selling their own brand-name organic foods. The demand for organic food is expected to continue to grow rapidly through at least 2010.

Organic certification is voluntary and applies to anyone who sells more than $5,000 worth of organic produce annually. (This exempts most small farmers who sell organic produce from their own farm stands). If a product carries the USDA Organic Seal indicating that it is "certified organic" it must meet the following conditions:

## KEY TERMS

**Biodiversity**—The presence of many different species of plants and animals within a limited geographical region.

**Pathogen**—An organism that causes a disease.

**Toxin**—A general term for something that harms or poisons the body.

- The product must be raised or produced under an Organic Systems Plan that demonstrates and documents that the food meets the standards for growing, harvesting, transporting, processing, and selling an organic product.
- The producer and/or processor are subject to audits and evaluations by agents certified to enforce organic standards.
- The grower must have distinct boundaries between organic crops and non-organic crops to prevent accidental contamination with forbidden substances through wind drift or water runoff.
- No forbidden substances can have been applied to the land organic food is raised on for three years prior to organic certification.
- Seed should be organic, when available, and never genetically altered through bioengineering.
- Good soil, crop, and animal management practices must be followed to prevent contamination of groundwater, contamination of the product by living pathogens, heavy metals, or forbidden chemicals, and to reduce soil erosion and environmental pollution.

To meet these requirements, organic farmers use natural fertilizers such as composted manure to add nutrients to the soil. They control pests by crop rotation and interplanting. Interplanting is growing several different species of plants in an alternating pattern in the same field to slow the spread of disease. Pest control is also achieved by using natural insect predators, traps, and physical barriers. If these methods do not control pests, organic farmers may apply certain non-synthetic pesticides made from substances that occur naturally in plants. Weed control is achieved by mulching, hand or mechanical weeding, the use of cover crops, and selective burning.

Animals products that are USDA certified organic must come from animals that are fed only organic feed, are not given growth hormones, antibiotics, or other drugs for the purpose of preventing

disease, and have access to the outdoors. This last requirement is rather vague, as regulations set neither a minimum amount of time the animal must spend outdoors nor any minimums concerning the amount of outdoor space available per animal.

## Selecting organic food

The USDA allows three label statements to help consumers determine if a food is organic.

- Labels stating "100% organic" indicate that all of the ingredients in the product are certified organic. These items have the USDA Organic Seal on the label.
- Labels stating "organic" indicate that at least 95% of the ingredients are certified organic. These items also carry the USDA Organic Seal on the label.
- Labels stating "made with organic ingredients" indicate that at least 70% of the ingredients are certified organic. These items are not permitted to have the USDA Organic Seal on the label.
- Items that contain fewer than 70% organic ingredients are not permitted to use either the word "organic" or the USDA Organic Seal on the label.

Consumers may be bewildered by other words on food labels such as "natural" or "grass-fed" that may be confused with organic. Natural and organic are not interchangeable. "Natural" foods are minimally processed foods but, they are not necessarily grown or raised under the strict conditions of organic foods. "Grass-fed" indicates that the livestock were fed natural forage ("grass"), but not necessarily in open pasture or for their entire lives.

Debate continues about the exact requirements to label animal products "cage-free," "free-range," or "open pasture." Cage-free simply means the animals were not kept caged, but does not necessarily mean that they were raised outdoors or allowed to roam freely. There is no certification process for the designation "cage-free." Animals can spend as little as five minutes per day outdoors and still be considered "free-range." Animal rights organizations are working to clarify these designations and improve the conditions under which all animals, are raised.

## Organic food and health

Certified organic food requires more labor to produce, which generally makes it more expensive than non-certified food. Some consumers buy organic food primarily because the way it is raised benefits the environment. Others believe absolutely in the health benefits of organic food. A larger group of consumers are uncertain if organic food offers enough health benefits to justify the additional cost.

Discussions of the health benefits of organic food can become quite heated and emotional. Advocates of buying organic foods firmly believe that they are preserving their health by preventing their bodies from becoming receptacles for poisonous chemicals that can cause **cancer**, asthma, and other chronic diseases. Non-organic food buyers take the position that the level pesticide and fertilizer residue in non-organic food is small and harmless. Neither side is likely to change the other's view. However, below are some conclusions from studies done comparing organic and non-organic foods.

- The food supply in the United States, whether organic or non-organic, is extremely safe.
- Fresh organic and non-organic produce are equally likely to become contaminated with pathogens such as *E. coli* that cause health concerns.
- Many, but not all, chemical contaminants can be removed from non-organic food by peeling or thorough washing in cool running water.
- Organic foods are not 100% pesticide and chemical free. However, their chemical load appears to be lower than that of non-organic foods.
- The nutrient value of identical organic and non-organic foods is the same.
- The long-term effect on humans of trace amounts of hormones, antibiotics, and drugs found in milk, meat, and other non-organic animal products is unclear.
- The long-term effect of genetically modified foods on both humans and the environment cannot yet be known.

## Precautions

Individuals should be informed about **food labeling** requirements and read food labels carefully so that they can make informed decisions about their purchases.

## Interactions

Organic food does not interact with drugs or other foods in a way that is different from non-organic foods.

## Complications

No complications are expected from eating organic food.

## Parental concerns

Chemicals found in foods may have a greater effect on the growth and development of younger children than older ones. Young children are rapidly growing while still developing their nervous system, immune system, and other organs. Chemicals may have a greater effect on these developing tissues than on adult tissues.

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National Organic Program. USDA-AMS-TM-NOP, ROOM 4008 s. Bldg, Ag Stop 0268, 1400 Independence Avenue, S.W., Room 1180, Washington, DC 20250. Telephone: (202)720-3252. Website: <http://www.ams.usda.gov/nop>

Organic Trade Association. PO Box 547, Greenfield MA 01302. Telephone: (413) 774-7511. Fax: (413) 774-6432. Website: <http://www.ota.com>


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Helen M. Davidson

# Orlistat

## Definition

Orlistat, also known as tetrahydrolipstatin (THL), is a drug used to treat **obesity** in conjunction with a low-calorie, **low-fat diet**. The anti-obesity drug is used as a medical aid to lose weight (weight loss) and to maintain that weight afterwards (weight maintenance). It is classified within the drug class called lipase inhibitors, where lipase is produced primarily in the pancreas. Orlistat is a crystalline power that is whitish in color. Chemically, it is the saturated derivative of lipstatin, which is isolated from *Streptomyces toxytricini*. The empirical chemical formula for orlistat is $C_{29}H_{53}NO_5$.

The drug orlistat was approved by the U.S. Food and Drug Administration (FDA) in 1999 for use within the United States. It was recommended for obese people with a **body mass index** (BMI) of more than 30 kilograms per square meters. It was also recommended when peoples' BMI was between 27 and 30 kilograms per square meters and other heath considerations such as high blood pressure, elevated blood cholesterol, or diabetes were detrimental to their lives. Medical studies, which paralleled previous conclusions, performed before orlistat was approved by the FDA found that when taken for six months, adults lost 12.4 to 13.4 pounds on average. Orlistat is marketed under the prescription name Xenical® and the over-the-counter name alli®.

## Purpose

Orlistat prevents the digestion and absorption of dietary **fats** into the bloodstream so that, instead, they pass through bowel movements within the feces. Consequently, they reduce the amount of calories that go into the human body. It is often used within a physician-supervised diet plan for obese people and as a maintenance plan for formerly obese people after they have lost weight. It is also used for people desiring to lose weight when they have such illnesses as diabetes, high cholesterol, heart disease, or high blood pressure.

## KEY TERMS

**Anorexia nervosa**—An eating disorder involving low body weight, distorted image of one's body, and fear of gaining weight.

**Bulimia**—An eating disorder that involves cycles of overeating and undereating.

**Cardiovascular disease**—Diseases that have to do with the heart and blood vessels (veins and arteries).

**Gastrointestinal**—Relating to the stomach and intestines.

**Hypertension**—Disease of the arteries that usually indicate high blood pressure.

**Immunosuppressant**—Suppression of the immune system.

**Lipase**—An enzyme produced from the pancreas that breaks down fats.

Inside the human body, orlistat diminishes the production of pancreatic lipase, which is an enzyme that decomposes **triglycerides** within the intestines. When pancreatic lipase is not present, triglycerides, which are ingested within foods, are stopped from being hydrolyzed into free fatty acids. They are, instead, excreted through bowel movements within feces without being digested. Orlistat, itself, is only slightly absorbed into the body. Most of it is taken into the gastrointestinal tract and eventually removed through the feces.

Orlistat was introduced into the marketplace primarily because of the increasing number of overweight or obese people in the United States and other countries around the world. According to the National Institutes of Health (NIH), as of 2007, about 65% of all U.S. adults are overweight or obese. NIH scientists have shown that being overweight or obese can lead to increased risk of developing health issues such as high blood pressure, heart disease, arterial disease, and type-2 diabetes. According to the World Health Organization (WHO), over one billion adults are overweight in the world, and at least 300 million of them are considered obese.

## Description

Orlistat is usually prescribed by medical professionals in a dosage of 120 milligrams three times per day, specifically after or during main meals. According to The Obesity Society, taking more than three dosages in one day has been shown ineffective at eliminating additional weight and, thus, is not recommended by medical doctors. Orlistat is available in a capsule that is taken orally (by mouth) during or up to one hour after the eating of main meals. It should be taken with a full glass of **water**.

According to the Mayo Clinic, these primary meals should contain no more than about 30% of fat by total calories. When used within these guidelines, about 30% of dietary fat is stopped from being absorbed into the body and, instead, is expelled through the feces.

The effectiveness of orlistat and, thus, the amount of weight loss achieved varies among humans. Orlistat, as of 2006, has been the most studied weight-loss medication on the international market. It has been used since 1999 in the United States and since 1998 in 145 other countries. Over 125 million people have used orlistat and more than 100 clinical studies with over 30,000 subjects have been performed. In all, it has been proved safe and efficient when used as prescribed.

A landmark one-year study, which concluded in 2007, was conducted by Xenical Pharmacology. The study shows that the drug reduces body mass by 5% or more in about one-third to one-half of the subjects and decreases body mass by at least 10% in about one-sixth to one-fourth of patients. The effectiveness and safety of orlistat have only been proven in four years or less of use.

## Precautions

Some side effects caused by the use of ortistat include gastrointestinal problems. Most problems reported happen within the first year of use, with the severity and number of problems diminishing over time. Because dietary fat is expelled with the feces, the stool may become oily, fatty, or loose. The color may change to an orange color. In addition, increased gas (flatulence) with noticeable discharge is frequently reported. Bowel movements are also more frequent and sometimes urgently sensed. It may become difficult to control bowel movements. Upon stopping the use of ortistat, feces return to normal fatty levels and color between 24 and 72 hours.

Some other common symptoms may include abdominal, rectal, or chest pain; diarrhea; chills; headache; fever; nasal congestion; runny nose; sneezing; sore throat; itching, hives, and skin rash and redness; swelling, and difficulty breathing and wheezing. These symptoms usually go away as the body becomes accustomed to the drug. Less common symptoms include tooth or gum problems, bloody or cloudy urine,

hearing loss, painful or difficult urination along with frequent urges to urinate, and ear pain and earache. If these side effects do not subside, contact a medical professional, especially with regards to abdominal pain or severe diarrhea.

To minimize side effects, foods with a high fat content should be avoided. Physicians recommend a low-fat, reduced-calorie diet when taking ortistat. In addition, a well balanced diet should consist of even proportions of **carbohydrates**, fat, and **protein** that are distributed throughout one day over three large meals. If a main meal is missed or contains no fat, the pill can be eliminated, too. It is recommended that whole-milk products be replaced with nonfat milk or 1% milk and low-fat or reduced-fat dairy items. Baked items and prepackaged, processed, and fast foods should be avoided because they are usually high in fat content. In general, people taking orlistat should actively read food labels before buying and eating in order to avoid foods high in fat.

Because orlistat can impair the absorption of **vitamins** (especially A, D, E. and beta-carotene, which are classified as fat-soluble vitamins) and other nutrients into the body, a multivitamin should be taken daily, at least two hours before or several hours after taking ortistat, or at bedtime.

## Interactions

Problems with interactions may arise if orlistat is taken along with anticoagulants (blood thinners) such as warfarin (Coumadin®). A physician should monitor patients who are taking both drugs. Orlistat can also cause problems with diabetic medicines such as glipizide (Glucotrol®), glyburide (DiaBeta®, Dynase®, Micronase®), metformin (Glucophage®, Diabex®, Fortamet®), and insulin. Diabetics should consult with their doctor because the amount of oral diabetic medicine may need to be changed when weight loss has occurred.

Orlistat can also reduce the effectiveness of cyclosporine while being taken as an immunosuppressant drug to reduce the body's risk of organ rejection after transplants. Make sure that cyclosporine is taken at least two hours before or after the taking of orlistat. The drug can also increase the absorption of pravastatin (Pravachol®, Selektine®), which is used to improve cholesterol levels and to prevent cardiovascular diseases.

The drug ortistat can also cause problems if other medicines for weight loss are taken along with the drug. According to the NIH, always consult with a medical physician before taking orlistat and to inform your doctor of any currently used medicines or allergic reactions (such as with animals, foods, dyes, or preservatives) before starting ortistat. Pregnant and nursing women should not take orlistat. Anyone with problems with an eating disorder, gallbladder, malabsorption syndrome (difficulty absorbing food), or kidney stones should not take orlistat.

## Complications

The use of orlistat has been shown to increase the risk of breast **cancer** and colon cancer. However, such medical claims are preliminary in nature and further scientific research is necessary. Orlistat has also been shown to increase the risk for problems with the gallbladder and kidneys, along with complications in pregnancies and **breastfeeding**. It may cause complications if patients have problems with **anorexia nervosa** or bulimia, and thyroid disease.

## Parental concerns

According to the Mayo Clinic, orlistat has only been tested on adults. Information is not currently available on how children are affected by orlistat. In addition, studies performed on pregnant animals do not show evidence of harm to fetuses. However, according to the Mayo Clinic, orlistat is not recommended for pregnant women. Also, due to lack of medical studies, it is not recommended for women who are nursing newborn babies. Proper dosage amounts for children have not been determined. When considering the use of orlistat for children, a medical professional should be consulted as to the amount given for each individual child.

On February 7, 2007, the FDA approved Alli® as an over-the-counter drug. Alli® is a lower dose version (60 milligrams) of the prescription drug Xenical®. Made by GlaxoSmithKline PLC, it is the first weight loss drug to be approved for over-the-counter (OTC) use. Partially due to controversy with its release, when buying Alli® the package also includes Welcome and Companion Guides, a Calorie and Fat Counter, Quick Fact Cards, a Guide to Healthy Eating, a Daily Journal, and free access to an online action program. The company recommends Alli® only to people over the age of 18 years. Consumer advocacy organizations, such as Public Citizen, opposed the easy availability of Alli® as being potentially dangerous to the health of consumers.

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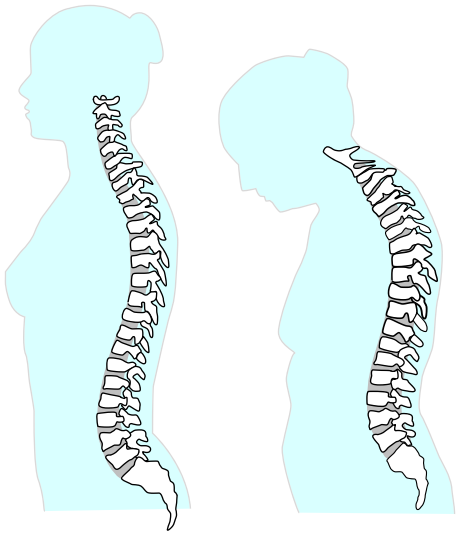
William Arthur Atkins

**Osteoporosis in the vertebrae**



SOURCE: National Women's Health Center, U.S. Department of Health and Human Services

**Osteoporosis is most common in the hips, wrist, and vertebrae (spine). The vertebrae are most important because these bones support the body to stand and sit upright. The vertebrae on the left is normal and the vertebrae on the right has been affected by osteoporosis.** *(Illustration by GGS Information Services/Thomson Gale.)*

# Osteoporosis

## Definition

Osteoporosis is a chronic disorder in which the mass of bones decreases and their internal structure degenerates to the point where bones become fragile and break easily.

## Description

Bone is living material. It is constantly broken down by cells called osteoclasts and built up again by cells called osteoblasts. This process is called bone remodeling, and it continues throughout an individual's life. Normally, more bone is built up than is broken down from birth through adolescence. In the late teens or early twenties, people reach their peak bone mass—the most bone that they will ever have. For twenty or so years, bone gain and bone loss remain approximately balanced in healthy people with good nutrition. However, when women enter menopause, usually in their mid to late forties, for the first 5to 7 years bone loss occurs at a rate of 1–5% a year. Men tend to lose less bone, and the loss often begins later in life. Osteoporosis occurs when bone loss continues and bones become so thin and their internal structure is so damaged that they break easily.

Bone remodeling occurs because bone is made primarily of **calcium** and phosphorous. Calcium is critically involved in muscle contraction, nerve impulse transmission, and many metabolic activities within cells. To remain healthy, the body must keep the level of free calcium ions (Ca 2+) within a very narrow concentration range. Besides providing a framework for the body, bone acts as a calcium "bank." When excess calcium is present in the blood, osteoblasts deposit it into bones where it is stored. When too little calcium is present, osteoblasts dissolve calcium from bones and move it into the blood. This process is controlled mainly by parathyroid hormone (PTH) secreted by the parathyroid glands in the neck. As people age, various conditions cause them to take more calcium out of the "bone bank" than they deposit, and osteoporosis (which literally means porous bones) eventually develops. Osteoporosis is a silent disorder. It usually

## KEY TERMS

**Anorexia nervosa**—An eating disorder that involves self-imposed starvation.

**Menopause**—The time when women are no longer able to reproduce, the menstrual cycles stops, and physical changes occur that are often related to a decrease in the reproductive hormone estrogen.

**Systemic lupus erythematosus (SLE)**—A serious autoimmune disease of connective tissue that affects mainly women. It can cause joint pain, rash, and inflammation of organs such as the kidney.

shows no symptoms until bones become so weak that they fracture from a seemingly minor bump of fall. All bones in the body may be affected by osteoporosis, but spinal vertebrae, the hip, and the wrist and forearm are the bones most often broken.

### Demographics

The National Osteoporosis Foundation estimates that 10 million people in the United States over age 55 have osteoporosis, and another 34 million have lost enough bone mass to put them at high risk for developing the disorder. The National Institutes of Health estimate that 25 million people in the United States have osteoporosis. Since people rarely seek treatment until they have a bone fracture, accurate estimates are difficult to obtain. However, about 1.5 million fractures are attributed to osteoporosis in the United States each year. Internationally, in Europe 1 of every 8 people over age 50 will have a spinal fracture, suggesting a high rate of osteoporosis.

Osteoporosis is a disorder of older individuals. It rarely develops before age 50. and the likelihood of developing it increases steadily with age. Eighty percent of the people who have osteoporosis are women, but there is a fair amount of variation among the rate in women of different ethnic groups. White women, especially those of northern European ancestry, are at highest risk of developing osteoporosis. Their rate is twice as high as Hispanic women and four times as high as black women. White men also are most likely to be affected, but the differences in the rate of osteoporosis among men of different races and ethnicities is smaller than among women.

### Causes and symptoms

Although the immediate cause of osteoporosis is loss of bone, there are many risk factors that increase the change of developing this condition. Age, race, gender, and heredity play a role in the development of osteoporosis, but other the risk factors are related to lifestyle. These include:

- cigarette smoking. Smoking causes the liver to destroy estrogen at a faster than normal rate .
- heavy alcohol consumption. Alcohol can interfere with calcium absorption.
- lack of exercise. Weight bearing exercises help increase bone mass.
- too much strenuous exercise in women. Extreme exercise causes menstrual cycles to stop (amenorrhea), reducing estrogen levels.
- Poor diet. Vitamin D and calcium are both necessary to build strong bones.

Medical conditions and treatments can also cause osteoporosis. These include:

- conditions that cause low testosterone levels in men (e.g. hypogonadism)
- cancer or treatment with certain chemotherapy drugs (e.g. cyclosporine A).
- early hysterectomy or removal of the ovaries. This reduces the level of estrogen in the body.
- use of anticonvulsant drugs (e.g. phenytoin, carbamazepin). These cause vitamin D deficiency and reduce the amount of calcium absorbed from the intestine.
- long-term use of corticosteroids drugs (e.g. cortisone, prendisone) to treat conditions such as systemic lupus erythematosus (SLE) or rheumatoid arthritis. These drugs directly inhibit bone formation.
- Certain hormonal disorders such as Cushing syndrome where the body makes too many corticosteroids
- spinal cord injury that results in paralysis or any other medical condition that severely limits the individual's physical activity

Osteoporosis is a disorder that shows few obvious symptoms. Elderly individuals may begin to lose height and develop a curved upper back and what is sometimes called a dowagers hump. For most people, signs of osteoporosis only become apparent when they either fracture a bone or have a bone mineral density (BMD) test done.

## Diagnosis

Diagnosis begins with a medical history to determine whether what risk factors the individual has. The physician may order blood and urine tests to rule out other disorders. The definitive test for osteoporosis is a bone mineral density (BMD) test. The most commonly used BMD is called a dual-energy x-ray absorptiometry (DXA)test. This test measures the density of bone in the hip and spine. It is similar to an x ray, only with less exposure to radiation, and it is painless. Results are given as a T-score, with negative numbers indicating low bone mass. Occasionally the physician may order a bone scan. A bone scan checks for bone inflammation, fractures, bone **cancer**, and other abnormalities, but it does not measure bone density.

## Treatment

Osteoporosis cannot be cured but it can be treated with exercise (see Therapy), diet, and sometimes with medication. There are several types of prescription medications approved by the United States Food and Drug Administration for the treatment of osteoporosis.

- Antiresorptive medications slow or prevent bone from being broken down. These include alendronate sodium (Fosamax), ibandronate sodium (Boniva), etidronate (Didronel), and risedronate sodium (Actonel). If drug therapy is used, these medication are often the first choice.
- In women, estrogen therapy and hormone replacement therapy drugs increase the level of estrogen in the body and improve bone health. Because of side effects such as the increase in breast cancer, heart attacks, and stroke, these drugs are used less frequently. Most often they are used to treat other symptoms of menopause rather than specifically to treat osteoporosis.
- Selective estrogen receptor modulators (SERMs) such as raloxifene (Evista). These drugs are being developed to replace estrogen and hormone therapy drugs. They act on estrogen receptors in bone in a way that prevents the bone from being broken down.
- Parathyroid hormone stimulates the formation of new bone by activating more new osteoblasts. It is marketed as teriparatide (Fortéo)
- Calcitonin (Miacalcin, Calcimar, Cibacalcin) is a hormone that slows bone breakdown by inhibiting osteoclast activity.

## Nutrition/Dietetic concerns

Calcium and **vitamin D** are both essential to building and maintaining strong bones. Dairy products are a good source of these nutrients. Calcium supplements are recommended for many women who have difficulty getting enough calcium in their diet. Recommended dietary allowances (RDAs)and lists of foods that are high in calcium and vitamin D can be found in their individual entries. **Fluoride** also is needed to develop healthy bones and teeth.

People with the eating disorder **anorexia nervosa** are at especially high risk of developing osteoporosis later in life because they have poor, unbalanced diets. The menstrual cycle in girls with anorexia is often delayed in starting or if it has started, stops. In addition, people with anorexia almost never get enough calcium to build strong bones during adolescence and they make unusually larger amounts of cortisol, a corticosteroid made by the adrenal gland that causes bone loss. Although the effect of this eating disorder on bones will not be seen until the individual is older, failure to build strong, dense bones during the teen years substantially increases the risk of osteoporosis later.

## Therapy

Physical therapy involving weight-bearing exercises an help individuals of any age, even those who are frail or have chronic illnesses slow bone loss and regain muscle mass. Physical therapy exercises that emphasize improving strength, flexibility, coordination, and balance also decrease the risk of falls and fractures in individuals who have osteoporosis.

## Prognosis

Osteoporosis cannot be cured but preventive behaviors and treatment can slow its progression. Falls that result in hip and spine fractures present the greatest risk of complications. Almost one-fourth of people over age 50 who have hip fractures die within one year. Although women have two to three times more hip fractures than men, men with hip fractures die twice as often as women. One study found that six months after a hip fracture, only about 15% of individuals could walk across a room unaided. Many require long-term care. About 20% end up in nursing homes. Quality of life is greatly affected by osteoporosis.

## Prevention

Prevention should begin in childhood and the teenage years with healthy diet and plenty of physical activity to build strong bones. The higher the bone mass density in early adulthood, the greater the chance of avoiding or delaying the effects of osteoporosis.

Individuals need to get the RDA for calcium and vitamin D beginning in childhood and continuing through old age. Exercise at any age is also beneficial in slowing osteoporosis. A BMD test should be done every two years in older individuals. Medicare will usually pay for a BMD test every two years. Signs of osteoporosis should be treated as soon as they appear.

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National Institutes of Health Osteoporosis and Related Bone Diseases National Resource Center. 2 AMS Circle, Bethesda, MD 20892-3676. Telephone: (800) 624-2663(BONE) or (202) 223-0344. TTY: (202)466-4315. Fax: (202) 293-2356 Website: <http://www.osteo.org>

National Osteoporosis Foundation. 1232 22nd Street N.W., Washington, DC 20037-1292. Telephone: (202) 223-2226. Website: <http://www.nof.org/>


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Tish Davidson, A.M.



# Osteoporosis diet

## Definition

**Osteoporosis**, most commonly referred to as "thinning of the bones", is a disease in which bone mineral density is reduced. This can cause the bones become brittle and fragile and easily fracture. Although there is no cure for osteoporosis, it can be prevented. Healthy diets, along with weight bearing exercise, are key factors in the prevention and treatment of osteoporosis. The focus of the osteoporosis diet is on optimising bone health at every stage in life and is based on a normal balanced diet with an emphasis on **calcium** rich foods and **Vitamin D**.

## Origins

Osteoporosis is a worldwide health concern. 2007 figures (International Osteoporosis Federation (IOF) estimate it affects 75 million people in the United States (US), Europe and Japan and this is forecast to double in 50 years in line with increasing populations and increased life expectancy. In other parts of the world, such as Africa and Asia, the incidence is much lower, but according to the World Health Organisation (WHO), it is projected that the greatest increase in osteoporosis will take place in developing countries.Despite being one of the world's most common diseases, it is only now receiving international

**Vitamin D**

| Age | Adequate Intake, U.S. recommendations | | FAO/WHO recommendations | |
|---|---|---|---|---|
| Up to 50 yrs. | 200 IU/day | 5 mcg/day | 200 IU/day | 5 mcg/day |
| Adults 51–65 yrs. | | | 400 IU/day | 10 mcg/day |
| Adults 51–70 yrs. | 400 IU/day | 10 mcg/day | | |
| Adults 65≥ yrs. | | | 600 IU/day | 15 mcg/day |
| Adults 71≥ yrs. | 600 IU/day | 15 mcg/day | | |

FAO = Food and Agriculture Organization
WHO = World Health Organization
IU = International Unit
mcg = microgram

*(Illustration by GGS Information Services/Thomson Gale.)*

**Calcium**

| Age | U.S. Recommended Dietary Allowance (mg/day) | FAO and WHO recommendations (mg/day) |
|---|---|---|
| Children 1–3 yrs. | 500 | 500 |
| Children 4–6 yrs. | | 600 |
| Children 4–8 yrs. | 800 | |
| Children 7–9 yrs. | | 700 |
| Children 9–13 yrs. | 900 | |
| Children 10–18 yrs. | | 1,300 |
| Adolescents 14–18 yrs. | 1,300 | |
| Adults 19–50 yrs. | 1,000 | |
| Adults 19–65 yrs. | | 1,000 |
| Adults 50> yrs. | 1,200 | |
| Adults 65≥ yrs. | | 1,300 |
| Post-menopause women | | 1,300 |

FAO = Food and Agriculture Organization
WHO = World Health Organization
mg = milligram

*(Illustration by GGS Information Services/Thomson Gale.)*

recognition. As recent as 30 years ago it was thought weak and broken bones was an unavoidable consequence of growing old.

In 1984 a Consensus Development Conference on Osteoporosis, held by the National Institute of Health (NIH) in the US, highlighted the need for more information on the prevention and treatment of osteoporosis. This led to the establishment of the National Osteoporosis Foundation (NOF) US in 1985, followed the United Kingdom (UK) National Osteoporosis Society (NOS) in 1986 both of which are now members of the much larger IOF, based in France, formed in 1998. In 2004, the first US Surgeon General's Report on Bone Health & Osteoporosis listed vitamin D, calcium and exercise, as the three essential elements for optimal bone health. The importance of diet was further highlighted in 2006, by a report from the IOF "Bone Appetit:the role of food and nutrition in building and maintaining strong bones", which shared its title with the theme of World Osteoporosis Day.

### *Calcium and osteoporosis*

Research on recommended calcium intakes has focussed on either meeting requirements or on optimising bone density. Also calcium requirements for adults vary between geographic regions and cultures because of differing dietary, genetic and lifestyle factors, including physical activity and sun exposure. As such Calcium requirements vary from country to country.

In 1997, the American calcium guidelines were set significantly higher, than the previous recommendations set in 1989, following a 1994 National Institute of Health (NIH) conference on calcium intake. They recommended that calcium intakes in young people be increased to maximize peak bone mass and protect against osteoporosis. Calcium levels increased from 1,200 to 1,300 milligrams (mg) per day for adolescents and teens. Adults had an increase of 200mg to 1,000mg daily, while adults after 50 years were increased to 1,200 mg daily, 400 mg more than previously recommended.

In 2005, the United States Department of Agriculture (USDA) Dietary Guidelines for Americans increased the dairy serving for the first time from 2–3 a day to three a day (1 serving is approximately equal to 300 mg of calcium) since they were first published in 1980. This was to meet the higher recommended calcium intakes.

In contrast some other developed countries have lower recommended levels for example in the UK the 1998 recommended daily intakes are 550mg for children age 7 to 10, 800mg–1,000mg for age 15 to 18 ranges and 700–800mg for adults aged 19 to 50. The NOS also recommends 1200mg for those with osteoporosis. The UK Cambridge Bone Study, still on going in 2007, is determining whether young people aged 16 to 18 should increase calcium intakes to 1000 mg a day. In France for age 15 to 18, 1,200mg is recommended and in Nordic countries for boys the range is from 900mg.

Despite the higher recommendations surveys indicate that actual calcium intakes are often inadequate. According to the US National Health and Nutrition Examination Survey III (NHANES 1988–1994) all age groups, with the exception of young children, have an intake lower than the recommended level. The UK 2000 National Diet and Nutrition Survey (NDNS) of British young people aged 4 to 18, indicated only one in four girls is eating at least three portions of dairy products daily.

As a result of multiple factors influencing calcium requirements, in 2007 there is no single internationally accepted recommended calcium intake. In countries where osteoporosis is common, such as Western European, America and Canada and Japan, calcium intakes are based on the 2002 Food and Agriculture Organisation (FAO) and World Health Organization (WHO) recommendations.

### *Vitamin D and osteoporosis*

Vitamin D is important for the development and maintenance of bone. It helps the body absorb calcium

## KEY TERMS

**Adequate intake (AI)**—If insufficient data exists to determine the RDA, then an Adequate Intake or AI is given, which has a greater uncertainty than an RDA.

**Dietary Approaches to Stop Hypertension (DASH)**—Study in 1997 that showed a diet rich in fruits, vegetables and low fat dairy foods, with reduced saturated and total fat can substantially lower blood pressure.

**Food fortification**—The public health policy of adding essential trace elements and vitamins to foodstuffs to ensure that minimum dietary requirements are met.

**Hydroxylapatite**—The main mineral component of bone, of which Zinc is a constituent.

**International Osteoporosis Federation (IOF)**—Based in Switzerland it functions as a global alliance of patient, medical and research societies, scientists, health care professionals, and international companies concerned about bone health. Its aim is to develop a world wide strategy for the management and prevention of osteoporosis.

**Lactose Intolerance**—Is the condition in which lactase, an enzyme for the digestion of lactose, the major sugar found in milk, is not produced. Abdominal bloating, stomach ache and diarrhea are symptoms.

**National Osteoporosis Foundation (NOF)**—The USA's leading voluntary health organization solely dedicated to osteoporosis and bone health.

**National Osteoporosis Society (NOS)**—The only UK national charity dedicated to eradicating osteoporosis and promoting bone health in both men and women.

**Osteocalcin**—The second most abundant protein in bone after collagen required for bone mineralization.

**Osteomalacia**—The softening of the bones in adults caused by Vitamin D deficiency

**Osteoporosis**—Disease of the bone in which bone mineral density is reduced. Osteoporotic bones are more at risk of fracture.

**Peak bone mass**—The highest level of bone strength generally reached in the mid 20's.

**Pulses**—Peas, beans and lentils are collectively known as pulses. The term is reserved for crops harvested solely for the dry grain, so excludes green beans and green peas.

**Recommended dietary allowances (RDA)**—The average daily dietary intake level that is sufficient to meet the nutrient requirements of nearly all (approximately 98 percent) healthy individuals/

**Rickets**—The softening of the bones in children leading to fractures and deformity, caused by Vitamin D deficiency.

**Vegan**—A vegetarian who excludes all animal products from the diet.

and deposit it in the bone. A deficiency in Vitamin D can cause a softening of the bone. Rickets in children and osteomalacia in adults are examples of extreme vitamin D deficiency. Osteoporosis is an example of long-term low levels of vitamin D.

Similar to calcium, there are several factors that affect the required intake of Vitamin D, including exposure to sunlight and dietary intake. The Recommended Dietary Allowance (RDA) for adults was set in 1941 at 400 international units (IU) or 10 microgram (mcg) per day. This was the amount of vitamin D in a teaspoon of cod liver oil found to prevent rickets in infants. This RDA remained around this level until the National Academy of Sciences (NAS) released new guidelines in 1997. The new adequate intake (AI) was based on Vitamin D intakes required to achieve an optimal blood level of Vitamin D, 25-hydroxyvitamin D, in the absence of sun exposure. Results suggested a level of at least 500 IU (12.5 mcg) from which an RDA could be set. As there is still no agreed definition of optimum 25-hydroxyvitamin D status, dietary Vitamin D recommendations vary from country to country.

Adequate intakes for vitamin D, in the US and Canada (2007), range from 200 IU (5 mcg) for 0 to 50 years, 400 IU (10 mcg) for 51 to 70 years and 600 IU (15 mcg) for over 70 years.

In the UK, Government's Committee on Medical Aspects of Food Policy Panel on Dietary Reference Values says "No dietary intake (of Vitamin D) is necessary for adults living a normal lifestyle." However, children up to the age of two years are recommended to receive a supplement containing 280 IU (7mcg) of vitamin D daily. Pregnant and lactating women and those age 65 and over are advised to take 400 IU (10 mcg).

As with calcium, evidence from surveys show that intake levels fall below the recommendations. In the USA, the NHANES (1999-2000), found a prevalence of vitamin D insufficiency in healthy adults living in Canada and the United States despite their Vitamin D food fortification programs. The UK NDNS (1998) of people aged 65 years and over found that approximately 98% had vitamin D intakes below the level. The same survey in 1990 of people aged 4 to 18 years also found a low vitamin D state in a significant proportion of those surveyed. In both sexes, this problem increased with age and thought linked to less time spent outside.

As of 2007, the IOF recommends the 2002 The Food and Agriculture Organisation (FAO) and the World Health Organisation (WHO) recommended Vitamin D intakes, which are based on Western European, American and Canadian data.

In addition to calcium and Vitamin D there is some evidence to suggest that other nutrients are beneficial to bone health such as **magnesium**, **zinc**, **vitamins** A, B, C, and K, however some of the evidence is weak and controversial as discussed below.

## Description

The osteoporosis diet focuses on maintaining or building strong bones throughout life. The emphasis is on Calcium and Vitamin D, but a balanced diet, with adequate **protein** and fresh fruits and vegetables and moderate intakes of alcohol, is also recommended. Other nutrients, which may promote or hinder bone health, are also included in this section.

### *Nutrients that promote bone health*

**CALCIUM.** There are many foods that contain calcium, but not all are good sources because the calcium may not be well absorbed. Some non-dairy sources of calcium, such as cereals and pulses, contain compounds that bind to the calcium reducing its ability to be absorbed. For example, oxalates in spinach and rhubarb and phytates in pulses such as lentil, chickpeas and beans, and cereals and seeds. They do not however interfere with the absorption of calcium from other foods.

The most readily absorbed sources of dietary calcium include:

- Dairy products: These are rich sources of well-absorbed calcium and include foods such as milk, cheese, cream, yoghurt and fromage fraise. They are also a good source of other nutrients that that work together to help protect bone such as protein, Vitamin D, zinc and magnesium. Three servings of dairy foods daily is the recommendation. One serving is approximately 250ml milk, 200 g yoghurt and 40 g cheese, which provide 300mg calcium.
- Green leafy vegetables: These include broccoli, collard greens, mustard greens, kale and bok choy. Broccoli (85g) provides 34mg calcium
- Tinned fish: These need to fish with edible bones such as sardine, pilchards, and salmon. Tinned sardines (100g) provides 430mg calcium
- Nuts and seeds: Especially Brazil nuts and almonds. 6 almonds provides 31mg calcium
- Fruit: Especially oranges, apricots and dried figs. 1 orange provides 75mg calcium
- Tofu set with calcium: If it is prepared using calcium sulphate tofu (100g) contains 200–330mg calcium.

Some foods and drinks are fortified with calcium such as breads, cereals, orange juice and Soya milk (Soya milk doesn't naturally contain calcium). These products should be specifically labeled as such.

**VITAMIN D.** It is made in the body by the action of the sun on the skin and a fifteen-minute walk each day usually provides all the vitamin D the body needs. Vitamin D is also fat-soluble vitamin found mainly in foods of animal origin.

Dietary sources of Vitamin D include:

- Oily fish: Salmon, tuna, mackerel, and sardines. Tinned sardine (100g) provides 260 IU Vitamin D
- Liver: Cooked liver (100g) provides 17 IU Vitamin D
- Egg yolk: 1 whole egg provides 20 IU Vitamin D
- Fish oil: 1 tablespoon provides 1360 IU Vitamin

In some countries vitamin D is added to breakfast cereals, grain products and pastas, milk, milk products, margarine, and infant formula. In the US milk has been fortified since the 1930's, which almost eliminated rickets. In 2003 the Food and Drug Administration (FDA) approved the fortification of calcium-fortified juice and juice drinks. Canada has mandatory fortification of milk and margarine. In the UK, all margarine is fortified with vitamin D and it is added voluntarily to other fat spreads and some breakfast cereals. In Australia, margarine and some milk products are fortified. Finland introduced fortification of milk and margarines in 2003, while other European countries do not allow for any food fortification.

**PROTEIN.** During growth, low protein intakes can impair bone development increasing the risk for osteoporosis later in life. Protein is also important for maintaining muscle mass and strength. This is particularly important for the elderly to help prevent falls and fractures.

Protein sources include lean red meat, poultry, eggs, fish and diary as well as legumes (lentils, kidney beans), tofu, soymilk, vegetables, nuts, seeds and grains. There has been some conflict regarding the effect of animal versus vegetable protein on bone health. This will be discussed in the research and acceptance section.

**FRUIT AND VEGETABLES.** The Framington Heart Study (1948–1992) showed that lifelong dietary intakes of fruit and vegetables have beneficial effects on bone mineral density in elderly men and women. A 2006 British study also suggests that fruit and vegetable intakes may have positive effects on bone mineral in adolescents as well as older women. As of 2007, the nutrients, which are thought to improve bone mineral density, are still to be determined. It may be due to their alkaline nature, which neutralizes acids of digestion without using the buffering effects of calcium, or to their **vitamin C**, beta-carotene, **vitamin K**, magnesium or potassium content. As such the recommendations are to aim for at least five portions of fruit and vegetable a day.

**VITAMIN K.** Vitamin K is required for the production of osteocalcin, which is important for bone mineralisation. It seems Vitamin K may not only increase bone mineral density in osteoporotic people, but also reduce fracture rates. However, the mechanism is not well understood and in 2007, there is still inadequate evidence to show adding vitamin K would be effective in preventing or treating osteoporosis. Good dietary sources of Vitamin K are green leafy vegetables such as spinach, lettuce, cabbage, kale, liver and fermented cheeses and soybeans. Keeping to the recommendation of 5 portions of fruit and vegetables a day can help optimise Vitamin K intakes.

**MAGNESIUM.** Magnesium is a mineral that helps keep blood calcium levels constant. The elderly are at most risk of low magnesium levels, as magnesium absorption rates decrease and excretion rates increase with age. However, as of 2007, no studies recommend magnesium supplementation for preventing or treating osteoporosis. Good food sources of magnesium are green leafy vegetables, legumes, nuts, seeds and whole grains.

**ZINC.** Zinc is a constituent of hydroxylapatite, the main mineral component of bone. Dietary sources include whole grain products, brewer's yeast, wheat bran and germ, seafood and meats and poultry. Zinc from animal sources are more easily absorbed than vegetable sources, so vegetarians may be at risk for low levels of zinc.

### *Nutrients that hinder bone health*

**ALCOHOL.** Moderate alcohol intake of 2 units of alcohol /day is not thought to be harmful to bone health. However, studies show that more than 2 units/day are associated with a decrease in bone formation.

**CAFFEINE.** **Caffeine** has been implicated as a factor for osteoporosis, but without any convincing evidence up to 2007. Moderate consumption of caffeine, 400mg/d, the equivalent of 3 to 5 cups of coffee, depending on the size and strength, can be taken as part of a healthy diet.

**SOFT DRINKS.** In 2007 there were suggestions that the high phosphate content of carbonated cola drinks can result in low peak bone mass. However, there is no conclusive evidence that supports the claim. The problem tends to be the soft drinks displace milk in the diets of children and teenagers. The advice is to consume these drinks in moderation.

**SALT.** A high salt (**sodium**) intake increases excretion of calcium in the urine, so is considered a risk factor for bone loss and osteoporosis.

**VITAMIN A.** **Vitamin A** plays an important part in bone growth, but too much in the form of retinol, found in foods of animal origin such as liver, fish liver oils and dairy products, may promote fractures. Vitamin A as carotene, in green leafy vegetables and red and yellow fruits and vegetables, does not appear to cause problems. As of 2007, more studies are recommended.

**BOTANICAL MEDICINES OR HERBAL SUPPLEMENTS.** Herbalists and Chinese medicine practitioners believe that certain herbs can slow the rate of bone loss. Some commonly recommended products are ones containing calcium carbonate or silica such as horsetail, oat straw, alfalfa, licorice, marsh mallow, yellow dock, and Asian **ginseng**. Natural hormone therapy, using plant estrogens (from soybeans) or progesterone (from wild yams), may be recommended for women who cannot or choose not to take synthetic hormones. However, because the FDA does not regulate the manufacture and distribution of herbal substances in the United States, no quality standards currently exist. Individuals need to discuss use of these substances with their doctor or pharmacist or dietitian.

## Function

Bone density at any time depends on the amount of bone formed by the early 1920s. Fracture risk is highest in those who do not achieve peak bone mass (the highest level of bone strength) in early life and or lose bone rapidly with age and menopause. Increased calcium intakes during the growth phase of childhood and adolescence maximizes peak bone mass. An increase of 10% in peak bone mass in adolescence

reduces the risk of an osteoporotic fracture by 50% during adulthood.

Once peak bone mass s is achieved, bone turnover is stable in both sexes until mid 1940s and so the nutritional requirement for calcium remains stable during this time. However, even after reaching full skeletal growth, adequate calcium intake is important because the body loses calcium every day through shed skin, nails, hair, sweat, urine and feces.

Bone loss begins from about 40 years. It is part of the normal ageing process and for women this bone loss is also accelerated further at the time of menopause. In addition, intestinal calcium absorption decreases and calcium excretion in the urine increases, so the body will compensate for low blood calcium levels by drawing on calcium in the bones. A decreased capacity of the skin to synthesize Vitamin D and less exposure to sunlight due to decreased mobility also makes the elderly high risk for low Vitamin D levels. Increasing calcium and Vitamin D from the diet therefore becomes more important.

The guidelines are important for age related bone loss as well as other groups at risk for developing osteoporosis such as:

- People allergic to diary products or with severe lactose intolerance avoid milk based products and foods containing milk products. Fortified soy or rice milks are adequate substitutes to meet calcium requirements, but they are not suitable for infants. Specialized milk substitute formulae are required for infant feeding. Green leafy vegetables, sardines, salmon, soymilk and calcium-fortified foods are all milk - free foods that are rich in calcium and vitamin D. Some lactose intolerant individuals may be able to tolerate some milk products as part of a meal, such as Swiss cheese and cottage cheese, which are naturally low in lactose.
- Vegans do not eat any products of animal origin, which includes milk and dairy products. Important calcium foods for Vegans include tofu, fortified Soya milk, green leafy vegetables, seeds, nuts and calcium fortified foods.
- Populations with limited exposure to sunlight, such as those in the northern latitudes, cover up for religious reasons or use sunscreen due to concerns about skin cancer and other skin diseases need to depend more on dietary sources of Vitamin D. Darker skinned people also make less Vitamin D from sunlight.
- Individuals who have problems with fat absorption may have low Vitamin D levels. As Vitamin D is fat-soluble, it requires some digestion of fat for absorption. A reduced ability to absorb fat is associated with conditions such as Cystic Fibrosis, Crohn's Disease, and Celiac disease
- Individuals on long-term oral corticosteroids, including those with asthma, arthritis or chronic obstructive pulmonary disease (COPD) have an increased risk of developing osteoporosis. Steroids contribute to increased osteoclast activity (bone break down) and inhibit osteoblast formation (bone building). Steroids also interfere with the absorption of calcium in the small intestine.

For those populations at risk for osteoporosis, calcium and Vitamin D supplements may be needed to meet daily requirement. The types of supplements available vary by country, so individuals should take medical advice before using them.

## Benefits

Three portions of low fat diary foods along with plenty of fruits and vegetables can help to lower blood pressure as shown in the DASH (Dietary Approaches to Stop **Hypertension**) study.

Research in 2003 looking at weight loss in over weight individuals showed diets high in low fat diary may contribute to lower body fat, especially in combination with a lower calorie intake. Increased dietary calcium is thought to bind more fatty acids in the colon, inhibiting fat absorption. It may also directly affect whether adipocytes store or break down fat.

Research supported by the U. S. National Cancer Institute and published in 2007 suggests diets rich in calcium, Vitamin D and diary foods may reduce the risk of colon cancer by 28%. The American Cancer Society encourages the inclusion of low-fat and fat-free dairy foods in a healthy diet, as part of their recommendations for cancer risk reduction.

## Precautions

For those who have high cholesterol, low-fat dairy products are recommended to meet their calcium requirements. Low fat alternatives have the same amount of protein and up to 20% higher in calcium, with less total and saturated fat than full fat products.

Calcium also has the potential to compete with the absorption of other important **minerals**, such as **iron**. Individuals with iron deficiency and taking iron supplements should avoid taking them at the same time.

## Risks

In the 2004 Nurses' Health Study II study, younger women age 27 to 44 who ate three or more

## QUESTIONS TO ASK YOUR DOCTOR

- With a family history of osteoporosis, should I take a calcium supplement?
- Do I need to take a Vitamin D supplement if I avoid sun exposure?
- If I don't eat diary foods, how can I get enough calcium in my diet?
- Does eating too much protein increase my risk of osteoporosis
- Will too much dairy cause kidney stones?

servings of dairy reported a 27% lower incidence of kidney stones than those who did not. However, higher levels of supplemental calcium in older men and women may be associated with an increased risk of kidney stones.

High calcium intakes may also increase **prostate** cancer risk. A 2001 Harvard School of Public Health study showed that men consuming the most dairy products had about 32% higher risk of developing prostate cancer than those consuming the least.

The recommendation is not to avoid calcium, but keep to the recommended guidelines of 1000mg for adults and not to exceed the upper limit set at 2000–2500mg of calcium per day.

Health concerns with too much Vitamin D are rare. Excess vitamin D is generally the result of taking high dose of supplements rather than from too much sunlight or food sources alone. The tolerable upper intake level (UL) for vitamin D at 1,000 IU (25 mcg) for infants up to 12 months of age and 2,000 IU (50 mcg) IU for children, adults, pregnant, and lactating women.

### Research and general acceptance

Adequate calcium and Vitamin D are key to reducing the risk of osteoporosis and this is the general acceptance all mainstream medical associations, member societies of the IOF, and part of the recommended dietary guidelines for many countries.

In 2007, The FDA is proposing to allow dairy processors and other food manufacturers to use new label language to promote the health benefits of calcium. Currently, a sample claim is "Regular exercise and a healthy diet with enough calcium helps teen and young adult white and Asian women maintain good bone health and may reduce their high risk of osteoporosis later in life". Under a proposed new rule, milk cartons, yogurt packages and even some fat-free cheeses could soon display wording to the effect that Vitamin D and calcium can help reduce the risk of osteoporosis and promote bone health.

However, there is still the continued debate on the benefit of consuming the large amounts of calcium currently recommended for adults. Countries with high calcium intakes such as America and Sweden have some of the highest rates of osteoporosis. In contrast, countries such as the Gambia, China, Peru and India, have a much lower fracture incidence, despite an average calcium intake of 300mg/d, less than a third the amount recommended in the USA. Differing dietary, genetic and lifestyle factors, including physical activity and sun exposure may account for the low fracture rate, but there are some thoughts that the differences are related to high intakes of animal protein, of which diary is included. High protein increases the acid load in the body. In order to neutralize the acid, the body pulls calcium from bones, which may increase bone loss and increase the risk of osteoporosis. As such there are thoughts that the focus of the guidelines should be aimed at encouraging everyone to eat more calcium-rich plant-based foods, instead of consuming more dairy foods. Fruits and vegetables are considered alkali rich foods that do not need neutralizing and as such are more beneficial to bone health. In addition, they are low in calories, full of **fiber** and **antioxidants**. As of 2007, recommendations are that more studies are needed to understand the consequences of this acid- base balance for skeletal health in the long term.

### Resources

#### BOOKS

Brown, Susan E. *Better bones, Better Body: beyond Estrogen and Calcium* McGraw-Hill; 2 edition (April 1, 2000). This book looks at osteoporosis from a wider perspective that includes lifestyle and exercise. It includes an osteoporosis risk assessment questionnaire and a step-by-step program for strengthening bones and improving overall health and well-being.

#### PERIODICALS

Celia J Pryrme, Gita D Mishra, Maria A O'Connell, et al."Fruit and Vegetable Intakes and Bone Mineral Status: A Cross-Sectional Study in 5 Age and Sex Cohorts" *American Journal of Clinical Nutrition* 2006, 83: 1420-1428

Park SY, Murphy SP, Wilkens LR, Nomura AMY, Henderson BE and Kolonel, LN . "Calcium and Vitamin D Intake and Risk of Colorectal Cancer: The Multiethnic Cohort Study" *American Journal of Epidemiology* 2007, Volume 165, Number 7, Pages 784-793

Teegarden D, et al. "Symposium: Dairy product components and weight regulation" *Journal of Nutrition* 2003; 133: 243S-256S

The North American Menopause Society. "The Role of Calcium in peri- and postmenopausal women: 2006 Position Statement of The North American Menopause Society" *Menopuase* 2006, 13:862-877

**OTHER**

Dawson Hughes, B. *Invest in Your Bones - Bone Appetit: The role of food and nutrition in building and maintaining strong bones* 2006, International Osteoporosis Federation publication available online <http://www.iofbonehealth.org/>.

National Institute of Health *Your guide to lowering high blood pressure with DASH* 2006, National Institute of Health publication. Tells how to follow the eating plan with a week of menus and some recipes available on line <http://www.nhlbi.nih.gov/health/public/heart/hbp/dash/new_dash.pdf/>

National Osteoporosis Society *Healthy Eating for Strong Bones* 2006, National Osteoporosis Society Leaflet. Available online at <http://www.nos.org.uk/>.

The Diary Council *Fill your Bones with Calcium* The Diary Council booklet 2006, available online <http://www.milk.co.uk/>.

United States Department of Heath and Human Services *Bone Health and Osteoporosis: A Report of the Surgeon General* 2004. Available on line at <http://www.surgeongeneral.gov/>

**ORGANIZATIONS**

National Osteoporosis Foundation (NOF), 1232 22nd Street N.W. Washington, D.C 20037-1292 USA.Website <http://www.nof.org/>

National Osteoporosis Society (NOS), Camerton, Bath, BA2 0PJ UK. Website <http://www.nos.org.uk/>

International Osteoporosis Federation (IOF), 9, rue Juste-Olivier, CH-1260 Nyon, Switzerland. Website <http://www.iofbonehealth.org/>

National Diary Council USA. Website <http://www.nationaldairycouncil.org/nationaldairycouncil/>

The Diary Council, Henriettea House. 17/18 Henrietta Street, Covent Garden, London WC2E 8QH UK. Website <http://www.milk.co.uk/>

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# Ovolactovegetarianism

## Definition

Ovolactovegetarians, who are also known as lacto-ovovegetarians, are vegetarians who do not eat fish, poultry, or red meat but accept eggs, milk, and honey as part of their diet on the grounds that these foods can be obtained without killing the animals who produce them. The *ovo-* part of the name comes from the Latin word for egg, while *lacto-* is derived from the Latin word for milk. In the West, ovolactovegetarians are the largest subgroup of vegetarians. As a result, most restaurants, institutional food services, cookbooks, and prepared foods that identify themselves as "vegetarian" without further qualification are ovolactovegetarian. Similarly, travelers who order special "vegetarian" meals from an airline before departure will be given ovolactovegetarian food unless they are more specific.

The reader should note, however, that some other cultures define "vegetarian" differently. In Japan, for example, many people think of fish as included in a vegetarian diet. Practitioners of Hinduism, who account for the largest single group of vegetarians worldwide, do not eat eggs, and therefore follow a lactovegetarian diet.

## Origins

**Vegetarianism** in general has existed for thousands of years, although the anatomical and archaeological evidence indicates that prehistoric humans were not vegetarians. The pattern of human dentition (teeth adapted for tearing meat as well as grinding plant matter), the length of the human digestive tract, and the secretion of pepsin (an enzyme that is necessary for digesting meat) by the human stomach are all indications that humans evolved as omnivores, or animals that consume both plant and animal matter.

Religious faith is the oldest known motive for consuming a vegetarian diet. Hinduism is the earliest of the world's major religions known to have encouraged a vegetarian lifestyle. As of the early 2000s, Hinduism accounts for more of the world's practicing vegetarians—70 percent—than any other faith or political conviction. The Hindu **religion** does *not*, however, endorse ovolactovegetarianism, as observant Hindus may not eat eggs. Christians and Jews who are vegetarians for religious reasons, however, are usually either ovolactovegetarians or vegans.

Ovolactovegetarianism as it is currently practiced by most Westerners is largely a byproduct of the animal rights movement that began in the mid-nineteenth century with the formation of the first societies for the prevention of cruelty to animals. The vegetarian groups of the late nineteenth century began by excluding meat, poultry, and fish from the diet on the grounds that these foods require the slaughter of animals, whereas the use of cow's milk and hen's eggs

## KEY TERMS

**Carnivore**—An animal whose diet consists mostly or entirely of meat. Cats, wolves, snakes, birds of prey, frogs, sharks, spiders, seals, and penguins are all carnivores.

**Dietitian**—A health care professional who specializes in individual or group nutritional planning, public education in nutrition, or research in food science. To be licensed as a registered dietitian (RD) in the United States, a person must complete a bachelor's degree in a nutrition-related field and pass a state licensing examination. Dietitians are also called nutritionists.

**Factory farming**—A term that refers to the application of techniques of mass production borrowed from industry to the raising of livestock, poultry, fish, and crops. It is also known as industrial agriculture.

**Lactose intolerance**—A condition in which the body does not produce enough lactase, an enzyme needed to digest lactose (milk sugar). Ovolactovegetarians with lactose intolerance often choose to use soy milk, almond milk, or other milk substitutes as sources of protein.

**Lactovegetarian**—A vegetarian who uses milk, yogurt, and cheese in addition to plant-based foods, but does not eat eggs.

**Omnivore**—An animal whose teeth and digestive tract are adapted to consume either plant or animal matter. The term does not mean, however, that a given species consumes equal amounts of plant and animal products. Omnivores include bears, squirrels, opossums, rats, pigs, foxes, chickens, crows, monkeys, most dogs, and humans.

**Ovolactovegetarian**—A vegetarian who consumes eggs and dairy products as well as plant-based foods. The official diet recommended to Seventh-day Adventists is ovolactovegetarian.

**Ovovegetarian**—A vegetarian who eats eggs in addition to plant-based foods but does not use milk or other dairy products.

**Pepsin**—A protease enzyme in the gastric juices of carnivorous and omnivorous animals that breaks down the proteins found in meat. Its existence in humans is considered evidence that humans evolved as omnivores.

**Vegan**—A vegetarian who excludes all animal products from the diet, including those that can be obtained without killing the animal. Vegans are also known as strict vegetarians.

does not. These groups, however, were formed before the rise of modern factory farming, which often results in inhumane living conditions for dairy cows and egg-producing hens. As a result, many contemporary ovolactovegetarians insist on purchasing their eggs or dairy products from small farmers who do not use factory-farming methods.

## Description

### *The 2003 vegetarian food guide*

Ovolactovegetarianism entered the medical mainstream in 2003 when the American Dietetic Association (ADA) and the Dietitians of Canada (DC) jointly issued "A New Food Guide for North American Vegetarians." This document contained the first major revisions of the familiar U.S. Department of Agriculture (USDA) food guide pyramid (originated 1912, modified in 1942 and 1992) and Canada's Food Guide to Healthy Eating (CFGHE; originated 1942, modified in 1992) intended for vegetarians. While the 1992 food guides were the first to consider overnutrition as a serious health problem, and emphasized the importance of plant foods in the diet, they did not include guidelines for planning vegetarian diets. The 2003 food guide borrowed the general concept of food groups from the older guides, but reclassified foods into five plant-based groups:

- Grains: The foundation of an ovolactovegetarian diet. Whole grains are best, but enriched refined grains are also acceptable.
- Vegetables and fruits: The ADA and DC recommend that vegetarians choose both vegetables and fruits rather than using only one or the other.
- Legumes, nuts, and other protein-rich foods: Legumes include soy milk and tofu. Dairy products used by ovolactovegetarians also fall into this category, as do meat substitutes.
- Fats: Ovolactovegetarians require plant-based sources of n-3 fats because they do not eat fish.

- Calcium-rich foods: Adult ovolactovegetarians require eight servings from this category each day. Each serving, however, counts toward one of the other food choices, as calcium-rich foods can be found across the other food groups.

### *Some specific vegetarian diets*

Ovolactovegetarian diets can accommodate a wide variety of regional and ethnic cuisines as well as different philosophical or religious approaches. The following are some of the possible choices:

**MEDITERRANEAN DIETS.** Mediterranean diets were not purely ovolactovegetarian in their origins. They are, however, easily adapted to ovolactovegetarian food choices; in fact, several European studies of the beneficial effects of vegetarian diets have been based on ovolactovegetarian modifications of Greek and Spanish Mediterranean diets. These diets are high in their use of whole grains, fruits, nuts, and high-fiber vegetables, and therefore appeal to many people because of their wide choice of flavorful foods.

**ORNISH DIET.** Developed by a medical doctor to reverse the signs of heart disease, the Ornish diet has also been popularized as a weight-loss program. It is a strict low-fat, **high-fiber diet** that excludes red meat, poultry, and fish. The Ornish diet can be used by ovolactovegetarians because it allows limited amounts of egg whites, fat-free milk, and other fat-free dairy products.

**SEVENTH-DAY ADVENTIST DIET.** Seventh-day Adventists (SDAs) have followed vegetarian dietary regimens since the denomination was first organized in 1863. The diet recommended by the church's General Conference Nutrition Council (GCNC) in the early 2000s is an ovolactovegetarian diet high in whole-grain breads and pastas, fresh vegetables and fruits; moderate use of nuts, seeds, and low-fat dairy products; and limited use of eggs. The church has its own professional organization for dietitians, which is affiliated with the ADA, and encourages all its members to follow the ADA guidelines for vegetarians.

## Function

Ovolactovegetarian diets are adopted by people in developed countries primarily for ethical or religious reasons rather than economic necessity. Another more recent reason is the growing perception that plant-based diets are a form of preventive health care for people at increased risk of such diseases as heart disease, type 2 diabetes and some forms of **cancer**. According to a survey conducted by the editors of *Vegetarian Journal* in 1997, 82% of the respondents gave health concerns as their primary reason for becoming vegetarians, with animal rights a close second.

## Benefits

The long-term NIH study of Seventh-day Adventists began to report in the 1970s and 1980s that lowered blood pressure, lower rates of cardiovascular disease and stroke, lower blood cholesterol levels, and lowered risks of colon and **prostate** cancer are associated with a vegetarian diet, especially the ovolactovegetarian regimen recommended by the church. In particular, SDAs were only half as likely to develop type 2 (adult-onset) diabetes as were nonvegetarian Caucasians. Although it is possible to gain weight on an ovolactovegetarian diet, most people lose weight, especially in the first few months; and most vegetarians have lower body mass indices (an important diagnostic criterion of **obesity**) than their meat-eating counterparts.

Several studies carried out in Germany and Austria reported in 2006 that ovolactovegetarian diets appear to lower the risk of rheumatoid arthritis, **osteoporosis**, kidney disease, **gallstones**, diverticulitis, and dementia as well as heart attacks, stroke, and diabetes. In addition, a team of Spanish researchers reported that an ovolactovegetarian version of the traditional Spanish **Mediterranean diet** was effective in lowering blood cholesterol levels in younger as well as middle-aged subjects.

## Precautions

The ADA strongly recommends that people consult a registered dietitian as well as their primary physician before starting an ovolactovegetarian diet. The reason for this precaution is the variety of dietary regimens that could be called ovolactovegetarian as well as the variations in height, weight, age, genetic inheritance, food preferences, level of activity, geographic location, and preexisting health problems among people. People with high blood cholesterol levels may need to limit their consumption of eggs as much as possible even though this type of vegetarian diet allows the use of eggs. A nutritionist can also help design a diet that a new ovolactovegetarian will enjoy eating as well as getting adequate nourishment and other health benefits.

## Risks

The longstanding concern about vegetarian diets in general is the risk of nutritional deficiencies, particularly for such important nutrients as **protein**,

## QUESTIONS TO ASK YOUR DOCTOR

- Would you recommend a vegan diet rather than an ovolactovegetarian diet?
- Have any of your other patients used either a modified Mediterranean diet or the Seventh-day Adventist ovolactovegetarian diet? Would you recommend these diets?
- Will I need to take vitamins or other dietary supplements if I adopt an ovolactovegetarian diet?
- Have you ever tried this type of vegetarian diet yourself?
- What is your opinion of the EPIC study and other recent long-term studies of ovolactovegetarians?

**minerals** (**iron**, **calcium**, and **zinc**), **vitamins** (**vitamin D**, **riboflavin**, **vitamin $B_{12}$**, and **vitamin A**), **iodine**, and n-3 fatty acids. The 2003 vegetarian food guide recommends that ovolactovegetarians over 50 years of age should take supplements of vitamin $B_{12}$ and vitamin D, or use foods fortified with these nutrients. Vitamin D supplements are particularly important for older vegetarians living in northern latitudes or other situations in which they receive little sun exposure.

In addition to nutritional concerns, there is some evidence that ovolactovegetarian diets may actually increase the risk of breast cancer in women, particularly in those with lactose intolerance who use large amounts of soy-based products as milk replacements. Soybeans contain phytoestrogens, or plant estrogens, which have been implicated in breast cancer. The plant estrogens in soy-based products may also explain why vegetarians have a disproportionate number of female babies, and why these girls have a higher rate of precocious puberty than girls born to nonvegetarian mothers.

Some researchers think that an ovolactovegetarian diet may delay physical maturation in girls. A study done in California in the early 1990s reported that girls using the Seventh-day Adventist diet were less tall prior to adolescence than their age-matched nonvegetarian counterparts. Further research in this field is necessary, however.

Ovolactovegetarianism may also be less beneficial than **ovovegetarianism** to maintaining fertility in women of childbearing age. A group of researchers at the Harvard School of Public Health reported in early 2007 that a high intake of low-fat dairy foods is associated with infertility in women caused by failure to ovulate.

## Research and general acceptance

### *General acceptance*

Vegetarianism in general is accepted by all mainstream medical associations and professional nutritionists' societies, and positively recommended by some. The position statement jointly adopted by the ADA and DC in 2003 states: "It is the position of the American Dietetic Association and Dietitians of Canada that appropriately planned vegetarian diets are healthful, nutritionally adequate and provide health benefits in the prevention and treatment of certain diseases. . . . Well-planned vegan and other types of vegetarian diets are appropriate for all stages of the life cycle, including during pregnancy, lactation, infancy, childhood and adolescence."

The ADA has a professional subgroup called the Vegetarian Nutrition Dietary Practice Group, or DPG, which publishes a quarterly newsletter called *Vegetarian Nutrition Update*. The newsletter is available to nonmembers of the ADA for an annual subscription fee of $25. The Vegetarian Nutrition DPG also has its own website at http://www.vegetarian nutrition.net/index.htm, with articles available to the public on vegetarian diets and cancer prevention, treatment of rheumatoid arthritis, **sports nutrition**, and pregnancy. Most of these articles assume that readers are ovolactovegetarians.

Once considered an eccentricity, ovolactovegetarianism is widely accepted by the general public in developed countries as a legitimate dietary option in the early 2000s. Most restaurants, school cafeterias, airlines, and other public food services presently offer ovolactovegetarian dishes as a matter of course. The ADA and DC state that about 2.5% of adults (defined as people over 18 years of age) in the United States and 4% of Canadian adults follow some type of vegetarian diet. The Vegetarian Resource Group (VRG), a nonprofit research organization, conducted a poll in 2006. It estimated that 2.3% of adults in the United States—4.7 million people—are vegetarians, with half to two-thirds of this group being ovolactovegetarians. In addition, the VRG notes that 30 to 40% of American adults choose vegetarian dishes over meat dishes at least some of the time.

Most of the opposition in developed countries to ovolactovegetarians is within vegetarian societies or groups rather than between this subgroup of

vegetarians and nonvegetarians. Vegans in particular are likely to regard ovolactovegetarians as ethically less "pure," as **veganism** itself was started in the 1940s by an Englishman who was frustrated by the fact that most of the vegetarians he knew saw nothing morally wrong with consuming eggs or dairy products. One registered dietitian who offers tutorials on vegetarian nutrition and food service has remarked, "This [definition of a proper vegetarian] is a very hot topic for some people, who are adamant that their definitions or life-style choices are the *only* way. For the sake of these lectures, it will be easier for those people . . . with very strong feelings to park their dogma by the door."

### *Research*

Most of the research in nutrition and medicine that has been carried out on vegetarians in the West has been done with research subjects who are ovolactovegetarians, with a smaller number of studies done on vegans. In general, Western researchers use "vegetarians" simply speaking as a synonym for ovolactovegetarians. Most studies done in India, however, have recruited lactovegetarian subjects, as strict Hindus do not eat eggs. As a result, it is not always easy to compare study findings from different countries unless the subjects were drawn from the same vegetarian subgroup. It is interesting to note that a recent study of French vegetarians used the term "classical vegetarians" to distinguish ovolactovegetarian subjects from those who were following lactovegetarian or macrobiotic diets.

As has been noted in Europe as well as the United States, the emphasis in medical research on all types of vegetarian diets has shifted in the early 2000s from concern about nutritional deficiencies in people following these diets to the role of vegetarianism in preventing or treating chronic diseases. It was the NIH's studies of Seventh-day Adventists that first indicated that ovolactovegetarian diets lower the risk of heart disease, stroke, and type 2 diabetes. The Adventist Health Study received new funding in 2003 for its continuation. As of early 2007, the NIH is conducting five additional clinical trials to evaluate the advantages of ovolactovegetarian diets in managing uremia in the elderly, cardiovascular disease, type 2 diabetes, high blood pressure, and postmenopausal disorders in women as well as treating obesity.

European studies of ovolactovegetarians often focus on regional diets—such as the health benefits of eliminating meat and fish from Mediterranean diets. In addition, as of 2007 there is an ongoing major European study of the associations between dietary intake and cancer risk known as the European Prospective Investigation into Cancer and Nutrition (EPIC). EPIC recruited over 521,000 healthy adults between the ages of 35 and 70 in 10 European countries between 1993 and 1999, with follow-ups scheduled through 2009 and possibly longer. One subcategory in the EPIC study is a cohort of 27,000 vegetarians and vegans in the United Kingdom—the largest single subgroup in the EPIC study. It is expected that the very high levels of phytoestrogens (5 to 50 times higher than in those in nonvegetarian European subjects) in the blood plasma of the British vegetarians will provide further information about the long-term effects of ovolactovegetarian as well as vegan diets.

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**ORGANIZATIONS**

American Dietetic Association (ADA). 120 South Riverside Plaza, Suite 2000, Chicago, IL 60606-6995. Telephone: (800): 877-1600. Website: http://www.eatright.org.

Dietitians of Canada/Les diététistes du Canada (DC). 480 University Avenue, Suite 604, Toronto, Ontario, Canada M5G 1V2. Telephone: (416) 596-0857. Website: http://www.dietitians.ca.

North American Vegetarian Society (NAVS). P.O. Box 72, Dolgeville, NY 13329. Telephone: (518) 568-7970. Website: http://www.navs-online.org.

Seventh-day Adventist Dietetic Association (SDADA). 9355 Telfer Run, Orlando, FL 32817. Website: http://www.sdada.org. SDADA is an official affiliate of the ADA.

Vegetarian Resource Group (VRG). P.O. Box 1463, Dept. IN, Baltimore, MD 21203. Telephone: (410) 366-VEGE. Website: http://www.vrg.org/index.htm. Publishes *Vegetarian Journal*, a quarterly periodical.

Rebecca J. Frey, PhD

# Ovovegetarianism

## Definition

Ovovegetarianism is a subcategory of **vegetarianism**. Ovovegetarians, who are sometimes called eggetarians, are people who consume a plant-based diet with the addition of eggs. The *ovo-* part of the name comes from the Latin word for egg. Ovovegetarians do not eat red meat, poultry, fish, or use cow's milk or milk-based products (cheese, yogurt, ice cream).

## Origins

Vegetarianism in general has existed for thousands of years, although the anatomical and archaeological evidence indicates that prehistoric humans were not vegetarians. The pattern of human dentition (teeth adapted for tearing meat as well as grinding plant matter), the length of the human digestive tract, and the secretion of pepsin (an enzyme that is necessary for digesting meat) by the human stomach are all indications that humans evolved as omnivores, or animals that consume both plant and animal matter.

Religious faith is the oldest known motive for consuming a vegetarian diet. Hinduism is the earliest of the world's major religions known to have encouraged a vegetarian lifestyle. As of the early 2000s, Hinduism accounts for more of the world's practicing vegetarians—70 percent—than any other faith or political conviction. The Hindu **religion** does *not*, however, endorse ovovegetarianism, as strict Hindus avoid all of the following foods:

- Beef and cow products, including gelatin.
- Other types of meat; fish; and eggs.
- Onions, garlic and mushrooms.
- Alcohol.
- Red lentils.

Devout Hindus are also not allowed to eat food that has been cooked in the same pot or pan used for cooking meat, fish or eggs, even if the implement has been washed and cleaned after such use, or food that has been heated in the same oven or microwave in which meat, fish, or eggs are cooked or heated.

Most ovovegetarians in North America, however, are guided by health or ethical concerns rather than religion in the strict sense. Some people are ovovegetarian because they suffer from lactose intolerance (a condition in which the body fails to produce enough lactase, an enzyme needed to digest the sugars in milk and dairy products) but do want to include eggs in their diet as a source of **protein**. They may also believe that eating eggs is more ethically acceptable than consuming dairy products, on the grounds that cows must have calves before giving milk; thus eating dairy products supports the meat industry indirectly through increasing the population of animals that cannot be sustained for any other purpose. Hens, however, can lay eggs for human consumption without being fertilized or reproducing.

Some ovovegetarians insist on purchasing eggs only from small farmers who raise free-range chickens, on the grounds that factory-farming of eggs is inhumane. Some factory farms contain as many as 100,000 chickens, typically crowded together in cages, debeaked (which is painful and leads some hens to starve themselves to death), and killed after 12 months, when their egg-laying capacity starts to decline. In addition, all male chicks of egg-laying breeds are killed between one and three days after birth, as they are not suitable for meat production. Free-range chickens, on the other hand, are often kept as pets by small farmers; allowed to run outside, build nests, and scratch in the

### KEY TERMS

**Albumen**—The white of the egg. It can be separated from the yolk for cooking or to avoid the high fat and high cholesterol content of the yolk.

**Factory farming**—A term that refers to the application of techniques of mass production borrowed from industry to the raising of livestock, poultry, fish, and crops. It is also known as industrial agriculture.

**Free-range**—Allowed to forage and move around with relative freedom. Free-range chickens are typically raised on small farms or suburban back yards, and are often considered pets as well as egg producers.

**Lactose intolerance**—A condition in which the body does not produce enough lactase, an enzyme needed to digest lactose (milk sugar). Lactose intolerance is the reason why some vegetarians are ovovegetarians.

**Ovolactovegetarian**—A vegetarian who consumes eggs and dairy products as well as plant-based foods. The official diet recommended to Seventh-day Adventists is ovolactovegetarian.

**Ovovegetarian**—A vegetarian who eats eggs in addition to plant-based foods.

**Pepsin**—A protease enzyme in the gastric juices of carnivorous and omnivorous animals that breaks down the proteins found in meat. Its existence in humans is considered evidence that humans evolved as omnivores.

**Vegan**—A vegetarian who excludes all animal products from the diet, including those that can be obtained without killing the animal. Vegans are also known as strict vegetarians.

**Yolk**—The yellow spherical mass in the inner portion of an egg. It contains almost all the fat and cholesterol found in eggs.

dirt; and are not killed automatically when they reach a certain age.

## Description

There is no "typical" ovovegetarian diet; however, several popular diets can be easily adapted by ovovegetarians.

### *Mediterranean diets*

Mediterranean diets are not purely ovovegetarian. They are, however, sparing in their use of red meat and eggs, and low in their use of fish and poultry. Ovovegetarians can simply cut meat, fish, and dairy ingredients from Mediterranean recipes, or use almond or **soy** milk in place of cow's milk. Mediterranean diets appeal to many people because of their wide choice of flavorful foods and their generous use of fresh vegetables and whole-grain breads.

### *Ornish diet*

Developed by a medical doctor to reverse the signs of heart disease, the Ornish diet has also been popularized as a weight-loss program. It is a strict low-fat, **high-fiber diet** that excludes red meat, poultry, and fish, although ovovegetarians following this diet may use limited amounts of egg whites.

### *Seventh-day Adventist diet*

Seventh-day Adventists (SDAs) have followed vegetarian dietary regimens since the denomination was first organized in 1863. The diet recommended by the church's General Conference Nutrition Council (GCNC) in the early 2000s is an ovolactovegetarian diet high in whole-grain breads and pastas, fresh vegetables and fruits; moderate use of nuts, seeds, and low-fat dairy products; and limited use of eggs. Some SDAs prefer a vegan diet, however, which indicates that the GCNC diet can be easily modified for ovovegetarians as well. The church has its own professional organization for dietitians, which is affiliated with the ADA, and encourages all its members to follow the ADA guidelines for vegetarians.

### *Some ovovegetarian recipes*

**HUNGARIAN OMELET.** Ingredients: 1 tbsp. olive oil; 1 small onion, sliced; 1/4 of a small red pepper, sliced and seeds removed; 2 medium tomatoes, peeled and sliced; 1 tsp. paprika; 2 beaten eggs; salt to taste; chopped fresh parsley or chives (garnish).

Cooking instructions: Heat 1 tsp. olive oil in a saucepan and sauté the onion and pepper until soft. Add tomatoes and paprika and cook gently (about 5 minutes) until mixture is soft. Add salt to taste. Heat remaining olive oil in an omelet pan. Beat two tbsp. **water** into the eggs to lighten the mixture; cook eggs in the omelet pan. To serve: fill the omelet with the tomato mixture and top with parsley or chives.

**SWEET POTATO SOUFFLÉ.** Ingredients: 1 cup soy milk; 1/2 cup sugar; 1/2 tsp. salt; 3 tbsp. margarine; 1 tsp. nutmeg; 2 cups mashed sweet potatoes; 2 eggs, separated; 1/2 cup raisins; 1/2 cup chopped pecans; miniature marshmallows (topping).

Cooking instructions: Scald soy milk; add sugar, salt, margarine, nutmeg, and mashed sweet potatoes; beat until fluffy. Beat egg yolks and add to sweet potato mixture. Add raisins and pecans. Beat egg whites until stiff; fold into sweet potato mixture and pour into a greased baking dish. Bake in a moderate oven (350 °F) for 50 to 60 minutes or until firm. Top wit miniature marshmallows and brown in oven. Serves 8.

**POTATO PANCAKES.** Ingredients: 2 large white potatoes; 1/2 onion; 1 egg; pepper to taste; 1/2 tsp. salt; 1/3 cup flour; 1/2 cup water.

Cooking instructions: Peel potatoes and put in food processor with the onion and water. Process and drain through a paper towel placed in a colander. In a separate small bowl, beat the egg together with the salt and pepper, and add to the drained potato/onion mixture. Stir well; then stir in flour. Drop by 1/4-cupfuls into hot oil in a large frying pan, and flatten the mixture while frying over medium heat. Fry until golden-brown on the outside. May be served with applesauce, stewed apples, soy-based sour cream, or soy-based yogurt.

## Function

Vegetarian diets in general, and ovovegetarian diets in particular, are adopted by people in developed countries primarily for ethical or religious reasons rather than economic necessity. Another more recent reason is the growing perception that plant-based diets are a form of preventive health care for people at increased risk of such diseases as heart disease, type 2 diabetes and some forms of **cancer**. According to a survey conducted by the editors of *Vegetarian Journal* in 1997, 82% of the respondents gave health concerns as their primary reason for becoming vegetarians, with animal rights a close second.

## Benefits

The benefits of an ovovegetarian diet include those of vegetarian diets in general, namely lowered

blood pressure, lower rates of cardiovascular disease and stroke, lower blood cholesterol levels, and lowered risks of colon and **prostate** cancer. There is also evidence that vegetarian diets lower the risk of developing type 2 (adult-onset) diabetes, and assist in weight reduction.

It is possible that ovovegetarianism is more beneficial to maintaining fertility in women than vegetarian diets allowing dairy foods. A group of researchers at the Harvard School of Public Health reported in early 2007 that a high intake of low-fat dairy foods is associated with infertility in women caused by failure to ovulate.

## Precautions

The ADA strongly recommends that people consult a registered dietitian as well as their primary physician before starting any type of vegetarian diet. The reason for this precaution is the variety of vegetarian regimens as well as the variations in height, weight, age, genetic inheritance, food preferences, level of activity, geographic location, and preexisting health problems among people. A dietitian can also answer questions about the desirability of limiting egg consumption within an ovovegetarian diet; for example, the Seventh-day Adventist Dietetic Association (SDADA) recommends that people following the Adventist vegetarian diet limit their use of egg yolks to three or less per week.

## Risks

The longstanding concern about all vegetarian diets is the risk of nutritional deficiencies, particularly for such important nutrients as protein, **minerals** (**iron**, **calcium**, and **zinc**), **vitamins** (**vitamin D**, **riboflavin**, **vitamin $B_{12}$**, and **vitamin A**), **iodine**, and n-3 fatty acids. Although the ADA food guide does not discuss ovovegetarians as a distinctive subgroup, their recommendations for vegans would apply to ovovegetarians, since eggs do not supply as much vitamin D or vitamin $B_{12}$ as milk. Moreover, ovovegetarians who remove the yolks from the eggs they consume would lose all the vitamin D content of the egg. The 2003 vegetarian food guide published by the ADA and DC recommends that vegans in all age groups should take supplements of vitamin $B_{12}$ and vitamin D, or use foods fortified with these nutrients.

It is particularly important for pregnant women to maintain an adequate intake of vitamin $B_{12}$, as a lack of this vitamin can cause irreversible neurological damage in the infant. A recent Canadian study reported that a reduced intake of milk during pregnancy, which would be characteristic of ovovegetarians as well as nonvegetarian women suffering from lactose intolerance, is associated with low birth weight in the infant. In addition, some studies indicate that vegans (and by implication ovovegetarians as well) are at increased risk of **osteoporosis** and bone fractures compared to either meat-eaters or less strict vegetarians because their average calcium intake is lower.

There is some disagreement among researchers regarding the cholesterol content of eggs as a health risk. Some maintain that the cholesterol in eggs actually raises high-density lipoprotein ("good" cholesterol) blood levels while lowering low-density lipoprotein ("bad" cholesterol) levels. Other researchers have noted wide variations among individuals in the effect of egg consumption on blood lipids. One Indian study of volunteers on a lacto-vegetarian diet found that the subjects' blood lipid levels rose for a few weeks after adding one boiled egg per day to their diets, but that the levels fell to baseline values by the end of 8 weeks for two-thirds of the subjects. The remaining third were hyper-responsive to the addition of eggs to their diet. This finding suggests that a vegetarian who is concerned about blood cholesterol levels may wish to find out whether he or she is hyper-responsive before increasing their level of egg consumption. In any case, the cholesterol in chicken eggs is concentrated in the yolk, and can be minimized or eliminated by eating only part of the yolk or eating only the white (albumen) of the egg—which is 87% water, 13% protein, and very little fat.

Ovovegetarians should avoid eating raw or undercooked eggs, however, because of the danger of contamination by *Salmonella enteritidis* and other *Salmonella* species associated with **food poisoning**. The shell of a chicken egg ordinarily acts as a barrier against bacterial contamination, but improper handling or an active infection in the hen producing the egg may allow *Salmonella* and other disease organisms to enter. According to a 2002 study produced by the U.S. Department of Agriculture, only one in every 30,000 eggs produced in the United States is contaminated, as most egg producers wash the eggs with a sanitizing solution shortly after they have been laid. It is best, however, to protect oneself and others by cooking eggs thoroughly and by not allowing containers or cutting boards that have held raw eggs to come into contact with food that is ready to eat. This precaution is particularly important for people with weakened immune systems or who are taking drugs that suppress the immune system.

## QUESTIONS TO ASK YOUR DOCTOR

- Are any of your other patients ovovegetarians?
- Would you recommend an ovovegetarian diet? In your opinion, is it preferable to a vegan diet?
- What is your opinion of eggs as part of an adult's diet? Should people limit their consumption of them even if they are ovovegetarians?

## Research and general acceptance

### *Basic nutritional information about eggs*

In order to evaluate the nutritional content of chicken eggs, the reader should note that eggs vary considerably in size and therefore in calorie or fat content. The following are the standard sizes as defined in the United States:

- Peewee: greater than 1.25 oz or 35 g
- Small (S): greater than 1.5 oz or 43 g
- Medium (M): greater than 1.75 oz or 50 g
- Large (L): greater than 2 oz or 57 g
- Extra Large (XL): Greater than 2.25 oz or 64 g
- Jumbo: Greater than 2.5 oz or 71 g

The nutrient content of a large egg (59 g) is as follows:

- Calories: 75 (17 in the white or albumen, 58 in the yolk)
- Cholesterol: 213 mg (all in the yolk)
- Protein: 6.25 g (3.5 g in the white, 2.78 g in the yolk)
- Carbohydrate: 0.61 g (0.34 g in the white, 0.27 g in the yolk)
- Fats: 5 g (all in the yolk)
- Vitamin A: 317 IU (all in the yolk)
- Vitamin D: 24.5 IU (all in the yolk)
- Vitamin $B_{12}$: 0.52 mcg (all in the yolk)
- Calcium: 25 mg (2 in the white, 23 in the yolk)
- Zinc: 0.55 mg (all in the yolk)

It will be evident from the foregoing list that ovovegetarians who omit all or part of the yolk from their egg consumption will be losing important vitamins and minerals along with the cholesterol and **fats**.

### *Evaluations of ovovegetarianism*

Vegetarianism, including ovovegetarianism, is accepted by all mainstream medical associations and professional nutritionists' societies, and positively recommended by some. The position statement jointly adopted by the ADA and DC in 2003 states: "It is the position of the American Dietetic Association and Dietitians of Canada that appropriately planned vegetarian diets are healthful, nutritionally adequate and provide health benefits in the prevention and treatment of certain diseases. . . . Well-planned vegan and other types of vegetarian diets are appropriate for all stages of the life cycle, including during pregnancy, lactation, infancy, childhood and adolescence."

On the other hand, little research has been done on ovovegetarianism as a subtype of vegetarianism, whether of ovovegetarianism by itself or in comparison to other vegetarian diets. It is therefore difficult to determine whether the consumption of eggs (or egg yolks) by itself has a negative effect on the overall health benefits of a vegetarian diet. Further research in this area would be beneficial.

Ovovegetarians are a fairly small subgroup of vegetarians. As is sometimes pointed out in discussions of meal choices in restaurants, school cafeterias, and airline food service, most institutions interpret "vegetarian" to mean "ovolactovegetarian." This fact requires ovovegetarians in many situations to ask whether a vegan meal or food choice is available. One website has a list of airlines that offer ovovegetarian (called "nondairy" vegetarian) meals (as well as vegan, Hindu vegetarian, and raw vegetarian choices) provided the customer calls 48 hours in advance of departure. The URL is listed below.

It is difficult to estimate either how many people in the general North American population are ovovegetarians or how many people who consider themselves vegetarians fall into this subgroup. Charles Stahler reported in an article in *Vegetarian Journal* in 2006, however, that a poll conducted by Harris Interactive indicated that 7.6% of adults in the United States "never eat dairy products."

Another factor that further confuses the issue is that vegetarians disagree among themselves as to how strictly their various subgroups should be defined; some ovovegetarians may be flexible about the occasional use of milk or other dairy products while others may not be. One registered dietitian who offers tutorials on vegetarian nutrition and food service has remarked, "Just as there are no culinary police that dictate how people eat or how food is prepared, there are no vegetarian police who oversee if people are adhering to their 'declared' vegetarian choice. This is a very hot topic for some people, who are adamant that their definitions or life-style choices are the *only* way. For the sake of these lectures, it will be

easier for those people . . . with very strong feelings to park their dogma by the door."

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### ORGANIZATIONS


American Dietetic Association (ADA). 120 South Riverside Plaza, Suite 2000, Chicago, IL 60606-6995. Telephone: (800): 877-1600. Website: http://www.eatright.org.

American Egg Board (AEB). 1460 Renaissance Drive, Park Ridge, IL 60068. Telephone: (847) 296-7043. Website: http://www.aeb.org. The AEB represents factory-farm egg producers.

American Poultry Association. P. O. Box 306, Burgettstown, PA 15021. Telephone: (724) 729-3459. This organization is a good source of information about backyard and urban poultry raising.

Dietitians of Canada/Les diététistes du Canada (DC). 480 University Avenue, Suite 604, Toronto, Ontario, Canada M5G 1V2. Telephone: (416) 596-0857. Website: http://www.dietitians.ca.

North American Vegetarian Society (NAVS). P.O. Box 72, Dolgeville, NY 13329. Telephone: (518) 568-7970. Website: http://www.navs-online.org.

Seventh-day Adventist Dietetic Association (SDADA). 9355 Telfer Run, Orlando, FL 32817. Website: http://www.sdada.org. SDADA is an official affiliate of the ADA.

Vegetarian Resource Group (VRG). P.O. Box 1463, Dept. IN, Baltimore, MD 21203. Telephone: (410) 366-VEGE. Website: http://www.vrg.org/index.htm. Publishes *Vegetarian Journal*, a quarterly periodical.


Rebecca J. Frey, PhD

# P

## Pacific Islander American diet

### Origins

The Pacific Islands contain 789 habitable islands and are divided into the three geographic areas: Polynesia, Melanesia, and Micronesia. According to the 2000 U.S. Census, there are over a million Pacific Islanders in the United States, most of whom live in California, Hawaii, Washington, Utah, and Texas. Pacific Islander ethnicities in the United States include Carolinian, Fijian, Guamanian, Hawaiian, Kosraean, Melanesian, Micronesian, Northern Mariana Islander, Palauan, Papua New Guinean, Ponapean, Polynesian, Samoan, Solomon Islander, Tahitian, Tarawa Islander, Tongan, Trukese (Chuukese), and Yapese. Prior to 1980, Pacific Islander Americans (except Hawaiians) were classified with Asian Americans under the classification of "Asian and Pacific Islander American." Today, the U.S. Census Bureau includes Pacific Islander Americans under the classification of "Native Hawaiian and Other Pacific Islander." Pacific Islanders are a racially and culturally diverse population group, and they follow a wide variety of religions and have an array of languages.

### Description

#### *Eating Habits and Meal Patterns*

The cuisine of Pacific Islander Americans varies slightly from culture to culture and is a blend of native foods and European, Japanese, American, and Asian influences. As with many cultures, food plays a central role in the culture. Pacific Islander Americans typically eat three meals a day. Breakfast is usually cereal and coffee; traditional meals are eaten for lunch or dinner; and fruits, fruit juices, vegetables, and nuts (e.g., peanuts and macadamia) are eaten in abundance. Milk and other dairy products are uncommon and there is a high prevalence of lactose intolerance among Pacific Islander Americans. Thus, **calcium** deficiency is prevalent.

Starchy foods are the foundation of the traditional diet. For example, the traditional Hawaiian diet is 75 to 80% starch, 7 to 12% fat, and 12 to 15% **protein**. Starch in the traditional diet comes primarily from root vegetables (e.g., taro, cassava, yam, green bananas, and breadfruit). In addition, the traditional diet is plentiful in fresh fruits, juices, nuts, and greens. Traditional meals include *poi* (boiled taro), breadfruit, green bananas, fish, or pork. Many dishes are cooked in coconut milk, and seaweed is often used as a vegetable or a condiment.

#### *Nutritional Transition*

Many Pacific Islander Americans now eat an Americanized diet consisting of fast foods and highly processed foodstuffs such as white flour, white sugar, canned meat and fish, butter, margarine, mayonnaise, carbonated beverages, candies, cookies, and sweetened breakfast cereals. Rice is now a staple food, having taken over yam and taro in popularity in the 1980s and 1990s. This nutritional transition has resulted in an increase in cardiovascular disease (i.e., **coronary heart disease**, stroke, hypertension), obesity, and type 2 diabetes.

Nutrition education is needed to stimulate nutrition-related indigenous knowledge and the consumption of traditional nutrient-rich local foods as a more healthful alternative to fast foods and processed foods. There is also an urgent need for increased awareness of the health perils of obesity, especially among individuals with low socioeconomic status. Many health professionals are now emphasizing eating traditional "native" foods and encouraging residents to get back to a healthy lifestyle and to their cultural roots. Language is a major barrier to health education and medical

**Native Hawaiian and other U.S. Pacific Islander population, 2000**

| National origin | Population | Percent |
|---|---|---|
| **Total** | **874,414** | **100.0%** |
| **Polynesian** | | |
| Native Hawaiian | 401,162 | 45.9 |
| Samoan | 133,281 | 15.2 |
| Tongan | 36,840 | 4.2 |
| Tahitian | 3,313 | 0.4 |
| Tokelauan | 574 | 0.1 |
| Polynesian, not specified | 8,796 | 1.0 |
| **Micronesian** | | |
| Guamanian or Chamorro | 92,611 | 10.6 |
| Mariana Islander | 141 | * |
| Saipanese | 475 | 0.1 |
| Palauan | 3,469 | 0.4 |
| Carolinian | 173 | * |
| Kosraean | 226 | * |
| Pohnpeian | 700 | 0.1% |
| Chuukese | 654 | 0.1 |
| Yapese | 368 | * |
| Marshallese | 6,650 | 0.8 |
| I-Kiribati | 175 | * |
| Micronesian, not specified | 9,940 | 1.1 |
| **Melanesian** | | |
| Fijian | 13,581 | 1.6 |
| Papua New Guinean | 224 | * |
| Solomon Islander | 25 | * |
| Ni-Vanuatu | 18 | * |
| Melanesian, not specified | 315 | * |
| Other Pacific Islander | 174,912 | 20.0 |

*Less than 0.1%.

SOURCE: U.S. Census Bureau, Census 2000

*(Illustration by GGS Information Services/Thomson Gale.)*

interventions, however, and more health professionals need to be recruited from this population into health and medical fields in specific geographic areas. Professionals from the dominant (white) culture also need to become more culturally competent.

## Risks

### *Nutrition and Health Status*

Accurate mortality and morbidity statistics for this population are limited, mainly because data on Pacific Islander Americans were classified with Asian Americans until a few years ago. Pacific Islander Americans have a high rate of **obesity**, and Native Hawaiians and Samoans are among the most obese people in the world. Dietary and lifestyle changes, as well as a likely genetic predisposition to store fat, are possible causes for this high rate. Lifestyles have changed from an active farming- and fishing-based subsistence economy to a more sendentary lifestyle. Pacific Islanders may be genetically predisposed to store fat for times of scarcity (the "thrifty gene" phenotype), and there is evidence that prenatal undernutrition modifies fetal development, predisposing individuals to adult obesity and chronic diseases.

Besides obesity, Pacific Islander Americans have high rate of diabetes, **hypertension**, cardiovascular disease, and stroke. Data collected from 1996 to 2000 suggest that Native Hawaiians are 2.5 times more likely to have diagnosed diabetes than white residents of Hawaii of similar age. Guam's death rate from diabetes is five times higher than that of the U.S. mainland, and diabetes is one of the leading causes of death in American Samoa. Overall, Pacific Islander Americans have much lower rates of heart diseasethan other minority groups in the United States, but it is still the leading cause of death within this population. Risk factors for and mortality from heart disease are high partly because of higher rates of obesity, diabetes, and high blood pressure. The poor health status of Pacific Islander Americans is also linked to socioeconomic indicators—Native Hawaiians have the worst socioeconomic indicators, the lowest health status, and the most diet-related maladies of all American minorities.

## Resources

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# Pacific Islander diet

## Origins

The Pacific Ocean—the world's largest ocean—extends about 20,000 kilometers from Singapore to Panama. There are 789 habitable islands within the "Pacific Islands," a geographic area in the western Pacific comprising Polynesia, Melanesia, and Micronesia. Polynesia includes 287 islands and is triangular, with Hawaii, New Zealand, and Easter Island at the apexes. Other major Polynesian islands include American (Eastern) Samoa, Western Samoa, Tonga, Tahiti, and the Society Islands. The Hawaiian Islands have been studied more than most other Pacific islands primarily because Hawaii is part of the United States of America. The Melanesian Islands (Melanesia) include the nations of Fiji, Papua New Guinea, Vanuatu, the Solomon Islands and New Caledonia (a French dependent). The 2,000 small islands of Micronesia include Guam (American), Kiribati, Nauru, the Marshall Islands, the Northern Mariana Islands, the Gilbert Islands, Palau, and the Federated States of Micronesia. Migration is very fluid between Polynesia, Melanesia, and Micronesia, and many Pacific Islanders also migrate to the United States and other countries. Pacific Islanders are a racially and culturally diverse population, and the people of the islands follow a wide variety of religions.

## Description

### *Eating Habits and Meal Patterns*

While the islands are geographically close, the Pacific Island region is racially and culturally diverse. The cuisine varies slightly from island to island and is a blend of native foods with European, Japanese, and American influences. The cuisine is also influenced by the Asian Indians, Chinese, Korean, and Filipino agricultural workers who arrived in the eighteenth century. Food plays a central role in Pacific Islander culture; it represents prosperity, generosity, and community support. Hospitality is extended to visitors, who are usually asked to share a meal. Even if a visitor is not hungry, he or she will generally eat a small amount of food so that the host is not disappointed. Food is also often given as a gift, and a refusal of food is considered an insult to the host or giver.

Fruits, fruit juices, vegetables, and nuts (e.g., peanuts, macadamia, and litchi) are eaten in abundance, while milk and other dairy products are uncommon (there is a high prevalence of lactose intolerance among Pacific Islanders). Coconuts are plentiful, and both the milk and dried fruit are used to flavor meals. Pigs, chickens, and cows exist on the Pacific Islands, but in areas like Fiji they are expensive, so local villagers tend to purchase them only for large celebrations and feasts. Modern conveniences exist in many areas, but it is not uncommon for villagers to cook on outdoor fires or kerosene stoves. Many villagers still eat with their hands, and a bowl of **water** is provided for washing hands (a guest may request one before the meal if it is not offered).

Pacific Islanders typically eat three meals a day. Breakfast usually includes cereal and coffee, while traditional meals are eaten for lunch and dinner. However, in areas such as Hawaii, Samoa, and Guam, traditional foods now contribute only minimally to daily intake, most of which is made up of imported foods or fast food.

### *Traditional Cooking Methods and Food Habits*

The traditional Pacific Islander diets are superior to Western diets in many ways. The weaknesses of the traditional Pacific Island diets are minimal and the strengths are immense. Traditional foods are nutrient-dense, meals are prepared in healthful ways, and oils are used sparingly. The high-fiber, lowfat nature of

### KEY TERMS

**Calorie**—unit of food energy.

**Diabetes**—Inability to regulate level of sugar in the blood.

**Heart disease**—Any disorder of the heart or its blood supply, including heart attack, atherosclerosis, and coronary artery disease.

**Hypertension**—High blood pressure.

**Insulin**—Hormone released by the pancreas to regulate level of sugar in the blood.

**Lactose intolerance**—Inability to digest lactose, or milk sugar.

**Stroke**—Loss of blood supply topart of the brain, due to a blocked or burst artery in the brain.

**Mineral**—An inorganic (non-carbon-containing) element, ion, or compound.

**Vitamin**—Necessary complex nutrient used to aid enzymes or other metabolic processes in the cell.

these diets reduces the risk for heart disease, **hypertension**, stroke, diabetes, obesity, and certain **cancer**.

Starchy foods are the foundation of the traditional diet. For example, the traditional Hawaiian diet is 75 to 80% starch, 7 to 12% fat, and 12 to 15% **protein**. Starch in the diet comes primarily from root vegetables and starchy fruits, such as taro, cassava, yam, green bananas, and breadfruit. In addition, the traditional diet is plentiful in fresh fruits, juices, nuts, and the cooked greens of the starch vegetables (e.g., taro, yam). Traditional meals include *poi* (boiled taro), breadfruit, green bananas, fish, or pork. *Poi* is usually given to babies as an alternative to cereal. Many dishes are cooked in coconut milk, and more than forty varieties of seaweed are eaten, either as a vegetable or a condiment. Local markets with fresh foods are still abundant in most islands.

As expected, fish and other seafood are abundant in the Pacific Islands and are eaten almost every day in some islands. Most fish and seafood are stewed and roasted, but some are served marinated and uncooked. Pork is the most common meat, and it is used in many ceremonial feasts. Whole pigs are often cooked in pits layered with coals and hot rocks. Throughout the Pacific Islands, pit-roasted foods are used to commemorate special occasions and religious celebrations. The part of the pig one receives depends on one's social standing.

Samoans usually welcome visitors with a *kava* ceremony. Kava is made from the ground root of a pepper plant and is mixed with water. It is strained and usually served in a stone bowl or a half of a coconut shell. It looks like dirty water and tastes somewhat like dirty licorice. Guests are expected to drink it in one gulp. In Hawaii, *luaus* are common. A *luau* usually features pit-roasted pig, chicken, fish, and vegetables.

Traditional meals are highly seasoned with ginger, lime or lemon juice, garlic, onions, or scallions, depending on the dish. Lard and coconut oil (both saturated **fats**) are the most common fats used in cooking and give foods a distinctive flavor. Traditional beverages include fruit juices, coconut water, local alcoholic concoctions, and teas (primarily introduced by Asian immigrants).

### *Nutritional Transition*

Many Pacific Islanders have moved to a more Western diet consisting of fast foods and processed foods, and as a result the incidence of both obesity and diabetes have soared. Pacific Islanders now rely on imported foods that are highly processed, such as white flour, white sugar, canned meat and fish, margarine, mayonnaise, carbonated beverages, candies, cookies, and breakfast cereals. Many locals sell their fruits and vegetables and then in turn purchase imported foods. On many islands, 80 to 90% of the foods are now imported. Imported rice is becoming the staple food in some areas, instead of locally grown provisions, and the ability to purchase imported foods is now a status symbol. Agricultural production also plays a role in the dietary transition. Local fruits and vegetables are increasingly less available due to population growth, urbanization, exporting of produce, and selling produce to hotels for the tourism industry. Traditional methods of hunting and gathering wild food, farming, processing, storing, and preserving traditional foods have all but disappeared in some areas.

Even though the health focus has been on the increase in obesity and diabetes, a different problem has occurred in Fiji. A dramatic increase in disordered eating among teenage girls has been observed in this nation, beginning with the introduction of television in 1995. In 1998 a researcher on Fiji reported that:

74% of girls reported feeling "too big or fat" at least sometimes.

Of those who watched television at least three nights per week, 50% perceived themselves as too fat and 30% were more likely to diet.

62% reported dieting in the previous month, a comparable or higher proportion than reported in U.S. samples.

Many health professionals in the Pacific Islands, especially Hawaii, are now emphasizing eating traditional foods and encouraging residents to get back to a healthy lifestyle and to their cultural roots. Programs may now need to be developed to target **eating disorders** and disturbances.

## Risks

### *Nutritional Status*

Mortality and morbidity statistics are limited, mainly because data on Pacific Islanders are often included with those on other Asians. A high percentage of Pacific Islanders live in poverty, though nutritional deficiencies are rare when there are adequate calories. Because Pacific Islander diets are based on whole foods found in nature and prepared without excess cooking, the recommended daily amounts of many **vitamins** and **minerals** can be met in only one meal. In addition, all of the fresh fruits consumed (mainly in the morning and during the afternoon) are abundant in nutrients.

Anemia, **riboflavin** deficiency, and **calcium** deficiency are common nutritional problems in the rural and urban areas of many islands, while heart disease, hypertension,type 2 diabetes, **obesity**, and other chronic diseases are on the rise. This is primarily due to a transition from traditional nutritious diets of fresh fruits, vegetables, poultry, and seafood to a diet with large amounts of imported and highly refined Western foods that are low in **fiber** and high in fat and sugars. Cigarette smoking, an increase in **alcohol consumption**, and a decreased level of physical activity are also contributing factors.

Obesity among Pacific Islanders is among the highest in the world, regardless of the island. Obesity may be due to a genetic predisposition and a cultural preference toward being heavy, but there is a high prevalence of physical inactivity among this population. Attitudes toward obesity are slowly changing, however, and it is gradually being viewed as unhealthy. Small studies that have placed obese and diabetic individuals on traditional diets have shown very good results, as individuals lost weight and diabetics were able to reduce or eliminate the need for insulin.

### Precautions

The natural beauty of the Pacific Islands makes them popular destinations for ecotourists, and food-borne and water-borne diseases are the number one cause of illness among travelers. Visitors are therefore advised to wash their hands often and to drink only bottled or boiled water or carbonated drinks in cans or bottles. They also should avoid tap water, fountain drinks, and ice cubes.

### Resources

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Delores C. S. James


# Pantothenic acid



## Definition

Pantothenic acid, also called vitamin $B_5$, belongs to the group of B-complex water-soluble **vitamins**. Every living organism needs pantothenic acid to survive. Humans do not make this vitamin and must obtain it from the food they eat.

## Purpose

Pantothenic acid is essential to all cells. It helps regulate the chemical reactions that produce energy from the breakdown of **fats**, **carbohydrates**, and proteins. It is also involved in the synthesis of cholesterol, some fatty acids, and some steroid hormones.

## Description

Pantothenic acid was discovered in 1936 and soon afterward was recognized as a vitamin essential to growth. Pantothenic acid is found in all living things. Its name is derived from the Greek word "pantos," which means "everywhere."

Pantothenic acid joins with another molecule to form coenzyme A (CoA). Coenzymes are small molecules that regulate enzyme reactions. CoA is involved in many essential metabolic reactions that produce energy and synthesize new molecules. Without pantothenic acid, there would be no CoA, and life would cease. Some of the activities that require CoA, and thus indirectly pantothenic acid, include:

- converting fats, carbohydrates, and proteins from food into energy that the body can use
- synthesizing heme, the molecule in red blood cells that picks up oxygen in the lung and carries it throughout the body
- synthesizing essential fatty acids, cholesterol, and steroid hormones needed to build new cells
- synthesizing acetylcholine, a neurotransmitter that carries electrical impulses between nerve cells
- stimulating chemical reactions in the liver that help rid the body of certain drugs and toxins (poisons).

Pantothenic acid is available in multivitamins, B-complex vitamins, and as a single-ingredient dietary supplement. Often pantothenic acid is found in **dietary supplements** in the form of **calcium** pantothenate or dexopanthenol, both more stable forms of pantothenic acid that the body can use. Diet supplement manufacturers suggest that pantothenic acid can treat or prevent certain health conditions. None of these uses have been proved by independent, well-controlled

**Pantothenic Acid**

| Age | Recommended dietary allowance (mg/day) |
|---|---|
| Children 0–6 mos. | 1.7 |
| Children 7–12 mos. | 1.8 |
| Children 1–3 yrs. | 2 |
| Children 4–8 yrs. | 3 |
| Children 9–13 yrs. | 4 |
| Children 14–18 yrs. | 5 |
| Adults 19≥ yrs. | 5 |
| Pregnant women | 6 |
| Breastfeeding women | 7 |

| Food | Pantothenic Acid (mg) |
|---|---|
| Liver, beef, cooked, 3.5 oz. | 5.3 |
| Salmon, baked, 3.5 oz. | 1.4 |
| Yogurt, 8 oz. | 1.35 |
| Chicken, dark meat, cooked, 3.5 oz. | 1.3 |
| Chicken, light meat, cooked, 3.5 oz. | 1.0 |
| Milk, nonfat, 1 cup | 0.80 |
| Corn, cooked, ½ cup | 0.72 |
| Sweet potato, cooked, ½ cup | 0.68 |
| Lentils, cooked, ½ cup | 0.64 |
| Egg, 1 large, cooked | 0.61 |
| Broccoli, steamed, ½ cup | 0.40 |
| Tuna, canned, 3 oz. | 0.18 |
| Bread, whole wheat, 1 slice | 0.16 |

mg = milligram

*(Illustration by GGS Information Services/Thomson Gale.)*

research studies. Some of the unsubstantiated uses for which the dietary supplement pantothenic acid is advertised include:

- stimulating wound healing
- improving athletic performance
- lowering cholesterol
- preventing osteoarthritis and rheumatoid arthritis

As of 2007, very few clinical trials were underway involving pantothenic acid. Individuals interested in participating in a clinical trial at no cost can check for new trials at <http://www.clinicaltrialsgov>.

### *Normal pantothenic acid requirements*

The United States Institute of Medicine (IOM) of the National Academy of Sciences has developed values called **Dietary Reference Intakes** (DRIs) for vitamins and **minerals**. The DRIs consist of three sets of numbers. The Recommended Dietary Allowance (RDA) defines the average daily amount of the nutrient needed to meet the health needs of 97–98% of the population. The Adequate Intake (AI) is an estimate set when there is not enough information to determine an RDA. The Tolerable Upper Intake Level (UL) is the average maximum amount that can be taken daily without risking negative side effects. The DRIs are calculated for children, adult men, adult women, pregnant women, and **breastfeeding** women.

The IOM has not set RDA values for pantothenic acid because of incomplete scientific information. Instead, it has set AI levels for all age groups. AI levels for pantothenic acid are measured by weight (milligrams or mg). No UL levels have been set for this vitamin because large doses of pantothenic acid do not appear to cause any side effects.

The following are the daily AIs of pantothenic acid for healthy individuals:

- children birth–6 months: 1.7 mg
- children 7–12 months: 1.8 mg
- children 1–3 years: 2 mg
- children 4–8 years: 3 mg
- children 9–13 years: 4 mg
- children 14–18 years: 5 mg
- adults age 19 and older: 5 mg
- pregnant women: 6 mg
- breastfeeding women: 7 mg

### *Sources of pantothenic acid*

Pantothenic acid is found small quantities in a wide variety of foods. Good sources include liver, kidney, fish, shellfish, egg yolk, broccoli, lentils, and mushrooms. Pantothenic acid is unstable. Much of it is lost during cooking, canning, freezing, and processing. Frozen meats and processed grains, for example, can lose up to half their pantothenic acid content.

The following list gives the approximate pantothenic acid content of some common foods.

- liver, beef, cooked, 3.5 ounces: 5.3 mg
- chicken, dark meat, cooked 3.5 ounces: 1.3 mg
- chicken, light meat, cooked 3.5 ounces: 1.0 mg
- salmon, baked, 3.5 ounces: 1.4 mg
- tuna, canned, 3 ounces: .18 mg
- egg, 1 large, cooked: .61 mg
- milk, nonfat, 1 cup: .80 mg
- yogurt, 8 ounces: 1.35 mg
- broccoli, steamed, 1/2 cup: .40 mg
- sweet potato, cooked 1/2 cup: .68 mg
- lentils, cooked, 1/2 cup: .64 mg
- corn, cooked 1/2 cup: .72
- bread, whole wheat, 1 slice: .16 mg

## KEY TERMS

**B-complex vitamins**—A group of water-soluble vitamins that often work together in the body. These include thiamine ($B_1$), riboflavin ($B_2$), niacin ($B_3$), pantothenic acid ($B_5$), pyridoxine ($B_6$), biotin ($B_7$ or vitamin H), folate/folic acid ($B_9$), and cobalamin ($B_{12}$).

**Coenzyme**—Also called a cofactor, a small nonprotein molecule that binds to an enzyme and catalyzes (stimulates) enzyme-mediated reactions.

**Dietary supplement**—A product, such as a vitamin, mineral, herb, amino acid, or enzyme, that is intended to be consumed in addition to an individual's diet with the expectation that it will improve health.

**Enzyme**—A protein that change the rate of a chemical reaction within the body without themselves being used up in the reaction.

**Fatty acids**—Complex molecules found in fats and oils. Essential fatty acids are fatty acids that the body needs but cannot synthesize. Essential fatty acids are made by plants and must be present in the diet to maintain health.

**Hormone**—A chemical messenger that is produced by one type of cell and travels through the bloodstream to change the metabolism of a different type of cell.

**Neurotransmitter**—One of a group of chemicals secreted by a nerve cell (neuron) to carry a chemical message to another nerve cell, often as a way of transmitting a nerve impulse. Examples of neurotransmitters include acetylcholine, dopamine, serotonin, and norepinephrine.

**Steroid**—A family of compounds that share a similar chemical structure. This family includes the estrogen and testosterone, vitamin D, cholesterol, and the drugs cortisone and prendisone.

**Vitamin**—A nutrient that the body needs in small amounts to remain healthy but that the body cannot manufacture for itself and must acquire through diet.

**Water-soluble vitamin**—A vitamin that dissolves in water and can be removed from the body in urine.

### *Pantothenic acid deficiency*

Pantothenic acid deficiency is so rare that it has only been seen in humans in severely malnourished prisoners of war in Asia after World War II and in research volunteers who were given a pantothenic-free diet. The main symptoms these groups experienced were burning, tingling, and numbness in the feet and fatigue. This symptoms disappeared when pantothenic acid was added to their diet.

## Precautions

Large doses of pantothenic acid taken over a long period are well tolerated. The only negative side effect reported is mild diarrhea.

## Interactions

There are no known interactions between pantothenic acid and drugs or herbal supplements. Using oral contraceptives may mildly increase the body's need for pantothenic acid.

## Complications

No complications are expected related to pantothenic acid. Deficiency occurs only with severe starvation. Excess intake is well tolerated.

## Parental concerns

Parents should have few concerns about pantothenic acid. Healthy children get enough of this vitamin in their diet and are unlikely to need or benefit from supplementation.

### Resources

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Linus Pauling Institute. Oregon State University, 571 Weniger Hall, Corvallis, OR 97331-6512. Telephone: (541) 717-5075. Fax: (541) 737-5077. Website: <http://lpi.oregonstate.edu>

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Tish Davidson, A.M.

# Peanut butter diet

## Definition

The peanut butter diet is a diet plan developed by Holly McCord, nutrition editor of Prevention magazine, a popular health and nutrition magazine. The diet allows consumers to enjoy peanut butter every day while still achieving their weight loss goals. The diet is appealing because it offers a wide variety of nutrients, while allowing the dieter to enjoy peanut butter, a satisfying "comfort" food.

The diet promotes weight loss, lower cholesterol, reduced risk of heart disease, and diabetes for consumers who stay on the meal plan. The eating plan consists of two separate caloric intakes, one for men (2,200 calories per day) and one for women (1,500 calories per day).

Some consumers have reported that the diet is easier to follow than other popular diet plans. Because peanut butter tastes good and is simple to add to daily menus, dieters have no difficulty staying on the plan and being consistent. In the year 2000, Kraft Foods conducted a survey to determine which foods Americans are regularly stocking and consuming. Out of 100 common food items, peanut butter came in fourth. Eggs, granulated sugar, and flour came in first, second, and third place respectively.

## Origins

The roots of the peanut butter diet can be traced to research that was conducted at Brigham and Women's Hospital in Boston, Massachusetts. Nutrition researchers Kathy McManus and Frank Sacks, M.D. worked with overweight patients over several years. During their meetings with patients, they discovered that some overweight individuals were unsuccessful at keeping weight off for any length of time when following **low-fat diet** plans.

Later in their careers, McManus and Dr. Sacks conducted research that compared the effects of calorie-controlled moderate-fat and low-fat diets in obese adults. The result of their research was surprising. Their studies suggested that calorie-controlled diet plans containing moderate amounts of fat, including peanut butter, may be a factor in losing weight.

In their study, McManus and Dr. Sacks assigned 101 men and women whose average weight was 200 pounds, to one of two study groups. One group was told to limit their fate intake to only 20% of their calories. The individuals in the second group had a daily fat allowance of 35%. The participants in the 35% group ate fat that came from foods that are rich in monounsaturated fat. These foods include peanut butter, olive oil, nuts, and avocados. Both study groups limited their intake of foods that were high in saturated fat such as cheese, butter, or red meats. In addition, both study groups were given the same caloric intake: women ate 1,200 calories and men ate 1,500 calories per day.

The study results were informative. Both groups lost an average of 11 pounds during the first six weeks. However, twice as many moderate-fat consumers (Peanut butter dieters) were able to stay with the diet, and were able to maintain their weight loss for a period of 18 weeks. On the other hand, the low-fat dieters had twice the amount of participants who dropped out, and the remaining participants regained about five pounds. McManus suggested that the Peanut Butter Dieters were more successful because they enjoyed their food choices more than the moderate-fat group, and that individuals can stick to a diet plan only if they feel satisfied by the foods they are consuming.

Another study suggested that eating peanut butter appeared to be almost twice as good for your heart compared to low-fat diets. A study conducted by scientists at Pennsylvania State University proved that

## KEY TERMS

**Diabetes**—A disease that causes an abnormally high level of glucose (sugar), to build up in the blood.

**Glycemic Index (GI)**—An index which ranks foods that contain carbohydrates to the effect they have on blood sugar levels after the food is consumed.

**High Density Lipoprotein (HDL) cholesterol**—A type of cholesterol in the blood that is considered to be good for the body. The higher the HDL level, the lower the risk of coronary artery disease.

**Kidney stones**—A small, hard mass in the kidney that forms from chemical deposits. Kidney stones can be extremely painful and are often difficult to diagnose.

**Low Density Lipoprotein (LDL) cholesterol**—A type of cholesterol in the blood that is considered to be bad for the body. High levels of LDL is a risk factor for heart disease.

**Monounsaturated fat**—This type of fat is found in olive, peanut, and canola oil. It is also found in nuts, seeds, and avocados.

**Obese**—Increased body weight caused by an excessive accumulation of fat.

**Saturated fat**—The type of fat that raises bad cholesterol and is linked to higher levels of cholesterol, heart disease, and other chronic diseases.

**Syndrome X**—A group of common disorders that produce a high risk of cardiac disease.

**Total cholesterol**—The total amount of cholesterol in the blood. Cholesterol is a fat-like substance made in the body and present in many foods.

**Triglycerides**—Triglycerides are produced by the body and are the major form of fat.

diets that were high in peanuts and rich in monounsaturated fat were just as effective as low-fat diets at lowering total cholesterol and "bad" LDL cholesterol. In addition, a very low-fat diet actually raised **triglycerides** (possibly as a result of very high carbohydrate intakes), a type of fat in the bloodstream and fat tissue, by 11%. Conversely, the Peanut butter diet actually lowered triglyceride levels by 13%. High amounts of triglycerides are associated with increased risk of diseases such as metabolic syndrome and heart disease. The net result of the study revealed that the Peanut Butter Diet lowered heart disease risk by 21%, while the low-fat diet lowered risk by only 12%.

## Description

The peanut butter diet is largely based on portion control. Men are allowed three servings of peanut butter per day, while women can consume two servings per day. For this diet, a serving is two level tablespoons of peanut butter.

Consumers need not measure peanut butter with a level measuring tablespoon, since this can be time consuming and impractical if travel interferes. The book recommends simply placing a ping-pong ball in the kitchen. Then, consumers use a regular kitchen spoon to remove peanut butter from the jar. As long as the amount of peanut butter on the spoon is no larger than a ping-pong ball, this is considered an acceptable portion. However, it is recommended that dieters measure two tablespoons of peanut butter at least once or twice to familiarize themselves with appropriate portion size. Dieters may choose any brand of peanut butter that appeals to them. They may choose either natural peanut butter brands or emulsified varieties.

The diet plan is very simple. Consumers include peanut butter in two of their meals or snacks in convenient ways, such as spreading it on toaster waffles or an English muffin. It is also recommended that consumers take a 300- to 500-mg **calcium** supplement to meet daily calcium requirements. The Peanut butter diet book includes several recipes and four weeks of meal plans for both men and women. The book also includes recipes for several desserts, including s'mores, a favorite childhood treat, or a peanut butter sundae. The inclusion of desserts makes the diet extremely easy to follow, prevents feelings of deprivation, and helps dieters integrate everyday foods in their diet. The menu plans and recipes are the mainstay of this diet plan and are extensively discussed in the Peanut butter diet book.

A typical menu plan is outlined below:

- Breakfast: Peanut Butter Maple Syrup Waffles1 cup fat-free milk, plain or in cafe latte
- Lunch: Tuna salad: Combine half of a 6-oz can drained, water-packed, white albacore tuna with 2 tsp reduced-calorie mayonnaise, 1/2 tsp Dijon mustard, and 2 Tbsp finely chopped carrots and celery. Optional: 1 tsp chopped pickles. 1 1/2 cups baby carrots, red bell pepper strips 3/4 cup calcium-enriched V-8 juice
- Snack: Orange, pear, or other fruit of your choice
- Dinner: Tahitian Chicken with Peanut Butter Mango Sauce served over 1/2 cup cooked rice (preferably brown basmati)1/2 cup cooked spinach
- Evening Treat:1 1/2 inch-thick slice of angel food cake topped with 1 1/2 cups coarsely mashed strawberries

The author of the peanut butter diet also recommends getting plenty of "Vitamin X, " also known as exercise or regular physical activity. The plan encourages consumers to exercise as much as possible, but states that even 10 or 15 minutes of activity is better than doing no exercise at all. The Peanut Butter Diet book includes a chart of typical exercises and the number of calories burned during each activity. The book also features some strength training moves, which are called "The Basic Six." These six movements work all of the body's major muscle groups. Exercises in the Basic Six include squats, overhead press, biceps curls, and other basic movements.

## Function

In 2002, updated guidelines were released from the National Cholesterol Education Program (NCEP), which is part of the National Institutes of Health (NIH). In their report, the NCEP states that many changes in the way Americans prevent and treat heart disease must occur in order for them to stay healthy. The creator of the Peanut butter diet states that many of these dietary changes are addressed within the Peanut butter diet's guidelines.

The NCEP guidelines suggest that consumers become aware of a set of symptoms referred to as Syndrome X. This cluster of symptoms may dramatically increase the risk of heart attack. The Peanut butter diet addresses many of these concerns due to the presence of heart-healthy **fats** in peanut butter.

Another suggestion raised in the NCEP report is for consumers to follow a nutrition plan that is low in saturated fat. The Peanut butter diet accomplishes this because it allows up to 35% of calories to come from total fat, provided that fat come from mostly unsaturated sources.

The NCEP suggests that consumers aim to reduce high or borderline high triglycerides. The Peanut Butter Diet meets this criterion, since studies show that diets rich in peanut butter aid in reducing triglyceride levels.

Finally, the NCEP report stated that consumers should attempt to increase HDL (this type of cholesterol helps reduce LDL, the unhealthy type of cholesterol) levels. According to new guidelines, HDL levels should be at least 40 mg/dL. Fortunately, research suggests that diets rich in peanut butter do not reduce HDL levels as do low–fat diets.

## Benefits

Peanuts and peanut butter contain more **protein** than any other nut or legume. Because peanut butter contains mainly monounsaturated and polyunsaturated fats, it is thought to be a heart-healthy food that may reduce cholesterol and the risk of coronary artery disease when included in a healthy diet.

When peanut butter is added to a meal or food containing carbohydrate, it lowers the overall Glycemic Index of the meal or snack. The Glycemic Index was developed in the early 1980s by researchers at the University of Toronto. The index ranks foods that contain **carbohydrates** to the effect they have on blood sugar levels after the food is consumed. Each food is then assigned a number. Foods that are rank high on the GI should be eaten in moderation since these foods tend to cause a spike in blood sugar levels. This increase causes insulin levels to increase. Too much insulin may result in high blood pressure and increased risk of heart disease.

Not only is peanut butter a comfort food, it is also loaded with nutrients. Peanut butter is rich in **folate**, **zinc**, **magnesium**, potassium, copper and **vitamin E**. It also contains two naturally-occurring compounds called resveratrol and beta-sitosterol. These compounds are believed to fight **cancer** and combat heart disease. Peanut butter also contains **fiber**, which encourages bowel regularity and helps boost weight loss efforts.

The Peanut butter diet is effortless to follow. Recipes provided in the book are plentiful, informative, and easy for the average consumer to prepare. Peanut butter can be added to protein drinks, carbohydrates such as toast, waffles, muffins, and oatmeal, and can be combined with fruit and other foods to maximize variety and prevent boredom. The Peanut butter diet can easily be followed if a person travels a great deal. Peanut butter is readily available and is easily stored in plastic containers or in its original jar. This allows the dieter to plan meals and customize menus for ultimate flexibility.

## Precautions

This diet plan is not recommended for everyone. As always, consumers should check with their physician before starting any type of diet or nutrition program. It is important for patients to avoid the diet if they are allergic to peanuts. If the patient is an older adult and/or has swallowing problems, the diet should be avoided since peanut butter may become caught in the throat. Individuals with high triglycerides should also avoid the diet or check with a physician before starting the diet plan. Finally, pregnant and/or **breastfeeding** women with a history of allergies should also check with their doctors before choosing this diet. The diet may cause a sensitization to peanut butter in newborns or infants.

## QUESTIONS TO ASK YOUR DOCTOR

- Is this diet appropriate for me?
- How long should I follow this diet?
- Are there any special precautions I should follow?
- Are there any drug precautions I should be aware of while following this diet?
- I am allergic to peanuts. Can I eat other nut butters instead of peanut butter?
- How much exercise should I do each week in conjunction with this diet?
- How often should I weigh myself while following this diet?
- If I become bored on this diet, what can I do to add variety?
- Do you agree with the recommended caloric intake for men (1500) and women (1200)?
- I have high triglycerides. Is this diet safe for me to follow?

## Risks

If the patient has any other serious health concerns, consultation with a physician is critical before starting this or any diet plan. Patients should read the precautions section of this diet to make sure that the diet is appropriate for them. As stated previously, pregnant and/or breastfeeding women with a history of allergies should always consult with their physician before starting the Peanut butter diet. An increased sensitization to peanuts may occur in newborns or infants.

## Research and general acceptance

### *General Acceptance*

No formal studies or data exist regarding the general acceptance of this diet. The diet was featured extensively in *Prevention* Magazine publications, suggesting that subscribers and readers may have been more likely to try the diet compared to non-subscribers and non-readers.

### *Research*

Research was conducted by Prevention Magazine to determine the effectiveness of the Peanut butter diet. An article entitled "Fight Fat with Peanut Butter-Real Life Success Stories" was featured in the November 2002 issue of *Prevention* Magazine. Successful participants were featured who lost up to 27 pounds and are maintaining the loss by following the Peanut butter diet during a field trial. As a group, Colleen Pierre (a registered dietitian and associate professor of nutrition at Johns Hopkins University) and her colleagues lost a total of 140 pounds over five months. None of the participants became bored with the diet or with eating peanut butter. The study participants were also pleased to find that their cholesterol levels dropped while they were on the diet. This added benefit underscores the study conducted by the Pennsylvania State University, whose research suggested that when included in a healthy diet, peanuts and peanut butter lowers bad LDL an! d total cholesterol by 14 and 11%.

No other formal research has been conducted on the Peanut butter diet.

## Resources

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### ORGANIZATIONS

The Peanut Institute. P.O. Box 70157, Albany, Georgia 31708. Telephone: 1-(229) 888-0216. Website: <http://www.peanut-institute.org>.

Sydney University Glycemic Index Research Service, Human Nutrition Unit, School of Molecular and Microbial Biosciences, Sydney University, NSW 2006, Australia. Website: <http://theglycemicindex.com>.

Deborah L. Nurmi, MS

# Perricone diet

## Definition

The Perricone diet is an anti-inflammatory and **anti-aging diet** that emphasizes salmon and nutritional supplements. It is designed to promote weight loss, maintain a healthy weight, and slow or reverse the visible aging process. The cornerstone food in the diet is fish, primarily salmon.

## Origins

The Perricone diet was developed by dermatologist Nicholas Perricone. It was first published in Perricone's 2001 book, *The Wrinkle Cure* which claims that proper nutrition is the key to preventing and eliminating wrinkles from the skin. It advocates eating foods rich in **antioxidants** and low in **carbohydrates**. It was followed in 2002 by *The Perricone Prescription,* which continued and expanded on the role of diet and nutrition in maintaining a healthy and youthful appearance. In 2005, Perricone published *The Perricone Weight-Loss Diet* which adapted his anti-aging diet into a weight loss program.

## Description

The Perricone diet is promoted for weight loss, improving physical appearance, and slowing the aging process. The diet is laid out in six major books by the author from 2001 through 2007. In general, each book emphasizes a different aspect of the diet: the first book is about the diet's effect on diminishing wrinkles and slowing or reversing the visible aging process; his second book focuses on skin care, his third book targets acne, and his fifth book deals with weight loss. Regardless of what it is used for, the basic components of the Perricone diet are foods that are rich in **omega-3 fatty acids**, **protein**, and antioxidants. Above all else, the diet emphasizes eating fish, especially wild Alaskan salmon. He suggests eating salmon at least five times a week but as often as two or three times a day. Other fish allowed on the diet include tuna, cod, shellfish, sole, flounder, swordfish, trout, and halibut. Among the other foods allowed on the diet are nuts, green vegetables, beans, berries, egg whites, low-fat milk and cottage cheese, citrus fruit, olives and olive oil, apples, cantaloupe, kiwi, honeydew melon, nectarines, peaches, pears, tomatoes and tomato juice, tofu, and yogurt.

Foods to be avoided include bread (and anything with flour), pasta, rice, cereal, popcorn, sugar, coffee, red meat, pizza, most cheese, butter and margarine, grapes, watermelon, bananas, carrots, corn, potatoes, and diet and regular soft drinks. The glycemic index (GI) is used by the Perricone diet as a basic guide for eating. Under the diet, foods that have a glycemic index of more than fifty should be avoided while those with a GI of 50 and under are acceptable.

### *The Glycemic Index*

The glycemic index measures the quality rather than the quantity of carbohydrates found in food. Quality refers to how quickly blood sugar levels are raised following eating. The base of the GI is glucose, which is assigned an index value of 100. Other foods are compared to glucose to arrive at their ratings. The higher the GI number, the faster blood sugar increases when that particular food is consumed. A high GI is usually considered to be 70 and greater, a medium GI is 56–69, and a low GI value is 55 or less.

The following is the GI for a few foods:

- Cornflakes, 83
- Grapefruit, 25
- Watermelon, 72
- Sugar, 64
- Potato chips, 56
- White bread, 70
- Sourdough bread, 54
- Macaroni, 46
- Baked red potato, 93
- French fries, 75
- Yogurt, plain, 14
- Salmon, 0

But the GI in not a straightforward formula when it comes to reducing blood sugar levels. Various factors affect the GI value of a specific food, such as how the food is prepared (boiled, baked, sautéd, or fried, for example) and what other foods are consumed with it. For these reasons, the American Diabetes Association has adopted a position that there is not enough conclusive evidence to recommend the general use of a low-GI diet for diabetics. Not all physicians and endocrinologists (medical specialists who treat disorders of the glands, including diabetes) subscribe to the association's position.

Besides salmon, Perricone has developed a list of what he calls ten "super foods" that are high in essential fatty acids, **fiber**, or antioxidants, along with foods that help to regulate blood glucose levels. These foods are: Acai (a berry grown in South America), the allium family (onions, garlic, and leeks), barley, greens (blue-green algae, wheat grass, and barley grass), buckwheat

## KEY TERMS

**Antioxidants**—Substances that inhibit the destructive effects of oxidation on cells.

**Carbohydrates**—An organic compound that is an important source of food and energy.

**Cholesterol**—A solid compound found in blood and a number of foods, including eggs and fats.

**Dermatologist**—A physician that specializes in conditions of the skin.

**Diabetes**—A disease in which the blood glucose (sugar) levels are too high and the body does not make insulin (which helps regulate blood sugar) or does not make or use insulin well.

**Free radicals**—A highly reactive atom or group of atoms with an unpaired electron that can cause oxidation in cells.

**Glucose**—A sugar produced in humans by the conversion of carbohydrates, proteins, and fats.

**Endocrinologist**—A medical specialist who treats diseases of the endocrine (glands) system, including diabetes.

**Glycemic index**—A measure of the quality of carbohydrates in food.

**Vegan**—A type of vegetarian that excludes dairy products and eggs from the diet.

seed, beans and lentils, hot peppers, nuts and seeds, sprouts, and yogurt. Perricone's anti-inflammatory diet is the cornerstone of his beauty and health program. Its core components are:

- High-quality protein found in fish, shellfish, poultry, and tofu.
- Low-glycemic carbohydrates from fresh fruit and vegetables, whole-grains, and beans.
- Healthy fats from cold-water fish, especially wild Alaskan salmon, nuts, seeds, and olive oil.
- Eight to 10 glasses of spring water each day.
- Beverages, such as green tea, that are rich in antioxidants.

Perricone says these foods and beverages act as natural anti-inflammatories and help maintain normal insulin and blood glucose levels. The following excerpt is from the Perricone Website and explains why his diet is anti-inflammatory and how it affects the aging process.

"Our cells use oxygen to produce energy and they generate free radicals as a byproduct of this and many other metabolic functions like circulation and digestion. Free radicals are also produced by sunlight, toxins such as pesticides, cigarette smoke and air pollution. Free radicals are without question the central players in the aging process. But there is another natural phenomenon that affects aging—inflammation. Not the redness, swelling or irritation you may think of but subclinical inflammation, which is not visible to the naked eye, and takes place at the cellular level. What is the relationship between free radicals and inflammation? When free radicals damage a cell, they cause inflammation. Antioxidants scoop up free radicals, preventing the cellular degeneration and production of chemicals within the body that cause further damaging."

The basic Perricone diet consists of five meals a day: breakfast, lunch, dinner, and two snacks. Protein-rich foods must be eaten before the rest of the meal. It also recommends 20–30 minutes of exercise each day. A sample one-day meal plan from *The Perricone Prescription* is:

- Breakfast: Three to four ounces of smoked salmon, one-half a cup of slow-cooked oatmeal with two tablespoons of blueberries, one teaspoon of slivered almonds, and green tea or water.
- Lunch: A four- to six-ounce broiled turkey patty, lettuce and tomato, one-half a cup of three-bean salad, and green tea or water.
- Afternoon snack: Two ounces of sliced turkey or chicken breast, four hazelnuts, and four celery sticks.
- Dinner: Four to six ounces of broiled salmon, one cup of lentil soup, a tossed green salad with olive oil and lemon juice, one-half a cup of steamed spinach, and green tea or water.
- Bedtime snack: One hard-boiled egg, three celery sticks, three red bell pepper strips, and three green olives.

### *Supplements, topical creams, and cost*

One of the biggest criticisms—and drawbacks—of the Perricone diet is the high cost of the more than two dozen **dietary supplements** and topical creams Perricone says people need as part of his diet plan for a healthy and youthful appearance. The products can be purchased through his company, N.V. Perricone, M.D., Nutriceuticals. A 30-day supply of eight supplements for his weight management program cost $195, as of April 2007. Other brands of the supplements also can be purchased at health food stores, vitamin shops, and many pharmacies.

His recommended supplements include **vitamins** A, $B_1$, $B_2$, $B_3$, $B_5$, $B_6$, $B_{12}$, C, and E, folic acid, **biotin**,

**calcium**, chromium, **magnesium**, **selenium**, **zinc**, L-carnitine, acetyl L-carnitine, coenzyme Q10, glutamine, pycnogenol or grape seed extract, gamma linolenic acid, and turmeric. Among his recommended topical creams and lotions are **vitamin C** ester, alpha lipoic acid, dimethylaminoethanol (DMAE), polyenylphosphatidyl **choline** (PPC), and tocotrienol. The company also sells dozens of products that target specific areas of the body (such as the face, eyes, and lips), specific problems (dull skin, acne, dry skin, and spider veins), along with products for men's skin care, weight loss, and sun protection. His weight-loss products (and their prices as of April 2007) include a 5.3-ounce (oz.) pouch of polysaccharide peptide blend ($65), 10.1-oz. of L-glutamine powder ($60), 270 softgel omega-3 fatty acids supplements ($97), and a 30-day supply of 90 maitake caplets ($60).

## Function

The primary function of the Perricone diet is to slow the aging process by counteracting the body's inflammatory process, resulting in healthier and younger looking skin and over-all appearance. Its secondary function is as a weight loss program that stresses a diet high in antioxidants and low in carbohydrates. Weight loss for overweight or obese people can lead to a lower risk for a number of diseases, including some types of **cancer**, heart disease, diabetes, high blood pressure, and high cholesterol. Diet specifics vary slightly among the six major books written by Perricone as of 2007. Since the diet has a **soy** component, it can be adapted to a vegetarian diet but probably not vegan. Omega-3 fatty acids can be obtained from **flaxseed** oil rather than fish.

## Benefits

Benefits include living longer and looking younger, according to Perricone. Specifically, Perricone says his diet plan will reduce wrinkles, slow or reverse the visible aging process, clear acne, and eliminate bags and dark circles around the eyes. Perricone says this is because his diet plan reduces inflammation in the body, which is the root of most of the physical appearance issues associated with aging. The Perricone diet and others like it can be beneficial in reducing the risks of many medical problems, such as heart disease and diabetes, since it emphasizes eating fish, vegetables, and fruit.

## Precautions

The Perricone diet recommends regulating blood sugar levels by eating foods that have a low glycemic index. The American Dietary Association, the American Diabetes Association, the American Heart Association, and the United States Department of Agriculture do not endorse low GI diets and these organizations do not support extreme intakes of fish. Such extreme intakes make the diet unbalanced. Since the diet advocates the use of numerous dietary supplements, persons considering the Perricone diet should check with their doctor or pharmacist to see if any of the supplements interact with any prescription medication they are taking. Persons who are on a blood thinner, such as Coumadin (warfarin) should consult their doctor before going on the diet. Women who are pregnant or lactating should not go on the diet without consulting their physician or obstetrician. People with existing medical conditions, including heart disease and diabetes, should discuss the diet with their physician before starting it.

## Risks

In the UK, the FSA have set upper limits for oily fish consumption that are no more than two portions per week for girls and women of childbearing age and no more than four portions per week for boys, men, and older women due to the risk of contamination.

## Research and general acceptance

Although his books have been best-sellers in the United States and elsewhere, there is not general acceptance of most of his philosophy and claims by the medical community. There is also very little scientific research to substantiate most of his claims regarding the anti-aging aspects of his diet. There is research that shows a diet low in carbohydrates can promote weight loss but most of the studies followed participants for a year or less.

The consumer watchdog Website Quackwatch (http://www.quackwatch.org) takes a skeptical view of many of the claims made by Perricone. "Dr. Perricone would be more credible if he could show us a study demonstrating that people who followed his prescription lived longer, had younger skin demonstrated by objective measures, or felt better than those on a placebo program—or that they were better in any measurable way," physicians Harriet Hall and Stephen Barrett wrote in a Quackwatch article dated August 12, 2004. "Instead, he provides only testimonials, exaggerated claims, partial truths, and incorrect statements." For example, they say the Perricone books fail to mention that a diet high in salmon may pose health risks due to mercury contamination in the

## QUESTIONS TO ASK YOUR DOCTOR

- Have you treated anyone else on the Perricone diet? If so, what has been their response to the diet?
- Will any of the supplements recommended by the diet interact with any medication I am currently taking?
- Would you recommend any other diets that will help me accomplish my goals?
- Do you see any risks associated with me being on the diet?
- What is your view on the association between inflammation at the cellular level and the aging process?
- What role do you believe antioxidants play in improving health and beauty?

fish. They also say the books fail to mention the toxic effects of high doses of some of the nutritional supplements Perricone recommends. The physicians do say his diet is low in calories and appropriate for weight loss.

The diet plan gets a mixed review on the popular and long-running health Website WebMD (http://www.webmd.com). In an article dated September 1, 2005, it quotes Roberta Anding, spokeswoman for the American Dietetic Association as saying she did not think the Perricone diet would harm anyone and praised it for its emphasis on fish, vegetables, and some fruits. Lona Sandon, a registered dietician with the dietetic association, took aim at the diet's emphasis on the glycemic index, saying the effects of foods with a high glycemic index are not proven by scientific research. Sandon also disapproves of Perricone selling his own line of products to supplement the diet. "Any time a diet is sold along with additional supplements and creams that cost more than what most people spend on a month of groceries, that raises a red flag," Sandon said.

In a article in the *New York Times Magazine* (February 6, 2005) Perricone admits that he has no peer-reviewed research to support his diet claims. However, he answered critics of his diet program by saying, "I'm standing on the shoulders of other scientists and translating for people. I've gotten the message to millions that eating makes a huge difference in the way you feel. If you're eating salmon now, or taking fish-oil capsules, I've helped you."

## Resources

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### ORGANIZATIONS


American College of Nutrition. 300 South Duncan Ave., Suite 225, Clearwater, FL 33755. Telephone: (727) 446-6086. Website: http://www.amcollnutr.org.

American Diabetes Association. 1701 N. Beauregard St., Alexandria, VA 22311. Telephone: (800) 342-2383. Website: http://www.diabetes.org.

American Dietetic Association. 120 South Riverside Plaza, Suite 2000, Chicago, IL 60606-6995. Telephone: (800) 877-1600. Website: http://www.eatright.org.

American Society for Nutrition. 9650 Rockville Pike, Bethesda, MD 20814. Telephone: (301) 634-7050. Website: http://www.nutrition.org.

Center for Nutrition Policy and Promotion. 3101 Park Center Drive, 10th Floor, Alexandria, VA 22302-1594. Telephone: (703) 305-7600. Website: http://www.cnpp.usda.gov.

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Ken R. Wells

# Personality type diet

## Definition

The personality type diet is a diet developed by Dr. Robert Kushner that helps dieters identify what kind of eating, exercising, and coping habits they have to help dieters achieve weight loss and better health through personalized incremental change.

## Origins

The personality type diet was developed by Dr. Robert Kushner. Dr. Kushner is a practicing physician who specializes in nutrition and weight loss. He developed the diet to meet the needs of the average dieter with a busy schedule. He used the information and insights he gained during many years of helping people lose weight. Dr. Kushner designed the diet to be a long term aid in the fight against **obesity** that was personalized enough to be meet each dieters unique needs.

Dr. Kushner attended medical school at the University of Illinois Medical School in Chicago, Illinois. During this time he became interested in obesity and weight loss. After completing his medical degree in 1979 he completed his residency at Northwestern Memorial Hospital and specialized in internal medicine. He also completed a fellowship in clinical nutrition at the University of Chicago in 1984. He is the Medical director of the Northwestern Memorial Hospital Wellness Institute and the president of the American Board of Nutrition Physician Specialists. He authored the American Medical Association's "Obesity Treatment Guide for Physicians," as well as numerous scientific papers on obesity, weight loss, and nutrition. Dr. Kushner is also the head of the expert support team for Diet.com. His book "The Personality Type Diet" was written with his wife Nancy Kushner who is a registered nurse.

**Personality type diet**

| Personality | Trait |
|---|---|
| Unguided grazer | Tends to not think about food very much |
| Night-time nibbler | Eats more than half of food intake at dinner or even later |
| Convenient consumer | May eat regular meals, but rarely cooks |
| Fruitless feaster | May eat regular meals, but tends to leave out two important food groups: fruits and vegetables |
| Mindless muncher | Snacks constantly throughout the day, usually in addition to eating a full breakfast, lunch, and dinner |
| Hearty portioner | May eat three meals a day, but tends to eat far too much at any given sitting |
| Deprived snacker | Constantly on a diet |

*(Illustration by GGS Information Services/Thomson Gale.)*

## Description

The personality type diet is designed to be useful to normal people who are trying to lose weight, but have very busy schedules and do not have the time or energy to devote many hours each day to weight loss. Before beginning the diet there is a 66 question questionnaire that the dieter takes to determine what type of dieter, exerciser, and coper the dieter is. The questions address eating and exercise habits, as well as stress and coping mechanisms. Dr. Kushner believes that identifying the way that a person eats, exercises, and deals with problems is the first step to successful weight loss and healthy living. He provides information directed at particular types, as well as general information and tips. The seven types of eaters are:

### *Unguided grazer*

Unguided grazers tends to not think about food very much. They will eat at various times during the day but rarely stop to have a meal or think about what they are eating. Usually eating is an afterthought to a very busy schedule, so foods tend to be whatever is around and easily available. Often this person eats while doing other things, so portion size can vary drastically depending on what is available or what size package is sold.

### *Nighttime nibbler*

Nighttime nibblers eat more than half of their food intake at dinner or even later. Instead of eating regularly throughout the day they might not eat at all until dinner time. Sometimes the nighttime nibbler

## KEY TERMS

**Diabetes mellitus**—A condition in which the body either does not make or cannot respond to the hormone insulin. As a result, the body cannot use glucose (sugar). There are two types, type 1 or juvenile onset and type 2 or adult onset.

**Dietary supplement**—A product, such as a vitamin, mineral, herb, amino acid, or enzyme, that is intended to be consumed in addition to an individual's diet with the expectation that it will improve health.

**Mineral**—An inorganic substance found in the earth that is necessary in small quantities for the body to maintain a health. Examples: zinc, copper, iron.

**Vitamin**—A nutrient that the body needs in small amounts to remain healthy but that the body cannot manufacture for itself and must acquire through diet.

doesn't even eat dinner, he or she just snacks after work until going to sleep.

### *Convenient consumer*

Convenient consumers may eat regular meals, but they barely ever cook. Because they don't cook meals at home, most of the foods that they eat are packaged or are from restaurants, often fast food chains. Convenient consumers may also eat a lot of microwave meals.

### *Fruitless feaster*

Fruitless feasters may eat regular meals, but they tend to leave out two important food groups, fruits and vegetables. Instead the fruitless feaster eats lots of meat and **carbohydrates**.

### *Mindless muncher*

The mindless muncher snacks constantly throughout the day, usually in addition to eating a full breakfast, lunch, and dinner. Often the snacking is done without actually being hungry, and is done instead out of habit or for emotional reasons.

### *Hearty portioner*

The hearty portioner may eat three meals a day, but tends to eat far too much at any given sitting. Sometimes this may occur because they let eating go for too long and then are ravenous when they sit down to eat, and end up eating too much.

### *Deprived snacker*

Deprived snackers are often people who are constantly on diets. They crave foods that they feel like they shouldn't eat, and then overeat alternative foods instead. This is often a vicious cycle of making resolutions and then eating in ways that may fit the specific rules, but violate the spirit of the diet.

Dr. Kushner believes that helping people to identify the ways in which they eat is an important first step in helping them change their eating behaviors. Paying attention to what is being eaten may even help to reduce negative patterns on its own. Dr. Kushner suggests specific techniques to help each type of eater overcome their specific type of problem. For example, for the healthy portioner, learning the basics of how much should be eaten at each meal can be very helpful. Also, adding a small snack or two throughout the day can help to ensure that the dieter is not so hungry by mealtime that he or she overeats.

There are also different types of exercisers, such as the hate-to-move struggler and the no-time-to exercise protester. Dr. Kushner provides ideas for making incremental changes to help achieve regular healthy exercise habits. There are also different types of copers, including cant't-say-no pleaser, and the emotional stuffer. There are suggestions about ways to put better coping mechanisms in place, and to deal with the problems that the dieter encounters.

Dr. Kushner believes that the best way for most people to make changes is by making one small change at a time along a single dimension. This may be helpful for many people because it can be frustrating to try to make complete lifestyle changes all at once when there are many other things that take attention each day such as a job and family. By focusing on one small change at a time the dieter can feel as if he or she are accomplishing things without the stress of complete change all at once. It is also a program that provides suggestions for ways to deal with accidental back sliding, that in any long term diet and exercise program is bound to occur occasionally. Dr. Kushner believes that when changes are made slowly over time, healthy eating and better exercising will lead to weight loss, without the dieter having to constantly focus on it. Instead of taking the spotlight, weight loss becomes a secondary result of better, healthier living. Some people who have follow! ed this diet reported that it was

not very much like being on a diet, which made it easier to follow over a long period of time.

### Function

The personality type diet is intended to help the dieter make incremental changes that are sustainable for a lifetime. Although weight loss is the primary function of the diet, it is only a secondary concern and is expected to take place as a natural consequence of the incremental changes for better eating and health that take place during the diet. Better eating, exercising, and coping strategies are expected to lead to weight loss and better health and well being that lasts a lifetime.

### Benefits

There are many benefits to losing weight and being more fit. The benefits of weight loss can be very significant, and are even greater for people who are obese. People who are obese are at higher risk of diabetes, heart disease, and many other diseases and disorders. The risk and severity of these disorders is generally greater the more obese a person is. Weight loss, if achieved at a moderate pace through a healthy diet and regular exercise, can reduce the risk of these and many other obesity-related diseases. Increased exercise can also reduce the risk of cardiovascular disease and other diseases. An additional benefit of the Personality Type Diet is that it may lead to a perception of increased control over life in general as the dieter learns to identify and correct problem behaviors and patterns and take more active control of his or her eating and weight.

### Precautions

Anyone thinking of beginning a new diet should consult a medical practitioner. Requirements of calories, fat, and nutrients can differ significantly from person to person, depending on gender, age, weight, and many other factors such as the presence of diseases or conditions. Pregnant or **breastfeeding** women should be especially cautious because the diet of the mother influences the nutrients that the baby receives.

### Risks

There are some risks to following any diet. The Dr. Kushner diet encourages the dieter to eat a wide variety of healthy foods, and does not completely restrict any food group. For this reason the risks associated with this diet are probably not as significant as with many other diets. However, a multivitamin or supplement may help ensure that the dieter receives all the necessary nutrients and **vitamins** required each day for good health. A dieter my want to ask his or her physician about an appropriate vitamin or supplement before beginning the diet. Vitamins and supplements have either own risks and women who are pregnant or breastfeeding should be especially cautious. There are no known risks specifically associated with the personality type diet as it suggests slow, incremental change and a balanced diet.

## QUESTIONS TO ASK THE DOCTOR

- Would a multivitamin or other dietary supplement be appropriate for me if I were to begin this diet?
- Is this diet appropriate for my entire family?
- Is it safe for me to follow this diet over a long period of time?
- Is this diet the best diet to meet my goals?

### Research and general acceptance

Although the personality type diet has not been studied specifically, there is a wealth of scientific evidence that suggests that a diet low in fat and high in vegetable and plant products is healthful. There is also a large quantity of evidence that suggests a generally balanced diet is important for weight loss and good overall heath.

It is also generally accepted that weight loss can significantly improve overall health. Obesity is associated with many different health problems. These include diabetes, sleep apnea, and cardiovascular disease. Studies have shown that the more overweight a person is, the more likely they are to have these and other obesity related health problems. Losing weight can significantly reduce these risks and may reduce the severity of the symptoms if the problems have already occurred.

Dr. Kushner has authored many scientific papers about obesity and weight loss. He is the author of the American Medical Association's "Obesity Treatment Guide for Physcians". His views on what constitutes a healthy diet and what the best ways to help patients control their weight are generally accepted by the medical community, and in some cases have set the standard in care for treating obese patients seeking to lose weight.

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Helen M. Davidson

# Phytonutrients

## Definition

Phytonutrients are a class of nutrients that are thought to have health-protecting properties. The prefix *phyto* is from the Greek and means plant, and it is used because phytonutrients are obtained only from plants.

## Purpose

Unlike the **macronutrients** (proteins, **carbohydrates**, **fats**) and micronutrients (**vitamins**, trace **minerals**) that are needed for growth, **metabolism**, and other body functions, phytonutrients are not considered essential. This is because they can be lacking in the diet without harmful health consequences. However, throughout history, plants have been cultivated and used to prevent and treat various human diseases. More recently, understanding the chemical role played by these phytonutrients in plants has provided new clues as to how they may help humans. When eating plant-based foods, some of these phytonutrients identified as protectors in plants are transferred to our bodies. The herbs and spices used for adding flavors and tastes to foods are now known to be associated with a long list of potential beneficial effects on human health. Phytochemicals derived from the plants to this day remain the basis of several medications used for the treatment of a wide range of diseases. Throughout the world, botanists and chemists actively search the plant kingdom for new phytochemicals. Over 40% of medicines now prescribed in the Unites States contain chemicals derived from plants. For example, ephedrine, a phytochemical, is used in the commercial preparation of pharmaceutical drugs prescribed for the relief of asthma symptoms and other respiratory problems. Phytochemicals isolated from plants have also been a great help for discovering a large proportion of the drugs now available for the treatment of a wide range of human diseases such as pulmonary diseases, cardiovascular diseases, diabetes, **obesity**, and cancers.

**Ways phytonutrients may protect human health**

Serve as antioxidants
Enhance immune response
Enhance cell-to-cell communication
Alter estrogen metabolism
Convert to Vitamin A (beta-carotene is metabolized to vitamin A)
Cause cancer cells to die (apoptosis)
Repair DNA damage caused by smoking and other toxic exposures
Detoxify carcinogens through the activation of the cytocrome P450 and Phase II enzyme systems

More research is needed to firmly establish the mechanisms of action of the various phytochemicals

SOURCE: Agricultural Research Service, U.S. Department of Agriculture

*(Illustration by GGS Information Services/Thomson Gale.)*

## Description

There are three broad classes of phytonutrients: phytochemicals, medicinal plants and herbs and spices.

### *Phytochemicals*

Thousands of phytochemicals have been isolated and characterized from plants, including fruits and vegetables. The most well-known include include terpenes, **carotenoids**, flavonoids, limonoids, and phytosterols. In nature the bright green and red pigments present in cabbages and lettuce, tomatoes and strawberries have evolved to help absorb otherwise harmful ultraviolet radiation from the sun. They include the yellow, orange, and red carotenoids. Green and leafy

vegetables are also rich in a carotenoid called beta–carotene. Flavonoids are other reddish pigments, found in red grape skins and citrus fruits. Other phytopigments include lutein that makes corn yellow, and lycopene that makes tomatoes red. Aroma compounds in garlic and onions help protect plants from bacterial and viral infections. Others are enzyme blockers that forme to fight toxic pollutants. Plants have developed literally hundreds of thousands of naturally phyto–protective chemicals. It is therefore believed that if people consume them, they may gain some of these protective benefits. When extracted from plants, isolated phytochemicals are grouped into distinctive classes depending on the number and kind of atoms that they contain and according to the chemical structure of their main functional groups. The main classes of phytochemicals are:

- Alkaloids. This class contains molecules with cyclic carbon groups containing at least one nitrogen atom in the carbon ring. They are obtained chiefly from many vascular plants and some fungi and include steroids and some saponins extracted from beans, cereals, herbs.
- Aromatics. This class includes substances that contain a benzene ring that consists of six carbon atoms in a flat, hexagonal pattern and are found in aromatic plants such as garlic and onions.
- Flavonoids. Many are extracted from fruits, and vegetables. They include flavones (found in chamomile), flavonols (found in grapefruit and rutin-buckwheat), flavanones (from citrus fruits, milk thistle) and the isoflavones (found in soy, peanuts, lentils).
- Indoles. Indoles, extracted from cabbage, are carbon compounds with two rings, a six-membered benzene ring fused to a five-membered nitrogen–containing pyrrole ring.
- Phytosterols. Sterols can be extracted from most plant species. Although green and yellow vegetables contain significant amounts, their seeds concentrate the sterols. Most of the research on phytosterols has been done on the seeds of pumpkins, yams, soy, rice and herbs.
- Terpenes. These are extracted from green vegetables, soy products and grains, and represent one of the largest classes of phytochemicals. The most intensely studied terpenes are carotenoids (from fruits, carrots). A subclass of terpenes are the limonoids found in citrus fruit peels.

It is well-known that plants produce phytochemicals to protect themselves and recent research increasingly shows that they may protect humans as well. Some examples of their health benefits include:

- Antioxidative properties. Most phytochemicals show antioxidant activity and are thus liable to protect lipids, blood and other body fluids from damage (oxidative stress) from reactive oxygen species while reducing the risk of developing certain types of cancer. Phytochemicals with antioxidant activity include allyl sulfides (onions, leeks, garlic), carotenoids, flavonoids, and polyphenols (tea, grapes).
- Hormonal properties. Isoflavones, also called phytoestrogens may function as human estrogens and help to reduce menopausal symptoms and osteoporosis.
- Enzyme stimulation. Indoles stimulate enzymes that lower the activity of estrogen and could reduce the risk for breast cancer. Other phytochemicals, which interfere with enzymes, are protease inhibitors (soy and beans) and terpenes.
- Interference with DNA replication. Saponins interfere with the replication of cell DNA, thereby preventing the multiplication of cancer cells. Capsaicin, found in hot peppers, is believed to protect DNA from carcinogens.
- Antibacterial properties. The phytochemical allicin from garlic has antibacterial properties. The intake of proanthocyanidins (from cranberries) will reduce the risk of urinary tract infections and will improve dental health.
- Cholesterol control. Phytosterols are believed to compete with dietary cholesterol for uptake in the intestines.
- Adhesion properties. Some phytochemicals bind to cell walls and it has been suggested that they prevent the adhesion of pathogens to human cell walls. Proanthocyanidins are responsible for the anti–adhesion properties of cranberry.

### *Medicinal plants*

Medicinal plants have been used since the dawn of history to prevent and treat various diseases and disorders. They were first discovered by trial and error, for instance by noticing that pain went away when drinking tea made from the bark of a willow tree. It is only much later as science developed in the 20th century that chemists isolated salicylic acid from willow bark, the active ingredient in aspirin. Of the estimated 250,000 plant species, only 2% have been thoroughly investigated for phytochemicals with potential medicinal use. Some of the most well-known include:

- Aloe vera (*Aloe vera*). Heals wounds, emollient, laxative.
- Angelica (*Angelica arcangelica*). Antispasmodic, promotes menstrual flow.

## KEY TERMS

**Analgesic**—A substance capable of producing analgesia, meaning one that relieves pain.

**Antianemic**—Preventing or curing anemia, a condition characterized by a lower than normal count of red blood cells.

**Antiemetic**—Agents that prevent nausea and vomiting.

**Antifungal**—Substance that prevents the growth of fungi.

**Antihyperlipidemic**—Substance used in the treatment of very high serum triglyceride levels.

**Antimicrobial**—Substance that prevents the growth of microorganisms including bacteria, viruses and fungi.

**Antimutagenic**—Substance that protects against genetic mutation.

**Antinociceptive**—Substance that reduces sensitivity to painful stimuli.

**Antioxidative**—A substance that inhibits oxidation.

**Antipyretic**—An agent that reduces or prevents fever.

**Antitussive**—Preventing or relieving cough.

**Astringent**—Tending to draw together or constrict tissues.

**Atherosclerosis**—Clogging, narrowing, and hardening of the body's large arteries and medium-sized blood vessels.

**Carminative**—A substance that stops the formation of intestinal gas and helps expel gas that has already formed.

**Demulcent**—A substance that soothes irritated tissue, especially mucous membranes.

**Diaphoretic**—An agent that promotes sweating.

**Emetic**—A medicine that induces nausea and vomiting.

**Emollient**—An agent that softens and soothes the skin when applied locally.

**Enzyme**—A protein that accelerates the rate of chemical reactions.

**Estrogen**—A hormone produced by the ovaries and testes. It stimulates the development of secondary sexual characteristics and induces menstruation in women.

**Expectorant**—A substance that stimulates removal of mucus from the lungs.

**Hematemesis**—The medical term for bloody vomitus.

**Intermittent claudication**—Symptoms that occur when the leg muscles do not receive the oxygen rich blood required during exercise, thus causing cramping in the hips, thighs or calves.

**Hypolipidemic**—Promoting the reduction of lipid concentrations in the serum.

**Hypotensive**—Agent that lowers blood pressure.

**Laxative**—A medicine that helps relieve constipation.

**Narcotic**—An agent that causes insensibility or stupor; usually refers to opioids given to relieve pain.

**Nervine**—An agent that calms nervousness, tension or excitement.

**Neurogenic bladder**—An unstable bladder associated with a neurological condition, such as diabetes, stroke or spinal cord injury.

**Osteoarthritis**—A form of arthritis, occurring mainly in older persons, that is characterized by chronic degeneration of the cartilage of the joints.

**Psoriasis**—A chronic disease of the skin marked by red patches covered with white scales.

**Sedative**—A substance that reduces nervous tension.

**Sialagogue**—Promotes the flow of saliva.

**Tonic**—An agent that restores or increases body tone.

**Trace minerals**—Minerals needed by the body in small amounts. They include: selenium, iron, zinc, copper, manganese, molybdenum, chromium, arsenic, germanium, lithium, rubidium, tin.

- Arnica (*Arnica montana*). Anti-inflammatory, antimicrobial, muscular soreness, pain relief.
- Arrowroot (*Maranta arundinacea*). Anti-inflammatory, digestive, antiseptic.
- Belladonna (*Atropa belladonna*). Antispasmodic, narcotic, reduces sweating, sedative.
- Bergamot (*Citrus bergamia*). Disinfectant, muscle relaxant.
- Calendula, marigold (*Calendula officinallis*). Anti-inflammatory, astringent, heals wounds, antiseptic, detoxifying.
- Camphor (*Cinnamomum camphora*). Antiseptic, antispasmodic, analgesic, expectorant.
- Cardus, milk thistle (*Carduus marianus*). Digestive, liver tonic, stimulates secretion of bile, increases breast–milk production, antidepressant.

- Chamomile (*Chamomilla recutita*). Anti-inflammatory, antiseptic, antispasmodic, relaxant, carminative.
- Clove (*Eugenia caryophyllata*). Antiseptic, mind and body stimulant, analgesic, antibacterial, carminative.
- Comfrey (*Symphytum officinale*). Anti-inflammatory, wound healing, astringent.
- Dandelion (*Taraxacum officinale*). Diuretic, digestive, antibiotic.
- Eucalyptus (*Eucalyptus globulus*). Antiseptic, expectorant, stimulates local blood flow, antifungal.
- Gentian (*Gentiana lutea*). Digestive stimulant, eases stomach pain.
- Ginkgo (*Ginkgo biloba*). Circulation stimulant and tonic, anti–asthmatic, antispasmodic, anti-inflammatory.
- Ginseng (*Panax ginseng*). Tonic, stimulant, physical and mental revitalizer.
- Hawthorn (*Crataegus oxyacantha*). Heart tonic, diuretic, astringent, dilates blood vessels, relaxant, antioxidant.
- Jasmine (*Jasminum grandiflorum*). Antispasmodic, expectorant.
- Juniper (*Juniperus communis*). Diuretic, antimicrobial, carminative, anti-rheumatic.
- Lavender (*Lavandula officinalis*). Carminative, relieves muscle spasms, antidepressant, antiseptic and antibacterial, stimulates blood flow.
- Malva, common mallow (*Malva silvestris*). Anti-inflammatory, emollient, astringent, laxative.
- Melissa (*Melissa officinalis*). Relaxant, antispasmodic, increases sweating, carminative, antiviral, nerve tonic.
- Mistletoe (*Viscum album*). Tranquilizer, reduces pain, controls blood pressure.
- Motherwort (*Leonurus cardiaca*). Antispasmodic, hepatic, nervine, hypotensive, cardiac tonic.
- Nettle (*Urtica dioica*). Diuretic, tonic, astringent, prevents hemorrhaging, anti-allergenic, reduces prostate enlargement.
- Palmetto (*Sabal serrulata*). Tonic, diuretic, sedative.
- Passion flower (*Passiflora incarnata*). Anti-inflammatory, antispasmodic, hypotensive, sedative.
- Peppermint (*Mentha piperita*). Carminative, relieves muscle spasms, increases sweating, stimulates secretion of bile, antiseptic.
- Rose (*Rosa gallica*). Antidepressant, sedative, anti-inflammatory.
- Rue (*Ruta graveolens*). Antispasmodic, increases peripheral blood circulation, relieves eye tension.
- Sarsaparilla (*Smilax sarsaparilla*). Diuretic, anti-inflammatory, anti-rheumatic.
- Scots pine (*Pinus sylvestris*). Antiseptic, diuretic and anti-rheumatic.
- St.-John's wort (*Hypericum perforatum*). Antidepressant, antispasmodic, astringent, sedative, relieves pain, antiviral.
- Valerian (*Valeriana officinalis*). Sedative, relaxant, relieves muscle spasm, relieves anxiety, lowers blood pressure.
- Verbena (*Verbena officinalis*). Nervine, tonic, mild sedative, stimulates bile secretion.
- Witch hazel (*Hamamamelis virginiana*). Astringent, anti-inflammatory, stops external and internal bleeding.
- Wormwood (*Artemisia absinthium*). Stimulates secretion of bile, anti-inflammatory, eliminates worms, eases stomach pains, mild antidepressant.
- Yarrow (*Achillea millefolium*). Antispasmodic, astringent, bitter tonic, increases sweating, lowers blood pressure, reduces fever, mild diuretic and urinary antiseptic.

### *Herbs and spices*

Spices have always been important in history. Spices belonged to the most valuable items of trade in the ancient and medieval world, providing the incentive for exploration and most great sea voyages of discovery. When Christopher Columbus discovered America, he described to his sponsors the many new spices available there. Herbs are leafy, green plant parts used for flavoring foods. They are usually used fresh. Unlike herbs, spices are almost always dried. Herbs and spices that are considered phytonutrients that are beneficial to health and have therapeutic properties include the following:

- Anise (*Pimpinella anisum*). Has carminative, sedative, antidepressant, antispasmodic, antifungal, and diuretic properties, used as a tonic.
- Bay leaves (*Laurus nobilis*). Has carminative, antiflatulent, antimicrobial, antirheumatic, anticonvulsive and insect repellent properties.
- Black cumin (*Nigella sativa*). Has anti-inflammatory, analgesic, antioxidant, sedative, carminative, stimulant and anti–asthma properties.
- Black pepper (*Piper nigrum*). Used as a central nervous system stimulant, has analgesic and antipyretic properties.
- Caraway (*Carum carvi*). Used for flatulence, indigestion, and irritable bowel syndrome.
- Cardamom (*Elettaria cardamomum*). Has stimulant and carminative, digestive, anti–obesity, aphrodisiac properties.

- Cinnamon (*Cinnamomum zeylanicum*). Used against heartburn, heavy menstruation, peptic ulcer, poor appetite, yeast infections.
- Cayenne Pepper (*Capiscum frutescens*). Topical use for diabetes, neurogenic bladder, osteoarthritis, pain and psoriasis.
- Celery (*Apium graveolens L.* ). Used as antimicrobial, antifungal, and antihyperlipidemic agent.
- Coriander (*Coriandrum sativum L.*). Used for treating bacterial infections, worm infections, indigestion, and inflammation.
- Dill (*Anethum graveolens*). Used against digestive problems
- Fennel (*Foeniculum vulgare*). Used against indigestion and irritable bowel syndrome.
- Garlic (*Allium sativum*). Used against atherosclerosis, high triglycerides, athlete's foot, bronchitis, heart attack, high blood pressure, high cholesterol, intermittent claudication
- Ginger (*Zingiber officinale*). Used against motion sickness, nausea and vomiting following surgery, morning sickness, and chemotherapy.
- Lemon Grass (*Cymbopogon citratus*). Has antimicrobial, antifungal, antibacterial, and mosquito repellent properties.
- Marjoram (*Origanum majorana*). Has carminative, antispasmodic, diaphoretic, and diuretic properties.
- Mustard (*Brassica alba*). Used as an emetic and a muscle relaxant.
- Nutmeg (*Myristica fragrans*). Has carminative, hallucinogenic, stimulant, expectorant, and sialagogue properties.
- Onion (*Allium cepa L.*). Used against pain, diarrhea, hematemesis, diabetes, asthma, cough and tumors.
- Oregano (*Origanum vulgare*). Has antifungal and antimicrobial properties and protects against colds.
- Paprika (*Capiscum annuum*). Has anti-inflammatory and antinociceptive properties, and is used as a circulatory stimulant
- Parsley (*Petroselinum crispum*). Has antihyperlipidemic, anticoagulant, antimicrobial, antioxidative, antianemic, and laxative properties, used as a tonic.
- Red beet root (*Beta vulgaris*). Has antioxidant and liver-protecting properties
- Saffron (*Crocus sativus L.*). Has antispasmodic, diaphoretic, carminative, heart–protective, hypolipidemic, antitussive, antioxidant, sedative, and memory–enhancing properties.
- Sage (*Salvia officinalis*). Used against night sweats and to relieve oral cavity and throat inflammations.
- Savory (*Satureja hortensis L.*). Has antibacterial, antifungal, antioxidative, antispasmodic, antidiarrheal, sedative, and anti-inflammatory properties.
- Sesame (*Sesamum indicum*). Used as a tonic and a laxative, emollient, demulcent, has antidiabetic and antioxidant properties.
- Spearmint (*Mentha spicata*). Has antibacterial, anti-inflammatory, carminative, analgesic and antimutagenic properties.
- Sweet basil (*Ocimum basilicum L.*). Has antioxidant, heart-protective, anti-fertility, anti-diabetic, liver-protective, anti-inflammatory, antifungal, antimicrobial, antiemetic, antispasmodic, and analgesic properties.
- Thyme (*Thymus vulgaris*). Has carminative, and antitussive properties.

## Precautions

There are no recorded harmful effects associated with medicinal plants, nor with herbs, and spices, except for unpalatable food when used in exaggerated quantities. Phytochemicals in isolated forms, however, can have adverse effects on some people and may not provide all of the health benefits of the whole plant foods they were extracted from. Phytonutrients are relatively new in nutritional public awareness. While there is ample evidence to support the health benefits of diets rich in plant foods such as fruits, vegetables, whole grains and nuts, hard evidence concerning the benefits of specific phytonutrients is limited. This is because plant-based foods are complex mixtures of numerous bioactive compounds, and information on potential health effects is linked to information on the health effects of foods that contain a group of phytochemicals rather than on the effect of a specific phytochemical. A wealth of information exist about vitamins and minerals, but researchers are still trying to determine scientifically the types of phytochemicals that are present in foods, how they interact with each other and the body and what their health benefits are. There is also a trend to package and promote phytonutrient supplements as the new magic cure for all diseases and disorders, which makes it difficult to assess the claims that are made concerning their benefits. Taken in the form of supplements, caution should accordingly be exercised to avoid excessive intake. For example, carotenoids are not toxic to the human body. An excessive intake of carrots and other vegetables containing carotene can lead to a yellowing of the skin, in itself harmless. However, beta-carotene in the form of a phytonutrient supplement be dangerous for smokers and people exposed to secondhand smoke or asbestos. The American **Cancer** Society has requested that warning labels for these people be

placed on phytonutrient supplements containing any isolated form of **vitamin A** or beta-carotene.

## Interactions

Though beneficial for certain conditions, phytonutrient supplements can not always capture the many different interactions of the phytonutrients found in food. For example, flavonoids and carotenoids are believed to have more health-promoting properties when they are taken together rather than separately in a supplement. The hundreds of phytonutrients present in plant foods help each other biochemically—and presumably also in the body. The food science and pharmaceutical developments of the past decades have consistently demonstrated the need to consume a broad range of whole foods on a regular basis. Eating a whole tomato is better than taking a supplement that contains a phytochemical isolated from a tomato. Eating a carrot does not only provide the beta carotene that could be obtained in a pill, but also the health benefits of hundreds or thousands of other phytonutrients that have not yet been identified or characterized. Some interactions are possible between phytonutrients. Citrus bioflavonoid preparations, such as grapefruit juice, may interact with drugs containing naringin. Naringin increases the oral bioavailability of **calcium** channel blocker medications such as: nifedipine, verapramil and felodipine. Naringin may enhance the effect of these drugs and result in a serious drop in blood pressure. Naringin also inhibits the breakdown of various drugs such as **caffeine**, coumarin, and estrogens. It is recommended to avoid flavonoid preparations containing naringin when taking any of these drugs. Studying the health benefits of individual phytonutrients is just one aspect of understanding how fruits and vegetables contribute to health, buy much research remains to be done on how the phytonutrients interact with each other and how they may protect against disease.

## Aftercare

In case of adverse or allergic reaction, the use of phytonutrient supplements should be discontinued.

## Complications

One risk associated with phytonutrients is if they are taken as supplements because they are then in a concentrated and more potent form. Hence, some may cause allergic reactions in hypersensitive people. They should also be kept out of reach of children. As with any nutritional supplement, a healthcare professional should be consulted if taken by pregnant or lactating women or by people with health conditions. For example, cauliflower contains goitrogens that can interfere with the functioning of the thyroid gland. Individuals with already existing medical problems may have to avoid specific phytonutrients.

## Parental concerns

There is a danger that phytonutrient classifications over-simplify the process of building a healthy diet. Most foods are packed with protective phytonutrients. They are present in all plant foods, and eating a wide variety of fruits and vegetables should be preferred to taking specific supplements, unless recommended by a health practitioner. Information on the disease-fighting functions of phytonutrients is becoming widely available and should be used to understanding their many properties. It is not possible to cover all of the cautions for people considering the purchase of phytonutrient supplements. However, one simple sentence covers whole foods and whole food supplements: they can be a safe and important method by which people improve their health and well-being because they are made from the whole fruit or vegetable and do not just contain isolated components.

## Resources

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American Society for Nutrition (ASN). 9650 Rockville Pike, Bethesda, MD 20814. (301) 634-7050. <http://www.nutrition.org>.

Office of Dietary Supplements, National Institutes of Health. National Institutes of Health, Bethesda, Maryland 20892 USA. <http://ods.od.nih.gov>.

U.S. Department of Agriculture, Food and Nutrition Information Center. National Agricultural Library,10301 Baltimore Avenue, Room 105, Beltsville, MD 20705. (301) 504-5414. Phytochemicals Database:< http://www.pl.barc.usda.gov/usda_chem/achem_home.cfm>.

USDA Center for Nutrition Policy and Promotion (CNPP). 3101 Park Center Drive, 10th Floor, Alexandria, VA 22302-1594. (703) 305-7600. <http://www.cnpp.usda.org>.

Monique Laberge, Ph.D.

Polynesian diet *see* Pacific Islander diet

# Pregnancy diet

## Definition

A healthy diet during pregnancy is essential to provide all the nutrients needed by a mother and her growing baby. It is a common misconception that pregnant women need to "eat for two". In fact, most of the additional nutrients needed during pregnancy can be obtained by selecting appropriate foods and eating a high quality nutrient-dense diet. However there are some specific recommendations, which include taking folic acid supplements in early pregnancy to reduce the risk of neural tube defects, such as spina bifida. It is also important for pregnant women to be adopt good food hygiene practices to minimize the risk of **food poisoning** from harmful bacteria and to avoid substances in foods and drinks that might be potentially harmful to them or their growing baby.

## Origins

The need for a healthy, balanced diet during pregnancy is well recognized and most dietary recommendations date back several years. For example, in the UK the Committee on Medical Aspects of Food Policy (COMA) set specific recommendations for nutrient intakes amongst the population as a whole and for pregnant women in 1991.However, in recent years there has been heightened concern about the potential risks from exposure to certain substances, for example **caffeine** and alcohol, and greater support for the role that some nutrients can play in ensuring a successful pregnancy outcome. For example, it is now well recognized that folic acid supplements before and in the first trimester (first 12 weeks) of pregnancy can help to reduce the risks of neural tube defects (such as spina bifida).

**Recommended weight gain for pregnant women**

| If you are: | You should gain: |
|---|---|
| Underweight | About 27 to 40 pounds |
| Normal weight | About 25 to 35 pounds |
| Overweight | About 15 to 25 pounds |
| Obese | About 15 pounds or less |

SOURCE: National Institute of Diabetes and Digestive and Kidney Diseases, National Institutes of Health, U.S. Department of Health and Human Services

**General weight-gain recommendations for women who are expecting only one baby.** *(Illustration by GGS Information Services/Thomson Gale.)*

## Description

Although pregnant women do not have to "eat for two", a healthy, balanced and varied diet that is rich in **vitamins** and **minerals** is important for both a mother and her baby. The mother's diet must provide sufficient energy (calories) and nutrients to meet her usual requirements, as well as the needs of the growing fetus, and enable the mother to lay down stores of nutrients required for the baby's development and for **breastfeeding**.

Pregnant women, as well as those planning for pregnancy, should follow a healthy, balanced diet. This can be achieved by following the usual guidelines, which are based around the five main food groups:

- Bread, other cereals and potatoes. Foods in this group include breakfast cereals, pasta and rice. These foods should make up the main part of the diet. They are good sources of carbohydrate, protein and B vitamins, low in fat and filling. Whole-grain varieties contain more vitamins and minerals and breakfast cereals that contain added iron and folic acid are a good choice during pregnancy.
- Fruit and vegetables. This includes fresh, frozen, tinned and dried varieties and fruit juice. It is recommended to consume at least five portions of different types each day (although fruit juice counts as only one portion however much is drunk in a day). Fruit and vegetables provide a number of important nutrients

including vitamin C, beta-carotene, folate and potassium, as well as fibre.

- Meat, fish and alternatives. Alternatives include eggs, nuts, pulses (such as beans, lentils, chickpeas) and textured vegetable protein. These should be consumed in moderate amounts and lower fat versions selected whenever possible. They are a major source of protein, vitamins and minerals. Atleast one portion of oily fish (e.g. sardines or salmon) a week will ensure an adequate supply of omega-3 fatty acids.
- Milk and dairy foods. These should be consumed in moderate amounts and lower fat versions are preferable. These foods are particularly high in calcium and good sources of protein. Skimmed and semi-skimmed milk contain just as much calcium and protein as whole milk.
- Foods containing fat and sugar. These foods add palatability to the diet but should be eaten infrequently.

## Energy intake and weight gain

Energy (calorie) requirements increase during pregnancy by a small amount. The body's increased need for some other nutrients, such as **iron** and **calcium**, can be met without increasing intakes. This is because the body adapts and becomes more efficient at absorbing and using these nutrients during pregnancy. However, for some nutrients, an increase in intake is necessary, including **protein**, the B vitamins - **thiamin** (vitamin $B_1$), **riboflavin** (vitamin $B_2$) and **folate**, and vitamins A, C and D. For some of these nutrients, such as for protein, the majority of women will already be consuming enough. However, for others, such as folate, dietary adjustments may be necessary in order to make sure that adequate amounts are consumed, and these are discussed in more detail below.

The total energy cost of pregnancy has been estimated at around 321 MJ (77,000 kcal). However, in reality, there are wide variations in individual energy requirements during pregnancy as women vary greatly in basal metabolic rate, body fat and physical activity levels. In the UK, the recommendation is for women to consume an extra 200 kcals per day during the third trimester only. But this assumes that women reduce their physical activity levels during pregnancy and women who are underweight or who do not reduce their activity level may require more. The American Dietetic Association recommends the additional energy needs during the second and third trimesters of pregnancy to be approximately 300 kcal per day in adults and older adolescents and 500 kcal per day in young adolescents (<14 years) but individual differences are also emphasised.

### KEY TERMS

**Basal metabolic rate**—basal metabolic Rate is the number of calories the body burns at rest to maintain normal body functions.

**DHA**—A long-chain omega-3 fatty acid found primarily in oily fish. It is important for the development of the brain and the retina of the eye.

**Folic acid**—The synthetic form of the B vitamin folate, found in supplements.Folate is needed to produce red blood cells.

**Iron deficiency anemia**—The inability to make sufficient red blood cells that results in fatigue, shortness of breath, headaches and in ability to fight infections. It is common in pregnancy.

**Low birth weight**—A low birth weight infant is one who is born after the the normal gestational period (38-42 weeks) but weights less than 2.5 kgs (5.5 pounds) at birth.

**Neural tube defects**—Neural tube defects are serious birth defects that involve incomplete development of the brain, spinal cord and/or protective coverings for these organs.

**Retinol**—Also known as vitamin A. This is a fat soluble vitamin found in animal food sources.

A good approach is for pregnant women to eat when they feel hungry. If weight gain is appropriate, then energy intake is likely to be adequate.

For women with a healthy pre-pregnancy weight, an average weight gain of 12kg (range 10–14kg) is associated with the lowest risk of complications during pregnancy and labour and with a reduced likelihood of having a low birth weight infant. However women who are normally a healthy weight vary widely in the amount of weight they gain during pregnancy. Women who gain an excessive amount of weight are more likely to remain overweight or obese following the birth. But pregnancy isn't a time for faddy diets or restricting food intake as this may lead to inadequate nutrient supplies for both the mother and fetus. Medical advice should be sought if there is concern about excessive weight gain during pregnancy.

## Important nutrients

Folate is essential for the normal development of the neural tube in the fetus. The neural tube develops into the brain and spinal cord and closes between the third and fourth week after conception. Insufficiet

folate at this crucial time can lead to serious malformations of the spine (spina bifida) and the brain (anencephaly). Folic acid supplements (400mg/day) are advised before conception and during the first 12 weeks of pregnancy because research has shown that they can reduce the risk of neural tube defects such as spina bifida by around 70%. Women who have already given birth to a baby with a neural tube defect should take a supplement that provides 5mg/day. Extra folate in the diet is also needed throughout pregnancy in order to prevent anaemia so pregnant women should also eat a diet that includes plenty of folate-rich foods (such as green leafy vegetables, oranges and pulses such as beans and lentils) and foods fortified with folic acid (such as fortified breakfast cereals). In the United States and Canada, fortification of flour with folic acid in recent years has greatly increased folate intakes. Although the number of babies born with neural tube defects has declined, this can not be attributed with certainty to increased folic acid intake.

Extra iron is needed during pregnancy, mostly in the last two trimesters. Inadequate blood iron levels causes iron deficiency anaemia which can make people feel tired, irritable and less able to concentrate. The risk of becoming anaemic is greater during pregnancy and anaemic women are more likely to deliver a baby of low birth weight and with poor iron stores. In the US, most recommendations advise pregnant women to take a supplement of 30 mg of ferrous iron as well as eating a well-balanced diet. In other countries, such as the UK, supplements are advised on an individual basis where considered necessary. However, pregnant women should eat plenty of iron-rich foods, such as lean red meat, pulses, dark green leafy vegetables and fortified breakfast cereals. Consuming foods containing **vitamin C** at the same time as non-meat iron-rich foods helps to enhance iron absorption. Examples include having a glass of orange juice (a source of vitamin C) with a bowl of cereal (containing iron) or baked beans (containing iron) with a baked potato (a source of vitamin C).

**Vitamin D** is needed to absorb calcium from the diet and an adequate supply is therefore essential for healthy bones and teeth. A vitamin D supplement of 10mcg/day is currently recommended for all pregnant women as a precautionary measure. Vitamin D is obtained mainly by the action of sunlight on the skin but is also found naturally in eggs, meat and oily fish. Most fat spreads are also now fortified with vitamin D.

DHA (docosahexaenoic acid) and EPA (eicosapentaenoic acid) are types of **omega 3 fatty acids** found in oil-rich fish (e.g. mackerel, salmon, kippers, fresh tuna, herring, trout and sardines). These are a major constituent of the brain and retina and there has been a lot of recent interest in their role in infant development. Eating fish has been associated with a lower risk of pre-term delivery and low birth weight. DHA and EPA can be made in the body from a type of polyunsaturated fatty acid called alpha-linolenic acid but it is not known how efficiently the body does this. Alpha-linolenic acid is found in oils (e.g. rapeseed, linseed, soya, walnut oils), nuts (e.g. walnuts, peanuts), grass-fed animals (e.g. beef) and green leafy vegetables (e.g. spinach).

## Recommended dietary supplements

Apart from folic acid (400mg/day) and vitamin D (10mg/day), other vitamin and mineral supplements should not normally be necessary during pregnancy. However, if dietary intakes are thought to be inadequate, then a low dose multivitamin and mineral supplement can be taken as a safeguard. High dose supplements should be avoided, particularly those that contain **vitamin A** (retinol). There are now a number of specially formulated supplements available for pregnant women, and those planning to conceive.

## The effect of diet on gastrointestinal symptoms and morning sickness

Indigestion, heartburn and intestinal discomfort are common, especially in late pregnancy when the baby takes up more space and squashes internal organs. Women usually learn by experience which foods to avoid and this is unlikely to lead to any nutritional problems unless it involves foods that are a major source of important nutrients (e.g. all meat or dairy products). Eating small meals, avoiding fatty and spicy foods may help.

Women who are experiencing **constipation** or haemorrhoids should increase the amount of fibre in the diet, by increasing intake of starchy carbohydrate foods, particularly whole-grain cereals and breads. An adequate fluid intake is also important, along with gentle exercise.

The causes of nausea and vomiting in pregnancy are not fully understood, although it has been suggested that changes in hormone levels or a heightened sense of smell may be involved. The experiences of individual women is very variable and can also differ with successive pregnancies. Some women find that the eating small, frequent meals can help to reduce nausea. Carbohydrate foods (e.g. bananas, toast, cereal, dried fruit), together with plenty of fluid are often the best choice. Some research has suggested that vitamin $B_6$

supplements may help some women but there are concerns about the safety of high doses and women are advised not to take more than 5-10mg per day.

It is not unusual to have **cravings** for certain foods and aversions to other foods during pregnancy. The cause of these is also uncertain but may be due to altered taste perceptions. Dairy and sweet foods are most commonly reported as being craved and the most common aversions are to alcohol, caffeinated drinks and meats. As long as a healthy, varied diet is being consumed, there should not be cause for concern. Once the baby has been born, tastes usually return back to normal.

## Food avoidance and risk of childhood food allergy

Infants whose parents have a history of allergic disease are more likely to develop allergies themselves and it has been suggested that by avoiding certain foods during pregnancy and breastfeeding mothers may help to prevent allergy in their infants. But there is little evidence to support this and others have suggested that exposure to these foods can actually help a baby develop tolerance to them. If there is strong family history of allergic disease (i.e. if either parent or a previous child has suffered from hayfever, asthma, eczema or other allergy), then it may be advisable to avoid peanuts or foods containing peanuts during pregnancy and while breastfeeding in order to reduce the risk of the infant developing a peanut allergy.

## Food safety advice during pregnancy

### *Vitamin A*

A high vitamin A (retinol) intake during pregnancy can cause birth defects. Pregnant women should therefore avoid liver and liver products, such as pâté, as these foods can contain high concentrations of vitamin A and foods that are fortified with this vitamin. It is also recommended that supplements containing vitamin A (in the form of retinol), or high dose multivitamins are avoided, as well as cod liver oil supplements.

### *Alcohol*

Drinking alcohol excessively or binge drinking during pregnancy can increase the risk of birth defects and low birth weight, as well as behavioural problems during childhood. The effects of lighter drinking on a developing child are less clear but to be cautious pregnant women are advised to avoid alcoholic drinks. If they choose to drink alcohol, intake should be reduced to a minimum (1-2 units once or twice a week). This is equivalent of half a pint to a pint of beer or lager or 1-2 small glasses of wine.

### *caffeine*

Pregnant women should not consume excessive amounts of caffeine, as levels above 300 mg/day have been linked with low birth weight and miscarriage. Caffeine occurs in a range of food and drinks such as coffee, tea, cola and chocolate. In the UK, the Food Standards Agency recommends that pregnant women should not drink more than the equivalent of around four average cups of coffee a day.

## Food-bourne illness

It is very important for pregnant women to follow general food hygiene guidelines when handling foods, especially raw meat. It is sensible to avoid foods which increase the risk of food-borne infections such as Listeriosis (e.g. unpasteurised milk, cheese made from unpasteurised milk, mould ripened cheeses which are usually soft or blue cheese) or salmonella poisoning (e.g. undercooked chicken, undercooked or raw eggs). It is also important to wash raw vegetables thoroughly as eating soil may cause toxoplasmosis.

Important foods to avoid to minimize the risk of foodbourne illness during pregnancy include:

- Raw seafood (e.g. oysters, uncooked sushi)
- Unpasteurised dairy products (these are unlikely to be sold by supermarkets but caution should be paid to exotic,smelly cheeses from the cheese counter)
- Cheeses with a white mouldy rind (e.g. Brie, Camembert, Cambozola) and blue-veined cheeses (e.g. Stilton, Blue Brie, Danish Blue, Roquefort)
- Pâté (unless tinned)
- Raw and undercooked meat and poultry (these should be cooked until there are no pink bits left, re-heat ready-cooked meals until piping hot)

## QUESTIONS TO ASK YOUR DOCTOR

- Would I benefit from taking a multivitamin and mineral supplement?
- Am I gaining a healthy amount of weight?
- Do I need to take iron supplements?

- Raw and undercooked eggs (eggs must be cooked until hard and foods containing raw eggs such as mousses and home-made mayonnaise avoided. Commercially prepared foods, made with pasteurised eggs, such as bottled mayonnaise are safe to eat)
- Unwashed vegetables and salads
- Liver and liver products (e.g. pâté, liver sausage)

### Contaminants in fish

Fish is a good source of protein, vitamins and minerals. In particular, oil-rich fish (e.g. mackerel, salmon, kippers, herrings, trout, sardines, fresh tuna) contain the long chain omega 3 fatty acids which are essential in brain and eye development in the fetus. However, fish can contain certain contaminants, namely mercury, dioxins and polychlorinated biphenyls (PCBs) and concern has been expressed about the consequences of prenatal exposure to these toxic chemicals on risk of brain and nervous system abnormalities.

High concentrations of methylmercury have been found in large, predatory fish such as shark, marlin and swordfish.These fish should be avoided during pregnancy and breastfeeding (in the US this also includes king mackerel and tilefish). Some samples of tuna have also been found to have higher levels than other species. In the UK, pregnant women (and those who may become pregnant) are advised to restrict their weekly intake to two 140g portions of fresh tuna or four 140g portions of canned tuna. The American Dietetic Association recommend a maximum of six ounces of albacore (white) tuna a week during pregnancy and that women restrict total fish consumption to 12 ounces of cooked fish per week (avoiding those listed above).

Oily fish can contain PCBs and dioxins. Because of the benefits of oily fish consumption, pregnant women are advised to follow the general advice for fish consumption in the UK and to consume at least two portions of fish per week, one of which should be oily. But to limit their intake to no more than two portions of oily fish per week. This advice also applies to women who might become pregnant and those who are breastfeeding.

### Resources

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#### ORGANIZATIONS

American Dietetic Association. 120 South Riverside Plaza, Suite 2000, Chicago, IL 60606-6995. Telephone: (800) 877-1600. Website: http://www.eatright.org.

British Nutrition Foundaton, 52-54 High Holborn, London WC1V 6RQ. Website: www.nutrition.org.uk

Food Standards Agency, UK. Website: www.eatwell.gov.uk

Scientific Advisory Committee on Nutrition, UK. Website: www.sacn.gov.uk

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Preservatives *see* Artificial preservatives

# Pritikin diet

### Definition

The Pritikin diet is a heart-healthy high-carbohydrate, low-fat, moderate-exercise lifestyle diet developed in the 1960s.

### Origins

Nathan Pritikin, the originator of the Pritikin Diet, was diagnosed with heart disease at the age of 42. In the late 1950s when Pritikin was diagnosed, about 40% of calories in the average American diet came from **fats**. Pritikin was given little medical guidance on how lifestyle changes might slow his heart disease. Although educated as an engineer, Pritikin devised his own heart-healthy diet, which he followed rigorously. Based on his experience, he opened the Pritikin Longevity Center in Florida in 1975. Here people could come and immerse themselves for one or more weeks in the Pritikin Eating Plan.

Pritikin's diet came to national attention when Pritikin and Florida cardiologist David Lehr appeared

in the CBS program "60 Minutes" in 1977. The Pritikin Diet soon became the most popular diet of the 1970s. Since that time, many research studies have been done to evaluate the effectiveness of the Pritikin Plan, the results of which have been published in mainstream, refereed medical journals. More than 75,000 people have experience the Plan at what is now the upscale Pritikin Longevity Center & Spa at the Turnberry Isle Yacht Club in Aventura, Florida. Millions of others have bought Pritikin's books and tried the Plan.

Nathan Pritikin developed **cancer** and committed suicide in 1985 at the age of 69. At his autopsy, doctors discovered no signs of heart disease, a fact they attributed to his rigorous life-long adherence to his diet. Robert Pritikin, Nathan's son, took over the Longevity Center enterprises after Nathan's death. While maintaining the core of the original diet, Robert updated some of the concepts in his book *The Pritikin Principle: The Calorie Density Solution*. published in 2000.

## Description

At the time Pritikin developed his diet, his concepts seemed quite radical. However Pritikin was ahead of his time, and today, despite a few controversies, most of his principles have been incorporated into advice given on how to reduce the risk of developing cardiovascular disease by mainstream organizations such as the American Heart Association.

The Pritikin Plan is a diet that is high in whole grains and dietary **fiber**, low in cholesterol, and very low in fats. Fewer than 10% of calories come from fats. This is much lower than the average twenty-first century American diet, in which about 35% of calories come from fats. It is about half the amount of fats recommended in the federal Dietary Guidelines for Americans 2005. The diet is also lower in **protein** than suggested in the federal guidelines. However, in general, the Pritikin Plan reflects many recommendations in the Dietary Guidelines for Americans 2005. It results in low calorie, nutritionally balanced meals. In addition, the Pritikin plan calls for 45 minutes daily of moderate exercise such as walking, another recommendation in line with mainstream medical advice.

The newest version of the Pritikin Plan calls for avoiding foods that are calorie dense. These are foods that pack a lot of calories into a small volume of food (e.g. oils, cookies, cream cheese). Instead, Plan followers are encouraged to choose low-calorie foods that provide a lot of bulk (e.g. broccoli, carrots, dried beans). This way, dieters can eat a lot of food and feel full without taking in a lot of calories. The plan does not limit the amount of healthy fruits and vegetables a dieter can eat, and it suggests that dieters divide their food among five or six smaller meals during the day.

### KEY TERMS

**Cholesterol**—a waxy substance made by the liver and also acquired through diet. High levels in the blood may increase the risk of cardiovascular disease.

**Dietary fiber**—also known as roughage or bulk. Insoluble fiber moves through the digestive system almost undigested and gives bulk to stools. Soluble fiber dissolves in water and helps keep stools soft.

**Fat-soluble vitamin**—a vitamin that dissolves in and can be stored in body fat or the liver

**Fatty acids**—complex molecules found in fats and oils. Essential fatty acids are fatty acids that the body needs but cannot synthesize. Essential fatty acids are made by plants and must be present in the diet to maintain health.

**Insulin**—a hormone made by the pancreas that controls blood glucose (sugar) levels by moving excess glucose into muscle, liver, and other cells for storage.

**Obese**—more than 20% over the individual's ideal weight for their height and age or having a body mass index (BMI) of 30 or greater.

**Triglycerides**—a type of fat found in the blood. High levels of triglycerides can increase the risk of coronary artery disease

**Type 2 diabetes**—sometime called adult-onset diabetes, this disease prevents the body from properly using glucose (sugar), but can often be controlled with diet and exercise.

The Pritikin Plan is based on eating a particular number of servings of each group of foods as follows:

- at least five 1/2-cup servings of whole grains such as wheat, oats, and brown rice or starch vegetables such as potatoes, and dried beans and peas. Refined grain products (white flour, regular pasta, white rice) are limited to two servings daily, with complete elimination of refined grain products considered optimal.
- at least four 1-cup servings of raw vegetables or 1/2-cup servings of cooked vegetables. Dark green, leafy, and orange or yellow vegetables are preferred.
- at least three servings of fruit, one of which can be fruit juice.

- two servings of calcium-rich foods such as nonfat milk, nonfat yogurt or fortified and enriched soymilk.
- no more than one 3.5 cooked serving of animal protein. Fish and shellfish are preferred. Lean poultry should optimally be limited to once a week and lean beef to once a month. This diet is easily adapted to vegetarians by replacing animal protein with protein from soy products, beans, or lentils.
- no more than one caffeinated drinks daily. Instead drink water, low-sodium vegetable juices, grain-based coffee substitutes (e.g. Postum) or caffeine-free teas.
- no more than four alcoholic drinks per week for women and no more than seven for men, with red wine preferred over beer or distilled spirits.
- no more than seven egg whites per week
- no more than 2 ounces (about 1/4 cup of nuts) daily

Other foods such as unsaturated oils, refined sweeteners (e.g. concentrated fruit juice, corn syrup), high-sodium condiments (e.g. **soy** sauce), and **artificial sweeteners** (e.g. Splenda) are "caution" foods. They are not recommended, but if they are used, the Plan gives guidance in how to limit them to reasonable amounts. Animal fats, processed meat, dairy products not made with non-rat milk, egg yolks, salty snacks, cakes, cookies, fried foods and similar high-calorie choices are forbidden.

The Plan also calls for at least 45 minutes of moderate exercise daily such as walking. People who check into the Longevity Center receive a personalized exercise program after a physician gives them an examination. This doctor follows their progress while at the center and makes a written report at the end of their stay that they can take home to their personal physician. People who do not visit the Longevity Center can receive support and inspiration through the Plan's extensive Web site. Pritikin has also developed a Family Plan aimed at families with obese children.

## Function

Unlike many diets, the Pritikin Plan never claims that a person will lose a certain amount of weight within a certain length of time. People who follow the Plan, which is a low calorie diet, do lose weight and keep it off so long as they stay on the plan. However, the Plan is primarily intended to cause changes in lifestyle that will promote heart health for a lifetime.

## Benefits

Pritikin Diet emphasizes the following health benefits:

- lowered total cholesterol and LDL or "bad" cholesterol
- lowered blood pressure, so that people with high blood pressure may no longer need pressure-lowering drugs
- better control of insulin levels, so that people with type 2 diabetes can often control their disease through diet and without drugs
- decrease in the circulating levels of compounds that increases the risk of heart disease and blood vessel damage
- a substantially reduced risk of heart disease, hypertension, type 2 diabetes, and breast, colon, and prostate cancers.
- lifetime freedom from obesity and all of its associated health risks and lifestyle-limiting conditions

## Precautions

As with any diet, people should discuss with their physician the pros and cons of the Pritikin Plan based on their individual circumstances. This diet may not be right for actively growing children.

## Risks

The greatest risk to this diet is that it is too rigorous for many people, and that they will lose weight on the diet and then gain it back, causing **weight cycling** (yo-yo dieting) and the potential health problems that repeated weight gain and loss cause.

## Research and general acceptance

Unlike many diets, the Pritikin Plan has the respect of much of the medical community and has a thirty-year history of delivering on most of its health promises. Supporters of the diet point to many studies done by both Longevity Center doctors and outside investigators and published in highly respected journals such as the *Journal of the American Medical Association* and the *New England Journal of Medicine*. People do lose weight and keep it off, along with decreasing the risk of heart disease when following the plan.

Dietitians and nutritionists also like the fact that the diet teaches people how to eat well using ordinary foods rather than special pre-packaged foods. This keeps the cost of following the Plan low, especially since the Plan calls for dieters to eat only small quantities of meat. In addition, the Plan is designed to provide a balance of **vitamins** and **minerals** from food and does not rely on **dietary supplements**.

## QUESTIONS TO ASK THE DOCTOR

- Does my current lifestyle put me at high risk for developing heart disease?
- Do I need to go on a diet this rigorous, or can my goals be met on a more moderate diet?
- Is this diet safe for my entire family?
- Are there any sign or symptoms that might indicate a problem while on this diet?
- At what level of intensity is it appropriate for me to begin exercising?
- If one of your family members wanted to go on a diet, would you recommend this one

The biggest criticism of the Pritikin Plan is that it requires rigorous self-discipline to stay on for a lifetime. People who do well on the Pritikin Plan tend to be highly motivated and zealous about following the diet. Many healthcare professionals feel long-term success for most people is more likely to occur if the dieter follows a well-balanced but less rigorous diet.

Some nutritionists also take issue with whether the low fat component of the diet allows people to get enough beneficial fats such as **omega-3 fatty acids** and whether absorption of the fat-soluble vitamins A, D, E, and K is impaired. To date these criticisms have not been supported by research findings. However, critics were handed more ammunition by a long-term study of 49,000 American women ages 50–79 that found that a **low-fat diet** had no effect on the risk of developing heart disease or cancer. The study was published in February 2006 in the *Journal of the American Medical Association*. The findings are controversial, and go against much current medical thinking. This study will certainly stimulate additional research on low-fat diets.

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#### ORGANIZATIONS


American Dietetic Association. 120 South Riverside Plaza, Suite 2000, Chicago, Illinois 60606-6995. Telephone: (800) 877-1600. Website: <http://www.eatright.org>

The Pritikin Longevity Center. 19735 Turnberry Way Aventura, FL 33180. Telephone: (800) 327-4914 or (305) 935-7131. Fax: (305) 935-7371. Website: <http://www.pritikin.com>


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Tish Davidson, A.M.

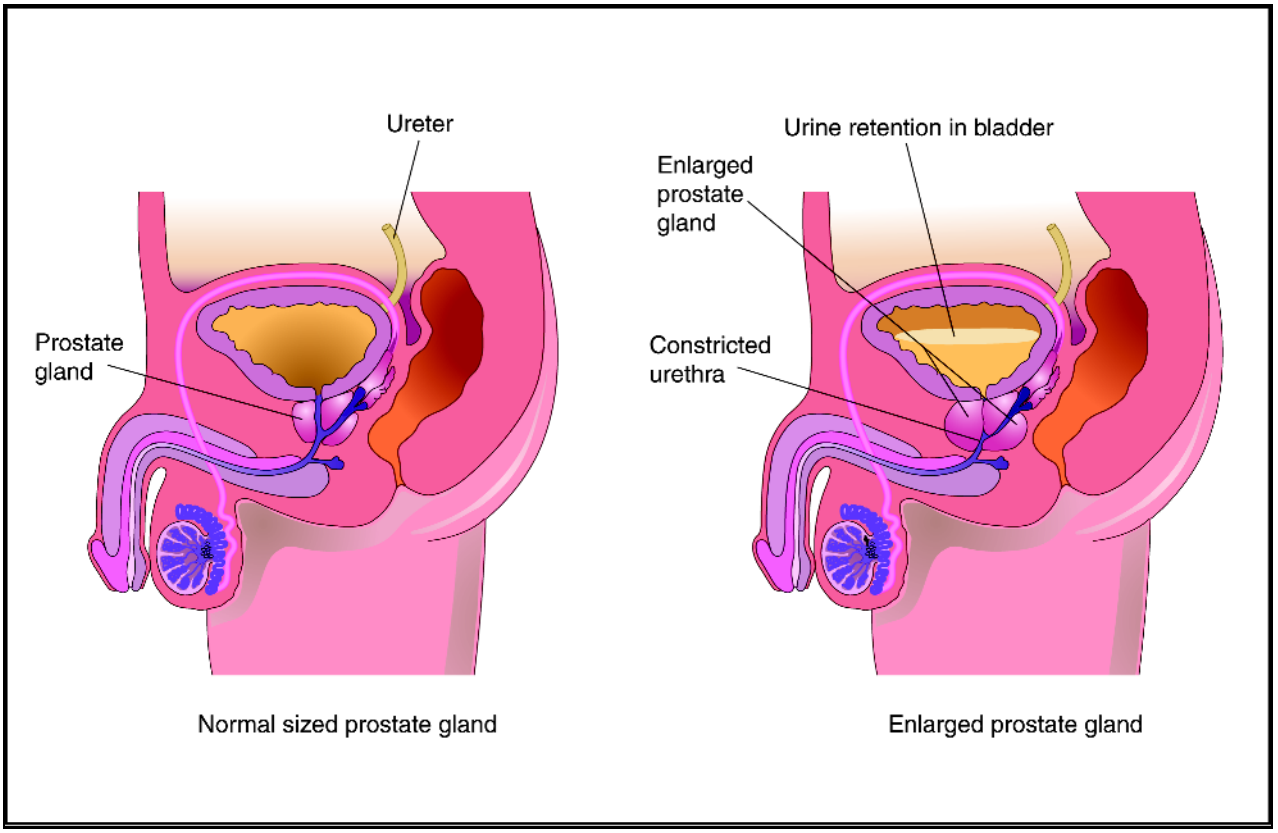
# Prostate

## Definition

The prostate is a male gland about the size of a walnut located just behind the bladder and is part of the reproductive system.

## Description

The prostate is a chestnut-shaped organ that surrounds the beginning of the urethra in men. It produces a milky fluid that is part of the seminal fluid discharged during ejaculation. Male hormones (androgens) make the prostate grow. The testicles are the main source of male hormones, including testosterone. The adrenal gland also makes testosterone, but in small amounts. If the prostate grows too large, it squeezes the urethra. This may slow or stop the flow of urine from the bladder to the penis. The common term for an enlarged prostate is BPH, which stands for benign (non-cancerous) prostatic hyperplasia or hypertrophy. Hyperplasia means that the prostate cells are dividing too rapidly, increasing the total number of cells and therefore the size of the organ itself. Hypertrophy simply means enlargement.




**An enlarged prostate is a non-cancerous condition in which the narrowing of the urethra makes the elimination of urine more difficult. It most often occurs in men over age 50.** *(Illustration by Electronic Illustrators Group/Thomson Gale.)*

There is some research that suggests a diet rich in **soy** products, berries, sunflower seeds, and peanuts can contribute to prostate health, according to the American **Cancer** Society. The mineral **zinc** has also shown beneficial properties for the prostate. Natural sources of zinc include pumpkin, sesame, and sunflower seeds, some nuts (almonds, cashews, Brazil, and walnuts), leafy lettuce, and whole oats, and onions. Zinc supplements are also available in health food stores, pharmacies, and some supermarkets.

## Demographics

### *Prostate cancer*

Prostate cancer is the most common cancer among men in the United States, and is the second leading cause of cancer deaths. The National Cancer Institute estimates that in 2007, 218,890 new cases of prostate cancer will be diagnosed, and it will cause 27,050 deaths. One in six men in the United States will be diagnosed with prostate cancer. Age is the main risk factor for prostate cancer. It is rarely seen in men younger than 45. The chance of getting it increases as a man ages. Most men diagnosed with prostate cancer are older than 65. A man's risk is higher if his father or brother had prostate cancer. Prostate cancer affects African American men about twice as often as it does Caucasian men, and the mortality rate among African Americans is also higher. African Americans have the highest rate of prostate cancer in the world.

### *BPH*

BPH is often part of the aging process. The actual changes in the prostate may start as early as the 30s but take place very gradually, so that significant enlargement and symptoms usually do not appear until after age 50. Past this age the chances of the prostate enlarging and causing urinary symptoms become progressively greater. More than 40% of men in their 70s have an enlarged prostate. Symptoms generally appear between the ages of 55 and 75. About 10% of all men eventually will require treatment for BPH. The condition is viewed as rare in African Americans, but this finding may partly be due to the fact that black patients may have less access to medical care. The

## KEY TERMS

**Androgen**—A male sex hormone.

**Benign**—Non-cancerous.

**Benign prostatic hyperplasia (BPH)**—A non-cancerous condition of the prostate that causes growth of the prostate tissue, thus enlarging the prostate and obstructing urination.

**Prostate-specific antigen (PSA)**—A blood test that helps in the early diagnosis of prostate cancer.

**Testosterone**—A male sex hormone produced mainly by the testicles.

**Urethra**—The tube that carries urine from the bladder out of the body and in men carries semen during ejaculation.

condition also seems to be uncommon in Chinese and other Asians, for reasons that are not clear.

## Causes and symptoms

### *Prostate cancer*

The precise cause of prostate cancer is not known. However, there are several known risk factors for disease including being over the age of 55, African American heritage, a family history of the disease, occupational exposure to cadmium or rubber, and a **high-fat diet**. Studies suggest that men who eat a diet high in animal fat or meat may be at increased risk for prostate cancer, whereas men who eat a diet rich in fruits and vegetables may have a lower risk. Men with high plasma (blood) testosterone levels may also have an increased risk for developing prostate cancer. Frequently, prostate cancer has no symptoms and the disease is diagnosed when the patient goes for a routine screening examination. However, when the tumor is big or the cancer has spread to the nearby tissues, the following symptoms may be seen:

- Weak or interrupted flow of urine
- Frequent urination, especially at night
- Difficulty starting urination
- Inability to urinate
- Pain or a burning sensation when urinating
- Blood in the urine
- Persistent pain in the lower back, thighs, or hips
- Painful ejaculation

### *BPH*

The cause of BPH is a mystery to medical researchers, but age-related changes in hormone levels in the blood may be a factor. Whatever the cause, an enlarging prostate gradually narrows the urethra and obstructs the flow of urine. Even though the muscle in the bladder wall becomes stronger in an attempt to push urine through the smaller urethra, in time, the bladder fails to empty completely at each urination. When the enlarging prostate gland narrows the urethra, a man will have increasing trouble starting the urine stream. Because some urine remains behind in the bladder, he will have to urinate more often, perhaps two or three times at night. The need to urinate can become very urgent and, in time, urine may dribble out to stain a man's clothing. Other symptoms of BPH are a weak and sometimes a split stream, and general aching or pain in the perineum (the area between the scrotum and anus). Some men may have considerable enlargement of the prostate before even mild symptoms develop.

## Diagnosis

### *Prostate cancer*

Prostate cancer is curable when detected early. Yet there are often no symptoms during the early stages of prostate cancer, so the disease often goes undetected until the patient has a routine physical examination. Diagnosis of prostate cancer can be made using some or all of the following tests: a digital rectal examination, blood tests, ultrasound, a needle biopsy, x rays, computed tomography (CT) scan, and magnetic resonance imaging (MRI).

## BPH

When a man's symptoms point to BPH, a physician will usually do a digital rectal examination, inserting a finger into the anus to feel whether—and how much—the prostate is enlarged. A smooth prostate surface suggests BPH, whereas a distinct lump in the gland might mean prostate cancer. The next step is a blood test for a substance called prostate-specific antigen (PSA). Between 30-50% of men with BPH have an elevated PSA level. Studies indicate that the PSA level can be used as a predictor of a man's long-term risk of developing BPH.

## Treatment

### *Prostate cancer*

Treatment options include surgery, radiation therapy, chemotherapy, and hormone therapy. The doctor

and the patient will decide on the treatment mode after considering many factors. For example, the patient's age, the stage of the disease, his general health, and the presence of any co-existing illnesses have to be considered. In addition, the patient's personal preferences and the risks and benefits of each treatment protocol are also taken into account before any decision is made.

#### *BPH*

A class of drugs called alpha-adrenergic blockers, which includes phenoxybenzamine and doxazosin, relax the muscle tissue surrounding the bladder outlet and lining the wall of the urethra to permit urine to flow more freely. These drugs improve obstructive symptoms, but do not keep the prostate from enlarging. Other drugs, such as finasteride (Proscar) and dutasteride (Avodart) may stop prostate enlargement or even shrink the prostate. Symptoms may not, however, improve until the drug has been used for three months or longer. Another class of drugs, called alpha-blockers, such as terazosin (Hytrin) and tamsulosin (Flomax), relax the muscles in the prostate and may relieve symptoms. However, they do not shrink the prostate. When drugs fail to control the symptoms of BPH, surgery may be required.

## Nutrition/Dietetic concerns

There are no known nutritional or dietetic concerns that play a role in prostate health or prostate conditions, such as cancer or BPH. In alternative medicine, saw palmetto, a dietary supplement usually sole in capsule form, is used to promote prostate health and to treat BPH.

## Therapy

A diet low in fat may slow the progression of prostate cancer. Hence, in order to reduce the risk of prostrate cancer, the American Cancer Society recommends a diet rich in fruits, vegetables, and dietary **fiber**, and low in red meat and saturated **fats**. Intake of lycopene, which is found in cooked tomatoes or tomato sauce, is also thought to help reduce the risk of prostate cancer. There is no known therapy for BPH.

## Prognosis

#### *Prostate cancer*

According to the American Cancer Society, the survival rate for all stages of prostate cancer combined has increased from 50% to 87% over the last 30 years. Due to early detection and better screening methods, nearly 60% of the tumors are diagnosed while they are still confined to the prostate gland. The five-year survival rate for early stage cancers is almost 99 percent. Sixty-three percent of the patients survive 10 years, and 51% survive 15 years after initial diagnosis.

#### *BPH*

In a man without symptoms whose prostate is enlarged, it is hard to predict when urinary symptoms will develop and how rapidly they will progress. For this reasons some specialists (urologists) advise a period of "watchful waiting." When BPH is treated by medication, symptoms are usually relieved and the man's quality of life will be enhanced.

## Prevention

#### *Prostate cancer*

Because the cause of the cancer is not known, there is no definite way to prevent prostate cancer. However, the American Cancer Society recommends that all men over age 40 have an annual rectal exam and that men have an annual PSA test beginning at age 50. Those who have a higher than average risk, including African American men and men with a family history of prostate cancer, should begin annual PSA testing even earlier, starting at age 45.

#### *BPH*

Whether or not BPH is caused by hormonal changes in aging men, there is no known way of preventing it. Once it does develop and symptoms are present that interfere seriously with the patient's life, timely medical or surgical treatment will reliably prevent symptoms from getting worse. Also, if the condition is treated before the prostate has become grossly enlarged, the risk of complications is minimal. One of the potentially most serious complications of BPH, urinary infection (and possible infection of the kidneys), can be prevented by using a catheter to drain excess urine out of the bladder so that it does not collect, stagnate, and become infected.

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American Cancer Society. P.O. Box 73123, Oklahoma City, OK 73123. Telephone: (800) 227-2345. Website: http://www.cancer.org.
Canadian Cancer Society. 10 Alcorn Ave., Suite 200, Toronto, ON M4V 3B1 Canada. Telephone: (416) 961-7223. Website: http://www.cancer.ca.
National Cancer Institute. P.O. Box 24128, Baltimore, MD 21227. Telephone: (800) 422-6237. Website: http://www.cancer.gov.
National Institute of Diabetes, & Digestive, & Kidney Diseases. Building 31, Room 9A06, 31 Center Drive, MSC 2560, Bethesda, MD 20892. Telephone: (800) 891-5390. Website: http://www.niddk.nih.gov.

Ken R. Wells

# Protein

Protein are compounds composed of carbon, hydrogen, oxygen, and nitrogen, which are arranged as strands of amino acid. They play an essential role in the cellular maintenance, growth, and functioning of the human body. Serving as the basic structural molecule of all the tissues in the body, protein makes up nearly 17% of the total body weight. To understand protein's role and function in the human body, it is important to understand its basic structure and composition.

**Protein**

| Age | Recommended Dietary Allowance (g/day) |
|---|---|
| Children 0–6 mos. | 9.1 (AI) |
| Children 7–12 mos. | 11 |
| Children 1–3 yrs. | 13 |
| Children 4–8 yrs. | 19 |
| Children 9–13 yrs. | 34 |
| Boys 14–18 yrs. | 52 |
| Girls 14–18 yrs. | 46 |
| Men19≥ yrs. | 56 |
| Women 19≥ yrs. | 46 |
| Pregnant women | 71 |
| Breastfeeding women | 71 |

| Food | Protein (g) |
|---|---|
| Hamburger, lean, 3 oz. | 24.3 |
| Pork chop, bone in, 3 oz. | 23.9 |
| Beef, pot roast, 3 oz. | 22.0 |
| Chicken, roasted, 3 oz. | 21.25 |
| Fish, 3 oz. | 20.6 |
| Tuna, water packed, 3 oz. | 20.0 |
| Oysters, 3.5 oz. | 13.5 |
| Yogurt, low fat, 1 cup | 11.9 |
| Tofu, ½ cup | 10.1 |
| Lentils, cooked, ½ cup | 9.0 |
| Milk, 1 cup | 8.0 |
| Beans, kidney, 1 cup | 7.6 |
| Cheese, cheddar, 1 oz. | 7.1 |
| Soymilk, 1 cup | 6.7 |
| Egg, 1 large | 6.1 |
| Peanut butter, 1 tbsp. | 4.6 |
| Potato, baked, 1 med. | 3.0 |
| Bread, whole wheat, 1 slice | 2.7 |
| Bread, white, 1 slice | 2.45 |
| Pecans, 1 oz. | 2.2 |
| Banana, 1 | 1.2 |
| Carrots, sliced, ½ cup | 0.8 |
| Apple, 1 med. | 0.4 |

AI = Adequate Intake
g = gram

*(Illustration by GGS Information Services/Thomson Gale.)*

## Amino Acids

Amino acids are the fundamental building blocks of protein. Long chains of amino acids, called *polypeptides* , make up the multicomponent, large complexes of protein. The arrangement of amino acids along the chain determines the structure and chemical properties of the protein. Amino acids consist of the following elements: carbon, hydrogen, oxygen, nitrogen, and, sometimes, sulfur. The general structure of amino acids consists of a carbon center and its four substituents, which consists of an amino group ($NH_2$), an organic acid (carboxyl) group (COOH), a hydrogen

## KEY TERMS

**adipose tissue**—Tissue containing fat deposits.

**amino acid**—Building block of proteins, necessary dietary nutrient.

**anabolic**—Promoting building up.

**catabolism**—Breakdown of complex molecules.

**epithelial cell**—Sheet of cells lining organs throughout the body.

**glycolysis**—Cellular reaction that begins the breakdown of sugars.

**hydrolyze**—To break apart through reaction with water.

**kwashiorkor**—Severe malnutrition characterized by swollen belly, hair loss, and loss of skin pigment.

**nonpolar**—Without a separation if charge within the molecule; likely to be hydrophobic.

**polar**—Containing regions of positive and negative charge; likely to be soluble in water.

atom (H), and a fourth group, referred to as the R-group, that determines the structural identity and chemical properties of the amino acid. The first three groups are common to all amino acids. The basic amino acid structure is R-CH($NH_2$)-COOH.

There are twenty different forms of amino acids that the human body utilizes. These forms are distinguished by the fourth variable substituent, the R-group, which can be a chain of different lengths or a carbon-ring structure. For example, if hydrogen represents the R-group, the amino acid is known as *glycine* , a polar but uncharged amino acid, while methyl ($CH_3$) group is known as *alanine,* a nonpolar amino acid. Thus, the chemical components of the R-group essentially determine the identity, structure, and function of the amino acid.

The structural and chemical relatedness of the R-groups allows classification of the twenty amino acids into chemical groups. Amino acids can be classified according to optical activity (the ability to polarize light), acidity and basicity, polarity and nonpolarity, or hydrophilicity (water-loving) and hydrophobicity (water-fearing). These categories offer clues to the function and reactivity of the amino acids in proteins. The biochemical properties of amino acids determine the role and function of protein in the human body.

Of the twenty amino acids, eleven are considered *nonessential* (or *dispensable* ), meaning that the body is able to adequately synthesize them, and nine are *essential* (or *indispensable* ), meaning that the body is unable to adequately synthesize them to meet the needs of the cell. They must therefore be supplied through the diet. Foods that have protein contain both nonessential and essential amino acids, the latter of which the body can use to synthesize some of the nonessential amino acids. A healthful diet, therefore, should consist of a sufficient and balanced supply of both essential and nonessential amino acids in order to ensure high levels of protein production.

### Protein Quality: Nutritive Value

The quality of protein depends on the level at which it provides the nutritional amounts of essential amino acids needed for overall body health, maintenance, and growth. Animal proteins, such as eggs, cheese, milk, meat, and fish, are considered *high-quality*, or *complete, proteins* because they provide sufficient amounts of the essential amino acids. Plant proteins, such as grain, corn, nuts, vegetables and fruits, are *lower-quality* , or *incomplete, proteins* because many plant proteins lack one or more of the essential amino acids, or because they lack a proper balance of amino acids. Incomplete proteins can, however, be combined to provide all the essential amino acids, though combinations of incomplete proteins must be consumed at the same time, or within a short period of time (within four hours), to obtain the maximum nutritive value from the amino acids. Such combination diets generally yield a high-quality protein meal, providing sufficient amounts and proper balance of the essential amino acids needed by the body to function.

### Protein Processing: Digestion, Absorption, and Metabolism

Protein digestion begins when the food reaches the stomach and stimulates the release of hydrochloric acid (HCl) by the parietal cells located in the gastric mucosa of the GI (gastrointestinal) tract. Hydrochloric acid provides for a very acidic environment, which helps the protein digestion process in two ways: (1) through an acid-catalyzed *hydrolysis* reaction of breaking peptide bonds (the chemical process of breaking peptide bonds is referred to as a hydrolysis reaction because **water** is used to break the bonds); and (2) through conversion of the gastric enzyme pepsinogen (an inactive precursor) to pepsin (the active form). Pepsinogen is stored and secreted by the "chief

cells" that line the stomach wall. Once converted into the active form, pepsin attacks the peptide bonds that link amino acids together, breaking the long polypeptide chain into shorter segments of amino acids known as dipeptides and tripeptides. These protein fragments are then further broken down in the duodenum of the small intestines. The *brush border enzymes* , which work on the surface of epithelial cell of the small intestines, hydrolyze the protein fragments into amino acids.

The cells of the small intestine actively absorb the amino acids through a process that requires energy. The amino acids travel through the hepatic portal vein to the liver, where the nutrient are processed into glucose or fat (or released into the bloodstream). The tissues in the body take up the amino acids rapidly for glucose production, growth and maintenance, and other vital cellular functioning. For the most part, the body does not store protein, as the **metabolism** of amino acids occurs within a few hours.

Amino acids are metabolized in the liver into useful forms that are used as building blocks of protein in tissues. The body may utilize the amino acids for either anabolic or *catabolic reactions* . Anabolism refers to the chemical process through which digested and absorbed products are used to effectively build or repair bodily tissues, or to restore vital substances broken down through metabolism.Catabolism, on the other hand, is the process that results in the release of energy through the breakdown of nutrients, stored materials, and cellular substances. Anabolic and catabolic reactions work hand-in-hand, and the energy produced in catabolic processes is used to fuel essential anabolic processes. The vital biochemical reaction of glycolysis (in which glucose is oxidized to produce carbon dioxide, water, and cellular energy) in the form of adenosine triphosphate, or ATP, is a prime example of a catabolic reaction. The energy released, as ATP, from such a reaction is used to fuel important anabolic processes, such as protein synthesis.

The metabolism of amino acids can be understood from the dynamic catabolic and anabolic processes. In the process referred to as deamination, the nitrogen-containing amino group ($NH_2$) is cleaved from the amino acid unit. In this reaction, which requires vitamin $B_6$ as a cofactor, the amino group is transferred to an acceptor keto-acid, which can form a new amino acid. Through this process, the body is able to make the nonessential amino acids not provided by one's diet. The keto-acid intermediate can also be used to synthesize glucose to ultimately yield energy for the body, and the cleaved nitrogen-containing group is transformed into urea, a waste product, and excreted as urine.

## Vital Protein Functions

Proteins are vital to basic cellular and body functions, including cellular regeneration and repair, tissue maintenance and regulation, hormone and enzyme production, fluid balance, and the provision of energy.

Cellular and tissue provisioning. Protein is an essential component for every type of cell in the body, including muscles, bones, organs, tendons, and ligaments. Protein is also needed in the formation of enzymes, antibody, hormones, blood-clotting factors, and blood-transport proteins. The body is constantly undergoing renewal and repair of tissues. The amount of protein needed to build new tissue or maintain structure and function depends on the rate of renewal or the stage of growth and development. For example, the intestinal tract is renewed every couple of days, whereas blood cells have a life span of 60 to 120 days. Furthermore, an infant will utilize as much as one-third of the dietary protein for the purpose of building new connective and muscle tissues.

Hormone and enzyme production. Amino acids are the basic components of hormones, which are essential chemical signaling messengers of the body. Hormones are secreted into the bloodstream by endocrine glands, such as the thyroid gland, adrenal glands, pancreas, and other ductless glands, and regulate bodily functions and processes. For example, the hormone insulin, secreted by the pancreas, works to lower the blood glucose level after meals. Insulin is made up of forty-eight amino acids.

Enzymes, which play an essential kinetic role in biological reactions, are composed of large protein molecule. Enzymes facilitate the rate of reactions by acting as *catalysts* and lowering the activation energy barrier between the reactants and the products of the reactions. All chemical reactions that occur during the digestion of food and the metabolic processes in tissues require enzymes. Therefore, enzymes are vital to the overall function of the body, and thereby indicate the fundamental and significant role of proteins.

Fluid balance. The presence of blood protein molecules, such as *albumins* and *globulins*, are critical factors in maintaining the proper fluid balance between cells and extracellular space. Proteins are present in the capillary beds, which are one-cell-thick vessels that connect the arterial and venous beds, and they cannot flow outside the capillary beds into the

tissue because of their large size. Blood fluid is pulled into the capillary beds from the tissue through the mechanics of oncotic pressure, in which the pressure exerted by the protein molecules counteracts the blood pressure. Therefore, blood proteins are essential in maintaining and regulating fluid balance between the blood and tissue. The lack of blood proteins results in clinical edema, or tissue swelling, because there is insufficient pressure to pull fluid back into the blood from the tissues. The condition of edema is serious and can lead to many medical problems.

Energy provision. Protein is not a significant source of energy for the body when there are sufficient amounts of carbohydrate and **fats** available, nor is protein a storable energy, as in the case of fats and **carbohydrates**. However, if insufficient amounts of carbohydrates and fats are ingested, protein is used for energy needs of the body. The use of protein for energy is not necessarily economical for the body, because tissue maintenance, growth, and repair are compromised to meet energy needs. If taken in excess, protein can be converted into body fat. Protein yields as much usable energy as carbohydrates, which is 4 kcal/gm (kilocalories per gram). Although not the main source of usable energy, protein provides the essential amino acids that are needed for adenine, the nitrogenous base of ATP, as well as other nitrogenous substances, such as creatine phosphate (nitrogen is an essential element for important compounds in the body).

## Protein Requirement and Nutrition

The recommended protein intake for an average adult is generally based on body size: 0.8 grams per kilogram of body weight is the generally recommended daily intake. The recommended daily allowances of protein do not vary in times of strenuous activities or exercise, or with progressing age. However, there is a wide range of protein intake which people can consume according to their period of development. For example, the recommended allowance for an infant up to six months of age, who is undergoing a period of rapid tissue growth, is 2.2 grams per kilogram. For children ages seven through ten, the recommended daily allowance is around 36 total grams, depending on body weight. Pregnant women need to consume an additional 30 grams of protein above the average adult intake for the nourishment of the developing fetus.

Sources of protein. Good sources of protein include high-quality protein foods, such as meat, poultry, fish, milk, egg, and cheese, as well as prevalent low-quality protein foods, such as legumes (e.g., navy beans, pinto beans, chick peas, soybeans, split peas), which are high in protein.

## Protein–Calorie Malnutrition

The nitrogen balance index (NBI) is used to evaluate the amount of protein used by the body in comparison with the amount of protein supplied from daily food intake. The body is in the state of nitrogen (or protein) equilibrium when the intake and usage of protein is equal. The body has a *positive nitrogen balance* when the intake of protein is greater than that expended by the body. In this case, the body can build and develop new tissue. Since the body does not store protein, the overconsumption of protein can result in the excess amount to be converted into fat and stored as adipose tissue. The body has a *negative nitrogen balance* when the intake of protein is less than that expended by the body. In this case, protein intake is less than required, and the body cannot maintain or build new tissues.

A *negative nitrogen balance* represents a state of protein deficiency, in which the body is breaking down tissues faster than they are being replaced. The ingestion of insufficient amounts of protein, or food with poor protein quality, can result in serious medical conditions in which an individual's overall health is compromised. The immune system is severely affected; the amount of blood plasma decreases, leading to medical conditions such as anemia or edema; and the body becomes vulnerable to infectious diseases and other serious conditions. Protein malnutrition in infants is called kwashiorkor, and it poses a major health problem in developing countries, such as Africa, Central and South America, and certain parts of Asia. An infant with kwashiorkor suffers from poor muscle and tissue development, loss of appetite, mottled skin, patchy hair, diarrhea, edema, and, eventually, death (similar symptoms are present in adults with protein deficiency). Treatment or prevention of this condition lies in adequate consumption of protein-rich foods.

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Jeffrey Radecki
Susan Kim

## Pyridoxine *see* Vitamin $B_6$

# R

## Raw foods diet

### Definition

The raw food diet is a lifestyle diet where at least 75% of all food consumed eaten raw and never commercially processed or cooked.

### Origins

Raw food has its origins in prehistory. As humans gradually developed tools and learned to control fire, a raw food diet gave way to a diet of cooked food. Modern interest in a raw food diet began in the 1930s. Ann Wigmore (1909–1994) was an early pioneer in using raw or "living" foods to detoxify the body. Herbert Shelton (1895–1985) was another early advocate of the health benefits of raw foods.

Shelton founded a school and clinic in Texas that promoted the practice of Natural Hygiene. Natural Hygiene is an offshoot of naturopathic or alternative medicine. Shelton believed that conventional medicines were poison, fasting would cleanse the body, and that only one type of food should be eaten at each meal. Shelton's philosophy has influenced both the raw food movement and Harry Diamond, founder of the **Fit for Life diet**.

Since the 1980s, several raw food diets have been promoted as cures for **cancer**. However, although the American Cancer Society and the National Cancer Institute support a diet high in vegetables, including raw vegetables, they do not support a raw foods diet as prevention or a cure for cancer. Raw food began to develop a more high-profile following in the 1990s, as celebrities such as Demi Moore and Woody Harrelson embraced a raw food diet, and in the 2000s raw food restaurants and cafes began showing up in some trendy urban areas, especially in Northern California.

### Description

The raw food diet is more of a philosophy and lifestyle choice than a conventional weight-loss diet. A raw food diet is one in which 75% or more of the food a person eats is uncooked. Generally, raw foodists believe that the closer a person can come to eating a diet that is 100% raw, the better that person's health will be.

Raw food, as defined by many raw foodists, is unprocessed food whose temperature has never reached above 116° F (47° C). Some raw foodists make a distinction between "raw" and "living" foods. Raw foods, they define as uncooked foods, while living foods are uncooked foods that contain more enzymes because they have been "activated." As an example, an unsprouted almond would be considered raw, but an almond soaked in **water** that has begun to sprout would be considered living. For discussion here, raw and living are used interchangeably to mean food that has not been processed or heated above 116° F (47° C).

Raw foodists can be vegans and eat no animal products, vegetarians, who eat dairy products and eggs but no meat, or omnivores who eat both vegetables and meat, so long as their food is raw. The majority tend to be vegetarians or vegans who prefer to eat uncooked, unheated, unprocessed **organic food**. Some go so far as to advocate that the raw foodist grow his or her food instead of purchasing it from commercial growers.

Some foods that are mainstays of the raw food diet include:

- fresh fruits and vegetables
- seeds
- nuts
- legumes (dried beans and peas)
- whole grains
- dried fruits and vegetables
- unpasteurized fruit and vegetable juices

**Raw foods preparation techniques**

- Blending
- Chopping, shredding, and grinding
- Dehydrating foods
- Juicing
- Soaking nuts and dried fruits
- Sprouting seeds, grains, and beans

**Equipment for preparing raw foods**

- Blender
- Coffee grinder
- Dehydrator (less than 116° F)
- Food processor
- Juice extractor
- Large glass containers and jars for soaking and sprouting

*(Illustration by GGS Information Services/Thomson Gale.)*

- young coconut milk
- seaweed and sea vegetables (not acceptable to all raw foodists)
- wheatgrass
- sprouts of all kinds
- purified or bottled water
- unpasteurized milk and dairy products made with unpasteurized milk (non-vegans)
- raw eggs (non-vegans)

Although a raw diet eliminated the time it takes to cook food, food preparation can be quite time consuming. Meal planning is essential to get a proper balance of **vitamins** and **minerals** from this limited diet. Raw foodists may need to take **dietary supplements** to meet their nutritional needs. In addition, many raw foods need to be soaked, ground, chopped, mixed, or handled in other ways before being eaten. Raw food preparation often requires a blender, food processor, juicer, and food dehydrator whose temperature does not exceed 116° F (47° C).

## Function

Although weight loss is not a goal of a raw food diet, weight loss inevitably occurs because this diet is very low in **fats**, **protein**, and calories. More importantly, raw food tends to be part of a lifestyle choice that involves a desire for purity, rejection of conventional medicine, and an effort to be closer to nature.

Raw foodists believe that raw food contains enzymes that help digestion. In their vies, cooking inactivates or kills (denatures) these enzymes, making it harder for the body to digest cooked food. Some raw foodists go so far as to claim that cooked foods are toxins. Raw foodists also believe that living food contains bacteria and microorganisms that are beneficial to digestion and that raw foods contain more nutrients than cooked foods.

## Benefits

Raw foodists claim that the raw food diet offers the following benefits:

- weight control. It is difficult, if not impossible, to become obese on a raw food diet
- increased energy
- better digestion
- a stronger immune system
- more mental clarity and creativity
- improved skin
- a reduced risk of heart disease and other chronic diseases

For the most part, these benefits are what followers of the raw food diet report rather than benefits proven by research that would be accepted by nutritionist and practitioners of conventional medicine.

## Precautions

Some foods are unsafe to be eaten raw.

- Buckwheat greens are poisonous if eaten raw and cause photosensitivity in fair-skinned people.
- Rhubarb leaves can be poisonous if eaten raw. The stalks can be toxic if they are not harvested when they are young.
- Raw kidney beans and kidney bean sprouts are poisonous.
- The greenish skin that develops on some potatoes is poisonous. The toxin is neutralized by cooking at high temperatures.
- Raw foods, especially meats and seafood, can be contaminated with bacteria and parasites that would be killed with cooking.

It is generally recommended that traditional eaters who wish to practice a raw food diet move gradually toward a higher percentage of raw food in their diet rather than making a sudden change. Initially, people switching to a raw food diet may experience what raw foodists called detoxifying symptoms—headaches, nausea, **cravings**, and depression.

## Risks

Raw foodists tend to be rather fanatical about their diet. They may be at risk of developing an eating disorder called orthorexia nervosa. Orthorexia nervosa is a term coined by Steven Bratman, a Colorado physician, to describe "a pathological fixation on

## KEY TERMS

**Alternative medicine**—A system of healing that rejects conventional, pharmaceutical-based medicine and replaces it with the use of dietary supplements and therapies such as herbs, vitamins, minerals, massage, and cleansing diets. Alternative medicine includes well-established treatment systems such as homeopathy, Traditional Chinese Medicine, and Ayurvedic medicine, as well as more-recent, fad-driven treatments.

**Body Mass Index (BMI)**—A measurement of fatness that compares height to weight.

**Carotenoids**—Fat-soluble plant pigments, some of which are important to human health.

**Cholesterol**—A waxy substance made by the liver and also acquired through diet. High levels in the blood may increase the risk of cardiovascular disease.

**Conventional medicine**—Mainstream or Western pharmaceutical-based medicine practiced by medical doctors, doctors of osteopathy, and other licensed health care professionals

**Dietary fiber**—Also known as roughage or bulk. Insoluble fiber moves through the digestive system almost undigested and gives bulk to stools. Soluble fiber dissolves in water and helps keep stools soft.

**Dietary supplement**—A product, such as a vitamin, mineral, herb, amino acid, or enzyme, that is intended to be consumed in addition to an individual's diet with the expectation that it will improve health

**Enzyme**—A protein that change the rate of a chemical reaction within the body without themselves being used up in the reaction

**Mineral**—An inorganic substance found in the earth that is necessary in small quantities for the body to maintain a health. Examples: zinc, copper, iron.

**Naturopathic medicine**—An alternative system of healing that uses primarily homeopathy, herbal medicine, and hydrotherapy and rejects most conventional drugs as toxic.

**Osteoporosis**—A condition found in older individuals in which bones decrease in density and become fragile and more likely to break. It can be caused by lack of vitamin D and/or calcium in the diet.

**Toxin**—A general term for something that harms or poisons the body

**Triglycerides**—A type of fat found in the blood. High levels of triglycerides can increase the risk of coronary artery disease

**Vitamin**—A nutrient that the body needs in small amounts to remain healthy but that the body cannot manufacture for itself and must acquire through diet

eating 'proper,' 'pure,' or 'superior' foods." People with orthorexia allow their fixation with eating the correct amount of properly prepared healthy foods at the correct time of day to take over their lives.

This interest in correct eating only becomes an eating disorder when the obsession interferes with relationships and daily activities. For example, an orthorectic may be unwilling to eat at restaurants or friends' homes because the food is "impure" or improperly prepared. The limitations they put on what they will eat can cause serious vitamin and mineral imbalances. Orthorectics are judgmental about what other people eat to the point where it interferes with personal relationships. They justify their fixation by claiming that their way of eating is healthy. Some experts believe orthorexia may be a variation of obsessive-compulsive disorder.

In addition potential psychological harm, without rigorous meal planning, raw foodists are at high risk of developing certain vitamin deficiencies, depending on whether they follow a vegan, vegetarian, or meat-eating raw food diet. Vegans are at highest risk. The most common deficiencies are of vitamin $B_{12}$ and protein.

### Research and general acceptance

The public does not generally accept a diet of raw food. Many medical practitioners and nutritionists also express skepticism about the ability of people on the raw food diet to get an adequate balance of vitamins, minerals, and protein to maintain long-term health. However, this diet undeniably reduces many of the risks (e.g. **obesity**, high cholesterol, high **triglycerides**) associated with the development of cardiovascular disease.

Few large, well-designed, long-term studies have been done on the raw food diet. One 2005 study looked at the bone health of a group of 18 volunteers who had followed a raw food vegetarian diet for at least 10 years and compared them to volunteers who ate a

## QUESTIONS TO ASK THE DOCTOR

- How does cooking affect the nutrient value of foods I commonly eat?
- Can I get the nutrients I need on this diet?
- Is this diet safe and healthy for my entire family?
- Will I need to take dietary supplements if I become a raw foodist?
- Do you believe the cardiovascular benefits of this diet outweigh the potential risk of not getting a balance of nutrients?
- Where can I get meal planning advice about a raw food diet?

standard American diet. They found that the raw foodists were thinner and had a lower average body mass index(BMI) than volunteers and that their bones were lighter. However, they found no sign that the bones of the raw foodists were more likely to fracture or that they had a greater degree of **osteoporosis** than those of people on the standard diet. The researchers concluded that the bones of the raw foodists were lighter because they ate fewer calories and had lower body weights, but that they were healthy bones.

Other research shown that some nutrients, such as **carotenoids** in carrots and lycopene from tomatoes, are absorbed into the body much more easily from cooked foods than from raw foods. The enzyme theory of digestion promoted by some raw foodists is also not substantiated by any scholarly research, nor are claims that a raw food diet will prevent cancer.

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Living and Raw Foods Support Groups. <http://www.living-foods.com/resources/support.html>

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Tish Davidson, A.M.

Reader's Digest diet *see* **ChangeOne diet**

# Religion and dietary practices

## Origins

Since the beginning of time, dietary practices have been incorporated into the religious practices of people around the world. Some religious sects abstain, or are forbidden, from consuming certain foods and drinks; others restrict foods and drinks during their holy days; while still others associate dietary and food preparation practices with rituals of the faith. The early biblical writings, especially those found in Leviticus, Numbers, and Deuteronomy of the Old Testament (and in the Torah) outlined the dietary practices for

**World religions, foods practices and restrictions, and rationale for behavior**

| Type of religion | Practice or restriction | Rationale |
|---|---|---|
| Buddhism | • Refrain from meat, vegetarian diet is desirable<br>• Moderation in all foods<br>• Fasting required of monks | • Natural foods of the earth are considered most pure<br>• Monks avoid all solid food after noon |
| Eastern Orthodox Christianity | • Restrictions on Meat and Fish<br>• Fasting Selectively | • Observance of Holy Days includes fasting and restrictions to increase spiritual progress |
| Hinduism | • Beef prohibited<br>• All other meat and fish restricted or avoided<br>• Alcohol avoided<br>• Numerous fasting days | • Cow is sacred and can't be eaten, but products of the "sacred" cow are pure and desirable<br>• Fasting promotes spiritual growth |
| Islam | • Pork and certain birds prohibited<br>• Alcohol prohibited<br>• Coffee/tea/stimulants avoided<br>• Fasting from all food and drink during specific periods | • Eating is for good health<br>• Failure to eat correctly minimizes spiritual awareness<br>• Fasting has a cleansing effect of evil elements |
| Judaism | • Pork and shellfish prohibited<br>• Meat and dairy at same meal prohibited<br>• Leavened food restricted<br>• Fasting practiced | • Land animals that do not have cloven hooves and that do not chew their cud are forbidden as unclean (e.g., hare, pig, camel)<br>• Kosher process is based upon the Torah |
| Mormonism | • Alcohol and beverages containing caffeine prohibited<br>• Moderation in all foods<br>• Fasting practiced | • Caffeine is addictive and leads to poor physical and emotional health<br>• Fasting is the discipline of self-control and honoring to God |
| Protestantism | • Few restrictions of food or fasting observations<br>• Moderation in eating, drinking, and exercise is promoted | • God made all animal and natural products for humans' enjoyment<br>• Gluttony and drunkenness are sins to be controlled |
| Rastafarianism | • Meat and fish restricted<br>• Vegetarian diets only, with salts, preservatives, and condiments prohibited<br>• Herbal drinks permitted; alcohol, coffee, and soft drinks prohibited<br>• Marijuana used extensively for religious and medicinal purposes | • Pigs and shellfish are scavengers and are unclean<br>• Foods grown with chemicals are unnatural and prohibited<br>• Biblical texts support use of herbs (marijuana and other herbs) |
| Roman Catholicism | • Meat restricted on certain days<br>• Fasting practiced | • Restrictions are consistent with specified days of the church year |
| Seventh-day Adventist | • Pork prohibited and meat and fish avoided<br>• Vegetarian diet is encouraged<br>• Alcohol, coffee, and tea prohibited | • Diet satisfies practice to "honor and glorify God" |

*(Illustration by GGS Information Services/Thomson Gale.)*

certain groups (e.g., Christians and Jews), and many of these practices may still be found among these same groups today. Practices such as fasting (going without food and/or drink for a specified time) are described as tenets of faith by numerous religions.

## Description

### *Religious Belief Expressed as Food Customs*

To understand the reasons for nutritional and dietary customs in any religion requires a brief orientation of the rationale for such practices and laws. Many religious customs and laws may also be traced to early concerns for health and safety in consuming foods or liquids. In the past, preservation techniques for food were limited. Modern conveniences such as electricity were unavailable, and the scholars of the day did not understand theories of health promotion, disease prevention, and illness as they do today.

Therefore, religious leaders of the day developed rules about the consumption of foods and drinks, and religious practices, restrictions, and laws evolved. Specific laws about what can be consumed remain in most religions today. The lack of mechanisms to refrigerate or preserve foods led to certain rituals, such as the draining of blood from slaughtered animals, while restrictions on the eating of foods known to spoil easily, such as eggs, dairy products, and meats, were devised for safety reasons.

Attention to specific eating practices, such as overeating (gluttonous behaviors), use of strong drink or oral stimulants, and vegetarian diets, were also incorporated into the doctrine of religious practice. In addition to laws about the ingestion of foods or drinks, the practice of fasting, or severely restricting intake of food and/or drink, became prevalent, and is still practiced by many religions today.

## KEY TERMS

**Malnourished**—lack of adequate nutrients in the diet

**Nausea**—unpleasant sensation in the gut that precedes vomiting

**Nervous system**—the brain, spinal cord, and nerves that extend throughout the body

**Proscription**—prohibitions, rules against

### *The Role of Fasting*

Many religions incorporate some element of fasting into their religious practices. Laws regarding fasting or restricting food and drink have been described as a call to holiness by many religions. Fasting has been identified as the mechanism that allows one to improve one's body (often described as a "temple" created by God), to earn the approval of Allah or Buddha, or to understand and appreciate the sufferings of the poor.

Fasting has also been presented as a means to acquire the discipline required to resist temptation, as an act of atonement for sinful acts, or as the cleansing of evil from within the body. Fasting may be undertaken for several hours, at a specified time of the day (e.g., from sunrise to sunset, as practiced by modern Jews), for a specified number of hours (e.g., twelve, twenty-four, or more, as observed by Catholics or Mormons who fast on designated days), or for consecutive days, such as during the month of Ramadan for certain Muslims. Regardless of the time frame or rationale, religious groups observe the practice of fasting worldwide.

### *Major Religions with Food Prescriptions*

Although no two religions hold exactly the same ideology about diet, health, and spiritual wellness, many do embrace similar practices.

Buddhism. Many Buddhists are vegetarians, though some include fish in their diet. Most do not eat meat and abstain from all beef products. The birth, enlightenment, and death of Buddha are the three most commonly recognized festivals for feasting, resting from work, or fasting. Buddhist monks fast completely on certain days of the moon, and they routinely avoid eating any solid foods after the noon hour.

Eastern Orthodox Christianity. An essential element of practicing an Orthodox life includes fasting, since its intrinsic value is part of the development of a spiritual life. To practicing Orthodox believers, fasting teaches self-restraint, which is the source of all good.

Hinduism. Hindus do not consume any foods that might slow down spiritual or physical growth. The eating of meat is not prohibited, but pork, fowl, ducks, snails, crabs, and camels are avoided. The cow is sacred to Hindus, and therefore no beef is consumed. Other products from the cow, however, such as milk, yogurt, and butter are considered innately pure and are thought to promote purity of the mind, spirit, and body.

Many devout Hindus fast on the eighteen major Hindu holidays, as well as on numerous personal days, such as birthdays and anniversaries of deaths and marriages. They also fast on Sundays and on days associated with various positions of the moon and the planets.

Islam. To the Muslims, eating is a matter of faith for those who follow the dietary laws called *Halal*, a term for all permitted foods. Those foods that are prohibited, such as pork and birds of prey, are known as *Haram*, while the foods that are questionable for consumption are known as *Mashbooh*. Muslims eat to preserve their good health, and overindulgence or the use of stimulants such as tea, coffee, or alcohol are discouraged. Fasting is practiced regularly on Mondays and Thursdays, and more often for six days during Shawwal (the tenth month of the Islamic year) and for the entire month of Ramadan (the ninth month). Fasting on these occasions includes abstention from all food and drink from sunrise to sunset.

Judaism. The Jewish dietary law is called *Kashrut*, meaning "proper" or "correct." The term *kosher* refers to the methods of processing foods according to the Jewish laws. The processing laws and other restrictions regarding to the preparation of food and drink were devised for their effects on health. For example, rules about the use of pans, plates, utensils, and separation of meat from dairy products are intended to reduce contamination. Other rules include:

- A Jewish person must prepare grape products, otherwise they are forbidden.
- Jewish laws dictate the slaughter and removal of blood from meat before it can be eaten.
- Animals such as pigs and rabbits and creatures of the sea, such as lobster, shrimp, and clams, may not be eaten.
- Meat and dairy products cannot be eaten at the same meal or served on the same plate, and kosher and nonkosher foods cannot come into contact with the same plates.

Mormonism. The law of health—the Word of Wisdom—contains the laws for proper eating and the rules of abstinence for tobacco, alcohol, coffee, tea, chocolate, and illegal drugs. Mormons must choose foods that build up the body, improve endurance, and enhance intellect. Products from the land, such as grains, fruits, vegetables, and nuts, are to take the place of meats; meats, sugar, cheeses, and spices are to be avoided. Reason and self-control in eating is expected in order to stay healthy.

Rastafarianism. Members of this group are permitted to eat any food that is *I-tal* food, meaning that it is cooked only slightly. Therefore, meats are not consumed, canned goods are avoided, and drinks that are unnatural are not allowed. Fish under twelve inches long may be eaten, but other types of seafood are restricted.

Roman Catholicism. The dietary practices of devout Catholics center around the restriction of meat or fasting behaviors on specified holy days.

On the designated days, Catholics may abstain from all food, or they may restrict meat and meat products. Water or nonstimulant liquids are usually allowed during the fast.

Seventh-day Adventists. The Seventh-day Adventist Church advocates a lacto-ovo vegetarian diet, including moderate amounts of low-fat dairy products and the avoidance of meat, fish, fowl, coffee, tea, alcohol, and toboacco products (though these are not strictly prohibited). The church's beliefs are grounded in the Bible, and in a "belief in the wholistic nature of people" (Seventh-day Adventist General Conference Nutrition Council).

While the dietary practices of different religions vary, and the rationale for each practice is based upon different texts, there is also much commonality. The practice of fasting is almost universal across religious groups, and most regard it as a mechanism to discipline the followers in a humbling way for spiritual growth. Many fasting practices are connected with specific holy days. The variation in consumption of meat and vegetables has a much wider variation.

## Health Benefits and Risks Associated with Specific Practices

Certain groups of people must necessarily be excused from fasting and restrictive practices. These groups include pregnant or nursing women; individuals with diabetes or other chronic disorders; those engaged in very strenuous work; malnourished individuals; young children; and frail elderly or disabled persons. Recognition of these exceptions has been addressed by each religious group. Most fasting practices allow certain intakes of liquid, particularly **water**. In fasting regimes where water is restricted, a danger of **dehydration** exists, and those fasting should be monitored.

Those who fast without liquids increase their risk of a number of health problems. Symptoms of dehydration include headache, dry mouth, nausea, fever, sleepiness, and, in extreme cases, coma. When these symptoms occur, it is important to end the fast or add water to the fast. Depending on the extent of the symptoms, ending the fast may be the only alternative. In severe dehydration cases, medical care should be sought as soon as possible to restore proper health.

Some negative health consequences have been observed as a result of fasting practices, however, especially those carried out over longer periods, such as the Muslim fast during Ramadan. For example, excess acids can build up in the digestive system during a prolonged fast. This gastric acidity results in a sour taste in the mouth, a burning in the stomach, and other symptoms of illness.

The structure and outward appearance of each person's body is, in part, a reflection of the food and drink he or she consumes. All the organs of the body, as well as the skin, bones, muscles, and nerves, need nutrition to survive, regenerate, maintain function, and develop structural foundations. The vital organs, such as the liver, heart, brain, and kidneys, depend upon essential nutrients from food and drink to sustain life, increase strength, and improve health. Throughout life, the body constantly breaks down the food products that are ingested, using some components to rebuild the tissues that contribute to good health. Similarly, the body also disposes of the waste products of food through excretory processes or in storage centers (fat deposits, for instance) in the body.

The restriction of, or abstention from, certain foods may have a direct impact on the health of those engaged in such practices. Some effects have been found to be positive, as in the case of vegetarian diets, which are eaten by many Seventh-day Adventists, Hindus, Buddhists, and Rastafarians. Research results have documented a 50% reduction in heart disease and longer life expectancy in people who eat a well-planned vegetarian diet. There are a number of religious rationales for a vegetarian diet. According to the Book of Genesis in the Bible, humans were given a plant-based diet at the creation of the world. There are

also ethical issues that involve the killing of animals for food, and environmental issues regarding the raising of livestock and the safety of the food supply.

### *Use of, and Abstention from, Stimulants*

A stimulant is a product, food, or drink that excites the nervous system and changes the natural physiology of the body, such as drugs and consumable products that contain **caffeine**, such as tea, coffee, or chocolate. The use of caffeine is prohibited or restricted by many religions because of its addictive properties and harmful physical effects. Many also restrict spices and certain condiments, such as pepper, pickles, or foods with preservatives, because they are injurious by nature and flavor the natural taste and effect of foods.

The use of wine in religious ceremonies is regarded as acceptable by certain groups. For example, Roman Catholics, Eastern Orthodox Christians, and certain Protestant denominations use wine as a sacramental product to represent the blood of Christ in communion services. According to the writings of the apostle Paul, wine used in moderation may be consumed for the soothing effect it has upon an upset stomach. Mormons, however, specifically forbid wine or any alcoholic drinks because of their stimulant properties. Jews regard grapes as a fruit of idolatry, and therefore forbid the use of wine or products made from grapes except under special conditions.

Many religious leaders and health care experts regard tobacco, another stimulant, as a malignant poison that affects the health of its users. Research continues to support the harmful and deleterious effects of the use of cigarettes and tobacco products. **Cancer**, high blood pressure, and heart disease have all been linked to tobacco use.

Although marijuana has been shown to control pain in advanced diseases such as cancer, it has been considered a restricted drug by all but those practicing Rastafarianism. Rastafarians introduced marijuana into their religious rites because they consider it the "weed of wisdom," and because they believe it contains healing ingredients.

### Resources

#### BOOKS

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Ruth A. Waibel

## Renal nutrition

### Definition

Renal nutrition is concerned with the special dietary needs of kidney patients.

### Purpose

According to the National Kidney Foundation, more than 20 million Americans, one in nine adults, have chronic kidney disease, and an additional 20 million others are at increased risk. Kidney disease is a consequence of damaged nephrons, the tiny structures inside the kidneys that function as filters to remove wastes and extra fluids from the blood. It takes a long time to damage the kidney's nephrons, and the process usually occurs gradually over years. The most common causes of kidney disease include:

- Diabetes mellitus: Diabetes results from the body's inability to use the sugar glucose efficiently, either because it lacks insulin, the hormone that controls the level of glucose in the blood, or because it can not use the available insulin. The glucose stays in the blood and over time, high blood sugar levels can damage the kidneys.
- Hypertension: High blood pressure can damage the small blood vessels of the kidneys with the result that the kidneys can no longer filter wastes from the blood very well.

**Conditions related to kidney failure and treatments**

**Anemia and Erythropoietin (EPO)**—Anemia is common in people with kidney disease because the kidneys produce the hormone erythropoietin, or EPO, which stimulates the bone marrow to produce red blood cells. Diseased kidneys often don't make enough EPO, causing the bone marrow to make fewer red blood cells. EPO is available commercially and is commonly given to patients on dialysis. Anemia can also contribute to heart problems.

**Renal Osteodystrophy**—This bone disease of kidney failure affects 90% of dialysis patients. The condition causes bones to become thin and weak or to form incorrectly and affects both children and adults. Symptoms can be seen in growing children with kidney disease even before they start dialysis. Older patients and women who have gone through menopause are at greater risk for this disease.

**Itching (Pruritus)**—Many patients treated with hemodialysis complain of itchy skin, which is often worse during or just after treatment. Itching can worsen from wastes in the bloodstream that current dialyzer membranes can't remove from the blood. The problem can also be related to high levels of parathyroid hormone (PTH), which help control the levels of calcium and phosphorus in the blood.

**Sleep disorders**—Patients on dialysis often have insomnia, which can be caused by aching, uncomfortable, jittery, or "restless" legs (a condition related to nerve damage or chemical imbalances). Some patients may have sleep apnea syndrome, signaled by snoring and breaks in snoring. Sleep apnea may be related to the effects of advanced kidney failure on the control of breathing. Overtime, sleep disturbances can lead to "day-night reversal" (insomnia at night, sleepiness during the day), headache, depression, and decreased alertness.

**Dialysis-related Amyloidosis (DRA)**—It is common for patients who have been on dialysis for more than 5 years to develop DRA. It is the result of proteins in the blood depositing on joints and tendons, causing pain, stiffness, and fluid in the joints, as is the case with arthritis. Working kidneys filter out these proteins, but dialysis filters are not as effective.

SOURCE: National Institute of Diabetes and Digestive and Kidney Diseases, National Institutes of Health, U.S. Department of Health and Human Services

*(Illustration by GGS Information Services/Thomson Gale.)*

- Heredity: Some kidney diseases result from hereditary factors, and run in families.

Kidney disease interferes with the vital function of the kidneys. The kidneys are bean-shaped organs located near the middle of the back, just below the rib cage. Kidneys filter blood, removing waste products and extra **water**, which become urine. They are very efficient filtering units, processing some 200 quarts of blood and producing about 2 quarts of urine per day in a healthy adult. The wastes in the blood result from the normal breakdown of active muscle and from digestion. After the body extracts nutrients from ingested food, the resulting waste is sent to the blood which is filtered by the kidneys. The kidneys also release three important hormones:

- Erythropoietin, which stimulates the bones to make red blood cells.
- Renin, which regulates blood pressure.
- The active form of vitamin D, required to regulate calcium for bones and for normal chemical balance in the body.

Damaged kidneys do not clean the blood efficiently. Instead, waste products and fluid build up in the blood leading to kidney disease that often cannot be cured. In the early stages of a kidney disease, treatment may be able to make the kidneys last longer. Eventually, kidneys may stop working altogether (kidney failure), and the body fills with extra water and waste products (uremia), which may lead to seizures or coma, and ultimately to death. When kidneys stop working completely, dialysis or a kidney transplantation is required.

Dialysis is an artificial way to filter blood after the kidneys have failed. With hemodialysis, the blood travels through tubes to a dialyzer, a machine that removes wastes and extra fluid. The cleaned blood is then returned to the body. The procedure is usually performed at a dialysis center three times per week for 3–4 hours. In peritoneal dialysis, a fluid (dialysate) is dripped into the abdomen to capture the waste products from the blood. After a few hours, the dialysate is drained out, and a fresh bag of dialysate is dripped into the abdomen. Patients can perform peritoneal dialysis themselves.

## Description

Renal nutrition is concerned with ensuring that kidney patients eat the right foods to make dialysis efficient and improve health. Dialysis clinics have dietitians on staff who help patients plan meals. Standard guidelines are: eating more high **protein** foods, and less high salt, high potassium, and high phosphorus foods. Patients are also advised on safe fluid intake levels. The National Kidney Foundation offers the following dietary advice to adults starting hemodialysis:

### *Sodium and salt*

- Use less salt and eat fewer salty foods to help to control blood pressure and reduce weight gains between dialysis sessions.
- Use herbs, spices, and low–salt flavor enhancers instead of salt.
- Avoid salt substitutes made with potassium.

### *Protein and meat*

- People on dialysis need to eat more protein. Eat a high-protein food (meat, fish, poultry, fresh pork, or eggs at every meal, for a total of 8–10 ounces of high protein foods everyday.

## KEY TERMS

**Amyloidosis**—Condition characterized by accumulation in body tissues of deposits of abnormal proteins (amyloids) produced by cells. Amyloidosis can lead to kidney disease.

**B–group vitamins**—Group of eight water-soluble vitamins that are often present as a single, vitamin complex in many natural sources, such as rice, liver and yeast.

**Bulk minerals**—Minerals needed by the body in small amounts (RDA > 200mg/day) They include: calcium, magnesium, phosphorus, potassium, sodium, and sulfur.

**Diabetes mellitus**—A condition characterized by high blood sugar levels resulting from the body's inability to use glucose efficiently. There are two types of diabetes: type 1 and type 2.

**Dialysis**—The process of cleaning wastes from the blood artificially. This is normally done by the kidneys but if the kidneys fail, the blood must be cleaned artificially with special equipment.

**Dialysis–related amyloidosis (DRA)**—Type of amyloidosis resulting from the use of dyalisis.

**Digestion**—The process by which food is chemically converted into nutrients that can be absorbed and used by the body.

**Glucose**—A monosaccharide sugar occurring widely in most plant and animal tissue. In humans, it is the main source of energy for the body.

**Hemodialysis**—Type of dialysis to clean wastes from the blood after the kidneys have failed: the blood travels through tubes to a dialyzer, a machine that removes wastes and extra fluid. The cleaned blood then goes back into the body.

**High blood pressure**—Blood pressure is the force of the blood on the arteries as the heart pumps blood through the body. High blood pressure, or hypertension, is a condition where there is too much pressure, which can lead to heart and kidney problems.

**Hormone**—Substance produced in one part of the body and released into the blood to trigger or regulate particular functions of the body. The kidney releases three hormones: erythropoietin, renin, and an active form of vitamin D that helps regulate calcium for bones.

**Insulin**—Hormone released by the pancreas in response to increased levels of blood sugar (glucose) in the blood.

**Micronutrients**—Nutrients needed by the body in small amounts. They include vitamins and minerals.

**Nephrons**—A tiny part of the kidneys. Each kidney is made up of about 1 million nephrons, which are the working units of the kidneys, removing wastes and extra fluids from the blood.

**Nutrient**—A source of nourishment, especially a nourishing ingredient in a food.

**Trace minerals**—Minerals needed by the body in tiny, trace amounts (RDA < 200mg/day). They include: selenium, iron, zinc, copper, manganese, molybdenum, chromium, arsenic, germanium, lithium, rubidium, tin.

**Type 1 diabetes**—In type 1 diabetes, the pancreas makes little or no insulin.

**Type 2 diabetes**—In type 2 diabetes, the body is resistant to the effects of available insulin. It is the most common form of diabetes mellitus. Most of the people who have this type of diabetes are overweight.

- Even though peanut butter, nuts, seeds, dried beans, peas, and lentils have protein, they are generally not recommended because they are high in both potassium and phosphorus.

### *Grains and cereals*

- 1 slice of bread (white, rye, or sourdough)
- 1/2 English muffin
- 1/2 bagel
- 1/2 hamburger bun
- 1/2 hot dog bun
- 1 6–inch tortilla
- 1/2 cup cooked pasta
- 1/2 cup cooked white rice
- 1/2 cup cooked cereal (cream of wheat)
- 1 cup cold cereal (corn flakes or crispy rice)
- 4 unsalted crackers
- 1 1/2 cup unsalted popcorn
- 10 vanilla wafers

### *Milk, yogurt, and cheese*

Most dairy foods are very high in phosphorus and intake of milk, yogurt, and cheese should be limited to 1/2 cup milk or yogurt or 1 ounce of cheese per day. Dairy foods low in phosphorus include:

- Butter and tub margarine
- Cream cheese
- Heavy cream
- Ricotta cheese
- Brie cheese
- Non-dairy whipped topping
- Sherbet

### *Fruits and juices*

All fruits have some potassium. Some fruits however, have more than others. Star fruit (carambola) should be always avoided. Other fruits that should be limited or totally avoided are:

- Oranges and orange juice
- Kiwis
- Nectarines
- Prunes and prune juice
- Raisins and dried fruit
- Bananas
- Melons (cantaloupe and honeydew)

2–3 servings of the following low potassium fruits should be eaten each day. One serving = 1/2 cup or 1 small fruit or 4 ounces of juice.

- Apple (1)
- Berries (1/2 cup)
- Cherries (10)
- Fruit cocktail, drained (1/2 cup)
- Grapes (15)
- Peach (1 small fresh or canned, drained)
- Pear, fresh or canned, drained (1/2)
- Pineapple (1/2 cup canned, drained)
- Plums (1 or 2)
- Tangerine (1)
- Watermelon (1 small wedge)

Drinks may include:

- Apple cider
- Cranberry juice cocktail
- Grape juice
- Lemonade

### *Vegetables*

All vegetables contain some potassium, but some have more than others and should be limited or totally avoided. Examples are:

- Potatoes (including French fries, potato chips and sweet potatoes)
- Tomatoes and tomato sauce
- Winter squash
- Pumpkin
- Asparagus
- Avocado
- Beets
- Beet greens
- Cooked spinach
- Parsnips and rutabaga

Patients are advised to eat 2–3 servings of the following low-potassium vegetables each day. One serving = 1/2 cup.

- Broccoli
- Cabbage
- Carrots
- Cauliflower
- Celery
- Cucumber
- Eggplant
- Garlic
- Green and wax beans
- Lettuce–all types (1 cup)
- Onion
- Peppers–all types and colors
- Radishes
- Watercress
- Zucchini and yellow squash

### *Desserts*

- Depending on calorie needs, the dietitian may recommend high–calorie deserts such as pies, cookies, sherbet, and cakes.
- Dairy-based desserts and those made with chocolate, nuts, and bananas should be limited.

## Precautions

The special diet followed by kidney patients requires taking several precautions. The National Kidney and Urologic Diseases Information Clearinghouse (NKUDIC)of the National Institute of Diabetes

and Digestive and Kidney Diseases (NIDDK) offers the following general guidelines:

- Fluids. A dietitian helps dialysis patients determine how much fluid to drink each day. This is because extra fluid can raise blood pressure, make the heart work harder, and increase the stress of dialysis treatments. Many foods, such as soup, ice cream, and fruits, also contain plenty of water and the dietitian is the best person to provide advice on controlling thirst.
- Potassium. Potassium is a bulk mineral found in many foods, especially fruits and vegetables. It affects how steadily the heart beats, and this is why eating high-potassium foods can be very dangerous for the heart. Foods like oranges, bananas, tomatoes, potatoes, and dried fruits must be avoided. Some potassium can be removed from potatoes and other vegetables by peeling and soaking them in a large container of water for several hours before cooking them in fresh water.
- Phosphorus. Phosphorus is another mineral found in foods. It can weaken bones and make skin itch if intake is too high. Control of phosphorus is very important for the prevention of bone disease and associated complications. High-phosphorus foods include milk and cheese, dried beans, peas, colas, nuts, and peanut butter and should be avoided.
- Sodium (salt). Another mineral present in many foods is sodium. Most canned foods and frozen dinners contain high amounts of sodium. A high sodium intake causes thirst and drinking more fluids, which makes the heart work harder to pump the fluid through the body. Over time, this can cause high blood pressure and congestive heart failure. Kidney patients are accordingly advised to eat fresh foods that are naturally low in sodium, and to look for products labeled "low sodium."
- Protein. Most kidney patients on dialysis are encouraged to eat as much high-quality protein as they can. Protein helps maintain muscle and repair tissue, but it breaks down into blood urea nitrogen (BUN) in the body. However, some sources of protein, called high-quality proteins, produce less waste than others. High-quality proteins are found in meat, fish, poultry, and eggs. Obtaining dietary protein from these sources can reduce the amount of urea in blood.
- Calories. Calories provide energy to the body and some dialysis patients need to gain weight. Vegetable oils, such as olive, canola, and safflower oils, are good sources of calories and do not result in cholesterol problems. Hard candy, sugar, honey, jam, and jelly also provide calories and energy. However, kidney patients with diabetes must follow the guidance of a dietitian.

## Interactions

Since dialysis patients must avoid several types of foods, their diet may be missing important **vitamins** and mineral micronutrients. Dialysis also removes some vitamins from the body. The treating physician may prescribe a vitamin and mineral supplement designed specifically for kidney failure patients. The physician may also prescribe **vitamin C** and a group of vitamins called B complex. A **calcium** tablet may also be given to bind the phosphorous present in food and provide the extra calcium needed by the body. Patients should never take off-the-counter supplements since they may contain vitamins or **minerals** that may cause harmful interactions.

## Aftercare

Kidney patients on dialysis have very special dietary needs that exceed restricting foods, because eating poorly can increase the risk of complications. This is why a dietitian is such a crucial member of the healthcare team. The dietitian will keep track of the fat and muscle stores in a patient's face, hands, arms, shoulders, and legs. The dialysis care team will look for changes in the blood level of proteins, especially the albumin level, as a change in this protein can be indicative of body protein loss. Special blood tests are also done on a monthly basis. They include Kt/V and urea reduction ratio (URR) tests. The tests are used by the care team to evaluate the appropriate course of dialysis required to help patients feel best. A change in any of these tests could mean that a patient is not getting enough dialysis. The tests also provide information about a patient's protein intake and on the protein equivalent of nitrogen appearance (PNA). Using the PNA, the albumin results and any changes in patient appetite, the dietitian can determine if the intake of the right foods is adequate.

## Complications

Kidney patients are at risk of developing complications such as high blood pressure, anemia (low blood count), weak bones, poor nutritional health and nerve damage. Also, kidney disease increases the risk of heart and blood vessel (cardiovascular) disease.

Patients undergoing dialysis can also experience side effects, caused by rapid changes in the body's fluid and chemical balance during treatment. Two common side effects are muscle cramps and hypotension. Hypotension can make the patient feel weak, dizzy,

or nauseous. Fortunately, dialysis side effects can often can be treated quickly and easily.

In patients receiving dialysis, a type of protein called beta-2-microglobulin builds up in the blood. As a result, beta-2-microglobulin molecules tend to join together to form aggregated molecules (amyloids). These aggregates can form deposits and eventually damage the surrounding tissues while causing significant discomfort. This condition is called dialysis–related amyloidosis (DRA). DRA is relatively common in patients, especially older people, who have been on hemodialysis for more than five years. This is because dialysis membranes after being used for several years do not effectively remove the beta-2-microglobulin amyloids from the bloodstream. New hemodialysis membranes, as well as peritoneal dialysis, remove beta-2-microglobulin more effectively, but not enough to keep blood levels normal. As a result, blood levels remain elevated, and deposits form in bone, joints, and tendons.

### Parental concerns

The two major problems faced by children with kidney failure are poor growth and weight gain, so their diet is usually not restricted unless needed. Children grow fastest during the first two years of life and the earlier the age at which kidney failure occurs, the more likely is growth to be affected. The goals in feeding a child with kidney failure are to balance nutrition for normal growth and protect health as well. The treating physician works with a dietitian to monitor possible problems and suggests, if needed, a diet that will try to take into account the child's food likes and dislikes.

Parents should learn as much as they can about a child's kidney disease and its treatment, encouraging the child to ask questions not only to family members but also to doctors, nurses, and other members of the care team. This also includes explaining the special nutrition restrictions of kidney disease. If explained clearly and simply, even very young children can understand special dietary needs. It is found on the whole that children are in general more compliant with dietary restrictions than adults. One way to help children develop a sense of control over the illness is to have a child make a list of favorite foods and take him or her along to dietitian appointments to see if these foods can be incorporated into the diet plan. Trying to bribe or force a child to eat is ill-advised and counterproductive. Helping a child understand kidney disease, its treatment and the purpose of the special diet is the only way to ensure dietary compliance while maintaining a positive climate of support and encouragement.

### Resources

#### BOOKS

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#### ORGANIZATIONS

American Association of Kidney Patients (AAKP). 3505 E. Frontage Rd., Suite 315, Tampa, FL 33607. 1-800-749-2257. <www.aakp.org>.

American Dietetic Association (ADA). 120 South Riverside Plaza, Suite 2000, Chicago, IL. 60606-6995. 1-800/877-1600. <www.eatright.org>.

American Society for Nutrition (ASN). 9650 Rockville Pike, Bethesda, MD 20814. (301) 634-7050. <www.nutrition.org>.

National Kidney Foundation. 30 East 33rd Street, New York, NY 10016. 1-800-622-9010. <www.kidney.org>.

National Kidney and Urologic Diseases Information Clearinghouse (NKUDIC). 3 Information Way, Bethesda, MD 20892–3580. <kidney.niddk.nih.gov>.

Renal dieticians (RPG). 120 South Riverside Plaza, Suite 2000, Chicago, IL. 60606-6995. 1-800-877-1600 ext. 4815. < www.renalnutrition.org>.

Monique Laberge, Ph.D.

## Riboflavin

### Definition

Riboflavin is a water-soluble vitamin that the body needs to remain healthy. Humans cannot make riboflavin, so they must get it from foods in their diet. Riboflavin is also called vitamin $B_2$.

**Riboflavin**

| Age | Recommended Dietary Allowance (mg/day) |
|---|---|
| Children 0–6 mos. | 0.3 (AI) |
| Children 7–12 mos. | 0.4 |
| Children 1–3 yrs. | 0.5 |
| Children 4–8 yrs. | 0.6 |
| Children 9–13 yrs. | 0.9 |
| Boys 14–18 yrs. | 1.3 |
| Girls 14–18 yrs. | 1.0 |
| Men 19≥ yrs. | 1.3 |
| Women 19≥ yrs. | 1.1 |
| Pregnant women | 1.4 |
| Breastfeeding women | 1.6 |

| Food | Riboflavin (mg) |
|---|---|
| Yogurt, low fat, 1 cup | 0.52 |
| Milk, 2%, 1 cup | 0.40 |
| Tempeh, cooked, 4 oz. | 0.40 |
| Beef tenderloin, broiled, 4 oz. | 0.35 |
| Milk, nonfat, 1 cup | 0.34 |
| Egg, boiled, 1 large | 0.27 |
| Almonds, roasted, 1 oz. | 0.24 |
| Spinach, cooked, ½ cup | 0.21 |
| Chicken, dark meat, roasted, 3 oz. | 0.18 |
| Salmon, broiled, 3 oz. | 0.13 |
| Asparagus, cooked, ½ cup | 0.11 |
| Chicken, light meat, roasted, 3 oz. | 0.10 |
| Broccoli, steamed, ½ cup | 0.09 |
| Bread, white, enriched, 1 slice | 0.09 |
| Bread, whole wheat, 1 slice | 0.07 |

AI = Adequate Intake
mg = milligram

*(Illustration by GGS Information Services/Thomson Gale.)*

## Purpose

Riboflavin has a broad range activities related to the conversion of nutrients into energy, making other **vitamins** and **minerals** available to the body, and acting as an antioxidant to remove of free radicals from cells.

## Description

Without riboflavin, much of the food people eat could not be converted into energy. To produce energy, the body breaks down **carbohydrates** (starches and sugars) and **fats** into smaller units (glucose) that are then "burned" (oxidized) by cells to produce the energy they need to function. Riboflavin does not break down carbohydrates by itself. Instead, it joins with compounds called flavins that control the pathway that produces energy from food. Other vitamins such as $B_1$ also are involved in this process. Riboflavin is especially important in supplying energy to muscles during physical activity and to the heart, which needs a continuous supply of energy.

When the body burns nutrients, free radicals are formed as a waste product of oxidation. Free radicals are highly reactive molecules that can damage cell membranes and DNA (genetic material). The damage that free radicals cause to cells is believed to play a role in the development of certain diseases, especially **cancer**. Riboflavin is an antioxidant. It binds to certain free radicals to neutralize them and remove them from the body so that they do not cause damage.

Riboflavin also plays a role in the way the body uses **vitamin $B_6$**, **niacin**, folic acid, ironm and **zinc**. It helps convert vitamin $B_6$ into its active form and is a necessary part of the chemical reactions that allow niacin to be used by the body. In the absence of riboflavin, less **iron** is absorbed from the intestines and the production of hemoglobin, the iron-containing molecule in red blood cells transports oxygen around the body, is depressed.

### *Normal riboflavin requirements*

The United States Institute of Medicine (IOM) of the National Academy of Sciences has developed values called **Dietary Reference Intakes** (DRIs) for vitamins and minerals. The DRIs consist of three sets of numbers. The Recommended Dietary Allowance (RDA) defines the average daily amount of the nutrient needed to meet the health needs of 97–98% of the population. The Adequate Intake (AI) is an estimate set when there is not enough information to determine an RDA. The Tolerable Upper Intake Level (UL) is the average maximum amount that can be taken daily without risking negative side effects. The DRIs are calculated for children, adult men, adult women, pregnant women, and **breastfeeding** women.

The IOM has not set RDAs for riboflavin in children under one year old because of incomplete scientific information. Instead, it has set AI levels for this age group. No UL levels have been set for any age group because no negative (toxic) side effects have been found with large doses of riboflavin. RDAs for riboflavin measured in micrograms (mg).

The following are the RDAs and AIs for riboflavin for healthy individuals:

- children birth–6 months: AI 0.3 mg
- children 7–12 months: AI 0.4 mg
- children 1–3 years: RDA 0.5 mg
- children 4–8 years: RDA 0.6 mg
- children 9–13 years: RDA 0.9 mg
- boys 14–18 years: RDA 1.3 mg

## KEY TERMS

**Antioxidant**—A molecule that prevents oxidation. In the body antioxidants attach to other molecules called free radicals and prevent the free radicals from causing damage to cell walls, DNA, and other parts of the cell.

**Dietary supplement**—A product, such as a vitamin, mineral, herb, amino acid, or enzyme, that is intended to be consumed in addition to an individual's diet with the expectation that it will improve health.

**Enzyme**—A protein that change the rate of a chemical reaction within the body without themselves being used up in the reaction.

**Jaundice**—A condition in which bilirubin, a waste product caused by the normal breakdown or red blood cells, builds up in the body faster than the liver can break it down. People with jaundice develop yellowish skin and the whites of their eyes become yellow. The condition can occur in newborns and people with liver damage.

**Vitamin**—A nutrient that the body needs in small amounts to remain healthy but that the body cannot manufacture for itself and must acquire through diet.

**Water-soluble vitamin**—A vitamin that dissolves in water and can be removed from the body in urine.

- girls 14–18 years: RDA 1.0 mg
- women age 19 and older: RDA 1.1 mg
- men age 19 and older: RDA 1.3 mg
- pregnant women: RDA 1.4 mg
- breastfeeding women: RDA 1.6 mg

### *Sources of riboflavin*

People need a continuous supply of riboflavin from their diet because very little riboflavin is stored in the body; any excess is excreted in urine. Almost all healthy people in the United States get enough riboflavin from their diet and do not need to take a riboflavin supplement. In the United States starting in 1943, riboflavin, along with **thiamin** and niacin, has been added to flour. Other good sources of riboflavin include brewer's yeast, whole grains, wheat germ, and dark green vegetables. Some breakfast cereals are also fortified with riboflavin.

Exposure to light breaks down riboflavin in foods. For example, milk stored in a clear container and left in sunlight for two hours will lose about half of its riboflavin content. Foods containing riboflavin should be stored in opaque containers to prevent breakdown of the vitamin by light. Consumers should select milk in paper cartons rather than glass bottles. Prolonged soaking or boiling also causes foods to lose riboflavin.

The following list gives the approximate riboflavin content for some common foods:

- spinach, cooked, 1/2 cup: 0.21 mg
- asparagus, cooked, 1/2 cup: 0.11 mg
- broccoli, steamed 1/2 cup: 0.09 mcg
- milk, 2% 1 cup 0.40 mg
- milk, nonfat 1 cup: 0.34 mg
- yogurt, low fat: 1 cup: 0.52 mg
- egg, boiled, 1 large: 0.27 mg
- almonds, roasted, 1 ounce: 0.24 mg
- salmon, broiled, 3 ounces: 0.13 mg
- chicken, light meat, roasted, 3 ounces: 0.10 mg
- chicken, dark meat, roasted, 3 ounces: 0.18 mg
- beef tenderloin, broiled, 4 ounces: 0.35 mg
- tempeh, cooked, 4 ounces 0.4 mg
- bread, whole wheat, 1 slice: 0.07 mg
- bread, white, enriched, 1 slice 0.09 mg

### *Riboflavin deficiency*

Most healthy people in the United States get enough riboflavin in their diet because riboflavin is added to many common foods such as bread. Although **dietary supplements** containing large amounts of riboflavin do not appear to cause negative health effects, they also do not appear to improve health or athletic performance. Excess riboflavin is simply removed from the body in urine. Riboflavin deficiency, also called ariboflavinosis, rarely occurs alone. People who are riboflavin deficient usually also have deficiencies of other B vitamins. Those who are more likely to develop riboflavin deficiency include:

- newborns who receive light therapy for jaundice
- people with alcoholism
- people with anorexia nervosa (self starvation)
- people with celiac disease who cannot eat products containing gluten (e.g. wheat flour, bread, pasta)
- people who are lactose intolerant or who do not eat dairy products
- older, low income individuals who eat a poor diet of highly processed foods

Symptoms of riboflavin deficiency tend to be fairly mild and include sore throat and tongue, cracked skin around the mouth and lips, skin inflammation, and eye problems such as excessive sensitivity

to light, burning eyes, and gritty-feeling eyes. Some researchers also believe that migraine headaches may be triggered by riboflavin deficiency. Inadequate levels of riboflavin may decrees the body's ability to use iron, zinc, folic acid, vitamin $B_3$ and **vitamin $B_{12}$**.

### Precautions

Riboflavin appears to be safe in high doses and also safe during pregnancy. Extended use of high-dose riboflavin supplements may cause an imbalance with other water-soluble vitamins, especially vitamin $B_1$.

### Interactions

Certain drugs appear to interfere with riboflavin's role in the chemical pathway that converts sugar to energy. These drugs include chlorpromazine and related anti-psychotic drugs, tricyclic antidepressants, quinacrine, a drug used to prevent malaria, and doxorubicin (Adriamycin), a drug used in cancer chemotherapy. Long-term use of phenobarbitol seems to increase the rate of destruction of riboflavin by the liver.

### Complications

No complications are expected from riboflavin use. However, for most people, taking riboflavin as a high-dose dietary supplement does not provide any benefits.

### Parental concerns

Parents should be aware that the riboflavin stores in newborns treated with light therapy for jaundice are rapidly depleted. Parents of these newborns should discuss the need for a short-term riboflavin supplement with their pediatrician.

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American Dietetic Association. 120 South Riverside Plaza, Suite 2000, Chicago, Illinois 60606-6995. Telephone: (800) 877-1600. Website: <http://www.eatright.org>

Linus Pauling Institute. Oregon State University, 571 Weniger Hall, Corvallis, OR 97331-6512. Telephone: (541) 717-5075. Fax: (541) 737-5077. Website: <http://lpi.oregonstate.edu>

Office of Dietary Supplements, National Institutes of Health. 6100 Executive Blvd., Room 3B01, MSC 7517, Bethesda, MD 20892-7517 Telephone: (301)435-2920. Fax: (301)480-1845. Website: <http://dietary-supplements.info.nih.gov>

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Tish Davidson, A.M.

## Rice-based diets

### Definition

Rice is the most important cereal crop for human consumption. It is the staple food for over 3 billion people (most of them economically challenged) constituting over half of the world's population.

### Origins

All of the world's great civilizations developed only after the domestication of various cereal grains,

**The nutritional composition of one cup of cooked rice**

| | Brown rice | White rice |
|---|---|---|
| Calories | 218 | 266 |
| Protein (grams) | 4.5 | 5.0 |
| Carbohydrate (g) | 45.8 | 58.6 |
| Fiber (g) | 3.5 | 0.5 |
| Fat (g) | 1.6 | 0.4 |
| Polyunsaturated fatty acids (g) | 0.6 | 0.1 |
| Cholesterol (mg) | 0 | 0 |
| Thiamin (mg)* | 0.20 | 0.34** |
| Vitamin A | 0 | 0 |

*Daily requirement of thiamin is 1.2 mg for an adult man
**Enriched or parboiled rice

*(Illustration by GGS Information Services/Thomson Gale.)*

which provided an adequate food supply for large populations. These have included corn in the Americas, wheat in the Near East and southern Europe (Greece and Rome), and rice in China and India. The use of rice spread rapidly from China, India, and Africa, and at the present time it is used as a principal food throughout the world. After the discovery of the Americas, the use of rice took hold in both continents. The national dish of Belize in Central America, for example, is composed of rice and beans. There are now hundreds of rice recipes, with each ethnic cuisine having developed individual recipes. Almost all cookbooks have rice recipes, including recipes for risottos and pilafs. Vegetarians, in particular, cherish rice because it is such an excellent food and can be prepared in so many different and appetizing ways. Rice, delicious in itself, readily takes on any flavor that is added. Long-grain rice, when cooked, becomes separate and fluffy, while medium-grain rice is somewhat chewier. Short-grain rice tends to clump together and remains sticky with its starchy sauce. Arborio is an example of a short-grained rice. Wehani rice has a nutty flavor. Basmati rice (aromatic) is very popular, as is jasmine rice.

## Description

Rice is the only subsistence crop grown in soil that is poorly drained. It also requires no nitrogen fertilizer because soil microbes in the rice roots fix nitrogen and promote rice growth. Rice adapts itself to both wetlands and dry soil conditions.

### *Nutritional Properties*

Rice is a high-carbohydrate food with 85% of the energy from carbohydrate, 7% from fat, and 8% from protein. However, rice also has a considerable amount of **protein**, with an excellent spectrum of amino acids. The protein quality of rice (66%) is higher than that of whole wheat (53%) or corn (49%). Of the small amount of fat in brown rice, much is polyunsaturated. White rice is extremely low in fat content.

A cup of cooked rice has approximately 5 grams of protein, which is sufficient for growth and maintenance, provided that a person receives adequate calories to maintain body weight or to increase it, if full growth has not yet occurred. Asiatic children for whom rice is the chief food source have not developed protein deficiency disorders such as kwashiorkor, as have infants that are fed corn or cassava as a chief staple after weaning. Growth and development are normal on a rice diet. Due to its easy digestibility, rice is a good transition food after the cessation of breast or formula feeding.

### *Rice and Thiamine Deficiency*

In Asiatic populations, rice has been, and still is, a main source of nutrition. Thiamine, or vitamin $B_1$, is contained in the outer husk and coating of the rice kernel. When the technology for polishing rice became available, people took to eating white rice in preference to brown rice, but that process removed thiamine, causing beriberi, or thiamine deficiency, in many people, as well as heart and nerve diseases.

Dutch physicians in Java and Japanese physicians particularly noted the occurrence of beriberi with edema, heart failure, neuropathy, and many deaths. Thiamine, of course, was an unknown substance at that time. The history of rice is of interest in illustrating how the technology to make a food more appetizing (i.e., white rice versus brown rice) led to an epidemic of a new disease for those populations whose food intake was largely based upon rice. Studies by physicians in Japan and in Indonesia led to a cure for beriberi that included a more varied diet, plus the use of rice husks and the outer coatings of rice, which contained thiamine.

Today, much of the rice consumed is either enriched with thiamine or parboiled, which leads to retention of thiamine in the matrix of the white rice kernel. Beriberi, as a disease from the consumption of white rice, is now rare if the rice is parboiled or enriched. However, some varieties of polished (white) rice may not be enriched with thiamine. Thus, when thiamine intake from other food sources is limited, thiamine deficiency could still occur. In the United States, thiamine deficiency typically occurs in chronic alcoholics.

## Benefits

### *Rice for Medical Therapy and Prevention*

Rice has been the mainstay of treatment for a number of conditions, particularly hypertension at a time when few effective drug therapies were available. In the 1940s, Walter Kempner developed a treatment for mild, and even malignant, **hypertension** at Duke University. His hypothesis was that a low-protein diet, free of salt, would be an effective treatment. He devised the "rice diet," which consisted of rice, fruits, and vegetables. This treatment had good results: the blood pressure of his patients fell, and even malignant hypertension was partially reversed. In addition, blood cholesterol levels also fell. Since this was a cholesterol-free and low-fat diet, it was one of the first to document a cholesterol-lowering effect from diet.

The other therapeutic role of rice is in the treatment of allergies. Rice seems to be nonallergenic, and rice milk has been fed to infants allergic to cow's milk. Rice proteins have also been incorporated into standard infant formulas.

### *Genetic Engineering of Rice*

"Golden rice" was genetically engineered to contain beta-carotene, not present in standard rice, to combat the widespread vitamin A deficiency and ensuing blindness in the children of the developing world. Beta-carotene is a vitamin A precursor that is converted to the vitamin by enzymes of the intestinal mucosa. Vitamin A, or retinol, is then absorbed and transported to the tissues, including the structures of the eye. Golden rice would thus seem to be an advance in the fight against vitamin A deficiency in rice-eating populations. However, there are some concerns about golden rice and other genetically engineered foods. Genetically engineered products have not necessarily been proven safe, and environmental or social risks may outweigh potential benefits that they may bring about.

Clinical trials of golden rice are needed before it is accepted universally. Only when it is clearly determined that it can prevent vitamin A deficiency in experimental animals, and that it presents no hazards, will this genetically engineered food be considered safe for use in human nutrition. Further, society itself must also decide if genetically created foods are acceptable, a point currently in dispute.

### *Sequencing the Rice Genome*

Since the 1960s, the "green revolution" has improved the yield of rice, and now the "green genome revolution" may bring about further improvements. The rice genome has now been sequenced, an achievement of great importance. The sequence of the rice genome will provide the template for the sequencing of other grasses (maize, barley, wheat, etc.). The genome sequences are now known for the *japonica* rice favored in Japan and other countries with a temperate climate, and for the *indica* subspecies of rice grown in China and most other parts of Asia. This knowledge will permit a future harnessing of genes for disease prevention, drought resistance, nutritional improvement, and many other possible modifiable features of rice. As a recent issue of *Science* suggested, a "green gene revolution" is needed to meet the challenge of "population growth, loss of arable land and climate changes."

## Resources


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William E. Connor
Sonja L. Connor


# Richard Simmons diet

## Definition

The Richard Simmons diet focuses on three areas: diet, exercise, and motivation. It emphasizes a balanced diet, moderate exercise, and a positive outlook.

## Origins

Richard Simmons was born on July 12th, 1948, in New Orleans, Louisiana. He reports that growing up in an area with so much good food was exciting, but that it had a very negative impact on his weight. Simmons says that by the time he was 8 years old he already weighed 200 pounds. He was picked on by the children at school for being so overweight. As he continued to get older he gained more weight, at one point weighing as much as 268 pounds. He reports trying many different unhealthy ways to lose weight such as purging (throwing up) and using laxatives. At one point he even tried starving himself and drinking only **water**. He says he nearly died when he starved himself for two and a half months.

When Simmons was 16, and weighed more than ever, he decided to try a different approach to weight loss. This time he educated himself about nutrition, healthy eating, and exercise by borrowing books from the library. Through this self-education he learned to stop doing things that were bad for his body and start to do things that were positive. Over time he slowly lost his extra weight and became healthier.

Simmons says that it was his early struggle with his weight, and how bad he felt about himself during that time, that inspired him to try to help others lose weight. And knowing all of the things he had tried made him want to help others lose weight the right way. In 1973, Simmons moved to Los Angeles, California, and was inspired to open his own weight loss and fitness club because he could not find any clubs that were welcoming to people who were not already in great shape. He called his club "Slimmons" and opened it in Beverly Hills. His own experience with weight loss is his only qualification. Simmons has no formal training in nutrition.

Over the more than 30 years since he opened "Slimmons" people have lost more than 3,000,000 total pounds following Richard Simmons' diet and exercise plans. He invented the Deal-a-Meal, the FoodMover to help people easily keep track of how much they have eaten each day, and a steamer to help people make healthy meals. He has also written an autobiography and cookbooks, made more than 50 exercise videos, which have sold more than 20 million copies, and had his own Emmy Award winning television show.

## Description

The Richard Simmons diet consists of three main parts: diet, exercise, and motivation. These three parts are combined to make a weight loss and exercise program that follows healthy guidelines for most adults, and is intended to provide weight loss at a moderate pace.

### KEY TERMS

**Dietary supplement**—A product, such as a vitamin, mineral, herb, amino acid, or enzyme, that is intended to be consumed in addition to an individual's diet with the expectation that it will improve health.

**Mineral**—An inorganic substance found in the earth that is necessary in small quantities for the body to maintain a health. Examples: zinc, copper, iron.

**Obese**—More than 20% over the individual's ideal weight for their height and age or having a body mass index (BMI) of 30 or greater.

**Toxin**—A general term for something that harms or poisons the body.

**Vitamin**—A nutrient that the body needs in small amounts to remain healthy but that the body cannot manufacture for itself and must acquire through diet.

### *Diet*

The Richard Simmons diet follows guidelines for a balanced, healthy diet and moderately paced weight loss. It emphasizes fruits and vegetables, with a minimum of seven servings of fruits and vegetables each day. The minimum daily number of calories on the diet is 1,200. This is generally thought to be a healthy number of calories per day for adults trying to achieve weight loss. The diet includes about 60% **carbohydrates**, 20% **fats**, and 20% proteins. Also included each day are 2 servings of low or non-fat dairy products.

Richard Simmons provides a number of different tools to help people follow his diet more easily. One of these is known as the Deal-A-Meal, which provides cards in a wallet. Each card represents one serving of a food group, and during the day as the dieter eats the cards are moved from one side of the wallet to the other. Once there are no cards left the dieter knows that he or she has eaten all of the allotted food for that day. A more recent version of this tool is the FoodMover, which is a tool designed to fit easily into pockets or purses. As the day goes by the dieter closes a tab for each serving of proteins, carbohydrates, and other food groups as they are eaten. It also includes windows for water and exercise, as well as motivational messages.

Many different cookbooks are also available, which include a wide variety of recipes designed to be eaten while on Simmons' diet. Also available is a food diary so that the dieter has an accurate way to record not only how many servings of what food groups were eaten, but which specific foods, and any other information the dieter wants to record.

### *Exercise*

The Richard Simmons diet is designed to be done with one of his exercise routines. He has many different routines and is known for pairing upbeat music with moderately strenuous exercises. Simmons designs his exercise programs so that they are safe and effective for almost anyone to do, including the very overweight and seniors. Some of the titles of his exercise videos and DVDs include "60s Blast Off," "Richard Simmons Dance Your Pants Off!," and "Richard Simmons Super Toning." He also has specialty videos for some groups such as "Richard Simmons and the Silver Foxes" a work out routine designed for seniors that features various celebrities who played moms and dads on television. His DVD "Sit Tight" is designed for people who, for any reason, cannot exercise standing up. It is designed to give a dieter a full workout all from a sitting position.

### *Motivation*

Richard Simmons provides motivation to dieters following his plan in many different forms. On his website, www.richardsimmons.com, dieters can join his clubhouse, for a fee, and get access to many helpful tools. There are discussion boards where dieters can share their frustrations or encourage others, and a daily motivation message from Simmons. He also frequently chats live to members and to give them even more motivation. His exercise DVDs are filled with up-beat music and encouraging words.

Simmons' website provides information about when he can be seen on any of the many television shows on which he appears as a guest. Additionally, there are also many opportunities for dieters to be motivated by Simmons, in person. He travels an average of 250 days per year, according to his website, and visits places as diverse as senior citizens centers, schools, and shopping malls. When he is not traveling he still regularly teaches exercise classes at his health and fitness club "Slimmons". He also organizes a cruise from New York to the Caribbean each year that dieters can sign up for. The cruise is designed for people following his program and includes special meals, motivational talks by Simmons, and exercise.

## Function

The Richard Simmons diet is intended to help people lose weight at a healthy, moderate pace, over time, and to help the dieter keep the weight off after the desired weight loss has been achieved. Simmons intends the diet for all dieters, even those who are disabled by their **obesity**. He also believes that it can be effective for senior citizens, or others who need a more moderate pace of exercise.

## Benefits

There are many benefits to losing weight, being more healthy, and being more fit. The benefits of weight loss can be very significant, and are generally considered to be the greatest for people who are extremely obese. People who are obese are at higher risk of type II diabetes, heart disease, and many other diseases and disorders. The risk and severity of these disorders is generally greater the more overweight a person is. Weight loss, if achieved at a moderate pace through a healthy diet and regular exercise can reduce the risk of these and other obesity-related diseases. Increased exercise can also reduce the risk of cardiovascular diseases. An additional benefit of the Richard Simmons diet is that his motivational messages are intended to help dieters get through the trickiest times of dieting without giving up, and can help lead the dieter to an more positive outlook overall.

## Precautions

Anyone thinking of beginning a new diet or exercise regimen should consult a medical practitioner. Requirements of calories, fat, and nutrients can differ significantly from person to person, depending on gender, age, weight, and many other factors such as the presence of any disease or conditions. Pregnant or **breastfeeding** women should be especially cautious because pregnant and breast feeding women have different needs of **vitamins** and **minerals**, and deficiencies of can have a significant negative impact on a baby. Exercising too strenuously or beginning a rigorous exercise program too suddenly can have negative effects on the body such as an increased risk of injury.

## Risks

With any diet or exercise plan there are some risks. It is often difficult to get enough of some vitamins and minerals when eating a limited diet. Anyone beginning a diet may want to consult their physician about whether taking a vitamin or supplement could help them reduce this risk. Richard Simmons' work-outs are generally intended for everyone to be able to do

## QUESTIONS TO ASK THE DOCTOR

- Is this diet the best diet to meet my goals?
- At what level of intensity is it appropriate for me to begin exercising?
- Does diet or exercise pose any special risk for me that I should be aware of?
- Would a multivitamin or other dietary supplement be appropriate for me if I were to begin this diet?
- Is this diet appropriate for my entire family?
- Is it safe for me to follow this diet over a long period of time?
- Are there any sign or symptoms that might indicate a problem while on this diet?

safely, although some risk of injury still exists as with any exercise program. Injuries during exercise can include as strained or sprained muscles, and proper warm up and cool down procedures should be followed to help minimize these risks. It is often best to begin with light or moderate exercise, and increase the intensity slowly over weeks or months.

### Research and general acceptance

Richard Simmon's diet has not been the subject of any significant scholarly research. However, moderately limiting caloric intake, eating a diet low in fats and carbohydrates and high in vegetable and plant products is generally accepted as a healthy diet for most people. The Richard Simmons diet follows the United States Department of Agriculture's MyPyramid guide recommendations for healthy eating.

As of 2007, the U.S. Center for Disease Control recommended a minimum of 30 minutes per day of light to moderate exercise for healthy adults. Following Richard Simmons' program would meet this minimum recommendation. Many studies have shown that even this amount of exercise can have significant health benefits including reducing the risk of cardiovascular disease. Studies have also shown that exercise is a very important part of any weight loss plan, and diet and exercise combined are more effective for long term weight loss and weight maintenance than either diet or exercise alone.

Helen M. Davidson

# Rosedale diet

## Definition

The Rosedale diet is a diet that was created by Dr. Ron Rosedale. It limits **carbohydrates** and proteins and is supposed to be able to help the body stabilize levels of leptin, a hormone believed to trigger the brain to send hunger signals to the body.

## Origins

Ron Rosedale, M.D. practices nutritional and metabolic medicine in Denver, Colorado. Metabolic medicine is generally considered an alternative medicine. Practitioners of metabolic medicine believe that a person's metabolic activity can be altered through diet, stress reduction, and other changes that do not have to include prescription drugs. It is believed that diseases and conditions can be resolved through these types of metabolic changes, and by bringing the metabolic activity of the patient back into a fully functioning state. It is this idea of changing metabolic activity that underlies the Rosedale diet.

Dr. Rosedale attended the Northwestern University School of Medicine, and graduated in 1977. He is the founder of the Rosedale Center in Denver, Colorado, as well as the Carolina Center of Metabolic Medicine in Ashville, North Carolina. He also co-founded of the Colorado Center for Metabolic Medicine in Boulder, Colorado. His book *The Rosedale Diet* was written with Carol Colman who has co-authored many diet and fitness books. The book first appeared in 2004.

For many years, doctors, researchers, and many others have been trying to decode all of the ways that the body gets signals about food and hunger, and how the body knows when and how much to eat. The process of eating and breaking down food is extremely complex and involves many different glands, hormones, organs, and other body parts. People have been studying leptin for more than a decade to try to determine what role it plays in the body's hunger, eating, and digestion processes. Dr. Rosedale came to the conclusion that leptin problems are responsible for many of the issues that cause people to gain and retain fat. Dr. Rosedale used this information about leptin and his background in metabolic medicine to develop a set of guidelines, called the Rosedale diet, which he believes will help dieters restore the proper functioning of leptin and their metabolic systems and allow them to lose fat and become more healthy.

## KEY TERMS

**Diabetes mellitus**—A condition in which the body either does not make or cannot respond to the hormone insulin. As a result, the body cannot use glucose (sugar). There are two types, type 1 or juvenile onset and type 2 or adult onset.

**Dietary supplement**—A product, such as a vitamin, mineral, herb, amino acid, or enzyme, that is intended to be consumed in addition to an individual's diet with the expectation that it will improve health.

**Leptin**—A hormone produced by fat cells (adipose tissue) that tells the brain that the body has eaten calories and should stop eating.

**Mineral**—An inorganic substance found in the earth that is necessary in small quantities for the body to maintain a health. Examples: zinc, copper, iron.

**Obese**—More than 20% over the individual's ideal weight for their height and age or having a body mass index (BMI) of 30 or greater.

**Vitamin**—A nutrient that the body needs in small amounts to remain healthy but that the body cannot manufacture for itself and must acquire through diet.

## Description

The Rosedale diet is based around the belief that leptin signals the body when to be hungry, when to be full, when to make fat, and when to burn fat. Leptin is a hormone secreted by fat. High leptin levels should tell the brain that there is plenty of stored fat, and that the body doesn't need to store any more. Some stored fat is important, because the body wants to make sure that if food becomes scarce, the body has a back-up store of energy so that it can survive until food becomes more plentiful.

Dr. Rosedale believes that many people with weight problems have become leptin resistant. This means that although their fat continues to produce leptin at normal levels, the brain cannot "hear" those signals correctly any more. Dr. Rosedale compares it to being in an room that smells bad for a long time, and no longer noticing the smell. When a person has a lot of stored fat the leptin signals going to the brain may eventually cause the same kind of phenomenon, beginning a vicious cycle of increased weight gain and increased leptin levels. Because the brain does not hear the leptin correctly, the brain thinks that the body has low levels of leptin. This signals the brain that the body needs to eat more and store more fat. Therefore, a person gets hungry and the body converts much of the food that gets eaten into fat.

The Rosedale diet is designed to get the body's leptin levels back into balance, and allow the brain to know that there is excess fat stored on the body. According to Dr. Rosedale, this will tell the brain to send signals to the dieter that he or she is satiated and not hungry, even if he or she has not eaten recently. Then the body will burn the fat stores, and weight loss will occur. Rosedale claims that this weight loss can occur without the muscle mass loss usually associated with weight loss, if leptin levels are balanced correctly.

The diet begins with a three week period of severe restriction. The only foods allowed during this period come from Dr. Rosedale's set of "A list" foods. During this period almost no carbohydrates are consumed, and **protein** consumption is limited. Saturated **fats** are restricted, but unsaturated fats are encouraged. Some of the foods suggested during this part of the diet include goat cheese, crab, lobster and other seafoods, olives, avocados, and many types of nuts.

Foods from the "B list" of foods are reintroduced after the initial phase of the diet. Some of the foods eventually allowed include fruit, lamb chops, steak, and beans. The second phase of the diet is intended to be followed for a lifetime to help maintain the body's leptin levels.

Dr. Rosedale suggests that dieters exercise for 15 minutes each day while on this diet. He also makes many recommendations for supplements that he suggests will help dieters lose weight and be more healthy while dieting. At one time, many of these recommended supplements were available from his company Rosedale Metabolics.

## Function

The Rosedale diet claims to be able help dieters lose fat mass without losing muscle mass. It is intended to be a lifestyle changing diet that continues after the initial three weeks are over as a changed set of eating habits that continue for a lifetime. It is intended to provide overall better health and well being.

## Benefits

Dr. Rosedale claims that this diet will allow dieters to lose weight, be more healthy, and even live longer. The diet is supposed to help dieters lose weight by regularizing their leptin levels. Because leptin is believed

to signal the brain when and how much to eat Dr. Rosedale believes that regulating leptin levels will stop **cravings**, allow dieters to eat less without feeling hungry, and eliminate cravings for sugary snacks.

There are many benefits associated with weight loss when the weight loss occurs at a moderate pace through healthy eating and regular exercise. There are many diseases and conditions for which **obesity** is considered a significant risk factor. These include diabetes and cardiovascular disease. People who are the more obese are generally at a higher risk and have more severe symptoms. Losing weight can reduce the severity of symptoms that occur with obesity-related disorders, and in some cases can even help the symptoms resolve completely. Dr. Rosedale believes that his diet can have these positive effects for patients with heart disease, diabetes, **hypertension**, and other diseases and conditions.

## Precautions

Anyone who is thinking about beginning a new diet should consult their physician or another medical practitioner. A physician can help the dieter determine if the diet in question is the right diet to meet their personal health and fitness goals. Requirements of calories, **vitamins**, and **minerals** can be very different for different people, and can vary based on age, gender, weight, activity level, the presence of diseases or conditions, and many other factors. A dieter's physician can help the dieter determine what his or her personal needs are for maintaining good health. This diet limits protein, so it is possible that some people, especially those who are very athletic, or those who are strength training, may not get enough protein for good health. Women who are pregnant or **breastfeeding** should be especially cautious. When babies are receiving all of their nutrients from their mother, what the mother eats can have a significant impact on the baby's health ! and well-being.

The various merits and risks of a high fat diet, even when the diet is only high in "good" fats are hotly debated. Anyone thinking of beginning this diet who has cardiovascular or any disease for which a high fat diet is considered a risk factor should exercise extreme caution. Before any kind of dietary change is made, especially one that could cause a condition to worsen, a personal physician and any other doctor supervising care (such as a cardiologist) should be consulted and the possible costs and benefits of such a diet should be weighed carefully.

## Risks

There are some risks with any diet. Any diet that significantly limits certain types of food may make it hard for a dieter to get enough of all the necessary vitamins and minerals needed for good health. Although this diet recommends a number of vitamins and supplements, a dieter should consult his or her own physician before starting any kind of supplement. Supplements and multivitamins can help reduce the risk of a deficiency occurring during a restricted diet, but taking a supplement or vitamin has its own risks that should be carefully considered.

### QUESTIONS TO ASK THE DOCTOR

- Is this diet the best diet to meet my goals?
- Would a multivitamin or other dietary supplement be appropriate for me if I were to begin this diet?
- Is this diet appropriate for my entire family?
- Is it safe for me to follow this diet over a long period of time?
- Are there any sign or symptoms that might indicate a problem while on this diet?

## Research and general acceptance

There has been no significant scientific research on the effectiveness of the Rosedale diet at helping people lose weight or burn fat. It also has not been scientifically shown to allow the body to burn fat without burning any muscle mass. It has not been evaluated to determine its effectiveness at improving the symptoms of or treating any diseases or conditions including type II diabetes, heart disease or hypertension. Studies have shown however that these and other obesity-related diseases and conditions can be improved through weight loss. The Rosedale diet also has not been clinically proven to help people live longer.

Leptin has been studied by many different researchers, but like many things that are engaged in more than one aspect of various reactions within the body, it is not always easy for scientists to come to a definite conclusion. Many of the studies done have been on animals, although some studies have been done on humans as well. It is more difficult for researchers to study reactions in humans because it would be unethical to do something in an experiment that was expected to cause a negative outcome in a person. Because of this, studies of humans often have to rely on evidence that cannot be as carefully controlled as when animal subject are used.

Although not everything is known about the way the leptin acts on the various organs of the body, scientists have linked it to obesity in both mice and humans. Injections of leptin were found to have significant effects on the body weight of mice. Mice with mutated genes that made their body unable to react to leptin were found to have a body mass three times greater than mice that had a normal gene. It is possible that some humans have a similar mutated gene, but evidence suggests that it is more likely that most leptin problems in humans stem from a decreased sensitivity to leptin due to the overproduction over time of the hormone. The presence of high leptin levels has been shown to correlate with obesity and weight gain in humans. In a March 2007 study published in the *Journal of Clinical Endocrinology and* ***Metabolism***, Abby F. Flesch et al. presented research showing that children with high levels of leptin in the blood were more likely to gain body fat during the follow-up period than children with low leptin levels.

The Rosedale diet suggests that dieters severely restrict carbohydrates in the diet, and eat a large quantity of "good" fats. Although unsaturated fats, like those found in olive oil and many nuts, have been found to be more healthy than saturated fats, such as the fat found in butter and fatty meats, it is not clear that unsaturated fats are good for the body in large quantities. Although some fat is necessary for a healthy diet, most experts recommended a diet low in all types of fats, with unsaturated fats preferable to saturated and trans fats.

The United States Department of Agriculture makes recommendations for the number of servings from each food group that should be eaten each day to get a balanced, healthy diet in its MyPyramid food guide. MyPyramid recommends the equivalent of 3 to 4 ounces of grains each day for healthy adults, of which at least half should be whole grains. Because the Rosedale diet limits carbohydrates so severely, dieters may not eat enough bread and grains to meet this recommendation.

In 2007, the Centers for Disease Control recommended that adults get 30 minutes or more of light to moderate exercise each day for good health. The recommendations that Dr. Rosedale makes for dieters following his diet plan is less than this minimum recommendation. Dieters may wish to consider doing exercise above and beyond the amount recommended by Dr. Rosedale.

## Resources


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### OTHER

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Russian diet *see* **Central European and Russian diet**

# S

## Sacred heart diet

### Definition

The Sacred Heart diet is a 7 day diet plan that allows a dieter to eat a specific set of foods each day and as much of a special soup as desired.

### Origins

The Sacred Heart diet exists in many different forms, although all of them are fairly similar. Usually the main differences that exist are differences in the ingredients used in the soup. Some versions of this diet allow diet soda to be consumed during the diet, but most do not. Supposedly this diet was created by Sacred Heart Memorial Hospital as a diet that would allow obese patients to lose weight quickly before they were to undergo surgery (some versions of this story specify cardiac surgery). There is no evidence however, that this story is true. There are many different Sacred Heart hospitals in the United States and Canada, and many of them have issued statements saying that this diet did not come from them and is not recommended. The diet seems to mainly circulate from person to person and on the internet.

The Sacred Heart diet has been known by many other names. It sometimes appears under the names Spokane Heart diet, the Cleveland Clinic diet, the Sacred Heart Memorial Hospital diet, and the Miami Heart Institute diet. It is very similar to some versions of the **cabbage soup diet**. The foods that are to be eaten each of the seven days are largely similar. The most significant difference between this diet and many versions of the cabbage soup diet lies in the soup. The Sacred Heart diet soup does not contain any cabbage, but the cabbage soup diet soup usually contains a large amount of cabbage.

### Description

The Sacred Heart diet is a 7 day diet plan. It consists of a soup recipe and a 7 day eating guide. During the diet, dieters may eat as much of the soup as desired and are often required to eat at least one serving each day. Some versions of the diet actually claim that this soup contains no calories, but as all food contains some calories this claim cannot be true. It is however generally a fairly low calorie soup.

#### *The Soup*

There are many different versions of the Sacred Heart diet circulating. Because it is not clear where this diet originated no one recipe can be considered more correct than any other recipe. The following recipe seems to be the most common.

- 1 or 2 cans of stewed tomatoes
- 3 (or more) large green onions
- 1 large can of fat-free beef broth
- 1 package chicken noodle soup mix
- 1 bunch celery
- 2 cans of green beans
- 2 pounds of carrots
- 2 green peppers

Some versions call for chicken broth instead of beef broth, or allow for any kind of fat-free soup mix to be used.

Directions: Chop the vegetables into small or medium pieces. Add everything to a large soup pot. Cover with **water** and bring to a boil. Boil for 10 minutes. Reduce the soup to a simmer and continue to cook until all the vegetables are tender. The soup may be seasoned with salt, pepper, hot sauce, bouillon, or Worcestershire sauce if desired.

#### *The Meal Plan*

The Sacred Heart diet has a very specific set of foods that may, or must, be eaten each day. There is no counting calories however. Most of the foods can be eaten in as large quantities as are desired. The soup can be eaten at any time, and as much soup as is desired

## KEY TERMS

**Dietary supplement**—A product, such as a vitamin, mineral, herb, amino acid, or enzyme, that is intended to be consumed in addition to an individual's diet with the expectation that it will improve health.

**Mineral**—An inorganic substance found in the earth that is necessary in small quantities for the body to maintain a health. Examples: zinc, copper, iron.

**Obese**—More than 20% over the individual's ideal weight for their height and age or having a body mass index (BMI) of 30 or greater.

**Toxin**—A general term for something that harms or poisons the body.

**Vitamin**—a nutrient that the body needs in small amounts to remain healthy but that the body cannot manufacture for itself and must acquire through diet

can be eaten. Many versions of the diet claim that eating more soup will actually help the dieter lose more weight. Many also claim that this diet will flush toxins from the body and leave the dieter feeling more healthy and more energetic.

Different versions of the diet differ somewhat on what kinds of drinks are allowed during the diet. Most versions require drinking 6–8 glasses of water a day. Some versions of the diet allow the dieter to drink diet soda, but most forbid all carbonated beverages. Tea is allowed, as is coffee. Some allow skim milk and others do not. Unsweetened fruit juices are also usually allowed. Most versions of the diet forbid alcohol while on the diet.

Day 1: On this day any fruit except bananas may be eaten. Some versions of the diet recommend watermelon and cantaloupe, saying they are lower in calories than other fruits. Only fruit and the soup are allowed on this day.

Day 2: On this day all vegetables are allowed, although some versions of the diet warn that dry beans, peas, and corn should be avoided. Green, leafy vegetables are recommended. Any kind of vegetables: fresh, raw, cooked, or canned are allowed. No fruits are allowed during this day. For dinner the dieter is instructed to have a baked potato with butter.

Day 3: During this day the dieter is instructed to have all of the fruits and vegetables desired. The dieter is not allowed to have a baked potato. Some versions of the diet claim that the dieter will have lost 5 or more pounds by this day if the diet is being followed exactly.

Day 4: During this day the only foods allowed in addition to the soup are bananas and skim milk. The dieter is instructed to eat at least 3 bananas. The dieter is often instructed to drink as much skim milk as they are able.

Day 5: This day is dedicated to beef and tomatoes. The dieter is instructed to eat between 10 and 20 ounces of beef and up to 1 can of tomatoes (or as many as 6 fresh tomatoes). The soup must be eaten at least once on this day.

Day 6: On this day the dieter is allowed to eat all of the beef and vegetables he or she desires. Usually leafy green vegetables are recommended. Often it is specified that no baked potato is allowed on this day. The soup must be eaten at least once on this day as well.

Day 7: On the last day of the diet the dieter is instructed to eat vegetables, unsweetened fruit juice, and brown rice. As much of these can be eaten as is desired. The soup is also required at least once on this day.

Some versions of the diet specify that boiled, broiled, or baked skinless chicken can be substituted for the beef. Broiled fish can also be substituted for beef, but only on one of the beef days. By the end of this week the diet claims that dieters will have lost between 10 and 17 pounds.

### Function

The Sacred Heart diet claims that dieters will lose between 10 and 17 pounds if they follow the diet exactly. Many versions claim that by day 3 the dieter will have lost between 5 and 7 pounds. This diet is not intended to be a new lifestyle but is intended for extreme weight loss in a short amount of time. Some versions of the diet recommend taking time off before repeating the week long diet again.

### Benefits

There are many benefits to losing weight if it is done at a safe, moderate pace through healthy eating and exercise. There are many obesity-related diseases and conditions such as diabetes and heart disease. The risk of the diseases can be reduced by weight loss. This is especially true for very obese people who are generally though to be at the greatest risk. This diet, however, is not generally considered appropriate for long term moderate weight loss.

The Sacred Heart diet does have some other possible benefits in addition to its claim of allowing the dieter to lose up to 17 pounds in 7 days. The soup is

usually low in calories and full of vegetables, which are an important part of a healthy diet because they contain many different **vitamins** and **minerals**. Eating a soup like the one required by this diet can help dieters feel full without eating too many calories, which may help dieters stick to a healthy reduced calorie diet.

### Precautions

Anyone thinking of beginning a new diet should consult a medical practitioner. Requirements of calories, fat, and nutrients can differ significantly from person to person, depending on gender, age, weight, and many other factors such as the presence of diseases or conditions. This diet may be of special concern because of the very limited number of foods that are allowed each day. Pregnant or **breastfeeding** women should be especially cautious because deficiencies of vitamins or minerals can have a significant negative impact on a baby. This diet may result in a very low intake of calories during some or all of the days on the diet because of the low calorie content of the soup. Pregnant and breastfeeding women should be especially careful to get enough calories each day because a diet with too few calories can also have a negative impact on baby.

### Risks

There are some risks to any diet. The Sacred Heart diet is severely limiting in the foods that can be eaten each day. This means that it is likely that the dieter will not get enough of all vitamins and minerals required each day for good health. Any dieter thinking of beginning this diet may want to consult a healthcare provider about a supplement that would be appropriate to help reduce the risk of deficiencies. Supplements have their own risks.

### Research and general acceptance

The Sacred Heart diet has not been the subject of any significant scientific studies. Although the name implies that it was created by doctors or other medical professionals, this is probably not the case. The origin of the diet is unknown and many Sacred Heart Hospitals have made statements indicating that they did not create it and do not recommend it.

The United States Department of Agriculture makes recommendations for what healthy children and adults should eat each day in MyPyramid, the updated version of the food guide pyramid. For most people these are good recommendations for the number of servings from each food group required daily for good heath. Because the Sacred Heart diet is extremely limited in the foods allowed it does not fulfill many of these recommendations. This makes the diet especially likely to be unhealthy if repeated frequently.

MyPyramid, recommends that healthy adults eat the equivalent of 2 to 3 cups of vegetables each day. The Sacred Heart diet would probably meet this requirements for most people because the soup has many different vegetables in it, and most of the days allow vegetables.

MyPyramid also recommends that healthy adults eat the equivalent of 1 1/2 to 2 cups of fruit per day. It is unlikely that a person following the Sacred Heart diet would get this much fruit, except on day 1 when fruit is the only food allowed and day 4 where the dieter is required to eat at least 3 bananas.

Some versions of The Sacred Heart allow skim milk to be consumed as much as the dieter wishes at any time during the diet. Other versions of the diet to not allow it. Dairy products are generally considered to be part of a healthy diet. MyPyramid recommends the equivalent of 3 cups of low-fat or non-fat dairy per day for healthy adults. This requirement would probably be met during day 4, when the dieter is instructed to drink as much skim milk as possible. It is unlikely that this requirement would be met on other days of the diet, however, especially if the dieter is following a version of the diet that does not allow skim milk during days other than day 4.

Starches and grains are also severely restricted on the Sacred Heart diet. Whole grains are generally considered a necessary and important part of any healthy diet. MyPyramid recommends the equivalent of 3 to 4 ounces of grains each day for healthy adults, of which at

### QUESTIONS TO ASK THE DOCTOR

- Is this diet safe for me?
- Do I have any dietary requirements this diet might not meet?
- Would a multivitamin or other dietary supplement be appropriate for me if I were to begin this diet?
- Is this diet safe for my entire family?
- Is it safe for me to follow this diet over a long period of time?
- Is this diet the best diet to meet my goals?
- Are there any sign or symptoms that might indicate a problem while on this diet?

least half should be whole grains. The Sacred Heart diet would very rarely meet this requirement. There are no significant sources of grains or starches in the soup. Days 1 and 2 do not allow any grains or starches at all, and although day 3 allows one baked potato it is not enough to meet this requirement. Days 5 and 6 also do not allow starches or grains. This requirement will probably be met on day 7 when brown rice is allowed.

MyPyramid recommends that healthy adults eat between 5 and 6 1/2 ounces of meat or beans each day. The Sacred Heart diet would not fulfill this requirement except on days 5 and 6. Day 5 requires 10 to 20 ounces of beef, which is far more than the recommended amount. Beef is also not usually a lean meat, and MyPyramid recommends mostly eating lean meats. Day 6 allows the dieter to eat as much beef as desired, which would probably also result in a consumption far in excess of the daily recommended amount.

This diet does not include any recommendation for exercise. Exercise is generally accepted to be an important part of any weight loss program. In 2007 the Centers for Disease Control recommended that healthy adults get 30 minutes or more of light to moderate exercise each day for good health.

### Resources

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Saint John's wort *see* **St. John's wort**

# Scandinavian diet

## Definition

Scandinavia is a term for the region that includes Norway, Sweden, and Denmark. The Scandinavian diet often includes many kinds of fish and seafood, and many kinds of salted and preserved foods.

## Origins

The origin of the Scandinavian diet dates back many thousands of years. Because the winters in Scandinavia are long and cold and last for many months, methods of preserving foods so that they could be kept and eaten through the winter months had to be developed early. Because the Scandinavian countries are all on the sea, many different types of seafoods were widely available. In an attempt to preserve these available foods, the process of smoking and drying was widely used. Even before the year 1000, the Vikings were catching and drying cod so that they could take it with them on their voyages.

The long, cold Scandinavian winters also meant that early Scandinavians needed to preserve other types of foods, not just meats and seafoods. Cheese making is popular in Scandinavia, because making cheese is a good way of preserving milk. Fresh milk spoils very quickly, but cheese concentrates many of the nutrients of milk, and concentrates the energy in it, in a way that can be stored for a long time, sometimes for years. Beets and potatoes are also popular in Scandinavia, possibly because they are root vegetables, and root vegetables tend to store better than other types of vegetables.

Sugar did not arrive in Scandinavia until relatively late. The first time that sugar is recorded as having been brought to Sweden was in 1324. At that time 1.5 kilograms (about 3.3 pounds) was imported to celebrate the funeral of the wealthiest man in the country. Sugar would have been available only to the extremely wealthy for a long time afterwards, and would have remained an expensive commodity for hundreds of years.

## Description

Scandinavia is comprised of three countries: Norway, Denmark, and Sweden. These countries are in northern Europe and all have significant sea access. The diets of these three countries do vary somewhat, but there are many commonalities.

The Scandinavian diet includes a wide variety of seafoods. Because the countries of Scandinavia have access to different bodies of **water** some seafoods commonly produced differ from country to country. Sweden produces large quantities of crayfish, Norway produces lobsters and prawns, and Denmark produces many oysters. Some fish products are common to all of Scandinavia, and include herring, cod, salmon, mackerel, and even eel. Many of these fish are eaten fresh, but they can also be smoked or cured. Some kind of fish are also salted, dried, or jellied.

## KEY TERMS

**Diabetes mellitus**—A condition in which the body either does not make or cannot respond to the hormone insulin. As a result, the body cannot use glucose (sugar). There are two types, type 1 or juvenile onset and type 2 or adult onset.

**Dietary supplement**—A product, such as a vitamin, mineral, herb, amino acid, or enzyme, that is intended to be consumed in addition to an individual's diet with the expectation that it will improve health.

Many different dairy products are consumed in large quantities in Scandinavia. These includes not only milk, but also buttermilk, sour cream, and many different types of cheese. Each country or region of Scandinavia produces its own unique types of cheese. In many areas cheese is eaten at nearly every meal.

Scandinavians also eat a variety of fruits and vegetables, although because of the winters, fresh fruits and vegetables are available only a few months each year. In the summer, many different kinds of berries are eaten including strawberries and blueberries. Berries and other fruits are often made into jams, preserves, or jellies so that they can be enjoyed during the winter. Scandinavians also eat many different types of vegetables including cabbage, beets, potatoes, apples, and onions. All of these vegetables tend to store well, which means that they could be kept through the winter even when no refrigeration was available.

Scandinavian cooking is generally simple. In Scandinavia most people eat three meals a day plus take some kind of coffee break. Dessert is usually eaten, but is not usually very sweet, and often consists of fruits or pastries. Special pastries or other foods are made for various different holidays and celebrations. Each different holiday has its own traditional foods that vary depending on the holiday and the country in which it is being celebrated.

### Function

The traditional Scandinavian diet contains many different types of preserved, dried, or salted foods. This allowed Scandinavians to survive the long winter months when few fresh foods were available. Today, Scandinavians do not need to depend so heavily on foods that can last through the winter because of freezing, refrigeration, modern growing techniques, and advanced transportation technology. However, the traditional foods are still popular.

### Benefits

There may be many benefits to following a Scandinavian diet. Scandinavians tend to eat large quantities of fish and other seafood as well as turkey, chicken, and other types of poultry. Seafood and poultry are generally considered lean meats. They are good sources of **protein** and do not contain as much fat as other types of meat such as beef. Poultry and seafood tend to be low in saturated **fats**. Saturated fats are fats that are generally solid at room temperature, such as butter and animal fat. Diets high in saturated fats have been shown to increase the risk of cardiovascular disease as well as other diseases and conditions.

The Scandinavian diet contains large quantities of fish. Fish are generally considered a good source of **omega-3 fatty acids**. These acids are necessary for good health, but cannot be manufactured by the body. Some evidence suggests that including these in a healthy diet may help prevent cardiovascular disease. Eating a diet that is low in fatty meats can also help to control weight. Protein is a necessary part of any healthy diet, and getting protein from sources such as seafood and poultry that are low in fat can help a dieter eliminate unnecessary calories from the diet.

### Risks

Every diet has some risks associated with it. The Scandinavian diet is often high in **sodium** because the traditional diet includes so many salted, cured, or otherwise preserved foods. A high level of sodium intake has many risks associated with it. Some sources indicate that a diet including a large quantity of salted and salt-cured foods has led Scandinavians to have an increased incidence of stomach **cancer**. People who eat diets high in sodium have a higher risk of developing high blood pressure. High blood pressure can lead to cardiovascular disease and even stroke or heart attack. A diet high in sodium also tends to cause water retention which can cause a dieter to feel bloated and uncomfortable.

Some Scandinavians have diets that are high in saturated fats. This is due to the consumption of large amounts of dairy products such as cheese, buttermilk, and sour cream that contain a lot of saturated fat. A diet high in saturated fat has been shown to increase the risk of **obesity**, type II diabetes, and cardiovascular disease. Foods that are high in saturated fat also tend to be high in calories, which can lead to unwanted weight gain.

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# Scarsdale diet

## Definition

The Scarsdale diet is a rapid weight loss regimen classified as a very low-calorie diet, or VLCD. It is also one of the oldest low-carbohydrate diets still followed by some dieters. Although the first edition of *The Complete Scarsdale Medical Diet* was published in 1978, over a quarter-century ago, the book is still in print as of early 2007. It is reported to be particularly popular in France in the early 2000s.

## Origins

The Scarsdale diet began as a two-page typewritten office handout drawn up in the 1950s by Dr. Herman Tarnower, a cardiologist who had built a medical center in Scarsdale, a middle- to upper middle-class community in Westchester County, New York. Tarnower had written the short reducing guide for patients who needed to lose weight for the sake of their hearts; he was not a professional nutritionist or dietitian. The two articles that he published in medical journals have to do with fever as a symptom of a heart attack and with management of congestive heart failure. His primary motive in writing down his diet plan was impatience; he disliked having to spend time explaining nutrition or other health issues to his patients and so chose to make up a weight-reduction handout. Tarnower gave an interview shortly before his death to the journal *Behavioral Medicine*, in which he stated, "If you don't have a routine written out that you can give to patients with common disorders, it will destroy you. You try to go over all the instructions with each patient, but no physician has that much patience."

Tarnower's patients often copied the diet for their friends, who in turn sent photocopies to other friends. At some point in the mid-1970s, following the early success of the **Atkins diet**, one of Tarnower's friends, Oscar Dystel, suggested that he expand his office handout into a full-length book. Tarnower hired a writer, Samm Sinclair Baker, who had published other books in the field of nutrition, and the first edition of *The Complete Scarsdale Medical Diet* was printed in 1978. It became an immediate bestseller, going through 21 printings in its first ten months in hardcover format. Tarnower's book became the choice of four book clubs; it sold the second-highest number of copies (over 642,000) of hardcover books published in 1979, outdone only by a humorous book by Erma Bombeck. According to *Time* magazine, Tarnower's diet book grossed more than $11 million by the spring of 1980. Sinclair Baker's most important contribution to the book was to suggest four new programs that represented variations on the basic diet: the Scarsdale Diet for Epicurean Tastes, the Scarsdale International Diet, the Scarsdale Vegetarian Diet, and the Scarsdale Money-Saver Diet. These will be described more fully below.

Tarnower's book received an initial surge in sales when it was featured in such prestigious fashion magazines as *Vogue*, which ran an article on "the Scarsdale-diet rage" in 1979. It received an even bigger boost when Dr. Tarnower was shot and killed in March 1980 by Jean Harris, a long-term lover who was then the headmistress of a prestigious private school for girls in Virginia. The made-for-media aspects of the murder and the trial that followed guaranteed that the diet book would receive its share of attention from the press and the public.

## Description

The Scarsdale diet can be summarized as a very low-calorie low-carbohydrate diet with a slightly different ratio of **carbohydrates**, proteins, and **fats**. An adult woman who follows the diet exactly will consume between 650 and 1000 calories per day. The nutrient ratio, which is unusual for a low-carbohydrate diet, is 43% **protein**, 22.5% fat, and 34.5% carbohydrate.

## KEY TERMS

**Ketone bodies**—A group of three compounds (acetoacetic acid, acetone, and beta-hydroxybutyric acid) that are formed in an intermediate stage of fat metabolism and excreted in the urine.

**Ketosis**—An abnormal increase in the number of ketone bodies in the body, produced when the liver breaks down fat into fatty acids and ketone bodies. Ketosis is a common side effect of low-carbohydrate diets like the Scarsdale diet. If continued over too long a period of time, ketosis can cause serious damage to the kidneys and liver.

**Porphyria**—A hereditary metabolic disorder characterized by the excretion in the urine of porphyrins, which are molecules that normally combine with iron atoms to form heme-a protein found in hemoglobin, the red pigment that gives blood its color. Some types of porphyria can be triggered by fasting or diets with severe calorie restriction like the Scarsdale diet.

**Very low-calorie diet (VLCD)**—A term used by nutritionists to classify weight-reduction diets that allow around 800 or fewer calories a day. The Scarsdale diet is a VLCD.

### *Basic Scarsdale diet*

The basic Scarsdale diet is to be followed for either seven to 14 days, alternating with two weeks off. The dieter is instructed to drink at least 4 glasses of **water**, tea, or diet soda every day in order to flush waste products from the body. The dieter may add the following seasonings to her foods: herbs, salt, pepper, lemon, vinegar, Worcestershire sauce, **soy** sauce, mustard, or ketchup.

An important feature of the basic Scarsdale diet is its rigidity. Although calories are not counted, the dieter is restricted to the three meal plans for each day; snacking is not allowed. When the diet was still in its office-handout stage, some of Dr. Tarnower's patients asked him whether they might substitute other fruits in season for the grapefruit that forms the centerpiece of the basic plan (18 servings in the course of the two-week regimen, 14 for breakfast and 4 for dessert at lunch or dinner), or substitute raw radishes and cauliflower for carrots and celery sticks. Tarnower invariably told his patients that they had to stick to the plan exactly as written. It was not until the basic diet was expanded into the book-length edition of 1978 that Tarnower seems to have realized that the meal plans could incorporate a greater variety of foods without requiring alterations in the nutrient balance or calorie count.

### *Sample menus from the basic diet*

Day 1

- Breakfast: coffee or tea with sugar substitute plus 1/2 grapefruit (the breakfast menu is the same for all 7 or 14 days of the diet)
- Lunch: any amount of lean beef, chicken, or fish plus tomato salad plus coffee or tea
- Dinner: broiled fish plus tomato and lettuce salad plus 1/2 grapefruit

Day 3

- Breakfast: coffee or tea with sugar substitute plus 1/2 grapefruit
- Lunch: tuna salad plus 1/2 grapefruit
- Dinner: 2 lean pork chops plus mixed green salad plus coffee

Day 5

- Breakfast: coffee or tea with sugar substitute plus 1/2 grapefruit
- Lunch: all the dry cheese you want plus raw or cooked spinach plus 1 slice of dry toast
- Dinner: broiled fish plus green salad plus 1 slice dry toast

### *Variations on the basic diet*

As was noted earlier, Dr. Tarnower's co-author was instrumental in expanding the basic diet into four additional options that offered the dieter a bit more variety. For purposes of comparison, here are the Day 5 menus from three of these 1978 additions:

Day 5, Gourmet Diet for Epicurean Tastes

- Breakfast: coffee or tea with sugar substitute plus 1/2 grapefruit or 1/2 cup diced fresh pineapple, 1/2 fresh mango, 1/2 papaya, 1/2 canteloupe, or "a generous slice of honeydew, casaba, or other available melon."
- Lunch: eggs and chicken livers, farm style; plus tomatoes, lettuce, celery, olives, or endives; plus 1 slice of protein toast; plus coffee, tea, or demitasse
- Dinner: consommé madrilène; plus baked chicken breasts; plus spinach delight; plus a fresh peach with raspberries; plus coffee or tea

Day 5, International Diet

- Breakfast: coffee or tea with sugar substitute plus 1/2 grapefruit or 1/2 cup diced fresh pineapple, 1/2 fresh

mango, 1/2 papaya, 1/2 canteloupe, or "a generous slice of honeydew, casaba, or other available melon."

- Lunch: pickled eggplant and cheese sticks; plus salad greens, "all you want," with vinegar and lemon dressing; plus a fresh peach with raspberry sauce; plus coffee, tea, or espresso
- Dinner: baked stuffed mushrooms; plus veal Napolitaine; plus 1/4 cup boiled white rice; plus zucchni stew; plus coffee, tea, or espresso

Day 5, Money-Saver Diet

- Breakfast: 1/2 grapefruit or canteloupe, plus coffee or tea with artificial sweetener
- Lunch: 2 eggs, any style, but prepared without fat; zucchni; 1 slice dry protein bread, no spread;
- Dinner: broiled, boiled, roasted, or barbecued chicken, "all you want," with skin and visible fat removed before cooking; plus "plenty of spinach" plus coffee or tea

## Function

The basic purpose of the Scarsdale diet is rapid weight loss. It is not intended as a lifetime regimen of sensible weight control; one of its distinctive features, in fact, is that the dieter is supposed to alternate one or two weeks on the diet with two weeks off.

## Benefits

The only benefit of the Scarsdale diet appears to be rapid initial weight loss. Most persons who have tried it and reported on their experiences found it unpleasant because of its lack of flexibility and the boring meal plans prescribed in the basic diet. One British reporter described the Scarsdale diet as "Bad news . . . A raw vegetable nightmare so extreme that Bugs Bunny would have revolted."

## Precautions

The Scarsdale diet has been criticized by nutritionists for a number of health-related deficiencies:

- Nothing is said in the 1978 edition of the diet about the importance of physical exercise in a weight-reduction regimen. Many nutritionists point out that the 700-1000 calories allowed each day are inadequate for a healthy woman who is even moderately active, let alone one who participates in sports or other forms of physical exercise.
- The exclusion of milk from the Scarsdale diet means that the dieter's calcium intake will be too low. This low level of calcium intake poses risks for women who are postmenopausal or over 50.
- The dieter does not learn how to choose foods wisely during the two weeks off the diet or in real-world situations like restaurants or meals shared with family or friends.
- Most of the weight lost is in the form of water, and is quickly regained when the dieter resumes normal eating.
- The Scarsdale diet demands more than the usual amount of will power from the dieter because of its rigidity and low-calorie structure.

Because of these deficiencies and drawbacks, anyone considering the Scarsdale diet in order to lose weight rapidly should consult their physician and a professional dietitian

## Risks

The Scarsdale diet does not allow enough calories for women with active life styles or for adolescents who are still growing. It is completely inappropriate for children. It carries the same risks for the dieter associated with other VLCDs, namely fatigue, **constipation** or diarrhea, irritability, and an increased risk of gallstone formation. The Scarsdale diet has also been reported to trigger episodes of porphyria, an inherited metabolic disorder, in patients with a genetic susceptibility to the disease. Porphyria, which is characterized by the excretion of excessive numbers of porphyrins (molecules used in the formation of the red pigment that gives blood its color) can be brought on by fasting or by long-term use of a VLCD.

The low-carbohydrate profile of the Scarsdale diet also poses the risk of potential kidney or liver damage resulting from ketosis. Ketosis is a metabolic process that occurs when the carbohydrates that serve the body as its basic fuel drop below a certain level. The body must then burn protein and fats to maintain its energy level. When fats are broken down, fatty acids are released into the bloodstream. There they are converted to ketone bodies, which are mild acids excreted in the urine. Excretion of the ketone bodies, however, places an additional burden on the kidneys. If ketosis continues for long periods of time without medical supervision, the kidneys may eventually fail. The health risks associated with ketosis are one reason why the Scarsdale diet should never be used for more than 14 days at a time. In addition, pregnant women, alcoholics, and persons already diagnosed with kidney or liver disease should not use the Scarsdale or any other low-carbohydrate diet for weight control.

## QUESTIONS TO ASK YOUR DOCTOR

- Considering that the Scarsdale diet does not reflect recent advances in the science of nutrition, would you recommend this diet?
- Have any of your patients ever tried the Scarsdale Diet?
- If so, were they able to keep off any weight they lost?
- If so, did they develop any health problems while following it?

### Research and general acceptance

The Scarsdale diet has not been the subject of extensive medical research, possibly because of its association with a notorious legal case. There is only one article in the medical literature that reported on the diet's usefulness as a means to rapid initial weight reduction for people who were then placed on less restrictive weight-loss regimens. The article, however, was published in 1982 and its findings would require reevaluation a quarter-century later. Dr. Tarnower himself never tested the diet in a clinical trial or published any outcome studies of his patients. Although the cover of the 1978 edition of *The Complete Scarsdale Medical Diet* promises a weight loss of "up to 20 pounds in 14 days" the only evidence provided to support this claim is anecdotal quotations from some of the doctor's patients.

Although the Scarsdale diet was popular when it was first published in book form, it is considered a fad diet as of the early 2000s, and listed as such by the American Dietetic Association (ADA). Although the publication on **fad diets** published by the American Academy of Family Physicians (AAFP) does not mention the Scarsdale diet by name, it would clearly come under the heading of controlled carbohydrates diets, which the AAFP does not recommend. Much of the early popularity of the Scarsdale diet may have been due to snob appeal. Dr. Tarnower was disliked as a person by many of his patients as well as by others who knew him for his pretentiousness and open social climbing. The association of the diet with the town of Scarsdale, which was a symbol of prosperity to people in the New York area, may well have encouraged some readers to think of weight loss as a path to economic or social success. Dr. Tarnower was obsessed with his own trim figure as evidence of his professional stature, reportedly dieting whenever his weight went even slightly over 174 pounds. One measure of the Scarsdale diet's loss of popularity is that the upscale fashion magazines that touted it in the late 1970s described it less than a decade later as one of the "diets that don't work."

In general, researchers in the United States and Canada maintain that VLCDs are not superior in any way to conventional low-calorie diets (LCDs). The first report of the National Task Force on the Prevention and Treatment of Obesity on these diets, which was published in the *Journal of the American Medical Association* in 1993, noted that ":Current VLCDs are generally safe when used under proper medical supervision in moderately and severely obese patients (**body mass index** > 30) and are usually effective in promoting significant short-term weight loss . . . . [but] long-term maintenance of weight loss with VLCDs is not very satisfactory and is no better than with other forms of obesity treatment."

One Canadian study reported in 2005 that a history of **weight cycling** tended to lower the health benefits that obese patients could receive from VLCDs, while a 2006 study carried out at the University of Pennsylvania in Philadelphia found that the use of liquid meal replacement diets (LMRs) with a daily calorie level of 1000–1500 calories "provide[d] an effective and less expensive alternative to VLCDs." The only study that reported that VLCDs are "one of the better treatment modalities related to long-term weight-maintenance success" was completed in the Netherlands in 2001. The Dutch researchers added, however, that an active follow-up program, including behavior modification therapy and exercise, is essential to the long-term success that they reported.

### Resources

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**ORGANIZATIONS**

American Academy of Family Physicians (AAFP). P.O. Box 11210, Shawnee Mission, KS 66207-1210. Telephone: (800) 274-2237 or (913) 906-6000. Website: http://www.aafp.org.
American Dietetic Association (ADA). 120 South Riverside Plaza, Suite 2000, Chicago, IL 60606-6995. Telephone: (800): 877-1600. Website: http://www.eatright.org.
Dietitians of Canada/Les diététistes du Canada (DC). 480 University Avenue, Suite 604, Toronto, Ontario, Canada M5G 1V2. Telephone: (416) 596-0857. Website: http://www.dietitians.ca.
Partnership for Healthy Weight Management (PHWM), c/o Federal Trade Commission (FTC), Bureau of Consumer Protection. 601 Pennsylvania Avenue, NW, Room 4302, Washington, DC. 20580. Website: http://www.consumer.gov/weightloss/.

Rebecca J Frey, PhD

Scottish diet *see* **Northern European diet**

Scurvy *see* **Vitamin C**

# Selenium

## Definition

Selenium is a trace element considered a micronutrient, meaning a nutrient needed in very small amounts, that is required as an essential cofactor for the antioxidant enzymes of the body to counteract the damaging effects of reactive oxygen in tissues.

## Purpose

The body requires selenium for the function of a special class of enzymes, called selenoproteins. Proteins are long folded chains of amino acids and selenoproteins are made by the body (selenoprotein synthesis), by incorporating dietary selenium in the form of an unusual amino acid, called selenocysteine, into a very specific location in their amino acid sequence. Animals and humans both require selenium, but not plants. Plants can however, incorporate selenium present in the soil into compounds that usually also contain sulfur.

The major function of selenoproteins is to prevent or reduce the damage (oxidative stress) caused by reactive oxygen species (ROS) or reactive nitrogen species (RNS). These can occur in the body mostly in the form of free radicals, such as peroxides. There are many types of selenoprotein enzymes that protect cells from these damaging molecules. For instance, some convert peroxides into non-toxic alcohols, thus protecting cells from membrane damage while others protect against other types of free radicals. Selenoproteins are also required to:

- Participate in the roduction the white blood cells of the immune system.
- Maintain balanced thyroid gland function.
- Promote healthy vision.
- Maintain healthy skin and hair.
- Protect cells against toxic minerals, such as mercury, lead, and cadmium.
- Help liver function.
- Help break down dietary fats.
- Maintain elasticity of tissues.

Recent research is also indicative of a physiological role for selenium, such as maintaining the blood brain barrier that protects the brain against harmful substances, with several other studies suggesting other protective roles. Although many findings are still uncertain, it is thought that an adequate selenium intake may have an anti-cancer effect, while protecting against lipid intake disorders (hyperlipidaemia), **hypertension** and other heart diseases. There are also reports suggesting

**Selenium**

| Age | Recommended Dietary Allowance (mcg) |
|---|---|
| Children 1–3 yrs. | 20 |
| Children 4–8 yrs. | 30 |
| Children 9–13 yrs. | 40 |
| Adolescents14–18 yrs. | 55 |
| Adults 19≥ yrs. | 55 |
| Pregnant women | 60 |
| Breastfeeding women | 70 |

| Food | Selenium (mcg) |
|---|---|
| Brazil nuts (from Brazil), 1 oz. | 544 |
| Egg, 1 whole | 14 |
| Fish (cod, shellfish, tuna) 1 oz. | 10-20 |
| Enriched noodles or macaroni, 1 cup | 10 |
| Rice, white, 1 cup | 10 |
| Organ and muscle meat, 1 oz. | 8-12 |
| Turkey or chicken, 1 oz. | 7-11 |
| Rice, brown, long-grain, 1 cup | 7 |
| Cheddar cheese, 1 oz. | 5 |
| Walnuts, 1 oz. | 5 |
| Oatmeal or bran, 1 cup | 3-4 |
| Garlic, 1 oz. | 0.25 |

mcg = microgram

*(Illustration by GGS Information Services/Thomson Gale.)*

that oral selenium supplements that increase the plasma selenium concentration result in higher sperm motility.

## Description

At least 11 selenoproteins have been discovered to date, with evidence suggesting that many more exist. They are found in cell membranes, blood, organs, **prostate** gland and testicles. They include:

- Glutathione peroxidases (GPx). Four have been identified: classical or cellular GPx, plasma or extracellular GPx, phospholipid hydroperoxide GPx, and gastrointestinal GPx. They are all antioxidant enzymes that reduce ROS, such as hydrogen peroxide and lipid hydroperoxides, to harmless products like water and alcohols.
- Thioredoxin reductase. This enzyme maintains thioredoxins, proteins that act as antioxidants, in the form required to properly regulate cell growth and viability.
- Iodothyronine deiodinases. Three of these have been identified. These selenoproteins are essential enzymes for normal development, growth, and the regulation of thyroid hormones. The thyroid gland releases very small amounts of biologically active thyroid hormone (T3) and larger amounts of an inactive form of thyroid hormone (T4) into the circulation. Most T3 is created by the removal of one iodine atom from T4 in a reaction made possible by iodothyronine deiodinases.
- Selenoprotein P (SeP). This one is found in plasma and in the cells that line the inner walls of blood vessels. It is believed to function as a transport protein, as well as an antioxidant capable of protecting cells from damage by RNS.
- Selenoprotein W (SeW). SeW is found in muscle. Its function is presently unknown, but it is believed to play a role in muscle metabolism.
- Selenophosphate synthetase. This enzyme is required to incorporate the special selenocysteine amino acid when selenoproteins are made (protein biosynthesis).

The richest food sources of selenium are Brazil nuts, organ meats and fish, followed next by muscle meats. As for plants and grains, there is a wide variation in their selenium content because it depends on the selenium content of the soil in which they grow. For example, Brazil nuts grown in areas of Brazil with selenium-rich soil provide more selenium than those grown in a selenium-poor soil. In the United States, grains are a good source of selenium, but not fruits and vegetables. However, people living in areas with low soil selenium avoid deficiency because they eat foods produced in areas with higher soil selenium. It appears that selenium from different sources is absorbed by the body with varying efficiency. For example, a recent study showed that the mean absorption of selenium from fish was 85–90%, compared with 50% from yeast. Some good food sources of selenium include (per 1oz–serving or as indicated):

- Brazil nuts from Brazil(~544 µg)
- Fish (cod, shellfish, flounder, tuna)(~10–20 µg)
- Eggs (~14 µg per egg, whole)
- Organ and muscle meats (~8–12 µg)
- Turkey, chicken (~7–11 µg)
- Long–grained brown rice (~7 µg per cup)
- Walnuts (~5 µg)
- Cheddar cheese (~5 µg)
- Oatmeal, bran (~3–4 µg per cup)
- Garlic (0.25 µg/g)
- Enriched noodles, macaroni, white rice (~10 µg per cup)

The Recommended Dietary Allowance (RDA) for selenium is:

- Infants: There is insufficient information on selenium to establish a RDA for infants.
- Children (1–3 y): 20 µg
- Children (4–8 y): 30 µg
- Children (9–13 y): 40 µg
- Adolescents (14–18): 55 µg
- Adults: 55 µg

## KEY TERMS

**Amino acid**—Organic (carbon–containing) molecules that serve as the building blocks of proteins.

**Antioxidant enzyme**—An enzyme that can counteract the damaging effects of oxygen in tissues.

**Cofactor**—A compound that is essential for the activity of an enzyme.

**Blood brain barrier**—A physiological mechanism that alters the permeability of brain capillaries, so that some substances, such as certain drugs, are prevented from entering brain tissue, while other substances are allowed to enter freely.

**Enzyme**—A biological catalyst, meaning a substance that increases the speed of a chemical reaction without being changed in the overall process. Enzymes are proteins and vitally important to the regulation of the chemistry of cells and organisms.

**Free radicals**—Highly reactive chemicals that damage components of cell membranes, proteins or genetic material by "oxidizing" them, the same chemical reaction that causes iron to rust.

**Hormone**—A chemical substance produced in the body that controls and regulates the activity of certain cells or organs.

**Immune system**—Defense system of the body responsible for protecting it against infections and foreign substances.

**Kashin–Beck disease**—A disorder of the bones and joints of the hands and fingers, elbows, knees, and ankles of children and adolescents who slowly develop stiff deformed joints, shortened limb length and short stature. The disorder is endemic in some areas of eastern Siberia, Korea, China and Tibet.

**Keshan's disease**—A potentially fatal form of cardiomyopathy (disease of the heart muscle).

**Macro minerals**—Minerals that are needed by the body in relatively large amounts. They include sodium, potassium, chlorine, calcium, phosphorus, magnesium.

**Oxidative stress**—Accumulation in the body of destructive molecules such as free radicals that can lead to cell death.

**Peroxides**—Peroxides are highly reactive free radical molecules, used as powerful bleaching agents and as disinfectant. In the body, they form as intermediate compounds, for example during the oxidation of lipids, and may damage tissues.

**Plasma**—The liquid part of the blood and lymphatic fluid, which makes up about half of its volume. It is 92% water, 7% protein and 1% minerals.

**Reactive oxygen species (ROS)**—Damaging molecules, including oxygen radicals such as superoxide radical and other highly reactive forms of oxygen that can harm biomolecules and contribute to disease states.

**Reactive nitrogen species (RNS)**—Highly reactive chemicals, containing nitrogen, that react easily with other molecules, resulting in potentially damaging modifications.

**Selenocysteine**—Unusual amino acid consisting of cysteine bound to selenium. The process of inserting selenocysteine into proteins is unique to cysteine, and occurs in organisms ranging from bacteria to man.

**Selenoprotein**—Enzyme that requires selenium to function. At least eleven have been identified.

**Thyroid**—A gland located beneath the voice box that produces thyroid hormone, a hormone that regulates growth and metabolism.

**Trace minerals**—Minerals needed by the body in small amounts. They include: selenium, iron, zinc, copper, manganese, molybdenum, chromium, arsenic, germanium, lithium, rubidium, tin.

- Pregnancy: 60 µg
- Lactation: 70 µg

Selenium in nutritional supplements is available mostly in the form of **sodium** selenite and sodium selenate, two inorganic forms of selenium or as selenomethionine in "high selenium yeasts" generally considered to be the best absorbed and utilized form of selenium.

### Precautions

Selenium is trace element that is essential in small amounts, but is toxic in larger amounts. Excessive intake can result in symptoms that may include fatigue and irritability, with increased toxicity leading to loss of hair and nails, white blotchy nails, and garlic breath odor. If not corrected, it leads to a condition called chronic selenium toxicity (selenosis), with symptoms

of vomiting, nausea, nerve damage, skin rashes, and brittle bones. Selenium toxicity is rare in the Unites States with a few reported cases associated with industrial accidents or manufacturing errors leading to an excessively high dose of selenium in a supplement.

On the other hand, diabetes and arthritis have been extensively shown to be associated with selenium deficiency. Gastrointestinal problems, such as Crohn's disease, or surgical removal of part of the stomach can lead to selenium defieciency.

## Interactions

Since selenium is part of the selenoproteins enzymes of the body, it is believed to interact with every nutrient that affects the antioxidant balance of cells. Selenium as gluthathione peroxidase also appears to work in conjunction with **vitamin E** in limiting the oxidation of lipids. Animal oxidative stress studies indicate that selenium can prevent some of the damage resulting from vitamin E deficiency. Thioredoxin reductase is also believed to maintain the antioxidant function of **vitamin C**. A selenium deficiency may also worsen the effects of **iodine** deficiency in the thyroid. At present, few interactions between selenium and medications are known. The anticonvulsant medication, valproic acid, has been found to decrease plasma selenium levels. Supplemental sodium selenite has been found to decrease toxicity from the antibiotic nitrofurantoin and the herbicide paraquat in animals.

## Aftercare

When the diet is corrected for selenium imbalance, most symptoms tend to disappear on intake to recommended RDA levels. People at risk of selenium deficiency, due to gastrointestinal disease or severe infection, are evaluated by physicians for depleted selenium blood levels to determine the need for supplementation.

## Complications

Acute and fatal complications have occurred with accidental ingestion of gram quantities of selenium. Significant selenium toxicity was reported in 13 individuals who took supplements that contained 27,300 µg per tablet due to a manufacturing error. Selenosis may occur with smaller doses of selenium over long periods of time. Overall, selenium deficiency is rare in the United States. When it occurs, it results in a decrease of the activity of the selenium-dependent enzymes, especially if the vitamin E is also missing. A lack of **antioxidants** in the heart, liver and muscles can lead to tissue death and organ failure. Selenium deficiency has also been suggested as a probable cause of Keshan's disease and Kashin-Beck disease and is currently associated with anemia, cataracts, increased risk of **cancer**, heart disease, stroke , diabetes, arthritis, decreased immune function, early aging, infertility, miscarriages, and birth defects in women.

## Parental concerns

Maintaining good nutrition in the home includes keeping informed about the food sources of various **minerals** such as selenium. A first source of information is the Nutrition Fact labels that list them in milligrams or micrograms and as a percentage of the RDA. Parents should also be aware of the risks associated with both selenium deficiency and over-consumption.

## Resources

### BOOKS


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### ORGANIZATIONS


American Dietetic Association (ADA). 120 South Riverside Plaza, Suite 2000, Chicago, IL 60606-6995. 1-800/877-1600. <www.eatright.org>.

American Society for Nutrition (ASN). 9650 Rockville Pike, Bethesda, MD 20814. (301) 634-7050. <www.nutrition.org>.

Office of Dietary Supplements, National Institutes of Health. National Institutes of Health, Bethesda, Maryland 20892 USA. <ods.od.nih.gov>.

U.S. Department of Agriculture, Food and Nutrition Information Center. National Agricultural Library, 10301 Baltimore Avenue, Room 105, Beltsville, MD 20705. (301) 504-5414. <www.nal.usda.gov>.


Monique Laberge, Ph.D.

# Senior nutrition

## Definition

Senior nutrition addresses the special dietary requirements of the elderly. Although wise food choices and a balanced diet are essential for older adults to maintain a healthy lifestyle and to promote longevity, there are various obstacles that prevent or limit seniors from practicing and benefiting from good eating habits. Such obstacles include loneliness, depression, economic concerns, lack of cooking skills or desire to cook, inadequate nutritional knowledge, reduced capacity to absorb and utilize nutrients, oral/dental problems and difficulty in chewing, loss of appetite, and eating/nutrient complications due to the use of various medications. In addition, older adults need certain **vitamins** and nutrients to aid in the maintenance of their health.

## Description

Healthy eating and regular physical activity are necessary to maintain good health at any age. However, older persons, especially after the age of 50, often experience various obstacles that prevent them from following healthy diets. They experience reductions in **metabolism** (the rate at which the body burns energy) and changes in physiology that significantly affect their nutritional needs. The metabolic rate of an individual can decline as much as 30% over the lifetime, and lean muscle mass can decrease by as much as 25%, accompanied by an increase in body fat. These changes often require the use of lower calorie diets as well as changes in nutritional intake.

The United States population is rapidly aging. By 2030, the number of Americans aged 65 and older will more than double to 71 million, comprising roughly 20% of the U.S. population. In some states, fully a quarter of the population will be aged 65 and older. The cost of providing health care for an older American is three to five times greater than the cost for someone younger than 65. By 2030, the nation's health care spending is projected to increase by 25% due to demographic shifts unless improving and preserving the health of older adults is more actively addressed.

Almost 90% of Americans over the age of 65 have one or more degenerative disorders, such as heart disease, **cancer**, arthritis, diabetes, macular degeneration, and **osteoporosis**. These conditions were once considered inevitable diseases of old age, but now are recognized as life-style diseases. Therefore, changes in habits, including diet, can significantly reduce the risks of developing these diseases as well as prevent premature aging. However, according to a report by the Merck Institute of Aging and Health and the Centers for Disease Control and Prevention, two-thirds of older adults fail to adhere to a healthy diet and one-third fail to exercise. Therefore, to ensure that the aging population takes necessary steps to stay healthy and independent and to reduce the risk of disabilities, it is necessary to educate the elderly about healthy behaviors and to help them translate that knowledge into action.

**Senior nutrition**

**Health risks of underweight older adults**

- Constipation
- Decreased immunity
- Decreased muscle strength
- Hypothermia (lowered body temperature)
- Osteoporosis (bone loss)
- Poor memory

**Health risks of overweight or obese older adults**

- Coronary heart disease
- High blood cholesterol
- High blood pressure
- Gallbladder disease
- Some types of cancer
- Stroke
- Type 2 diabetes

SOURCE: National Institute of Diabetes and Digestive and Kidney Diseases, National Institutes of Health, U.S. Department of Health and Human Services

*(Illustration by GGS Information Services/Thomson Gale.)*

Energy decline in the elderly, as lean body mass, including muscle, decreases with age. Therefore seniors need to eat foods that are concentrated in nutrients but low in calories. It has been recommended that after the age of 50 that men reduce their daily calorie intake by 600 calories and that women reduce their daily calorie intake by 300 calories. However, calorie needs will vary with the level of exercise a person gets, as well as other health conditions. For example, the calorie needs of a wheelchair-bound 80-year-old will differ from an 85-year-old who plays tennis and swims every day.

Maintaining a healthy weight may reduce the risk of many chronic diseases, help with flexibility and mobility, and aid in mental alertness. The risks of being underweight include poor memory, decreased immunity, osteoporosis, decreased muscle strength, hypothermia (lowered body temperature), and **constipation**. The risks of being overweight or obese include type 2 diabetes, high blood pressure, high blood cholesterol, **coronary heart disease**, stroke, some types of cancer, and gallbladder disease.

## KEY TERMS

**Antioxidants**—Compounds that protect against cell damage inflicted by molecules called oxygen-free radicals, which are a major cause of disease and aging.

**Diverticulitis**—A condition in which pouch-like bulges or pockets (diverticula) in the wall of the intestine—most commonly the large intestine—become inflamed or infected.

**Diverticulosis**—A condition in which pouch-like bulges or pockets (diverticula) develop along the digestive tract. Normally, these pouches don't cause any problems but may become inflamed or infected (diverticulitis).

**Degenerative disorders**—A condition leading to progressive loss of function.

**Macular degeneration**—A chronic disease of the eyes caused by the deterioration of the central portion of the retina, known as the macula, which is responsible for focusing central vision in the eye.

**Osteoporosis**—Thinning of the bones with reduction in bone mass due to depletion of calcium and bone protein. Osteoporosis predisposes a person to fractures, which are often slow to heal and heal poorly. It is more common in older adults, particularly postmenopausal women; in patients on steroids; and in those who take steroidal drugs. Unchecked osteoporosis can lead to changes in posture, physical abnormality (particularly the form of hunched back known colloquially as "dowager's hump"), and decreased mobility.

**Triglycerides**—The body's storage form for fat. Most triglycerides are found in adipose (fat) tissue, while some triglycerides circulate in the blood to provide fuel for muscles. Triglycerides come from the food we eat as well as from being produced by the body.

**Osteoporosis**—Thinning of the bones with reduction in bone mass due to depletion of calcium and bone protein. Osteoporosis predisposes a person to fractures, which are often slow to heal and heal poorly. It is more common in older adults, particularly postmenopausal women; in patients on steroids; and in those who take steroidal drugs. Unchecked osteoporosis can lead to changes in posture, physical abnormality (particularly the form of hunched back known colloquially as "dowager's hump"), and decreased mobility.

Generally, the daily recommended amount of calories for women over the age of 50 are:

- 1,600 calories, if her physical activity level is low
- 1,800 calories, if her physical activity level is moderate
- 2,000 to 2,200 calories if her physical activity level is high.

The recommended daily amount of calories for men over the age of 50 are:

- 2,000 calories, if his physical activity level is low
- 2,200 to 2,400 calories, if his physical activity level is moderate
- 2,400 to 2,800 calories if his physical activity level is high.

The **dietary guidelines** from the U.S. Department of Agriculture (USDA) suggest that persons select a suggested amount from five major food groups each day. Selecting the smallest amount will result in about 1,600 calories per day, while the largest number has about 2,800 calories. The USDA Daily Dietary Guidelines are:

- Grains: 5 - 10 ounces (with at least three ounces from whole grains)
- Vegetables: 2 to 3 1/2 cups, with a variety of colors and types
- Fruits: 1 1/2 to 2 1/2 cups
- Milk, yogurt, and cheese: 3 cups of milk (1 cup of yogurt, 1 1/2 to 2 ounces of cheese, or 2 cups of cottage cheese are equivalent to one cup of milk)
- Meat, poultry, fish, dry beans, eggs, and nuts: 5 - 7 ounces of lean meat, poultry or fish (1/4 cup of cooked beans or tofu, 1 egg, 1/2 ounce of nuts or seeds, or 1 tablespoon of peanut butter are equivalent to one ounce of meat)

Elderly persons should ensure that there is adequate **protein** in their diets, for protein is necessary for a healthy immune system and for repair and maintenance of body tissues. In addition, only small amounts of **fats**, oils, and sweets should be eaten each day. Fats can provide energy and vitamins, but too much fat can lead to heart disease. fat is also high in calories. To lower fat in the diet, a person can:

- Choose lean cuts of meat, fish, or skinless poultry
- Trim off fat before cooking

- Use low-fat dairy products and salad dressings
- Use non-stick cooking pans and pots and cook without added fat
- If fat is used for cooking, use an unsaturated vegetable oil or nonfat cooking spray
- Broil, roast, bake, stir-fry, steam, microwave, or boil foods rather than frying
- Season foods with lemon juices, herbs, or spices instead of butter or margarine

Dietary **fiber** from fruits, vegetables, beans, nuts, seeds, brown rice, and whole grains can help an older person avoid intestinal problems such as constipation, diverticulosis, and diverticulitis. Fiber may also help lower cholesterol and blood sugar. If a person is not used to eating large amounts of fiber, additional fiber should be added to the diet slowly to avoid intestinal problems. Drinking fluids are necessary to help move the fiber through the intestines.

Although a person's diet is the preferred source of nutrition, evidence suggests that the use of a single daily multivitamin-mineral supplement may be an effective way to address nutritional gaps that exist among the elderly population, especially the elderly poor. Low dietary intakes are a problem for almost all micronutrients because older people do not eat as much as younger people. Less food means fewer calories but also fewer vitamins and **minerals**. It is appropriate for an elderly person to take in fewer calories than younger people, for they burn fewer calories through exercise; however, the body's need for some vitamins and minerals may actually increase with age.

For example, **vitamin D** and **calcium** are especially important for the elderly, to strengthen bones and to prevent bone loss, but intake through dietary sources may be low. All elderly people are prone to vitamin D depletion, but this is a particular concern for those who are in a nursing home or a hospital, partly because of poor diet and partly because of insufficient exposure to sunlight. Calcium sources include low- and non-fat yogurt, cottage and ricotta cheeses, milk, tofu processed with calcium, broccoli, kale, Asian greens such as bok choy, orange juice fortified with calcium, and legumes and fortified bread and cereal products. **Soy** or rice milk fortified with calcium and vitamin D may be used by lactose-intolerant seniors. Calcium supplements are also recommended, especially for women. In addition, seniors may secrete less hydrochloric acid, which is involved in food digestion, resulting in less absorption of calcium.

Many health care professionals advise seniors to add **antioxidants**, such as **vitamin C** and **selenium**, to their supplementation routine. Antioxidants may have several positive effects, such as slowing the aging process, reducing the risks of cancer and heart disease, and reducing the risks of illness and infection by strengthening the immune system. Coenzyme Q10 is another antioxidant that some health care professionals recommend, especially with regards to protection of heart health. The supplement **glucosamine** and chondroitin may be useful for seniors with joint problems and pain.

**Sodium**, which is contained in salt, is necessary for healthy blood, muscles, and nerves. However too much sodium can result in high blood pressure. Person over the age of 50 should consume only about 1,500 mg of sodium daily from all their food sources, which is about 2/3 of a teaspoon of table salt. Spices, herbs, and lemon juice can be used in place of table salt to add flavoring to food. Canned vegetables and beans can be washed under cold **water** to lower their salt content. Potassium can counter the effects of salt on blood pressure. Sources of potassium include leafy green vegetables, fruit from vines, such as tomatoes, bananas, and root vegetables such as potatoes.

Seniors are at high risk for becoming dehydrated because they tend to feel less thirsty. **Dehydration** can result in disorientation, confusion, and changes in blood pressure. It can also lead to kidney and cardiac abnormalities. In addition to water, seniors can drink fruit and vegetable juices, sparkling waters, chilled and flavored soy and rice milk, and hot or cold herbal teas. **Caffeine** and alcohol containing beverages do not replenish but deplete the body of fluids.

There are also other obstacles to seniors receiving necessary nutrition. Factors such as dexterity (for example, being able to use a knife with ease), flavor preferences and personal tastes (for example, preferences for spicy or bland foods) and the ability of seniors to chew and swallow (for example, missing teeth or poorly adjusted dentures) can affect nutrition. Problems with chewing can often be addressed through eating canned fruits, creamed or mashed vegetables, ground meat, or foods made with milk or drinking fruit and vegetable juices.

An elderly person might avoid certain foods because of fear of possible gastrointestinal disturbances, such as gas or diarrhea associated with dairy products, this missing out on important sources of calcium and protein. Even the names of food items can affect whether a senior will eat a particular food. For example, a senior unfamiliar with tortellini, a pasta stuffed with meats, cheese, and/or vegetables, may refuse to eat that particular food item. However,

by changing the name to home-style stuffed noodles, the senior may try and enjoy the tortellini.

The sense of taste and smell commonly diminish with age, often adversely affecting the appetite. In addition, medications can also alter the sense of taste. A switch in medications may help with this problem.

**Food safety** is also important with regards to taste and smell. Older persons may not be able to tell if foods have gone bad. To counter this problem, foods can be dated when placed in the refrigerator. If there is any doubt on whether a food item is spoiled, it should be thrown out.

Older people should also be careful when preparing foods that need to be cooked thoroughly to prevent disease. Examples of these types of food include eggs, pork, shellfish, poultry, and hot dogs. Raw sprouts, some deli meats, and foods that are not pasteurized (heated sufficiently to destroy disease-causing organisms) may also be unsafe.

Diseases such as arthritis and dementia can affect the nutritional status of elderly persons. A person may not to able to shop, cook, or even use utensils. Persons with Alzheimer's Disease or other types of dementia may eat poorly or even forget to eat at all.

Dietary restrictions of fat and cholesterol are recommended in order to lower blood cholesterol levels and the associated cardiovascular disease risks. However, there have not been any long-term drug or dietary cholesterol-lowering intervention trials in healthy persons older than 65 years. Some studies have shown that although total cholesterol levels may be good predictors of cardiovascular disease in middle-aged persons, they are not good predictors for elderly persons. Research has also shown that levels of high density lipoproteins (HDL, or the "good cholesterol) are a better predictor of risk in the elderly than low density lipoproteins (LDL, known as the "bad" cholesterol). When seniors reduce fat in their diets with **carbohydrates**, blood triglyceride levels can increase, which in turn results in lowering the HDL (the "good") cholesterol levels and in increasing the levels of LDL (the "bad") cholesterol levels. Often these simple carbohydrates that are used to replace higher fat food choices contain less nutrients and may have more calories, thus leading to **obesity** and its associated risks. Overall it is recommended that dietary restrictions for the elderly not be overly restrictive and that any dietary changes be addressed to specific health problems, such as diabetes, food allergies, and kidney problems.

Elderly people may require special diets because of chronic medical problems. These special diets could include a low-fat, **low-cholesterol diet** for heart disease, a **low-sodium diet** for high blood pressure, or a low-calorie diet for weight reduction. However, often it takes extra effort to adhere to these dietary needs, and the elderly may settle for easy to prepare meals that may not be appropriate for the specific diet required.

Social isolation is also an obstacle to good nutrition. Older persons who find themselves single after many years of living with another person may find it difficult to be alone at mealtimes. Depression may lead to a lack of desire to prepare or eat meals. A study of newly widowed people found that nearly 85% reported a weight change during the two years following the death of a spouse, as compared to 30% of married subjects. The widowed group reported an average weight loss of 7.6 pounds. Widowed women reported that cooking was a "chore," especially since there was no one to appreciate their cooking efforts. Widowed men may not know how to cook and may become dependent on snacks and fast foods, thus not getting sufficient nutrients and vitamins. Microwave ovens can be useful by providing an easy means for cooking nutritious frozen foods or foods already prepared by grocery stores.

Family members and friends can provide assistance to help seniors with nutritional needs. They can help elderly persons take advantage of food programs by aiding them in contacting agencies and organizations that can provide assistance and by helping them fill out forms and paperwork. They can stop by and make sure the person is eating, they can prepare foods for the person, and they can join the person for meals. An explanation of proper nutrition and how to read food labels may also be helpful. In some cases, family members and friends may need to help the person move to an assisted living facility or nursing home to ensure that the older person gets adequate nutrition.

Many elderly persons in the United States depend only on Social Security for their income. In the United States, the number living in poverty increased for seniors 65 and older 3.6 million in 2005, up from 3.5 million in 2004, which is about 10% of the senior population. An older person with limited financial resources can minimize food costs by:

- Purchasing generic or store brands of food
- Purchasing low-cost foods such as dried beans and peas, rice, and pasta, or processed foods that contain such items
- Planning menus by incorporating food items that are on sale or use money-saving coupons

- Dividing left-overs into individual servings and freezing for later use
- Sharing meal shopping, preparation and costs with a friend
- Planning potluck dinners where everyone brings a prepared dish
- Taking part in group meal programs at senior citizen's centers or at churches or synagogues
- Utilizing food stamps

In the United States, food stamps are also an option that seniors can utilize to purchase food. In many areas, there is grocery-shopping assistance available to help the home-bound purchase food items - sometimes a service fee may be required, in addition to the cost of the groceries.

The Elderly Nutrition Program, authorized under Title III of the U.S. Older Americans Act, provides grants to state community agencies on aging and federally recognized tribal governments to support congregate and home-delivered meals to persons 60 years and older. Additional funds for the program are provided by state and local agencies. The program is designed to address problems of dietary inadequacy and social isolation among older persons, especially low-income minorities and rural populations. Although these programs target the poor, they are available at no cost to all elderly persons, regardless of income. Many seniors participate in these programs while confidentially and voluntarily donating money in order to keep active and socially engaged.

The congregate meal program allows seniors to gather at a local site, such as a senior citizen's center, school, or restaurant for a meal. Often additional services are available, such as health and nutrition screenings and education, counseling, fitness programs, or recreational activities. This program assures that for five to seven days each week, seniors eat at least one nutritious meal that provides at least one-third of the recommended dietary allowances for an older person. Often meals are available that meet the requirements for special diets, such as low-sodium for high blood pressure or soft foods for those who have trouble chewing.

Meals on Wheels Association of America (MOWAA) is an organization whose membership is comprised mostly of senior nutrition programs in the United States. MOWAA member programs throughout the country provide nutritious meals and other nutrition services to men and women who are elderly, homebound, disabled, frail, or at risk. These services significantly improve the quality of life and health of the individuals they serve and postpone early institutionalization. Many participants are people who do not require hospitalization, but who need a helping hand in order to maintain their independence. As a national organization, MOWAA focuses on those issues that can best assist its members in achieving their individual missions of providing quality meals and nutrition services to as many vulnerable people as possible in the most efficient and effective manner "so no senior goes hungry".

Volunteers who deliver meals to older persons who are homebound through MOWAA are encouraged to spend time with their clients. The volunteers also check on the welfare of the homebound so that they can report any health or other problems that they note during their visits.

The Senior Farmers' Market Nutrition Program (SFMNP) awards grants to states, United States territories, and federally-recognized tribal governments to provide low-income seniors with coupons that can be exchanged for eligible foods at farmers' markets, roadside stands, and community support agriculture programs. In addition to providing fresh, nutritious locally grown fruits, vegetables, and herbs to low-income seniors, the program also increases and expanding domestic consumption of local agricultural commodities. Persons eligible for SFMNP benefits are individuals who are at least 60 years old and who have household incomes of not more than 185% of the federal poverty guidelines. In 2004, 802,000 low-income seniors purchased food from 14,500 farmers at 2,500 farmers' markets as well as at 2,500 roadside stands and 215 community-supported agriculture programs.

You Can! - Steps to Healthier Aging is part of the U.S. Department of Health and Human Services' Steps to a Healthier US initiative, which encourages Americans of every age to make healthier choices. The You Can! campaign is designed to increase the number of older adults who are active and healthy by using a partnership approach to mobilize communities. Information about this community program is available on the web site of the United States Administration of Aging: [www.aoa.gov/youcan/]. By September 30, 2006, a total of more than 2,800 community organizations had made a commitment to reach 4.2 million older adults with information and 436,000 with programs.

## Complications

Without adequate nutrition, the health of senior citizens will suffer.

## Resources

### BOOKS

Bales, Connie Watkins (ed.), and Ritchie, Christine Seel. *Handbook of Clinical Nutrition and Aging* Totowa, NJ: Humana Press, 2003.

Dangour, Alan (ed.), Grundy, Emily (ed.), and Fletcher, Asrtrid. *Ageing Well: Nutrition, Health, and Social Interventions*.Boca Raton, FL: CRC Press, 2007.

Lam, Pat. *Nutrition: The Healthy Aging Solution*. Carol Stream, IL: Allured Publishing Corporation, 2004.

Watson, Ronald R. *Handbook of Nutrition in the Aged, Third Edition*. Boca Raton, FL: CRC Press, 2000.

### ORGANIZATIONS

Meals on Wheels Association of America, 203 South Union, Alexandria, VA 22314. Telephone: 703-548-5558. Website: [www.mowaa.org]

National Institute on Aging, Building 31, Room 5C27, 31 Center Drive, MSC 2292, Bethesda, MD 20892. Telephone: 301-496-1752. Website: [www.nia.nih.gov]

United States Administration on Aging, 330 Independence Avenue, SW, Washington, DC 20201. Telpehone: 202-619-0724. Website: [www.aoa.gov]

United States Department of Agriculture Food and Nutrition Information Center, 10301 Baltimore Avenue, Department of Agriculture, Beltsville, MD 20705-2351. Telephone: 301-504-5719. Website: [www.nal.usda.gov/fnic/]

Judith L. Sims

# Shangri-la diet

## Definition

The Shangri-la diet is not a diet in the usual sense of a set of meal plans or detailed instructions about calorie intake and nutrition. The book that was published in 2006, *The Shangri-la Diet*, is perhaps better described as a discussion of a psychological theory about human appetite than a diet book strictly speaking. The core of the author's theory is that people gain weight because they have been conditioned to have a strong association between food and flavor, which keeps the appetite demanding more of a specific source of calories in order to continue tasting the flavor. If a person can break the association between flavor and food intake, they can lose weight because they won't feel hungry as often or as intensely. The book suggests several ways in which this association can be broken, thus leading to lifelong reduction in calorie intake with relatively little physical or emotional distress. As one newspaper reporter describes the diet, " . . . it seems that you may eat whatever you wish under the [author's] plan, but you just won't want to." The diet has generated considerable controversy since its publication, not only in regard to its theory of appetite and weight control, but also about the role of expert review and clinical trials in evaluating new diets.

The name of the Shangri-la diet comes from a novel titled *Lost Horizon*, written in 1933 by James Hilton about a mythical paradise called Shangri-la, hidden from the world somewhere in the Himalayas and guided by the wisdom of a Tibetan lama. The word Shangri-la entered English common speech as a synonym for a utopia or Garden of Eden when Frank Capra directed a movie based on Hilton's novel in 1937. Seth Roberts, the author of *The Shangri-la Diet*, maintains that he chose the name of his diet because of its association with an earthly paradise. He told an interviewer in 2005, " [I picked the name] because it puts people at peace with food—like being in Shangri-la, a peaceful place. It reduces or eliminates food compulsions, such as eating between meals and eating late at night. It is also a kind of ideal diet, just as Shangri-la was a kind of ideal place."

## Origins

Seth Roberts, the originator of the Shangri-la diet, is (as of 2007) a middle-aged (b. 1953) professor of psychology at the University of California, Berkeley; he is not a medical doctor or nutritionist. He has said in the course of several television interviews, including a November 2005 segment with Diane Sawyer on the ABC News program *Good Morning America*, that the Shangri-la diet emerged over the course of some years of self-experimentation coupled with a chance discovery during a visit to France in 2000. With regard to self-experimentation as such, the paper available on the official website of the Shangri-la diet is essentially a discussion of self-experimentation as a potentially fruitful approach to generating topics for further research; it is not a report on the Shangri-la diet by itself.

According to this paper, which Roberts published in 2004, he experimented with his own body systems for over 10 years concerning other issues before focusing on weight control. He began with acne and then decided to study his long-standing problem with awakening too early in the morning and feeling tired most of the day. He states that he first noticed this problem in 1980. By experimenting, he noticed that he could improve the quality as well as the duration of his sleep by skipping breakfast, exposing himself to an hour of morning light, standing up for 8 hours a day, and "seeing faces on television in the morning." Roberts concluded from these apparently unrelated changes in food intake and other activities that human beings are still better suited

## KEY TERMS

**Anecdotal evidence**—A category of medical or dietary evidence based on or consisting of individual reports, usually written by observers who are not doctors or scientists.

**Association**—In psychology, a connection between two ideas, actions, or psychological phenomena through learning or experience. The Shangri-la diet is based in part on the notion that humans eat more than they need to in the modern world because of a strong association between food flavors and calories.

**Conditioning**—In psychology, the process of acquiring, developing, or establishing new associations and responses in a person or animal. The author of the Shangri-la diet believes that modern food products condition people to make an association between the flavors in the foods and calorie intake.

**Dietitian**—A health care professional who specializes in individual or group nutritional planning, public education in nutrition, or research in food science. To be licensed as a registered dietitian (RD) in the United States, a person must complete a bachelor's degree in a nutrition-related field and pass a state licensing examination. Dietitians are also called nutritionists.

**Glycemic index (GI)**—A system devised at the University of Toronto in 1981 that ranks carbohydrates in individual foods on a gram-for-gram basis in regard to their effect on blood glucose levels in the first two hours after a meal. There are two commonly used GIs, one based on pure glucose as the reference standard and the other based on white bread.

**Set point**—In medicine, a term that refers to body temperature, body weight, or other measurements that a human or other organism tries to keep at a particular value. The Shangri-la diet is said to work by lowering the dieter's set point for body weight.

**Shangri-la**—A utopia; a mythical place in the Himalayas where life approaches perfection, depicted in a 1933 novel by James Hilton.

to Stone Age life than to contemporary lifestyle patterns. Roberts believes that humans living in the Stone Age had most of their contact with other people in the morning rather than after dark, that they spent most of the day on their feet, and that the modern preference for watching late-night television creates a mismatch with inbred human sleep-wake patterns.

The hypothesis that there is a mismatch between human evolution and modern life then suggested itself to Roberts as a possible explanation for his difficulties in losing weight. He had already come to accept the so-called set point theory, first proposed in 1950, that weight in human adults is controlled by an internal set point that functions much like a thermostat in a heating system. According to the set point theory, whenever a person's amount of body fat drops below a specific set point, the person's body will eventually regain the fat through increasing appetite, lowering **metabolism**, or both. Roberts decided to test the set point theory by seeing whether changing his diet could change his body's set point. Over the years he had tried a series of diets—a sushi diet, a pasta diet, a diet that required the dieter to drink five quarts of **water** per day—but none had proved effective in bringing about permanent weight loss.

On a trip to France in 2000, however, Roberts had a chance discovery that he thinks enabled him to reset his body weight set point. He drank a number of French soft drinks with unfamiliar flavors and lost weight. He theorized that his body did not associate the strange flavors with calorie intake, and that the key to resetting the set point was to break the association that the mind makes between the taste of food and taking in calories. After some experimenting, he came up with the notion that ingesting a small amount of bland or flavorless calories in the form of either an unflavored solution of sugar and water (sweetness has no taste as such) or flavorless liquid cooking oil (he tried canola oil and very light olive oil).

The connection that Roberts sees between human evolution and food flavors is as follows: he thinks that human metabolism essentially acquired its present pattern during the Stone Age, when the food supply was highly variable. When food was scarce, the metabolism of our Stone Age ancestors slowed down, lowering their set point to a lower weight and a more efficient metabolism with fewer hunger pangs. When food was once again available in large amounts, people actually got hungrier; they gorged on the food and fattened themselves in preparation for the next period of scarcity. This pattern, according to Roberts, indicates that the human body is programmed to crave more—not less—food when food is readily available so that it can store the extra calories in the form of fat to protect it during the next time of famine.

Roberts went further and hypothesized that this metabolic pattern is accompanied by an association that the brain makes between food flavor and calorie intake. When Stone Age people ate something they found tasty (during a period of abundance) and familiar (which meant that they had found by experience that the food nourished their bodies), their bodies demanded that they eat as much of the tasty food as possible in order to store the extra calories as fat. The problem with modern life in the developed countries is that the constant availability of affordable good-tasting food leads to rampant overeating that is no longer necessary as a protection against hard times, and that food advertising as well as food availability conditions people to associate food flavor with calorie consumption.

## Description

The Shangri-la diet in its present form requires the dieter to take either a small quantity of sugar water or a bland oil (extra-light olive oil, canola oil, or highly refined walnut oil) twice or three times a day, at least an hour before or an hour after consuming anything with flavor (including toothpaste or mouthwash). Roberts recommends 1 to 2 tablespoons of oil per day, which comes to 120 to 240 calories. The sugar mixture that Roberts used while losing weight was about 6 tablespoons of fructose (about 275 calories) diluted in a quart of water. According to Roberts, the oil or sugar water gives the dieter some calories in a nutrient-dense substance without flavor, thus breaking the learned association between flavor and calories. In effect, breaking this learned association tricks the body into lowering its set point, suppressing appetite, and leading to weight loss without hunger **cravings**. Roberts suggests taking the doses of oil or sugar water first thing in the morning and just before bedtime, but says that dieters should feel free to experiment and take their doses at other times that may work better for them.

The dieter need not make any other changes in the types of food they prefer. Roberts does, however, suggest ways in which people using the Shangri-la diet can lower their set point even further:

- Avoid food commercials, cooking shows on television, and other visual stimuli related to feed. Seeing images of food is thought to increase the appetite.
- Choose foods with a low glycemic index (GI). The glycemic index is a measurement system that evaluates the carbohydrates in specific foods for their effect on the body's blood sugar level within two hours after a meal. Foods with a low GI index are thought to satisfy hunger longer because they do not increase blood sugar levels as rapidly as foods with a high GI index.
- Eat very bland foods other than the doses of oil (sushi, boiled rice, egg whites, etc.) to help break the association between flavor and calorie intake.
- Practice "crazy spicing," which is Roberts's term for adding 10 to 20 spices chosen at random to one's food so that the original flavor is unrecognizable. As Roberts says, "No flavor recognition = no set point increase = lower set point = weight loss."

As of 2007, Roberts maintains that he has kept his weight at about 150 pounds by eating one 900-calorie meal per day, 150 calories of fruit sugar dissolved in water, and 2 pieces of fresh fruit (about 75 calories each).

## Function

The function of the Shangri-la diet is to induce and maintain weight loss through an approach intended to reset the dieter's set point and improve control of appetite, rather than by eliminating specific food categories or restricting portion size.

## Benefits

There is anecdotal evidence that the Shangri-la diet helps some people lose significant amounts of weight and maintain weight loss. Roberts, who claims to have lost 40 pounds on his diet and kept it off, maintains a website with a forum where people can post success stories.

Some specific benefits mentioned by people who have tried the Shangri-la diet:

- They can still have their favorite foods if they wish.
- The diet is easy to use because it doesn't require weighing and measuring foods or special cooking techniques.
- It can be readily combined with cooking for a family, eating out, or other activities that are often problematic for dieters; as one person remarked, "No one knows you're doing it."
- The oil or sugar water is inexpensive, making the Shangri-la diet one of the least stressful weight reduction regimens in terms of financial investment. An attorney who has successfully lost weight on the diet comments, " It is the cheapest diet I've ever been on. Five dollars worth of extra light (not extra virgin) olive oil from Costco or Sam's Club lasts you six months. I've probably eaten less than half the food I would have otherwise eaten in that time. Even if I bought a copy of the book every week . . . I would still come out ahead on what I spend on food."

## QUESTIONS TO ASK YOUR DOCTOR

- Do you know of anyone who has tried the Shangri-la diet? Were they able to lose weight and keep it off?
- What do you think of the author's theories about human evolution and appetite underlying the diet?
- Do you see any significant potential health risks associated with such an unusual diet?
- Would you recommend this diet to any of your patients who needs to lose more than 30 pounds?

### Precautions

According to Roberts, diabetics should not use the sugar water option but take only oil if they follow the Shangri-la diet. In addition, people should not use strong-flavored oils, such as ordinary olive oil or **flaxseed** oil, because the flavors in those oils will prevent breaking the brain's association between flavor and calorie intake.

Roberts also warns that individual body chemistry seems to affect the time it takes the Shangri-la diet to have an effect on the dieter's appetite. Some people apparently feel a difference within a few hours of their first dose of flavorless oil, others take several days, and some may require three weeks to notice a change in appetite.

### Risks

There do not seem to be any major risks to health associated with the Shangri-la diet, provided that the dieter consumes an appropriate balance of nutrients, **vitamins**, and **minerals**; and consults a physician beforehand to exclude the possibility of a previously undiagnosed serious health condition.

### Research and general acceptance

One of the major criticisms of the Shangri-la diet is its lack of pre-publication clinical testing on a group of subjects. John Ford, an assistant professor of medicine who is highly skeptical of Roberts's claims, notes that Roberts, himself a scholar, should have had more academic integrity. In an online article published in May 2006, shortly after the first press run of Roberts's book, Ford said, " . . . the scientific method exists for a reason: to root out poor hypotheses and to direct research towards those more likely to be fruitful. If Roberts were truly interested in investigating his approach, he should have subjected it to the dispassionate rigor of clinical study and peer review. His hypothesis is clearly testable with a controlled trial by a careful scientist willing to be proven wrong if necessary. That hasn't happened. Presenting a highly speculative idea as proven science to an audience unlikely to appreciate the difference between an academic psychologist dabbling in this field and seasoned experts who have devoted their careers to it is misleading at best . . . ."

Ford goes on to point out that the published article that Roberts has posted on his website is not about the Shangri-la diet but rather a speculative essay about self-experimentation as a way to generate ideas for further exploration. Self-experimentation is not necessarily inappropriate as a technique in medicine or nutrition; a recent book on the history of medical self-experimentation devotes a full chapter to physicians who risked their lives testing the role of vitamins in preventing scurvy and other diseases by subjecting themselves to diets lacking these vitamins. The question, however, is whether the results of Roberts's self-experiment with weight control can be generalized to other overweight people. As of early 2007, no articles about the effectiveness of or risks associated with the Shangri-la diet have appeared in any peer-reviewed medical or nutrition journal. In addition, the diet has not been endorsed by the American Dietetic Association (ADA) or any other professional nutritionists' association. It has, however, been featured in such popular magazines as *Woman's World*.

One researcher in the field of appetite and taste, however, has been quoted as saying that Roberts's theory about the human mind's association of food flavor with calorie intake is open to question. Dr. Mark Friedman, a physiologist at the Monell Chemical Senses Center in Philadelphia, an independent institute that collaborates on research projects with the University of Pennsylvania, commented in an interview with the *Dallas Morning News* that "The idea that the taste of food can set food intake and the calories you eat over the long term is an idea that has no scientific evidence." Friedman allows that research done at Monell does indicate that people tend to like safe, familiar foods and thereby learn certain food preferences. "But that doesn't mean you'll overeat."

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American Dietetic Association (ADA). 120 South Riverside Plaza, Suite 2000, Chicago, IL 60606-6995. Telephone: (800): 877-1600. Website: http://www.eatright.org.

Dietitians of Canada/Les diététistes du Canada (DC). 480 University Avenue, Suite 604, Toronto, Ontario, Canada M5G 1V2. Telephone: (416) 596-0857. Website: http://www.dietitians.ca.

Monell Chemical Senses Center. 3500 Market Street, Philadelphia, PA 19104-3308. Telephone: (215) 898-6666. Website: http://www.monell.org/index.htm.

Rebecca J. Frey, PhD



# Six day body makeover

## Definition

The Six Day Body Makeover is a rapid weight loss program designed by Michael Thurmond. The diet is intended to let dieters "drop a dress or pant size" in only six days by following a strict plan of dieting and exercise designed to boost **metabolism**.

## Origins

The Six Day Body Makeover was designed as a shortened version of the Six Week Body Makeover. Both these plans were developed by Michael Thurmond. Thurmond grew up in Los Angeles, California. He says that he was an obese child who ate for emotional reasons. At age 11, his parents put him on a medically supervised diet that included drugs, but even that approach failed. He began lifting weights in his teenage years and he although be became more muscular, he still could not lose the fat.

In his late teens, Thurmond joined the military and met a bodybuilder while stationed on an aircraft carrier on its way to Vietnam. By training with this bodybuilder, he learned the techniques he provides in his exercise program. While in the military, Thurmond says he also learned about food because he was assigned to kitchen duty and used that time to experiment with his diet.

After his time in the military, Thurmond began competitive bodybuilding and won numerous titles. His struggle with and eventual victory over his weight problems led him to want to help others lose weight and get in shape. In 1985, he began the Six Week Body Makeover program in San Francisco. It was the culmination of the work Thurmond had been doing with individuals for years. This program grew in popularity, and soon Thurmond was on the cover of the *San Francisco Chronicle*, as well as appearing on several television talk shows. Thurmond has no formal training in nutrition.

The Six Day Body Makeover is a shortened version of Thurmond's popular Six Week Body Makeover. It is designed to help dieters achieve results even more quickly. Thurmond makes regular appearances on the Home Shopping Network, and his weight loss programs have also been featured on ABC's "Extreme Makeover" television show.

## Description

The Six Day Body Makeover is intended to produce rapid weight loss in a short period. It uses a variety of diet and exercise techniques to raise metabolism and

## KEY TERMS

**Dietary supplement**—A product, such as a vitamin, mineral, herb, amino acid, or enzyme, that is intended to be consumed in addition to an individual's diet with the expectation that it will improve health.

**Mineral**—An inorganic substance found in the earth that is necessary in small quantities for the body to maintain a health. Examples: zinc, copper, iron.

**Obese**—More than 20% over the individual's ideal weight for their height and age or having a body mass index (BMI) of 30 or greater.

**Vitamin**—A nutrient that the body needs in small amounts to remain healthy but that the body cannot manufacture for itself and must acquire through diet.

burn calories. There are strict guidelines that a dieter is expected to follow closely to achieve the promised results.

The first step of the plan is body type identification using the plan's "Body Type Blueprinting System." The system requires that users answer 48 questions, and the answers to these questions determine the dieter's body type. This body type is based on the dieter's metabolism and the way that the dieter's body reacts to food. Each body type has a different six day plan, which dieters are then directed to follow.

The Six Day Body Makeover provides complete meal plans for each day of the six-day diet. These meals are low in calories and high in **protein** and complex **carbohydrates**. Thurmond says that lean protein and natural carbohydrates are slow-burning, clean foods that are good for keeping a high metabolism. During the diet, the dieter is required to eat frequently. The daily caloric intake is divided into five to six small meals spaced throughout the day. According to Thurmond, "you'll probably eat more than you've ever eaten on any other diet." Thurmond believes that eating frequently will help speed up a dieter's metabolism, so that he or she will burn calories more quickly. This method may also help to control appetite and allow a dieter to consume fewer calories throughout the day without feeling as hungry.

For both men and women, for all body types, the diet forbids the consumption of dairy products while on this diet. This means that dieters may not drink milk, eat cheese, butter, yogurt, ice cream, or other dairy products for six days. The diet requires that dieters drink 12 8-ounce glasses of **water** every day. Thurmond says that proper hydration is vital to weight loss and overall good health, and that drinking the amount of water prescribed by the diet will make a dieter's skin practically wrinkle-free.

Thurmond also says his diet can have other "anti-aging" effects as well. Eating the foods prescribed by the diet is supposed to make dieters look and feel younger. For example, fish is one of the foods included in the plan, and Thurmond claims this seafood can slow the aging process, as well as improve the look of the dieter's skin.

The exercise guidelines for the six-day plan emphasize low-intensity exercise done over extended periods. According to Thurmond, difficult or high-intensity exercises, such as running on an elliptical machine or kickboxing, should be avoided because they burn less fat. During the six days when dieters are on the plan, they are to do 60 minutes of low-intensity exercise for at least 5 of the days. Low-intensity exercises can include walking, bicycling, hiking, or even shopping, as long as these activities are done at an acceptable pace. The plan does not address strength training activities such as weight lifting, rowing, or stair climbing.

One of the exercises the plan requires is called "abdominal breathing." It is a special type of breathing that is supposed to help to oxygenate the body more effectively. Increased oxygenation is supposed to aid in weight loss, raise energy levels, and promote general fitness. The exercise is basically deep breathing through the abdomen, and can be done during exercise or throughout the day.

### Function

The Six Day Body Makeover is intended to cause rapid weight loss in a short time. It is a shortened version of Thurmond's Six Week Body Makeover. The six-day plan claims that dieters can lose 10 pounds and one dress or pants size during the 6 days if they follow the strict program exactly. Thurmond says this rapid weight loss can motivate people to change their lifestyle and engage in healthier activities after the diet as well.

### Benefits

The benefits of weight loss can be enormous. People who are obese are at higher risk of diabetes, heart disease, and many other diseases and disorders. Weight loss, if achieved at a moderate pace through a healthy diet and regular exercise, can reduce the risk of these and many other obesity-related diseases. However, losing water weight does not carry these same benefits. Some experts suggest that the Six Day Body Makeover

is likely to result in the loss of mostly water weight. There is a possible psychological benefit associated with this kind of rapid weight loss, but this is may be undone if the weight returns shortly after the diet is over.

### Precautions

The Six Day Body Makeover requires a diet that often is less than 1,200 calories per day. This calorie level is the minimum daily amount recommended by the American Heart Association for most people. Dieters should consult a medical practitioner to be sure that this diet and exercise regimen is safe for their body. Requirements of calories, fat, and nutrients can differ significantly from person to person, depending on gender, age, weight, and many other factors such as the presence of diseases or disorders. Pregnant or **breastfeeding** women should be especially cautious, because deficiencies of **vitamins** or **minerals** can have a significant negative impact on a baby. Exercising too strenuously can cause injury, and exercise should be started gradually to see how the body responds. Because the Six Day Body Makeover does not allow dieters to consume dairy products, a **calcium** supplement may be helpful in preventing calcium deficiency.

### Risks

With any diet or exercise plan there are some risks. It is often difficult to get enough of all necessary vitamins and minerals when eating a limited diet. Anyone beginning a diet may want to consult his or her physician about whether taking a vitamin or supplement can help reduce this risk.

Injuries can occur during exercise, such as strained or sprained muscles, and proper warm up and cool down procedures should be followed to minimize these risks. Dieters should begin exercising at a light or moderate intensity, and increase the intensity of their workout slowly over weeks or months to minimize the risk of serious injury. This gradual build-up of exercising is not possible with the Six Day Makeover. The abdominal breathing exercise does carry possible hyperventilation risk and dieters should consult a physician before beginning any exercise regime.

### Research and general acceptance

The Six Day Body Makeover has not been the subject of any significant scholarly research. Thurmond provides no scientific evidence for the ideas behind his diet. The Six Day Body Makeover requires that many dieters eat fewer than 1200 calories a day, which is a level of calorie intake considered unhealthy for most people, especially those who are spending a significant amount of time exercising. There is no significant scientific evidence to support the theory that frequent eating of low-calorie meals will speed up metabolism. For most people, moderately limiting caloric intake, eating a diet low in **fats** and carbohydrates and high in vegetable and plant products is generally accepted as a healthy diet. Most experts believe that a diet of this length cannot cause any significant loss of fat but depends mostly on dieters losing water weight.

As of 2007, the United States Centers for Disease Control recommended a minimum of 30 minutes a day of light to moderate exercise for healthy adults. Following Thurmond's exercise program would meet, and in most cases exceed, this minimum recommendation. However, most fitness experts recommend strength training exercise in addition to aerobic exercise for maintaining proper fitness. No evidence has shown "abdominal breathing" to be a safe or effective exercise.

Another strict guideline for the Six Day Body Makeover involves drinking a lot of water. Dieters are told to drink 12 8-ounce glasses of water every day during this diet. This requirement generally follows guidelines for good hydration.

### QUESTIONS TO ASK THE DOCTOR

- Can I maintain proper health on a diet with fewer than 1200 calories per day?
- Is this diet the best diet to meet my goals?
- At what level of intensity is it appropriate for me to begin exercising?
- Does diet or exercise pose any special risk for me that I should be aware of?
- Would a multivitamin or other dietary supplement be appropriate for me if I were to begin this diet?
- Is this diet appropriate for my entire family?
- Is it safe for me to follow this diet over a longer period of time than six days?
- Are there any signs or symptoms that might indicate a problem while on this diet?

### Resources

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**ORGANIZATIONS**

American Dietetic Association. 120 South Riverside Plaza, Suite 2000, Chicago, Illinois 60606-6995. Telephone: (800) 877-1600. Website: <http://www.eatright.org>

**OTHER**

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Tish Davidson

# Six week body makeover

## Definition

The Six Week Body Makeover is designed for rapid weight loss over a relatively short period of time. It promises that dieters can lose thirty pounds and completely reshape their body in only six weeks by following a plan of dieting and exercise designed to boost **metabolism**.

## Origins

The Six Week Body Makeover was designed by Michael Thurmond. Thurmond says that growing up Los Angeles, California, he was an obese child who ate for emotional reasons. His parents put him on a medically supervised diet when he was eleven, but although the diet even included special drugs, he still did not lose weight. When he was a teenager he began lifting weights and became more muscular, but he still could not lose the fat he wanted to.

Thurmond joined the military in his late teens and met a bodybuilder while stationed on an aircraft carrier on its way to Vietnam. By training with this bodybuilder he learned many of the techniques he provides in his exercise program. Thurmond says he also spent time experimenting with his diet and learning about food while assigned to kitchen duty.

Thurmond began competitive bodybuilding after he left the military. His own troubles with **obesity** and weight loss inspired him to begin helping others to lose weight and get in shape. He introduced the Six Week Body Makeover in San Francisco in 1985. It was the culmination of the work Thurmond had been doing with dieters on an individual basis for many years. It grew in popularity and Thurmond was on the cover of the *San Francisco Chronicle*, and he appeared on several television talk shows.

In 2000, Thurmond and Provida Life Sciences produced an infomercial to sell the Six Week Body Makeover on television. As of 2007, Thurmond also makes regular appearances on the Home Shopping Network, and his weight loss programs have been featured on the television show "Extreme Makeover," which airs on the ABC network.

## Description

The Six Week Body Makeover is intended to help people lose a large amount of weight rapidly. It uses a variety of diet and exercise techniques to raise metabolism and burn calories. The plan promises that the dieter's body will change shape drastically in only six weeks.

When dieters order the Six Week Body Makeover, they receive a package of dieting materials that includes the "Body Blueprinting System," a video guide to introduce the plan, an exercise video and "sculpting bands," a guide to dining out, a recipe guide and menu planner, and an audio cassette library. In addition to these materials, people who use this program receive 24-hour support through an on-line forum.

The first step of the plan is body type identification using the plan's Body Type Blueprinting System. This is done through a questionnaire consisting of 48 questions. Based on the answers to these questions dieters find out their body type. The body types are divided based on metabolism and how the body reacts to food. Once dieters determined their body type, they then use the provided guidelines to develop a meal plan based on body type. The planned meals are supposed to be low in calories and high in **protein** and complex **carbohydrates**. Individuals are supposed to eat small amounts frequently. Thurmond says that lean protein and natural carbohydrates are slow-burning, clean foods that are good for keeping metabolism high.

A prominent feature of the Six Week Body Makeover diet is the frequency of meals. Dieters make a plan that involves eating almost every time they are hungry. Thurmond says this makes the body think that plenty of food is available so it will stop storing fat. He also says that frequent eating speeds up a dieter's metabolism, so that he or she will burn calories more quickly. The number of calories consumed through out day is

## KEY TERMS

**Dietary supplement**—A product, such as a vitamin, mineral, herb, amino acid, or enzyme, that is intended to be consumed in addition to an individual's diet with the expectation that it will improve health.

**Mineral**—An inorganic substance found in the earth that is necessary in small quantities for the body to maintain a health. Examples: zinc, copper, iron.

**Obese**—More than 20% over the individual's ideal weight for their height and age or having a body mass index (BMI) of 30 or greater.

**Vitamin**—A nutrient that the body needs in small amounts to remain healthy but that the body cannot manufacture for itself and must acquire through diet.

low, but they are spread evenly between five or six meals. This may help dieters to not feel hungry while on the diet.

For both men and women, the diet requires that all body types consume no dairy products during the six weeks while on this diet. This means that dieters may not drink milk, eat cheese, butter, yogurt, or ice cream for weeks. Many of these foods contain high levels of **calcium**, which can be difficult to get from other sources. Dieters should consider taking calcium supplements during this diet to prevent calcium deficiency. The Six Week Body Makeover also eliminates **caffeine**, sugars, and fat from the diet.

The Six Week Body Makeover recommends that dieters drink large quantities of **water**. Dieters are told to drink 12 8-ounce glasses of water every day. Thurmond says that proper hydration is vital to many of the body's functions, and that water promotes weight loss and general good health. He also says that drinking the amount of water described in the diet will make a dieter's skin practically wrinkle-free.

Thurmond claims that the foods prescribed in his diet will make dieters look and feel younger. For example, fish are one of the foods included in the plan. Thurmond claims that fish can slow the aging process as well as improve the look of the dieter's skin.

The exercise guidelines for the Six Week Body Makeover emphasize specific exercises for problem areas. By targeting only the areas dieters want to change dieters can see better results while actually working out less. Many of these exercises use a band, which is included with the program package, for resistance. During the weeks when dieters are on the plan, they are to do 15–18 minutes of low-intensity exercise for at least 2 days per week. The plan does not place emphasis on strength training activities such as weight lifting, rowing, or stair climbing, or fat burning, aerobic exercises such as walking or bicycling.

### Function

The Six Week Body Makeover is intended to cause rapid weight loss over a fairly short period. If dieters follow the plan exactly, the Six Week Body Makeover claims that they can lose 30 lb (14 kg) 00d completely reshape their body in only six weeks. Thurmond claims that this rapid weight loss has an additional benefit of motivating people to change their lifestyle and engage in healthier activities after the diet has been completed. Established research has shown that, for most people, long-term, successful weight loss and healthy living depend on slowly establishing healthy lifestyle habits rather than making drastic short-term changes.

### Benefits

There can be enormous benefits both physically and psychologically for overweight people who lose excess weight. People who are obese are at higher risk of diabetes, heart disease, sleep apnea, and many other diseases and disorders. If achieved at a moderate pace through a healthy diet and regular exercise, weight loss can reduce the risk of obesity-related diseases. The weight loss promises made by the Six Week Body Makeover would not be considered moderately paced. There is a possible psychological benefit associated with rapid weight loss, but this is likely to be undone if much of the weight is regained shortly after the diet plan is over.

### Precautions

Rapid weight loss can be dangerous. Anyone thinking of beginning a new diet or exercise regimen should consult a medical practitioner. Requirements of calories, fat, and nutrients can differ significantly from person to person, depending on gender, age, weight, and many other factors such as the presence of any disease or conditions. Women who are pregnant or **breastfeeding** should be especially cautious because deficiencies of **vitamins** or **minerals** can have a significant negative impact on an infant. Exercising too strenuously can cause injury. Exercise should be started at light or moderate intensity and gradually increased.

## QUESTIONS TO ASK THE DOCTOR

- How much weight can I reasonably lose per week?
- Is this diet the best diet to meet my goals?
- Does diet or exercise pose any special risk for me that I should be aware of?
- Is it safe for me to cut out caffeine and dairy products from my diet?
- Would a multivitamin or other dietary supplement be appropriate for me if I were to begin this diet?
- Is this diet appropriate for my entire family?
- Is it safe for me to follow this diet over a long period of time?
- Are there any sign or symptoms that might indicate a problem while on this diet?

Because the Six Week Body Makeover eliminates dairy products from the diet, anyone considering the plan may also want to consider taking calcium supplements. Additionally, some dieters may experience certain negative side effects because the diet eliminates caffeine from the diet. People who, before beginning this diet, frequently consume caffeinated beverages such as colas or coffee may experience symptoms of caffeine withdrawal such as headache, fatigue, or muscle pain.

### Risks

There are risks associated with starting any new diet plan. Often, it is difficult to get enough of some vitamins and minerals when eating a limited diet. The Six Week Body Makeover does not allow dieters to consume dairy products, so dieters may want to consult their physician about whether taking a vitamin or supplement would help them reduce the risk of calcium or other vitamin and mineral deficiencies.

Injuries can occur during exercise, such as strained or sprained muscles. Proper warm-up and cool-down procedures should be followed to minimize these risks. To minimize the risk of serious injury, dieters should begin with light exercise and increase the intensity of their workout slowly over weeks or months.

### Research and general acceptance

The Six Week Body Makeover has not been the subject of any significant scholarly research. Thurmond provides no scientific evidence for the ideas behind his diet. There is no evidence to support the theory that frequent eating of low-calorie meals will speed up metabolism. For most people, moderately limiting caloric intake and eating a diet low in **fats** and carbohydrates and high in vegetable and plant products is generally accepted as a healthy diet.

As of 2007, the United States Center for Disease Control recommended a minimum of 30 minutes a day of light to moderate exercise for healthy adults. Following The Six Week Body Makeover's exercise program of 18 minutes of exercise twice per week would not meet this recommendation.

### Resources

#### BOOKS

Bijlefeld, Marjolijn and Sharon K. Zoumbaris. *Encyclopedia of Diet Fads*. Westport, CT: Greenwood Press, 2003.

Icon Health Publications. *Fad Diets: A Bibliography, Medical Dictionary, and Annotated Research Guide to Internet References*. San Diego, CA: Icon Health Publications, 2004.

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Willis, Alicia P. ed. *Diet Therapy Research Trends*. New York: Nova Science, 2007.

#### ORGANIZATIONS

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#### OTHER

*Six Week Body Makeover* 2007. <http://www.mybodymakeover.com> (April 12, 2007).

Tish Davidson, A.M.

# Slim4Life

### Definition

Slim4Life is a center-based approach to weight loss that helps dieters lose weight through regular sessions with personal diet counselors.

### Origins

It is not clear how the Slim4Life program originated. The website, <http://www.Slim4Life.com> says that they have been helping dieters for more

than 25 years. There are centers located in area of Denver, Colorado, Minneapolis Minnesota, and Kansas City, Missouri. The Web site offers minimal information about the program, but there is no Web-based support program. This means that dieters who do not live near the three cities in which the Slim4Life centers are located may have significant problems accessing this program.

## Description

The Slim4Life program is based around weight-loss centers. At these centers, dieters meet one-on-one with counselors to receive personalized advice, support, and guidance. The Slim4Life Web site says that its programs focus on supervision, individual counseling, and behavior education. The centers offer programs for men and women, as well as children ages 10 and up.

Dieters interested in participating in the Slim4Life program can set up a free 30-minute meeting and consultation with a diet counselor. If the dieter decides to enter the program, he or she will meet regularly with counselors, sometimes as many as two to three times a week. Dieters do not have specifically assigned personal counselors, and do not need to make appointments. Instead, dieters may come into the center whenever it is open (usually Monday through Saturday) and see counselors on a first-come first-served basis.

The focus of the Slim4Life program is the individual needs and preferences of the dieter. The program offers dietary guidance for people with diabetes, high blood pressure, and other health conditions, as well as for vegetarians and people with serious dietary limitations. The guidelines set by the dietary counselors allow dieters to make many choices about the foods that they eat each day. The program is designed to allow dieters to prepare foods from the supermarket, and does not require that prepackaged meals be purchased.

Slim4Life emphasizes a diet high in vegetables and fruits and includes whole grains and other healthy foods. Sugar and **fats** are limited, and some dieters have reported restrictions on dairy or other foods. In general, Slim4Life, tries to help dieters stay away from processed foods and eat healthier, fresh foods. The counselors can also provide dieters with suggestions for how to choose healthy foods when eating out.

Slim4Life tries not only to teach dieters about what foods to eat, but also how much to eat. An important part of helping dieters prepare to maintain their weight loss is through focusing on being able to visually identify what constitutes an appropriate portion size. Most Slim4Life diet plans restrict the dieter to fewer than 1500 calories per day. The specific number of calories determined for each dieter based on age, weight, activity level, and other factors.

### KEY TERMS

**Dietary supplement**—A product, such as a vitamin, mineral, herb, amino acid, or enzyme, that is intended to be consumed in addition to an individual's diet with the expectation that it will improve health.

**Mineral**—An inorganic substance found in the earth that is necessary in small quantities for the body to maintain a health. Examples: zinc, copper, iron.

**Obese**—More than 20% over the individual's ideal weight for their height and age or having a body mass index (BMI) of 30 or greater.

**Type 2 diabetes**—Sometime called adult-onset diabetes, this disease prevents the body from properly using glucose (sugar), but can often be controlled with diet and exercise.

**Vegetarian**—A diet containing no meat, but usually containing other animal products such as milk and eggs.

**Vitamin**—A nutrient that the body needs in small amounts to remain healthy but that the body cannot manufacture for itself and must acquire through diet.

Slim4Life does not provide specific exercise recommendations. Although the program does encourage its dieters to be active and promises increased energy levels, dieters do not receive a personalized exercise plan or guide. Although Slim4Life does not require the dieter to buy prepackaged meals, many dieters have reported being encouraged to buy various nutritional supplements such as bars and mixes, as well as various **dietary supplements**. The cost of the program varies, but may exceed $600.00, much of which may be due up front. This cost may be prohibitive for many dieters.

## Function

Slim4Life is intended to produce significant weight loss while helping dieters change their eating habits and behaviors to make the weight loss easier to maintain. Slim4Life says that dieters will lose weight at a rate of 3–5 pounds (1.3–2.3 kg) per week, and that the average weight lost per week is 3.3 lb (1.5 kg). The one-on-one counseling is intended to allow dieters to

get personalized feedback, help, and support. Although the main focus of the program is weight loss, the program is also intended to help dieters achieve overall better health and to have more energy.

## Benefits

There are many benefits to weight loss if it is achieved at a moderate pace through healthy eating and exercise. Most experts suggest that a moderate pace is about 1–2 pounds of weight loss per week. Slim4Life claims that its dieters lose weight at about twice this rate. **Obesity** is a risk factor for type 2 diabetes, **hypertension**, cardiovascular disease, and many other diseases and conditions. People who are the most obese are at the greatest risk, and are most likely to have severe symptoms if the diseases do develop. Weight loss can reduce the risk of obesity-related disease and can even reduce the severity of the symptoms in some cases when the diseases have already developed.

Many dieters may find that the one-on-one nature of the counseling at Slim4Life centers is extremely helpful. People who are shy or have feelings of embarrassment about their weight may find that it is easier to talk about weight and weight-related issues in an individual, instead of a group setting. Others, however, may find that they would prefer the social support system that group settings can bring. Individual counseling can also help by addressing the individual needs and preferences of dieters. Slim4Life says that it can work with a dieter's personal physician to address any dietary needs related to diseases and conditions, such as high blood pressure or diabetes. This possible integration of physician and weight-loss center may be beneficial for people with strict dietary requirements or concerns, and may help the dieter make the best dietary decisions for his or her particular needs.

## Precautions

Anyone thinking of beginning a new diet should consult a medical practitioner. Requirement of calories, **protein**, and other nutrients vary from person to person based on age, weight, sex, activity level, and many other factors. Pregnant or **breastfeeding** women should be especially cautious because what the mother eats can have significant impact on the health and well-being of the baby. When accepting advice about diet and other health concerns, dieters should not be afraid to enquire about the credentials of the person who is advising them. Trained and certified dieticians, nutritionists, registered nurses and others will usually be happy to share information about credentials, school, training, and certifications. Dieters should be cautious about accepting dietary or medical advice from people who are not trained and certified.

### QUESTIONS TO ASK THE DOCTOR

- Is this diet safe for me?
- Is this diet the best diet to meet my goals?
- Are any supplements, herbs, or multivitamins recommended to me necessary for me?
- Are any supplements, herbs, or multivitamins recommended to me likely to be safe for me?
- Do I have any dietary requirements this diet might not meet?
- Is this diet safe for my entire family?
- Is it safe for me to follow this diet over an extended period of time?
- Are there any sign or symptoms that might indicate a problem while on this diet?

## Risks

There are some risks to any diet, but there are generally more risks to a diet that is very restrictive of any type of food. This is because eating a limited variety of foods can make it difficult to get all of the **vitamins** and **minerals** required for good health. Dieters may want to talk to their doctor about whether a multivitamin or supplement would help reduce this risk. Dietary supplements have their own risks, even if they are herbal or "all nautral". Dieters should discuss any recommended herbs, vitamins, or supplements with their doctor or another health care professional to ensure that the supplements are necessary and safe before beginning to take them.

## Research and general acceptance

There have been no significant scientific studies investigating the effectiveness of the Slim4Life program. It is generally accepted that a moderately reduced calorie diet, when combined with exercise, is a good way for people to lose weight. Most experts recommend 1–2 pounds a week, less than Slim4Life promises, as a reasonable amount of weight to lose each week for most people.

The United States Department of Agriculture makes recommendations for healthy eating in its MyPyramid food guide. MyPyramid recommends the number of servings from each food group needed

daily by most people for good health. Any healthy diet plan should generally follow these guidelines. The MyPyramid recommendations can be found online at <http://www.MyPyramid.gov>. The dietary recommendations made by Slim4Life counselors are supposed to be individualized to a dieter's needs and likes, as well as to take into account any diseases or conditions present that might affect dietary needs. Therefore it is difficult to determine the nature of the overall dietary recommendations.

Some dieters have reported that dairy products were extremely limited or completely eliminated from their diet while following the plan set by their Slim4Life counselors. MyPyramid recommends that healthy adults consume the equivalent of 3 cups of dairy products each day for good health. Low or non-fat dairy products are strongly recommended. Any diet that does not meet this recommendation means that a dieter runs the risk of having a **calcium** deficiency, which can lead to **osteoporosis** and other negative outcomes.

The necessity and wisdom of taking pills, herbs, and other products intended to aid weight loss is a hotly debated subject. Many people believe that such dietary supplements can help dieters achieve weight loss more quickly and may have positive health benefits. Other people believe that such supplements are usually unnecessary, and that their effectiveness is questionable because of the lack of controlled, reproducible, studies indicating their effectiveness. Critics of such supplements also often argue that because dietary supplements are not regulated by the Food and Drug Administration (FDA) as strictly as prescription medicines, they may have negative side effects that are not yet documented.

An example of this kind of problem occurred involving supplements containing **ephedra**. On April 12, 2004 the FDA banned the sale of dietary supplements containing ephedra because of evidence that the compound increased a dieter's risk of cardiovascular complications and because of a lack of evidence of significant positive health benefits that could outweigh this risk. Before this time, many dieters all over the United States were taking supplements that contained ephedra without being aware of the possibility that it could cause extremely serious side effects.

The Centers for Disease Control recommended in 2007 that adults get 30 minutes of light to moderate exercise each day for good health. Slim4Life suggests that its participants be active, but it does not make specific exercise recommendations. Therefore it may be up to the dieter to ensure that he or she follows an exercise regimen that meets these minimum requirements. Regular exercise is a generally accepted part of a healthy weight-loss program. Studies have shown that diet and exercise are more effective at producing sustainable weight loss when done in combination than either diet or exercise is when done alone.

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#### ORGANIZATIONS

American Dietetic Association. 120 South Riverside Plaza, Suite 2000, Chicago, Illinois 60606-6995. Telephone: (800) 877-1600. Website: <http://www.eatright.org>

#### OTHER

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Tish Davidson, M.A.

# Slim-Fast

## Definition

Slim-Fast is the trademarked brand name of both a line of diet products and a weight-management program known as the Slim-Fast Optima Diet. Slim-Fast Foods, the manufacturer of the diet products, was acquired by Unilever N.V., a company headquartered in the United Kingdom, in 2000. Slim-Fast diet shakes are perhaps the best-known products in the line, which also includes snack bars, meal bars, smoothies, cookies, and powders for reconstituting by mixing with skimmed milk. The Slim-Fast diet plan is sometimes categorized together with other plans based on liquid diet products as a liquid meal replacement or LMR diet. LMR diet products themselves are a major business in the United States, reported in 2006 to account for over $1 billion in consumer purchases each year.

## Origins

Although Slim-Fast as a specific product was introduced only in the early 1980s, LMR products as a type have been on the North American market since 1960, when Mead Johnson, a company better known as the maker of such baby foods as Pablum and Dextri-Maltose, introduced a liquid diet formula called Metrecal. Metrecal was packaged in 8-oz cans, each containing 225 calories' worth of product. The dieter

**Slim-Fast®**

| Slim-Fast® product | Calories per serving | Protein (g) | Carbohydrates (g) | Fat (g) | Cholesterol (mg) | Sodium (mg) | Potassium (mg) | Fiber (g) |
|---|---|---|---|---|---|---|---|---|
| Original shake | 220 | 10 | 40 | 2.5–3 | 5 | 220 | 600 | 5 |
| Easy to digest shake | 180 | 10 | 24–26 | 5 | <5 | 200 | 500–600 | 3 |
| Low-carb shake | 180–190 | 20 | 4–6 | 9 | 15 | 220–260 | 550 | 2–4 |
| High-protein shake | 190 | 15 | 23–24 | 5 | 10 | 220 | 550–600 | 5 |
| Optima shake | 180–190 | 10 | 23–25 | 5–6 | 5 | 200 | 550–600 | 5 |
| Original nutrition bar | 140–150 | 5 | 19–20 | 5–6 | 5 | 65–80 | 115–160 | 2 |
| Low-carb nutrition bar | 120 | 1–6 | 14–21 | 4.5–5 | <5 | 70–80 | n/a | 1–2 |
| High-protein nutrition bar | 190–200 | 15 | 20–21 | 6–7 | 0–<5 | 200 | 270–300 | 2 |

Amounts vary with product flavors

*(Illustration by GGS Information Services/Thomson Gale.)*

was supposed to drink four cans daily, for a total of 900 calories.

Metrecal itself was a rebranded food product originally designed for hospital patients or other invalids unable to digest solid foods. Named Sustagen, the liquid meal substitute consisted of a mixture of skimmed-milk powder, corn oil, and soybean flour, supplemented with **vitamins** and **minerals**. When Mead Johnson found that patients reported feeling comfortably full on Sustagen and were satisfied with it as the equivalent of a meal, the company decided to rename their product Metrecal and market it as a diet food in 1960. In the mid-1960s the company introduced Metrecal cookies, nine of which made a meal, as an alternative to the liquid formula.

Metrecal lost much of its market in the 1980s as a result of competition from Slim-Fast, which cost much less and was aggressively promoted in the mass media. In addition to lower price, the original Slim-Fast products tasted much better to most consumers than Metrecal, which had a noticeably chalky taste—so much so, in fact, that one team of researchers in Philadelphia used Metrecal to test its effects on the concentration of gastric acid in patients diagnosed with peptic ulcer. In addition to a more pleasing taste, the original Slim-Fast formula came in a wider variety of flavors and included breakfast and lunch meal bars as well as the canned shakes and a powdered formula that the dieter could mix with skimmed milk at home.

In the early 2000s, Slim-Fast lost some of its popularity due to widespread interest in the **Atkins diet**. The company replaced the sugar in its original liquid formula with Splenda, an artificial sweetener, and added an additional gram of fat to the formula in order to help dieters feel fuller longer. Another modification to the earlier formula was increasing the proportion of nonsoluble dietary **fiber**, which also increases the dieter's feeling of satiety. The new line of Slim-Fast LMRs is called Slim-Fast Optima Hunger Control Shakes. In addition, the company has added several lines of specialized diet products for dieters with lactose intolerance, dieters interested in a low-carbohydrate weight-control plan, and dieters who prefer a **high-protein diet**. As of 2007, there are five separate lines of Slim-Fast diet products:

- Original Slim-Fast formula: available in ready-to-drink shakes, smoothies, meal bars, and powder.
- Slim-Fast Optima: available in shakes, meal bars, snack bars, and powder. Cookies, a new product, were added to this line in early 2007. Each serving of one of these products supplies about 8 grams or 14% of an average adult's daily protein requirements. The products come in a range of vanilla, chocolate, peanut butter, coffee, caramel, and strawberry flavors, as well as various combinations of these.
- Slim-Fast High Protein: available in shakes and meal bars. These products contain almost twice as much protein (15 grams per serving) as the Optima products.
- Slim-Fast Easy-to-Digest: available only in shakes, this formula is lactose- and gluten-free, for people who cannot digest products containing wheat or milk.
- Products for a Lower-Carb Diet: available as shakes or snack bars.

## Description

The Slim-Fast Optima diet plan is available in a 44-page booklet that can be downloaded from the Slim-Fast website. The booklet explains that the Slim-Fast plan is based on the dieter's present weight level rather than a one-size-fits-all calorie level or rigid menu. The dieter is instructed to substitute Slim-Fast products for two meals per day, use them for a between-meals snack if desired, drink plenty of

## KEY TERMS

**Gluten**—An elastic protein found in wheat and some other grains that gives cohesiveness to bread dough. Some people are allergic to gluten and cannot digest products containing wheat.

**Lactose**—A sugar found in milk and milk products that produces lactic acid during the process of fermentation. Some people cannot digest lactose and must avoid products containing milk.

**Liquid meal replacements (LMRs)**—A general term for prepackaged liquid shakes or milk-like drinks intended to substitute for one or more meals a day as part of a weight-loss regimen or source of nutrition for people who cannot eat solid foods.

**Metrecal**—The first product marketed as an LMR for weight reduction, introduced in 1960 by Mead Johnson.

**Satiety**—The quality or state of feeling comfortably full. It is sometimes used as a criterion for evaluating people's satisfaction with diets or diet products.

**Smoothie**—A blended beverage resembling a milkshake in texture but often made with nondairy ingredients. Slim-Fast and other diet product companies market prepackaged smoothies as well as shakes.

**water**, and add 30 minutes per day of physical exercise to their lifestyle. The dieter does not have to give up coffee, tea, or other low-calorie caffeinated beverages. The daily meal plans for the four specific weight levels (for adults) are as follows:

- Up to 140 pounds: 1 Slim-Fast Meal On-the-Go; 1 Slim-Fast Meal Combination; 1 Sensible Meal; 3 fruits or vegetables
- 141–170 pounds: 1 Slim-Fast Meal On-the-Go; 1 Slim-Fast Meal Combination; 1 Sensible Meal; 4 fruits or vegetables; 1 snack
- 171–200 pounds: 1 Slim-Fast Meal On-the-Go; 1 Slim-Fast Meal Combination; 1 Sensible Meal; 4 fruits or vegetables; 3 snacks
- Over 200 pounds: 1 Slim-Fast Meal On-the-Go; 1 Slim-Fast Meal Combination; 1 Sensible Meal; 5 fruits or vegetables; 4 snacks

Dieters can arrange these meals, snacks, and meal combinations in any daily pattern that works for them. The plan defines its various components as follows:

- Meal-On-the-Go: A Slim-Fast meal replacement liquid shake or solid bar (180–220 calories)
- Meal combination: A Slim-Fast meal replacement shake or bar combined with a serving of "a favorite healthy food" (180–220 calories plus 200 calories; healthy food suggestions include a cup of lentil soup; half a roast beef sandwich; cottage cheese plus a glass of tomato juice)
- Sensible meal: A nutritious meal of about 500 calories, accompanied by a large glass of water or other calorie-free beverage. The booklet contains a diagram of a plate divided into half with the top half divided in half again. The dieter is instructed to think of the bottom half of the plate as filled with vegetables and the two top segments as filled with lean protein and starch (preferably whole grains) respectively. Instead of counting calories or weighing and measuring, the person is advised to visualize portions as follows: 1 cup = the size of a softball; 1/2 cup = size of a light bulb or baseball; 3 ounces (meat or fish) = size of a deck of cards or the palm of the hand; 2 tablespoons = size of a ping-pong ball. Thus the sensible meal is about 1/4 protein food, 1/2 vegetables, and 1/4 whole grains.
- Fruits and vegetables: 1 serving = 1 medium-size whole fruit or 1/2 cup sliced; 1 cup raw vegetables or 1/2 cup cooked.
- Snacks: Slim-Fast snack bars (120 calories).

The Optima diet plan allows a daily calorie count of 1250–1400 calories for a 140-pound dieter and up to 1850 or 1900 for a dieter over 200 pounds.

### Function

The Slim-Fast Optima diet plan and the various Slim-Fast products are intended for weight reduction (at a moderate rate approved by most health professionals) or weight maintenance. Some people also use them as convenient and easily portable meal or snack substitutes when hiking or traveling.

### Benefits

The Slim-Fast diet plan has several advantages:

- It is intended to produce a safe, moderate weight loss of 1–2 pounds per week, which allows many people to use it without constant medical oversight or intervention. Some published studies indicate that this relative independence of medical monitoring is an attractive feature to many people.
- The Slim-Fast products can be readily purchased in most supermarkets; the dieter does not need to order them through a physician or other distributor. In addition, some of the products are available in single-serving

packages, which allows the dieter to sample a specific flavor without having to purchase six or more servings.

- The Optima diet plan is available in a downloadable booklet free of charge on the Internet; in addition, the various boxed Slim-Fast products have thumbnail summaries of the diet printed on the side or back panels. The Slim-Fast website contains much more general information about nutrition, weight reduction, and exercise than most product-related diet websites. It also contains a number of recipes for such popular foods as chili, barbecued chicken, steak with mushrooms, and meat loaf.
- The diet plan urges physical exercise as an important part of a healthy lifestyle as well as a weight reduction program.
- The Optima diet plan follows the U. S. Department of Agriculture's (USDA) 2005 dietary guidelines.
- It does not require calorie counting or careful measurement of portion size.
- The plan's recommendation of support groups and the use of a food diary are important psychological helps to many dieters. In addition, the company has weight loss advisors and professional dietitians available by telephone for dieters who need "help in setting realistic goals" or specific dietary advice.
- The diet plan's overall flexibility in regard to meal replacements and "sensible meals" makes it easier for dieters to tailor it to their own time schedules and meal preferences.
- The fact that both the diet plan and the products have been evaluated in clinical trials is reassuring to many dieters.

The Slim-Fast products themselves are tastier and appear to satisfy hunger better since their reformulation in 2004. Some studies indicate that the solid bars, however, are more effective in controlling feelings of hunger than the LMRs. An additional advantage is the relatively low cost of Slim-Fast products compared to other prepackaged diet formulas. In fact, Slim-Fast owed its initial success in competing with Metrecal in the 1980s to its considerably lower price. One clinical study of Slim-Fast focused specifically on its effectiveness in helping low-income dieters lose weight, on the grounds that the incidence of **obesity** is high in this population. The study found that the subjects were significantly more successful in losing weight (7% of body weight on average) with the Slim-Fast plan (2 meal replacements per day plus one sensible meal) than they were when they simply attended a nutrition clinic. However, cost will still be a barrier for some. Typical prices for Slim-Fast products as of early 2007 are $10 for a can of Optima powder (14 servings); $5.79 for a box of 6 snack bars; $4.29 for a box of 6 cookie bars; and $6.79 for a six-pack of Optima shakes.

## QUESTIONS TO ASK YOUR DOCTOR

- Would you recommend the Slim-Fast diet plan for a person of my age, sex, lifestyle, and medical history?
- Have you read any of the medical research about Slim-Fast?
- Have any of your other patients tried Slim-Fast, and if so, did they lose weight? Did they like the products?
- Do you know of anyone who has developed a new health problem or had a previous condition grow worse from using Slim-Fast?

Another benefit is that they are supplemented to provide sufficient intakes of minerals and vitamins when consumed in the recommended amounts so micronutrient deficiencies are unlikely to be a problem despite reduced energy/calorie intakes.

### Precautions

In general, women who are pregnant or nursing; adolescents under 18 years of age; and anyone who needs to lose more than 30 pounds and/or has not been physically active should consult their physician before starting any weight reduction program. The Slim-Fast plan and the products themselves, however, are less likely to cause health problems than very low calorie diets (VLCDs) or **fad diets**. The Slim-Fast plan booklet specifically warns against eating less than 1200 calories per day.

### Risks

No major health risks have been reported from use of either the diet plan or Slim-Fast products when used as directed.

### Research and general acceptance

A number of research studies using Slim-Fast have been published in academic medical journals since 1994, with studies of its predecessor Metrecal going back to 1960. Many of the studies of the 1960s measured such factors as the effect of these drinks on blood lipid levels or on chemical changes in human saliva, but several early studies directly addressed the question of the effectiveness of LMRs in weight reduction. Slim-Fast has been studied more often than most comparable diet products, having

been used in at least 30 clinical studies since 1982. It has also been used as the basis of a book-length weight-reduction program by Kelly Brownell, an internationally known expert on the psychology of weight reduction who now heads an obesity study center at Yale University. As of 2007, the National Institute of Health (NIH) is conducting a clinical trial of Slim-Fast and other LMRs in preventing or managing obesity in teenage males.

Published studies of Slim-Fast in the United Kingdom as well as the United States report that it enables dieters who follow the program to lose significant amounts of weight in a safe manner with minimal medical intervention or problematic side effects. One 2002 study of Slim-Fast products as part of weight reduction programs in four high-stress occupations (police, medical professionals, firefighters, and flight crew members) found that the products were effective in reducing weight and **body mass index** (BMI) even in overweight adults whose stressful jobs would encourage overeating. Four-fifths of the subjects completed the 12-week clinical study and were maintaining their weight loss at six-month follow-up, with the firefighters losing the most weight and the medical professionals the least.

The Slim-Fast plan and products were also shown in a study published in 2001 to be safe and effective for patients diagnosed with type 2 (adult-onset) diabetes. The study of the diabetic patients reported that the subjects showed improvements in blood sugar, insulin, hemoglobin A1c, and blood lipid levels as well as losing weight. The chief drawback reported, as with all weight reduction programs, is patient compliance. About 40% of the subjects in one clinical study of Slim-Fast were excluded from the second stage of the study because they were judged noncompliant. This rate, however, is no higher than the noncompliance rate of subjects on other weight reduction regimens.

Another problem with meal replacements is that they do not necessarily change eating habits so when they are stopped weight regain can occur.

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**ORGANIZATIONS**

North American Association for the Study of Obesity (NAASO), The Obesity Society. 8630 Fenton Street, Suite 918, Silver Spring, MD 20910. Telephone: (301) 563-6526. Website: http://www.naaso.org.

Rudd Center for Food Policy and Obesity. 309 Edwards Street, Yale University, New Haven, CT 06520-8369. Telephone: (203) 432-6700. Website: http://www.yaleuddcenter.org/home.aspx.

Slim-Fast Foods Company. Website: http://www.slim-fast.com/index.asp. Contact by e-mail only, at http://www.slim-fast.com/contact/comments.asp. Telephone line for nutritional advice: (800) 754-6327.

Rebecca J. Frey, Ph.D.

# Sodium

## Definition

Sodium is a mineral that exists in the body as the ion Na+. Sodium is acquired through diet, mainly in the form of salt (sodium chloride, NaCl). Regulating the amount of Na+ in the body is absolutely critical to life and health.

## Purpose

Sodium is possibly the most important mineral in the body. It plays a major role in controlling the distribution of fluids, maintaining blood pressure and blood volume, creating an electrical gradient that allows nerve transmission and muscle contraction to occur, maintaining the mechanisms that allow wastes to leave cells, and regulating the acidity (pH) of the blood. Many different organ working together, including the kidneys, endocrine glands, and brain, tightly control the level of Na+ in the body. Researchers estimate that between 20% and 40% of an adult's resting energy use goes toward regulating sodium. Sodium affects every cell in the body, and a major failure of sodium regulatory mechanisms means death.

## Description

In the body, sodium exists as electrolyte. **Electrolytes** are ions that form when salts dissolve in **water** or fluids. These ions have an electric charge. Positively charged ions are called cations. Negatively charged ions are called anions. Electrolytes are not evenly distributed within the body, and their uneven distribution allows many important metabolic reactions to occur. Sodium (Na+), potassium (K+), **calcium** (Ca 2+), **magnesium** (Mg 2+), chloride (Cl-), phosphate ($HPO_4$ 2-), bicarbonate ($HCO_3$-), and sulfate ($SO_4$ 2-) are important electrolytes in humans.

**Sodium**

| Age | Adequate Intake (mg) |
|---|---|
| Children 0–6 mos. | 120 |
| Children 7–12 mos. | 370 |
| Children 1–3 yrs. | 1,000 |
| Children 4–8 yrs. | 1,200 |
| Children 9–13 yrs. | 1,500 |
| Adolescents 14–18 yrs. | 1,500 |
| Adults 19–50 yrs. | 1,500 |
| Adults 51–70 yrs. | 1,300 |
| Adults 71≥ yrs. | 1,200 |
| Pregnant women | 1,500 |
| Breastfeeding women | 1,500 |

| Food | Sodium (mg) |
|---|---|
| Table salt, 1 tsp. | 2,300 |
| Dill pickle, 1 large | 1,731 |
| Chicken noodle soup, canned, 1 cup | 850–1,100 |
| Ham, 3 oz. | 1,000 |
| Sauerkraut, ½ cup | 780 |
| Pretzels, 1 oz. | 500 |
| Turkey breast, deli, 1 oz. | 335 |
| Soy sauce, 1 tsp. | 304 |
| Potato chips, 1 oz. | 165–185 |

mg = milligram

*(Illustration by GGS Information Services/Thomson Gale.)*

Na+ is ten times more concentrated in fluid outside cells (i.e. extracellular fluid and blood) than it is in fluid inside cells. This difference in concentration is maintained through the expenditure of cellular energy, and it is critical to many metabolic functions, including maintaining the proportion of water that exists inside and outside of cells. (See the entry on electrolytes for a more detailed explanation of how this occurs). When Na+ is too high or too low, it is almost never because an individual has eaten too much or too little salt. Instead, it is because organs such as the kidneys or endocrine glands that regulate the conservation or removal of sodium from the body have broken down.

### *Sodium requirements*

Researchers estimate that humans can remain healthy taking in only 500 mg of sodium daily. Salt is 40% sodium by weight, and 500 mg is slightly less than the amount of sodium found in 1/4 teaspoon of salt. Humans almost never take in too little salt; their health problems result from too much salt in the diet.

The United States Institute of Medicine (IOM) of the National Academy of Sciences has developed values called **Dietary Reference Intakes** (DRIs) for many **vitamins** and **minerals** including sodium. The DRIs

## KEY TERMS

**Diuretic**—a substance that removes water from the body by increasing urine production

**Ion**—an atom or molecule that has an electric charge. In the body ions are collectively referred to as electrolytes.

consist of three sets of numbers. The Recommended Dietary Allowance (RDA) defines the average daily amount of the nutrient needed to meet the health needs of 97–98% of the population. The Adequate Intake (AI) is an estimate set when there is not enough information to determine an RDA. The Tolerable Upper Intake Level (UL) is the average maximum amount that can be taken daily without risking negative side effects. The DRIs are calculated for children, adult men, adult women, pregnant women, and **breastfeeding** women.

The IOM has not set RDAs for sodium, but instead it has set AI levels for all age groups based on observed and experimental information about the amount of sodium needed to replace what is lost by a moderately active individual each day. Sodium is lost in both urine and sweat. IAs for sodium are measured in milligrams (mg). UL levels have not been set. However, the IOM recommends that adults limit their sodium intake to less than 2,400 mg per day, and the American Heart Association recommends an adult daily intake of 1,500–2,300 mg.

The following list gives the recommended daily AL levels of sodium for each age group.

- children birth–6 months: AI 120 mg
- children 7–12 months: AI 370 mg
- children 1–3 years: AI 1,000 mg
- children 4–8 years: AI 1,200 mg
- children 9–13 years: AI 1,500 mg
- adolescents 14–18 years: IA 1,500 mg
- adults age 19–50: AI 1,500 mg
- adults ages50–70 1,300 mg
- adults 71 years or older: AI 1,200 mg
- pregnant women: IA 1,500 mg
- breastfeeding women: AI 1,500 mg

### *Sources of sodium*

Many people think that the main source of salt in their diet is what they add to food when they are cooking or at the table while eating. In reality, more than three-quarters of the sodium in the average American's diet is added to food during processing. Another 12% is already naturally in the food. For example, 1 cup of low-fat milk contains 110 mg of sodium. About 6% of sodium in the diet is added as salt during cooking and another 5% from salting food while eating.

Although most sodium in diet comes from salt, other sources of sodium include preservatives and flavor enhancers added during processing. Sodium content is required to be listed on food labels of processed foods. Some common "hidden" sources of sodium include:

- baking soda
- baking powder
- disodium phosphate
- monosodium glutamate (MSG)
- sodium nitrate or sodium nitrite

Below are some common foods and their sodium content.

- table salt, 1 teaspoon:2,300 mg
- dill pickle, large: 1731 mg
- canned chicken noodle soup, 1 cup: 850–1,100 mg
- ham, 3 ounces: 1,000 mg
- sauerkraut, 1/2 cup: 780 mg
- pretzels, 1 ounce: 500 mg
- potato chips, 1 ounce: 165–185 mg
- soy sauce, 1 teaspoon: 304
- deli turkey breast, 1 ounce: 335 mg

Fresh fruits, vegetables, unsalted nuts, and rice, dried beans and peas are examples of foods that are low in sodium.

### *Sodium and health*

Too high a concentration of sodium in the blood causes a condition called hypernatremia. Too much sodium in the diet almost never causes Hypernatremia. Causes include excessive water loss (e.g. severe diarrhea), restricted water intake, untreated diabetes (causes water loss), kidney disease, and hormonal imbalances. Symptoms include signs of **dehydration** such as extreme thirst, dark urine, sunken eyes, fatigue, irregular heart beat, muscle twitching, seizures, and coma.

Too low a concentration of sodium in the blood causes hyponatremia. Hyponatremia is not usually a problem in healthy individuals, although it has been known to occur in endurance athletes such as ultra-marathoners. It is common in seriously ill individuals and can result from vomiting or diarrhea (extreme loss

of sodium), severe burns, taking certain drugs that cause the kidney to selectively excrete sodium, extreme overconsumption of water (water intoxication, a problem among the elderly with dementia), hormonal imbalances, kidney failure, and liver damage. Symptoms include nausea, vomiting, headache, tissue swelling (edema), confusion, mental disorientation, hallucinations, muscle trembling, seizures, and coma.

Hypernatremia and hyponatremia are at the extreme ends of sodium imbalance. However, high dietary intake of salt can cause less visible health damage in the form of high blood pressure (**hypertension**). Hypertension silently damages the heart, blood vessels, and kidney and increases the risk of stroke, heart attack, and kidney damage. A low-salt diet significantly lowers blood pressure in 30–60% of people with high blood pressure and a quarter to half of people with normal blood pressure. Some individuals are more sensitive to sodium than others. Those people who are most likely to see a rise in blood pressure with increased sodium intake include people who are obese, have type 2 diabetes, are elderly, female, and African American.

The American Heart Association recommends reducing sodium in the diet to between 1,500 mg and 2,300 mg daily. Below are some suggestions for cutting down on salt.

- Eat more fresh fruits and vegetables.
- Look for processed foods that say "no salt added"
- Limit or eliminate salty snacks such as chips and pretzels.
- Restrict the amount processed meats such as hot dogs, pepperoni, and deli meats.
- Avoid high salt canned soups; choose heart-healthy lower salt soups instead.
- Use spices instead of salt to give foods flavor.

## Precautions

People who are salt-sensitive may need to keep their salt intake at levels below the suggested daily amounts to control their blood pressure.

## Interactions

Certain drugs cause large amounts of sodium to be excreted by the kidneys and removed from the body in urine. **Diuretics** ("water pills") are among the best known of these drugs. Other types of drugs that may cause low sodium levels, especially in ill individuals, include non-steroidal anti-inflammatory drugs (NSAIDs) such as Advil, Motrin, and Aleve, opiates such as codeine and morphine, selective serotonin-reuptake inhibitors (SSRIs) such as Prozac or Paxil, and tricyclic antidepressants such as Elavil and Tofranil.

## Complications

Health concerns about sodium have been discussed above. Most problems related to high blood pressure are chronic, slow to develop disorders that do not cause serious complications until the second half of an individual's lifetime. Kidney failure, heart attack, and stroke are all complications of high blood pressure and potentially of high sodium intake.

## Parental concerns

Salt is an acquired taste. Parents can help their children control their salt intake and discourage the development of a craving for salt by substituting low-salt foods for high-salt foods.

## Resources

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### ORGANIZATIONS

American Heart Association. 7272 Greenville Avenue, Dallas, TX 75231. Telephone: (800) 242-8721. Website: <http://www.americanheart.org>

International Food Information Council. 1100 Connecticut Avenue, NW Suite 430, Washington, DC 20036. Telephone: 02-296-6540. Fax: 202-296-6547. Website: <http://ific.org>

Linus Pauling Institute. Oregon State University, 571 Weniger Hall, Corvallis, OR 97331-6512. Telephone: (541) 717-5075. Fax: (541) 737-5077. Website: <http://lpi.oregonstate.edu>

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Tish Davidson, A.M.

Somersizing *see* **Suzanne Somers weight loss plan**

# Sonoma diet

## Definition

The Sonoma diet is a plan for eating healthy, flavorful foods that emphasizes the enjoyment of eating, rather than restrictions. It draws from the culinary cultures of the Sonoma region of California and the Mediterranean coast of Europe. It is intended both to help people lose weight and to maintain a healthy lifestyle.

## Origins

Connie Guttersen, R.D., Ph.D., introduced the Sonoma diet in January of 2006 with her book *The Sonoma diet: Trimmer Waist, Better Health in Just 10 Days!*. Her background in nutrition and food science helped her develop the program, which also draws from the influence of the Mediterranean and South Beach diets.

Guttersen earned her undergraduate degree in nutrition and dietetics from Texas Christian University and her doctoral degree from Texas Women's University before returning to Texas Christian University to teach food science and food preparation from 1992 to 1993. She has been a visiting nutrition instructor at the Culinary Institute of America, a dietary consultant for numerous food producers including Kraft, Nestle, and Panera Bakery Café, and a guest speaker at food conferences such as the International Conference on **Mediterranean diet** in Palma de Mallorca, Spain. She is also a registered dietician.

### KEY TERMS

**Antioxidant**—A molecule that prevents oxidation. In the body antioxidants attach to other molecules called free radicals and prevent the free radicals from causing damage to cell walls, DNA, and other parts of the cell.

**Dietary supplement**—A product, such as a vitamin, mineral, herb, amino acid, or enzyme, that is intended to be consumed in addition to an individual's diet with the expectation that it will improve health.

**Mineral**—An inorganic substance found in the earth that is necessary in small quantities for the body to maintain a health. Examples: zinc, copper, iron.

**Vitamin**—A nutrient that the body needs in small amounts to remain healthy but that the body cannot manufacture for itself and must acquire through diet.

As of 2007, Guttersen lives in Napa Valley with her husband and two children. She continues to promote the Sonoma diet and lifestyle through lectures, books, and her website, and continues to develop new recipes. In December of 2006, she published *The Sonoma Diet Cookbook* which provides 150 new recipes to be used with the diet.

Guttersen says that the concept behind her diet is the lifestyle of people who live in the Sonoma Valley region of California. This area, approximately 30 miles north of San Francisco, is known for its over 250 award-winning wineries. Sonoma County is one of the most agriculturally productive counties in the United States. It is also a popular tourist destination, with many hotels, fine restaurants, golf courses, and spas. According to Guttersen, the people of the Sonoma Valley live a healthy lifestyle that emphasizes the enjoyment of food and wine.

## Description

The Sonoma diet is provided through two books and an online program available at www.sonomadiet.com. Like the Mediterranean diet and the **South Beach diet**, it emphasizes enjoyment of food. Dieters are guided to change the types and amount of food they eat. The plan involves three waves, or phases, that dieters are to go through. Each wave involves different guidelines and recipes for preparing meals. The diet also involves changing the types of plates and bowls a

dieter uses and also encourages moderate consumption of wine.

In addition to the general guidelines, the Sonoma diet encourages dieters to use 10 "power foods' as often as possible. Guttersen says that these power foods are not only low in calories and high in nutrients, but that they can prevent disease and illness. The foods are frequently included in the recipes, which she says are high in flavor, yet nutritious. These foods are prominent all throughout the recipes in the book and online program.

These 10 power foods are:

- Almonds
- Bell Peppers
- Blueberries
- Broccoli
- Grapes
- Olive Oil
- Spinach
- Strawberries
- Tomatoes
- Whole grains

Guttersen says olive oil and almonds are on the list because they are heart-healthy **fats**, and almonds can help dieters stave off hunger between meals. Whole grains are on the list because they contain **fiber**, and the fruits and vegetables are on the list because they contain **antioxidants**, both of which she says are important to weight loss.

The first wave of the Sonoma diet lasts ten days and is designed to redefine many eating habits that may have led dieters to gain weight previously. Foods that contain large amounts of sugar and processed flour are restricted. This is also the time when dieters are to replace their plates. During this wave, participants are told they will be doing the most changing and seeing the greatest results in terms of weight loss.

The second wave lasts longer than the first wave, and dieters are told that weight loss will begin to occur more slowly. Recipes for this wave are more varied and dieters learn more about enjoying meals slowly. Desserts are still not allowed during this wave, but wine is incorporated during this wave for those who wish. This is the main wave of the diet and it lasts until the dieter has reached his or her desired weight.

Once the dieter has lost the weight desired, the diet moves to the third and final wave. This wave maintains the habits learned during the previous stages of the diet and can last a lifetime. Infrequent desserts and snacks are allowed during this wave as well as wine. Dieters are also encouraged to design their own recipes during this wave, as long as the meals follow the diet guidelines.

Throughout all of the waves, limiting portion size is emphasized. The Sonoma diet relies on its "plate-and-bowl concept" which says that dieters should use 7-inch plates and 2-cup bowls for meals. Diagrams in the books and the online program demonstrate how these plates and bowls should be filled and what portions of each type of food should be included. Shrinking portion size and increasing overall enjoyment of the meal is key to the Sonoma diet. Guttersen says that one of the advantages of the Sonoma diet is that there are no difficult calculations to be made and that everything is intended to be simple.

Like several other diets modeled on European influences, the Sonoma diet does encourage the inclusion of wine in the diet, though it is not a necessary part of the program. A wine guide is included with the diet to help dieters choose a wine to pair with each meal. The diet is not particular about whether the wine be white, red, or sparkling.

## Function

The Sonoma diet is meant as a complete lifestyle change affecting the way a person eats, to promote weight loss. The first wave is intended for rapid weight loss, while the second wave of the diet emphasizes learning new patterns for eating. The third wave of the diet emphasizes dietary patterns and a variety of food types that can be eaten over the long term. It is intended not only to help people lose weight, but to maintain good health over the entire course of their lives.

## Benefits

Weight loss is generally quite beneficial for overweight individuals. Obese individuals are at greater risk for many diseases and other health problems, such as type II diabetes, heart disease, and **cancer**. A diet that lowers portion size and increases vegetable and fruit consumption, like the Sonoma Diet, is likely to aid weight loss.

## Precautions

Anyone thinking of beginning a new diet should consult a medical practitioner. Requirements of calories, fat, and nutrients can differ significantly from person to person, depending on gender, age, weight, and many other factors such as the presence of any disease or conditions. Pregnant or **breastfeeding** women should be especially cautious because deficiencies of **vitamins** or **minerals** can have a significant negative impact on a baby.

## QUESTIONS TO ASK THE DOCTOR

- Is this diet the best diet to meet my goals?
- Does this diet pose any special risk for me that I should be aware of?
- Would a multivitamin or other dietary supplement be appropriate for me if I were to begin this diet?
- Is it safe for me to consume moderate amounts of wine?
- Is this diet appropriate for my entire family?
- Is it safe for me to follow this diet over a long period of time?
- Are there any sign or symptoms that might indicate a problem while on this diet?

Special precaution should also be taken when consuming alcohol. The American Heart Association recommends that if a person decides to drink wine, that they do so in moderation, which means one to two drinks per day for men and only one drink per day for women. Consuming more than this can increase the risk of health problems such as high blood pressure, **obesity**, stroke, and breast cancer. Women who are pregnant or breast-feeding should not consume alcohol. Dieters should consult their physician before beginning to consume alcohol.

### Risks

With any diet plan there are some risks. It is often difficult to get enough of some vitamins and minerals when eating a limited diet. Anyone beginning a diet may want to consult their physician about whether taking a vitamin or supplement might help them reduce this risk. Consuming wine in greater than moderate amounts can also increase the risk of alcoholism, high blood pressure, obesity, stroke, breast cancer, as well as automobile and other fatal accidents. The American Heart Association recommends that if a person does not already drink alcohol, that they do not start.

### Research and general acceptance

Recently introduced, the Sonoma diet has not been the subject of any significant scholarly research. However, moderately limiting caloric intake, eating a diet low in fats and **carbohydrates** and high in vegetable and plant products is generally accepted as a healthy diet for most people. No direct comparison studies have conclusively demonstrated any health benefits associated with drinking wine.

Some critics have noted that the Sonoma diet is not likely to be practical for the average American because of the expense of the ingredients and the amount of cooking involved. Olive oil is generally more expensive than butter and fresh fruits and vegetables can cost more than frozen or canned ones. In addition, many dieters may find that they will need to spend more time preparing meals following the Sonoma diet than they did before they began the diet.

Although the Sonoma diet is intended as a lifestyle change, its main focus is food and wine. The plan does not include any specific recommendations for exercise. As of 2007, the U.S. Center for Disease Control recommended a minimum of 30 minutes a day of light to moderate exercise for healthy adults. Following the Sonoma diet without supplementing it with an exercise routine would not meet these recommendations.

### Resources


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American Dietetic Association. 120 South Riverside Plaza, Suite 2000, Chicago, Illinois 60606-6995. Telephone: (800) 877-1600. Website: <http://www.eatright.org>

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Helen Davidson

# South American diet

### Definition

South America is the fourth largest continent on the planet, making up 12% of the earth's surface. It contains twelve independent nations: Argentina, Brazil,

Bolivia, Chile, Colombia, Ecuador, Guyana, Paraguay, Peru, Suriname, Uruguay, and Venezuela. In addition, it contains three territories: The Falkland Islands (Great Britain), French Guiana (France), and the Galapagos Islands (Ecuador). The continent has a very diverse population. There are small pockets of native Indian groups and significant numbers of descendents of Spanish, Portuguese, Italian, German, West African, and East Indians settlers. There also are considerable numbers of Chinese and Japanese. Approximately 90 to 95% of South Americans are Roman Catholic.

## Description

### *Eating Habits and Meal Pattern*

South Americans typically eat three meals and one or two snacks daily. Milk is usually not consumed as a beverage but used in fruit-based drinks and coffee, and milk-based desserts are popular. Fruits, vegetables, and nuts are eaten in abundance. Cassava flour and meal are common in many areas.

Coffee is a major beverage throughout the continent, and South American countries now produce most of the coffee consumed worldwide; Brazil alone produces about a third of the world's coffee. Coffee usually is served concentrated, then diluted with evaporated milk or **water**. Coffee is consumed heavily in Argentina, Colombia, Ecuador, and Brazil, while tea is popular in Chile and Uruguay. Herbal teas are used as remedies throughout the continent.

Yerba maté (pronounced "yerba mahtay") is a caffeinated, tea-like beverage that is consumed for its "medicinal" properties. Its many health claims include energizing the body, stimulating mental alertness, strengthening the immune system, and aiding weight loss. Maté is consumed mainly in Argentina, Uruguay, Paraguay, and southern Brazil. It is brewed from the dried leaves and stemlets of the perennial tree *Ilex paraguarensis*. The *bombilla* is a special metal straw used to drink this brew.

Breakfast is normally a light meal with coffee or tea; bread with butter and jam; and sometimes fruit or fruit juice. Meat and cheese are usually eaten in Brazil and Chile. Lunch is traditionally a heavy meal, and it is followed by a *siesta* (nap), which helps one recover from both the food and the heat. The *siesta* is still common among many locals, but the tradition is disappearing from the business day. Appetizers such as fritters and turnovers may start the lunch meal, followed by grilled meat, rice, beans, cassava, and greens. Dinner is another heavy meal, and it often lasts several hours. Dinner usually begins late in the evening, sometimes as late as 9:00 P.M. Desserts are usually simple.

### KEY TERMS

**Calorie**—Unit of food energy.

**Heart disease**—Any disorder of the heart or its blood supply, including heart attack, atherosclerosis, and coronary artery disease.

**Hypertension**—High blood pressure.

**Malnutrition**—Chronic lack of sufficient nutrients to maintain health.

**Parasitic**—Feeding off another organism.

Typical desserts are fresh or canned fruits with cheese, a custard called *flan*, and a milk cake called *tres leches*. Snacks are readily available from street vendors and bakeries. Popular snacks include turnovers filled with spicy meats, seafood, and vegetables; hot dogs; and steak or meat sandwiches.

### *Traditional Cooking Methods and Food Habits*

The cuisine of South America varies from country to country and region to region. The cuisine tends to be a blend of cultural backgrounds, available foods, cooking styles, and the foods of colonial Europeans. Some regions have a largely maize-based diet (often spiced with chili peppers), while other regions have a rice-based diet. Grilled meats are popular. Traditionally, sides of beef, hogs, lamb, and goats are grilled slowly for hours. Another cooking method is to steam foods in a pit oven. For example, in Peru, a *pachamanca* typically includes a young pig or goat (as well as chicken, guinea pig, tamales, potatoes, and corn) cooked under layers of hot stones, leaves, and herbs. Clambakes are popular in Chile.

Quinoa, the seed of the *Chenopodium*, or goosefoot plant, has been a staple food of millions of native inhabitants, but production declined for centuries after the Spanish conquest in the 1500s. It is used as a grain and substituted for grains because of its cooking characteristics. It became a minor crop due to its decline, and at times it has been grown only by peasants in remote areas for local consumption. In Peru, Chile and Bolivia, quinoa is widely cultivated for its nutritious seeds, which are used in creating various soups and bread, and it is also fermented with millet to make a beer-like beverage. A sweetened concoction of quinoa is used medicinally.

### *Regional Food Habits*

Brazil. Brazilian foods have a heavy Portuguese, African, and native influence. The Portuguese contributed

dried salt cod, *linguiça* (Portuguese sausage), spicy meat stews, and desserts such as corn and rice pudding. Africans brought to the area as slaves contributed okra, *dendê* oil (palm oil), and peppercorns. The national dish of Brazil is *feijoda completa*, which consists of black beans cooked with smoked meats and sausages served with rice, sliced oranges, boiled greens, and hot sauce. It is topped with toasted cassava meal. Coffee, rum, and beer are common beverages.

Colombia and Venezuela. Venezuelan and Colombian foods have Spanish influences. Many foods are cooked or served with olive oil, cheese, parsley, cilantro, garlic, and onions. Hot chile peppers are served on the side of most dishes. Local fruits and vegetables are abundant, and tropical fruits are often dried to make fruit leather. In Columbia, chicken stew and *sancocho* (a meat stew with starchy vegetables) are popular. One of the most unusual specialties of Columbia is *hormiga*, a dish made from fire ants. Toasted ants are also a favorite treat during the insect season in June. In Venezuela, cornmeal bread, or *arepa*, is a staple food. *Arepa* is cooked on a griddle and is sometimes stuffed with meat or cheese before it is fried. *Pabellón caraqueño* is also popular. This dish consists of flank steak served on rice with black beans, topped with fried eggs and garnished with plantain chips. Coffee, rum, and beer are common beverages.

Argentina, Chile, Bolivia, Uruguay, and Paraguay. These southern countries are major beef producers. Argentineans eat more beef per capita than any other country in the world. Argentina is famous for *asados*, restaurants specializing in barbecued and grilled meat dishes—mainly beef, but also pork, lamb, and chicken. The national dish of Argentina is *matambre*, which is herb-seasoned flank steak rolled around a filling of spinach, whole hard-boiled eggs, and whole or sliced carrots. It is then tied with a string and either poached in broth or baked.

Citizens of these southern states enjoy hearty soups and stews daily. Fish soups and stews are popular in coastal Chile. Stews in Argentina often combine meats, vegetables, and fruits. The soups of Paraguay have heavy European influences and include *bori-bori*, which is a beef soup with cornmeal and cheese dumplings. Pizza, pasta, and meat dishes are popular in these countries. Wines from the midlands of Chile are considered to be some of the best produced on the continent.

Guyana, French Guiana, and Suriname. Guyanese cuisine is a culinary hybrid with African, East Indian, Portuguese, and Chinese influences. Guyanese usually cook three full meals every day. Rice and *roti* (flat bread) are staples at lunch and dinner. Fresh cow's milk may be part of the morning or evening meal. A favorite dish is *pepper pot*, a stew made with bitter cassava juice, meat, hot pepper, and seasoning. Other popular foods are *roti* and curry, garlic pork, cassava bread, chow mein, and "cook up," a one-pot meal that can include any favorite meats or vegetables. Popular homemade drinks are *mauby*, made from the bark of a tree, *sorrel*, made from a leafy vegetable used in salads, and ginger beer. People in French Guiana enjoy an international cuisine, as well as Chinese, Vietnamese, and Indonesian dishes. Imported soft drinks and alcoholic drinks are popular but expensive. Suriname's cuisine has heavy Javanese, Dutch, Creole, Chinese, and Hindustani influences. Beer and rum are popular alcoholic drinks.

Peru and Ecuador. The cuisine of Peru and Ecuador is typically divided into the highland foods of the Andes and the lowland dishes of the tropical coastal regions. The cuisine in the mountain areas is the most unique in South America, preserving many dishes of the Inca Indians. Potatoes are eaten at nearly every meal, including snacks. More than 200 varieties of potato can be found in the Lake Titicaca region. They range in color from purple to blue, and from yellow to brown. Size and texture vary as well—some are as small as nuts, while others can be as large as oranges. The foods of Peru and Ecuador feature an abundant use of chile peppers. *Salsa de ají*, a mixture of chopped chile, onion, and salt is served at most meals. The coastal region is famous for its *cerviches*, a method for preparing seafood in which the main ingredient is marinated in lime or sour orange.

## Risks

### *Nutritional Status*

A high percentage of South Americans live in extreme poverty. Parasitic infection, protein-calorie malnutrition, iron-deficiency anemia, **iodine** deficiency, and vitamin-A deficiency are common nutritional problems in the rural and urban areas in many South American countries. Heart disease, **hypertension**, and **obesity** are also on the rise.

## Precautions

The natural beauty of South America makes it a popular ecotourism destination. Food-borne and water-borne diseases are the number one cause of illness in travelers. Visitors are therefore advised to wash their hands often and to drink only bottled or boiled water or carbonated drinks in cans or bottles. They also should avoid tap water, fountain drinks, and ice cubes.

### Resources

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#### OTHER

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Delores C. S. James

**South Beach Diet products**

| Product | Calories per serving |
|---|---|
| Frozen entrees | 360 or less |
| Frozen pizzas | 330–350 |
| Wrap sandwich kits | 250 or less |
| Frozen breakfast wraps | 200 or less |
| Cereal | 110–210 |
| Cereal bars | 140 |
| Meal replacement bars | 210–220 |
| Snack bars | 100 |
| Cookies and crackers | 100 or less |
| Dressings | 50–70 |
| Steak sauce | 5 |

*(Illustration by GGS Information Services/Thomson Gale.)*

# South Beach diet

## Definition

The South Beach diet is a popular short-term fast-weight-loss diet combined with a long-term calorie-controlled diet. The South Beach diet sets itself apart form several other popular diets by differentiating between "good carbohydrates" and "bad carbohydrates" based on their glycemic index and "good fats" and "bad fats" based on their degree of saturation.

## Origins

Arthur Agatston, the originator of the South Beach diet, is a medical doctor. He is has a cardiology practice that emphasizes disease prevention and is an associate professor at the University of Miami Miller School of Medicine in Miami, Florida.

Agatston first developed the South Beach diet for his obese cardiac patients who were having trouble staying on the standard **low-fat diet** recommended by the American Heart Association. After these patients had success with his diet, Agatston began promoting the diet to the public, shifting the emphasis away from heart health and toward rapid weight loss. In 2003, he published *The South Beach Diet: The Delicious, Doctor-designed, Foolproof Plan for Fast and Healthy Weight Loss.*. Television coverage boosted the popularity of the South Beach diet, and in 2004, Kraft Foods entered into an agreement that allowed it to use the South Beach diet name on line of foods that were nutritionally compatible with the diet.

## Description

The South Beach diet is part a fast-weight-loss diet and part a calorie-restricted, portion-controlled long-term diet. Agatston says that the South Beach diet is neither a low-carbohydrate nor a low-fat diet, although it restricts both these food groups.

The South Beach diet is divided into three phases. Phase 1 lasts the first two weeks of the diet. During this time Agatston claims that people can lose up to 13 lb (6 kg) on the diet, and that they will lose mainly belly fat. Phase 1 eliminates all **carbohydrates**, both "good" and "bad" from the diet. This means that the dieter eats no bread, pasta, rice, potatoes, fruit, milk, baked goods, ice cream, alcohol, anything containing sugar or flour, and any fatty meats. Portion size is not strictly controlled. The total calorie intake during phase 1 is usually between 1,200 and 1,400 per day spread out over three meals and two or three snacks.

Some permitted foods in phase 1 include:

- meat: veal and lean cuts of beef; low fat or fat-free lunchmeat
- poultry: skinless chicken and turkey breast and Cornish hen
- seafood: any kind of fish or shellfish
- cheese: many types, low-fat and fat-free only, excluding any type of cream cheese except dairy-free cream cheese substitute
- tofu: soft low-fat or calorie-reduced types only
- eggs: whole eggs, egg substitute, egg whites
- vegetables: non-starchy such as salad vegetables excluding tomato, artichokes, asparagus, broccoli, cauliflower, collard greens, eggplant, mushrooms, turnips, and zucchini
- fats: olive oil and canola oil
- spices: any seasoning that does not contain sugar
- artificial sweetened treats and artificial sweetener: sugar free only and limited in amount

After two weeks on the very rigorous phase 1 diet, the dieter is permitted to start adding back a limited amount of "good" carbohydrates that have a low

## KEY TERMS

**B-complex vitamins**—A group of water-soluble vitamins that often work together in the body. These include thiamine ($B_1$), riboflavin ($B_2$), niacin ($B_3$), pantothenic acid ($B_5$), pyridoxine ($B_6$), biotin ($B_7$ or vitamin H), folate/folic acid ($B_9$), and cobalamin ($B_{12}$).

**Dietary fiber**—Also known as roughage or bulk. Insoluble fiber moves through the digestive system almost undigested and gives bulk to stools. Soluble fiber dissolves in water and helps keep stools soft.

**Glucose**—A simple sugar that results from the breakdown of carbohydrates. Glucose circulates in the blood and is the main source of energy for the body.

**Glycemic index**—A ranking from 1–100 of how much carbohydrate-containing foods raise blood sugar levels within two hours after being eaten. Foods with a glycemic index of 50 or lower are considered "good."

**Glycogen**—A compound made when the level of glucose (sugar) in the blood is too high. Glycogen is stored in the liver and muscles for release when blood glucose levels are too low.

**Hormone**—A chemical messenger that is produced by one type of cell and travels through the bloodstream to change the metabolism of a different type of cell.

**Insulin**—A hormone made by the pancreas that controls blood glucose (sugar) levels by moving excess glucose into muscle, liver, and other cells for storage.

**Insulin resistance**—A condition in which the cells of the body do not respond to insulin to the degree they normally should. This creates a condition in which more and more insulin must be used to control glucose levels in the blood.

glycemic index. Weight loss in phase 2 is expected to be 1–2 lb (0.6–1 kg) per week. The permitted foods are the same as in phase one with the addition of whole grain cereals, oatmeal, whole-grain bread and whole-grain pasta, barley, low-fat milk, nuts, beans, starchy vegetables, wine, and most fruits. These items are portion-controlled. Watermelon, bananas, raisins, white bread, baked goods, and sugary foods are not allowed. Saturated **fats** and *trans* fats (animal fats, butter, cream, fatty meats, some solid-type margarines) are forbidden.

Dieters stay on the phase 2 diet until they have achieved their desired weight, at which time they move to phase 3, a maintenance phase. The list of restricted foods in phase 3 is quite similar to phase 2. Foods made with white flour and high levels of refined sugar are sill off limits. Individuals who get off track and violate the diet in phases 2 or 3 are instructed to go back to phase 1 and start again.

For a fee, the South Beach diet Website offers tools to help the dieter stay on track. These include as recipes, advice from dietitians, food journals, and meal planners. Daily moderate aerobic exercise and strength training are recommended for people on this diet.

### Function

The South Beach diet is based on the idea that to lose weight, the dieter must replace "bad carbohydrates" with "good carbohydrates" and "bad fats" and "good fats". Good carbohydrates are defined as those that have a low glycemic index, while bad carbohydrates have a high glycemic index in order to reduce insulin resistance.

The glycemic index compares foods on a scale of 1–100 for how much they increase the level of glucose (sugar) in the blood. When people eat, the level of glucose in their blood increases. How much it increases depends on the foods they eat. "Good" foods with a low glycemic index (below 50) raise blood sugar less than "bad" foods with a high glycemic index (above 50 or above 65 depending on which authority is consulted). When blood glucose levels increase, cells in the pancreas release the hormone insulin. This signals cells in the body to convert some of the glucose into a compound called glycogen that is stored in the liver and muscles and some into fat, stored in fat cells. When blood glucose levels go down, different cells in the pancreas release the hormone glucagon. Glucagon signals cells in the liver and muscle to release glycogen, which is converted back into glucose and is burned by the body. If glucose levels continue to be low, fat is also burned for energy.

When people eat foods that contain a lot of sugar or carbohydrates that break down rapidly in the body into glucose (the "bad" carbohydrates of the South Beach diet) their insulin level spikes. When people eat carbohydrates that break down more slowly into glucose (the "good" carbohydrates of the South Beach diet), their insulin level rises more slowly and does not reach as high a level. When someone eats too many sugary foods too often, they secrete a lot of insulin, and eventually cells in the body may become insulin resistant. Insulin resistance is a factor in type 2 diabetes. By removing all carbohydrates from the diet for two weeks, the South Beach diet is claims to eliminate insulin resistance.

The fats that the South Beach diet calls "good" fats are unsaturated fats. Unsaturated refers to a certain part of their chemical structure. "Bad" fats are saturated fats that have a slightly different chemical structure. Saturated fats are thought to promote atherosclerosis or "hardening of the arteries." In this condition, cholesterol and other materials build up on the walls of the arteries (blood vessels) blocking blood flow and causing the arteries to lose their elasticity.

## Benefits

According to Agatston, benefits of the South Beach diet include:

- rapid weight loss followed by lifetime weight control
- loss of weight from the belly region
- fewer hunger pangs because of slower carbohydrate breakdown and frequent small meals
- a heart-healthy approach to fats
- decreased risk of developing cardiovascular disease.

## Precautions

The South Beach diet is unlikely to meet the nutritional needs of growing children.

## Risks

Many nutritionists question whether this diet provides long-term balanced nutrition. Specific objections are that limiting milk may lead to **calcium** deficiency and limiting and whole grains even in the maintenance phase may lead to deficiencies in dietary **fiber** and B-complex **vitamins**. The initial rapid weight loss also is of concern to many weight-loss experts.

## Research and general acceptance

The South Beach diet is relatively new, and no independent scholarly research has been done on it. A few small studies that report decreased blood fats and similar heart-protective effects have been sponsored by organizations with South Beach diet affiliations. However, nutritionists are in general agreement that replacing saturated fats with unsaturated fats in the diet is a healthy choice. Nutritionists also agree that whole grains tend to be more healthful than refined grains, but express concern about the small quantity of whole grains permitted on the diet.?

Of more concern is the rapid weight loss of phase 1. This rate of weight loss is not in line with generally accepted practices for healthy dieting and long-term weight control, and **obesity** experts find highly questionable the claim that dieters can control weight loss so that they preferentially lose belly fat. The public has enthusiastically embraced the South Beach Diet, but how many people can stay on this fairly rigorous diet and maintain long term weight-loss remains to be seen.

## QUESTIONS TO ASK THE DOCTOR

- What are my current risk factors for heart disease?
- Is there another diet that might better meet my health goals
- Do I have any health conditions that might be worsened by the restrictions of this diet?
- Can my whole family follow this diet?
- Are there any sign or symptoms that might indicate a problem while on this diet?
- Do you have any experience with the long-term success of this diet?
- If one of your family members wanted to go on a diet, would you recommend this one?

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Southeast Asian diet *see* **Asian diet**
Southern African diet *see* **African diet**

# Soy

## Definition

Soy is a general term for products made from soybeans. Soy products include tofu, tempeh, soy oil, natto, miso, soymilk, and edamame.

## Purpose

Soybeans are the most widely used beans in the world. They are a good source of **protein** and contain no cholesterol. Soy is a complete protein. It contains all the essential amino acids that the body needs, and in this sense is different from most vegetable proteins and nutritionally equivalent to animal protein. Unlike animal protein, soy contains no cholesterol and is low in saturated fat. Soy is a heart-healthy choice and has met the United States Food and Drug Administration (FDA) requirements to make that claim on certain soy product labels.

Soy is believed to promote cardiovascular health, but many other health claims are also made for soy. Some of these claims remain unsubstantiated, are under review, or are in dispute. These health claims include that soy:

- promotes weight loss
- helps prevent certain cancers
- helps slow bone loss

## Description

Soybeans are the seeds of the plant *Glycine max*. This plant is native to China, where it has been cultivated for about 13,000 years. From China, soybeans gradually spread to other areas of Asia, where soy is now a major part of the diet of millions of people. Intense breeding has produced a number of variants (cultivars) of the original plant, some which have a higher oil content and others which have a higher protein content. Soybeans may be green, yellow, brown, or black in color, but all variations are edible.

**Soy**

| Soy sources | Amount of soy protein |
|---|---|
| 1 cup (8 ounces) soymilk | 10 grams |
| 4 ounces tofu | 13 grams |
| 1 soy burger | 10–12 grams |
| 1 soy protein bar | 14–gram average |
| 1 soy sausage link | 6 grams |
| ¼ cup roasted soy nuts | 18–20 grams |

*(Illustration by GGS Information Services/Thomson Gale.)*

Soybeans were introduced into the United States in the mid-1700s. George Washington Carver (1864–1943) experimented with them before he began his famous nutrition research on peanuts. Today the United States is the world's largest grower of soybeans, producing almost 84 million metric tons in 2005. However, most soybeans grown in the United States are pressed to make soy oil. After the oil is extracted the beans are ground into meal and used as livestock feed.

Soy products are part of the daily diet of many Asians. However, soy has only become readily available in mainstream food stores in the United States since the 1990s. In 1979 the first major company, Vitasoy, introduced soymilk into the United States. Since then, the number of soy products has soared. The Soyfoods Association of North America estimates that sales of soy products in the United States increased from $300 million in 1992 to $3.9 billion in 2004, and sales were expected to continue rising through the end of the decade. Between 2000 and 2006, 2,500 new food products containing soy were introduced to the U.S. market.

### *Nutritional value of soy*

Soy is a nutrient dense food, and it is the least expensive source of complete dietary protein. It is relatively low in calories and contains no cholesterol, saturated fat, or trans–fat. One cup (172 g) of cooked soybeans has about 300 calories and contains the following nutrients. The percentage DV is the percent of the daily requirement that 1 cup of cooked soybeans meets for the average adult.

## KEY TERMS

**Amino acid**—Molecules that are the basic building blocks of proteins.

**Dietary fiber**—Also known as roughage or bulk. Insoluble fiber moves through the digestive system almost undigested and gives bulk to stools. Soluble fiber dissolves in water and helps keep stools soft.

**Dietary supplement**—A product, such as a vitamin, mineral, herb, amino acid, or enzyme, that is intended to be consumed in addition to an individual's diet with the expectation that it will improve health.

**Essential amino acid**—An amino acid that is necessary for health but that cannot be made by the body and must be acquired through diet.

**Fatty acids**—Complex molecules found in fats and oils. Essential fatty acids are fatty acids that the body needs but cannot synthesize. Essential fatty acids are made by plants and must be present in the diet to maintain health.

- protein 28.6 g: 57% DV
- dietary fiber: 10.3 g; 41% DV
- total fat: 15.4 g; calories from fat 139
- molybdenum: 129 mcg; 172% DV
- manganese: 1.4 mg; 71% DV
- iron: 8.8 mg: 49% DV
- vitamin K: 33.0 mg; 41.3 57% DV
- omega-3 fatty acids: 1.03; 41.3 57% DV
- magnesium: 147.9 mg: 37% DV
- vitamin $B_2$ (riboflavin): 0.5 mg: 29 % DV
- potassium: 886 mg: 25% DV

### *Soy foods*

Fresh soybeans can be cooked briefly in boiling **water** and then eaten, or they can be toasted. Dried beans need to be soaked overnight before cooking and require relatively long cooking times. Soybeans can also be pressed to make soy oil, but the most familiar soy products come from soybeans that are processed in various ways that give them a variety of textures and make them easier to use in cooking. These include:

- Tofu: Tofu is made of cooked, pureed, soybeans that are processed and then formed into soft slabs that must be kept wet until they are used. The slabs are produced with consistencies that vary from very soft or "silken" to firm or extra firm. Other tofu variations include reduced-calorie tofu and tofu fortified with calcium. Tofu is used to make cheese substitutes, blended into smoothies, and stir fried. It has a bland taste and tends to take on the flavors of the foods it is cooked with.
- Tempeh: Tempeh is made from partially cooked soybeans that are then fermented in a controlled environment. Tempeh is chewier than tofu and is often used as a meat substitute.
- Miso: Miso is a fermented soybean paste that is used as a soup base and for seasoning.
- Soymilk: Soymilk is a soy beverage made by grinding soybeans and mixing them with water. Soymilk can be flavored (chocolate, vanilla, coffee) or sold plain. Some soymilk is fortified with calcium. People who are lactose intolerant often use soymilk as a substitute for cow's milk, and soy is also used in formula for infants who cannot tolerate lactose.
- Soy flour: Soy flour comes from roasted, ground soybeans. It can be used in baked goods, cereals, and many other foods. Soy flour contains more moisture than wheat flour. People with celiac disease who cannot tolerate wheat, barley, or rye products can use soy flour.
- Textured soy protein: This product is used most often as a meat substitute in processed foods such as soy burgers or home-cooked foods such as meatloaf. It is made by defatting soyflour, which is then compressed into clumps and dehydrated.

### *The role of soy in health*

In October 1999, the FDA decided that well-designed, well-controlled, repeatable research studies had shown that soy was a heart healthy food that could help decrease the risk of developing cardiovascular disease. Since that date, the FDA has allowed products that contained at least 6.25 g of soy per serving to make the following health claim on their label: "25 grams of soy protein a day, as part of a diet low in saturated fat and cholesterol, may reduce the risk of heart disease." This endorsement applies only to complete soy products, not to soy-based **dietary supplements**. The American Heart Association (AHA) also gave its approval to soy as a food that can reduce the risk of heart disease.

Soy is a food that can also help in weight loss because it can be used as a substitute for higher calorie meat. If soy is substituted for meat on a regular basis, the reduction in calories can be significant. For example:

- A soy burger patty has about 100 fewer calories than an equivalent-sized beef burger patty.
- Two links of soy breakfast sausage have about 90 fewer calories than two links of pork breakfast sausage.
- A soy veggie dog has about 70 fewer calories than a beef hotdog.

Some health controversies about soy center on compounds called isoflavones that are found in abundance in soybeans. These compounds have a chemical structure similar to the female hormone estrogen. Several health effects, both positive and negative, have been attributed to isoflavones. In 2006, the American Heart Association concluded that isoflavones are not the cause of the cholesterol-lowering, heart-healthy properties in soy and that dietary supplements containing soy-derived isoflavones do not have the same cardiovascular benefits as whole soy.

Another claim is that isoflavones can improve bone health in women. This claim appears plausible because of the chemical similarity between isoflavones and estrogen. Estrogen is known to increase the amount of **calcium** deposited in bones, and the lack of estrogen in post-menopausal women is linked to decreasing estrogen levels. However plausible the connection between bone health and isoflavones in soy may be, studies have produced inconclusive results. As of 2007, any effect that soy may have on bone health appears to be weak. Also, because of their estrogen-like structure, isoflavones from soy have been touted as a dietary supplement that will help prevent symptoms of menopause such as hot flashes. A committee of the AHA that investigated isoflavones found that they had no effect on hot flashes.

A far bigger health question concerns the relationship between isoflavones and **cancer**. The AHA committee found that despite claims that soy isoflavone supplements can treat and prevent breast, endometrial, and uterine cancer in women and **prostate** cancer in men, there was no evidence to suggest that this treatment was safe or effective. On the other hand, there was also no evidence that, as some experts have suggested, soy increases the chance of post-menopausal women developing breast cancer. A large number of federally sponsored clinical trials are underway to investigate these and other effects of isoflavones and soy.

## Precautions

Although soy is often thought of as a benign food, some people are allergic to soy.

## Interactions

Soy contains compounds called goitrogens. Goitrogens interfere with the body's ability to absorb or use **iodine**. The goitrogens in soy should not cause problems with iodine uptake in healthy people, but people with thyroid deficiencies should discuss with their healthcare provider whether they should limit soy in their diet.

## Complications

No complications are expected from eating soy products.

## Parental concerns

One long-term study is underway to investigate the effect of increased concentrations of isoflavones in the blood of children who drink soy formula. The study plans to look for potential effects across a period of about 20 years, so no results are available yet.

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American Soybean Association. 12125 Woodcrest Executive Drive, Suite 100, St. Louis, MO 63141. Telephone: (800) 688-7692. Website: <http://www.amsoy.org>
Soyfoods Association of North America. 1723 U Street NW, Washington, DC 20009. Telephone: (202) 986-5600. <http://www.soyfoods.org>
United Soybean Board. 424 Second Avenue West, Seattle, WA 98119. Telephone: (800) TALK-SOY (825-5769). Website: <http://www.talksoy.com> and <http://www.soyfoods.com>

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# Spirulina

## Definition

Spirulina is a genus of blue-green algae used as a nutritional supplement. Blue-green algae, microscopic fresh-water organisms, are also known as cyanobacteria. Their color is derived from the green pigment of chlorophyll, and the blue from a protein called phycocyanin. The species most commonly recommended for use as a nutritional supplement are *Spirulina maxima* and *Spirulina platensis*. These occur naturally in warm, alkaline, salty, brackish lakes, but are also commonly grown by aquaculture and harvested for commercial use. Spirulina contains many nutrients, including B vitamins, beta-carotene, gamma-linolenic acid, iron, calcium, magnesium, manganese, potassium, selenium, zinc, bioflavonoids, and protein.

Spirulina is composed of about 65% protein. These proteins are complete, in that they contain all essential amino acids, plus some nonessential ones. In that regard, it is similar to animal protein, but does not contain saturated fats, or residues of hormones or antibiotics that are in some meats. Since spirulina is normally taken in small amounts, the quantity of dietary protein supplied for the average, reasonably well-nourished person would not be significant. However, it is a good source of trace minerals, some vitamins, bioflavonoids, and other phytochemicals. It also has high digestibility and bioavailability of nutrients.

## Purpose

Spirulina has been used as a source of protein and nutrients, particularly beta-carotene, by the World Health Organization (WHO) to feed malnourished Indian children. The program resulted in a decrease of a type of blindness that results from inadequate dietary vitamin A. The dose used in this year-long study was 1 gram per day.

## Description

There is a high vitamin $B_{12}$ content in spirulina. For this reason, it has often been recommended as a supplemental source of the vitamin for vegans and other strict vegetarians, who are unlikely to have adequate dietary vitamin $B_{12}$. Unfortunately, spirulina is not an effective source of the usable vitamin. Much of the vitamin $B_{12}$ is in the form of analogs that are unusable for humans, and may even block the active forms of vitamin $B_{12}$ consumed from other sources.

**Spirulina tablets of blue green algae.** *(Sheila Terry/Photo Researchers, Inc. Reproduced by permission.)*

Gamma linolenic acid (GLA) is present in significant amounts in a small percent of spirulina species. This essential fatty acid can be used in the body to form products that are anti-inflammatory and anti-proliferative. It is potentially useful for individuals with rheumatoid arthritis and diabetic neuropathy. It may also play a role in lowering plasma triglycerides and increasing HDL cholesterol.

Spirulina is a good source of available iron and zinc. A study done in rats found that those consuming spirulina had equivalent or better absorption than those given a ferrous sulfate iron supplement. A small human study of iron-deficient women had good response to iron supplementation with spirulina, although the amounts used were large (4 grams after each meal). Similarly, a study of zinc deficient children found that those taking spirulina had a superior response to those taking zinc sulfate, and had fewer side effects.

In addition to serving as a source of nutrients itself, spirulina has been used in the manufacture of fermented dairy products to guarantee the survival of the bacteria used to ferment the milk.

A stronger immune system is one claim made by boosters of spirulina. A number of animal studies appear to support stimulation of both antibody and cellular types of immunity. Immune function was markedly improved in children living in the areas surrounding Chernobyl. The measurements were

## KEY TERMS

**Algae (sing., alga)**—Any of numerous groups of one-celled organisms containing chlorophyll. Spirulina is a blue-green alga.

**Neuropathy**—Condition of weakness affecting the nervous system.

**Phenylalanine**—An essential amino acid that cannot be consumed by people with a metabolic disease known as phenylketonuria (PKU).

**Phycocyanin**—A protein found in spirulina that gives the alga its blue color. Phycocyanin has anti-inflammatory effects.

**Phytochemicals**—Nutritional substances contained in plants.

made after 45 days, with each child consuming 5 grams of spirulina per day.

The growth of beneficial intestinal bacteria, including lactobacillus, appears to be stimulated by the consumption of spirulina, based on a study of rats who consumed it as 5% of their diets. The absorption of vitamin $B_1$ was also improved.

Cholesterol, serum lipids, and low-density lipoprotein (LDL) cholesterol may be lowered by a small, but significant, percentage by the consumption of spirulina. One study group of men with high cholesterol took 4.2 grams per day of spirulina, and experienced a 4.5% decrease in cholesterol after one month.

Spirulina is also thought to be helpful in the treatment of oral leukoplakia, a precancerous condition that is manifested as white patches in the mouth. It improves experimentally induced oral carcinoma (cancer in the mouth) as supported by studies done in animals.

The evidence for the ability of spirulina to promote weight loss is not very strong. Results have been mixed, and the phenylalanine content does not appear to be an appetite suppressant as is sometimes claimed. Whether other components of the algae are beneficial for weight loss is uncertain and unproven.

Spirulina has been recommended to alleviate the symptoms of attention-deficit hyperactivity disorder (ADHD), although evidence for this indication is lacking.

Spirulina has the highest concentration of evercetin found in a natural source. It is a potent antioxidant and anti-inflammatory compound that can be used to alleviate the symptoms of sinusitis and asthma. Phycocyanin, the protein that gives spirulina its blue color, has also been shown to relieve inflammation associated with arthritis and various allergies.

## Preparations

One recommended dose is 3–5 grams per day, but the amount used may depend on the product, the individual using it, and the indication for which it is being taken.

Spirulina supplements are available in powder, flake, capsule, and tablet form. These supplements are generally expensive, and have a strong flavor that many people find unpleasant.

## Precautions

Because spirulina is sensitive to pollutants in sea water, it can be used as a biosensor to measure the toxicity of a given body of water. Unfortunately, this sensitivity means that spirulina grown in water contaminated with heavy metals can concentrate these toxic substances. Mercury levels are of particular concern. Infectious organisms may also be present and contaminate harvested algae, so reputable sources of spirulina should be used.

Phenylketonurics should avoid spirulina due to the potential content of phenylalanine.

A number of varieties of blue-green algae, including *Aphanizomenon flos-quae* and *Anabaena*, have been found to sometimes produce toxins that may affect the nervous system or the liver.

The potential side effects of spirulina are primarily gastrointestinal, and include diarrhea, nausea, and vomiting. Allergic reactions occur rarely, but can cause insomnia and anxiety.

## Interactions

No interactions of spirulina with foods, conventional medications, or herbs have been documented as of 2007.

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# Sports nutrition

## Definition

Sports nutrition is a broad interdisciplinary field that involves dietitians, biochemists, exercise physiologists, cell and molecular biologists, and occasionally psychotherapists. It has both a basic science aspect that includes such concerns as understanding the body's use of nutrients during athletic competition and the need for nutritional supplements among athletes; and an application aspect, which is concerned with the use of proper nutrition and **dietary supplements** to enhance an athlete's performance. The psychological or psychiatric dimension of sports nutrition is concerned with eating and other mental disorders related to nutrition among athletes.

Some persons who specialize in the field of sports nutrition are registered dietitians (RDs) who have pursued a master's or other advanced degree in the field of exercise physiology; the American Dietetic Association (ADA) has a dietetic practice group or DPG for sports nutritionists called Sports, Cardiovascular, and Wellness Nutritionists (SCAN), which has its own website and telephone contact number. Most academic sports nutritionists, however, hold doctoral degrees in the field of exercise physiology and often specialize in working with athletes in one particular type of sport, such as baseball or swimming. Although sports nutrition can be applied to almost any form of athletic training or physical activity—including yoga, tai chi, martial arts, and professional dance—professional sports nutritionists do most of their work with team sports, endurance sports (cycling, long-distance running, triathlon training, etc.) or sports involving weight training (wrestling, weight-lifting, some forms of bodybuilding). Some nutritionists also work one-on-one with individual athletes.

**Fluid intake guidelines**

| Time in reference to event | Ounces of fluid (oz.) |
|---|---|
| 24 hours before | Drink freely |
| 2 hours before | 8–16 oz. |
| 15 minutes before | 8–16 oz. |
| During | 4 to 8 oz. every 15–20 minutes |
| After | Drink freely |

**Recommended fluid intake for athletes.** *(Illustration by GGS Information Services/Thomson Gale.)*

## Purpose

Sports nutrition has several purposes:

- To prepare athletes before performance or training.
- To maintain an acceptable level of performance during competition or training.
- To help the athlete's body recover after training or athletic competition.
- To provide sound information about healthy dietary practices and use of supplements.
- To monitor athletes for signs of eating disorders, doping, supplement abuse, or other unhealthful nutritional practices.
- To provide specialized nutritional advice to athletes following vegetarian, vegan, or other special diets.
- To monitor the special nutritional needs of persons with disabilities who participate in athletic activities and programs.

## Description

### *Hydration*

Hydration, or maintaining a proper level of fluid in the body, is an important aspect of sports nutrition because of the loss of **water** and **sodium** through sweating during athletic activity. **Dehydration** results in loss of muscle strength, difficulty concentrating, irritability, and headache. An adult who has lost more than 8% of

## KEY TERMS

**Amenorrhea**—Absence or suppression of normal menstrual periods in women of childbearing age, usually defined as three to six missed periods.

**Bioelectrical impedance analysis (BIA)**—A technique for evaluating body composition by passing a small amount of electrical current through the body and measuring the resistance of different types of tissue.

**Body dysmorphic disorder**—A mental disorder involving extreme preoccupation with some feature of one's appearance. Excessive time spent in physical exercise, often involving bodybuilding or weight-lifting practices, is a common symptom of the disorder in adolescents.

**Creatine**—An organic acid formed and stored in the body that supplies energy to muscle cells. Meat and fish are good dietary sources of creatine.

**Doping**—The use of performance-enhancing drugs in sports competition, including anabolic steroids and other substances banned by most international sports organizations. The English word is thought to come from the Dutch *dop*, which was the name of an alcoholic beverage drunk by Zulu warriors before a battle.

**Electrolyte**—Any of several chemicals dissolved in blood and other body fluids that are capable of conducting an electric current. The most important electrolytes in humans and other animals are sodium, potassium, calcium, magnesium, chloride, phosphate, and hydrogen carbonate.

**Ergogenic**—Enhancing physical performance, particularly during athletic activity.

**Erythropoetin (EPO)**—A hormone produced by the kidneys that regulates the production of red blood cells. It is sometimes used by athletes to increase the oxygen-carrying capacity of their blood.

**Female athlete triad**—A group of three disorders often found together in female athletes, consisting of disordered eating, amenorrhea, and osteoporosis.

**Glycogen**—A complex sugar that is the primary form in which glucose is stored in muscle and liver tissue.

**Purging**—A behavior associated with eating disorders that includes self-induced vomiting and abuse of laxatives as well as diuretics.

**Sports drink**—Any beverage containing carbohydrates, electrolytes, and other nutrients as well as water, intended to help athletes rehydrate after training or competition. Sports drinks are isotonic, which means that they contain the same proportion of water, electrolytes, and carbohydrates as the human body.

**Vegan**—A vegetarian who excludes all animal products from the diet, including those that can be obtained without killing the animal. Vegans are also known as strict vegetarians.

**Water intoxication**—A potentially fatal condition that occurs when an athlete loses sodium from the body through perspiration and drinks a large quantity of water in a short period of time without replacing the sodium. Long-distance runners are particularly susceptible to water intoxication.

initial body weight through sweating without replacing the lost fluid is at risk of heat cramps, heat exhaustion, and heat stroke. Moreover, dehydration may be progressive in athletes who do not replace fluid loss overnight; the greater the loss of body fluid, the longer it takes to rehydrate the body. When dehydration has taken place over 2 to 3 days, it will take a minimum of 48 hours to replace the fluids in body tissues. The health risks of dehydration are a major reason why abuse of **diuretics** is dangerous in athletes.

People vary in their sweating rates; therefore, health professionals must evaluate athletes on an individual basis to determine how much fluid is needed after exercise or training. The most common way to measure this need is to weigh the athlete before and after exercise; the amount of weight lost should be replaced with an equal amount of fluid before the next workout. The usual rule of thumb is 1 pint of fluid containing **carbohydrates** and **electrolytes** for each pound of weight loss.

Good hydration is more effectively maintained by consuming sports drinks or other beverages that contain salt and carbohydrates than by drinking plain water. Sports drinks are isotonic; that is, they contain the same proportion of electrolytes and carbohydrates to fluid as the human body. After exercise, the body requires carbohydrates to replace the glycogen (a complex sugar) stored in muscle tissue and the liver. Glycogen is an important source of reserve energy for muscles; long-distance runners who deplete their stores of glycogen may experience fatigue to the point of being unable to move. In addition to the risk

of glycogen depletion, drinking only water places the athlete at risk of water intoxication, a potentially fatal condition in which the sodium lost through sweat is not replaced and is followed by the rapid intake of a large quantity of water. The resulting electrolyte imbalance affects the brain and central nervous system. Blood plasma sodium levels below 100 mmol/L (2.3g/L) frequently result in swelling of the brain tissue, coma, and even death.

### *Assessment of energy needs*

Athletes usually require a higher level of calorie intake than nonathletes, although the amount varies depending on the athlete's sex, age, height, weight, body composition, stage of growth, level of fitness, and the intensity, frequency, and duration of physical exercise. An appropriate diet for most athletes consists of a minimum of 2000 calories per day; 55–65% should come from carbohydrates, 15–20% from **protein**, and 20–30% from **fats**.

### *Assessment of weight and body composition*

The use of the **body mass index** (BMI) to evaluate athletes' weight is not recommended because many have a high proportion of muscle tissue to fat and may therefore be considered "overweight" by standard body mass charts. A better reference guide is to check whether the athlete falls between the 25th and the 75th percentile of weight for height by age, measured according to the National Center for Health Statistics (NCHS) guidelines.

Well-nourished athletes should have a lean muscle mass above the 25th percentile, although the ideal ratio of lean muscle to body fat has not yet been established for any sport. Male athletes, however, should not have less than 7% body fat. There are several methods for estimating the proportion of body fat on an athlete's body: underwater weighing (equipment is expensive and limited in availability); skinfold measurements taken by high-precision calipers on three to five sites on the right side of the body (the right side is always used even if the athlete is left-handed); bioelectrical impedance analysis or BIA (a technique that measures body composition by passing a small electrical current through the body and measuring the resistance of various body tissues, as lean muscle contains a higher proportion of water than fat); and computerized calipers.

### *Strategies for weight change*

It is important for athletes in any age group needing or desiring to lose or gain weight to be properly supervised by a nutritionist as well as a physician, because unhealthful dietary practices can lead to long-term mental as well as physical disorders. The American Academy of Pediatrics (AAP) makes the following recommendations for weight change in young athletes:

- The dietary program should be started in a timely fashion to permit gradual weight gain or loss over a reasonable time period.
- The program should allow a gain or loss of no more than 1.5% of body weight per week.
- It should be designed to permit weight lost to be fat and weight gained to be muscle.
- It should be accompanied by appropriate strength and conditioning training.
- The diet should provide an appropriate balance of carbohydrates, protein, and fats.

**WEIGHT LOSS.** Weight loss programs are sometimes recommended for athletes in weight-sensitive sports, most often wrestling or judo for boys and figure skating, gymnastics, long-distance running, rowing, and swimming for girls. Unfortunately, many young people go too far in adopting unhealthful eating or exercise patterns in order to keep their weight down. Because of this tendency, the AAP states that children younger than the ninth grade should not be put on weight-loss regimens to improve athletic performance.

Restricting food intake is the most common method of weight loss among athletes, but a large percentage of young athletes also engage in purging (self-induced vomiting plus abuse of laxatives and diuretics), fasting, or the use of stimulants, wet suits, sauna baths, or compulsive exercising. Some studies have shown that as many as 11% of wrestlers meet the criteria for **eating disorders**, and 15% of swimmers.

Unhealthful weight loss practices are dangerous because much of the weight lost will be lean muscle rather than fat, which can affect athletic performance. Girls who develop eating disorders or body dysmorphic disorder are at risk of developing the so-called female athlete triad, which consists of disordered eating, cessation of menstrual periods (amenorrhea), and **osteoporosis** or brittle bones. A common symptom associated with the triad is an unusually high number of stress fractures during the girl's athletic career. The triad, which was first described in 1993, may have long-term consequences for a woman's health. Female athletes in their freshman year of college are reported to be at increased risk of developing the triad, particularly if it is their first experience of living away from home or they are having academic difficulties.

**WEIGHT GAIN.** Athletes in sports requiring strength or weight lifting (football, rugby, basketball, bodybuilding) may try to gain weight in order to build the body's muscle mass. Inappropriate methods, however, will lead to gaining fat rather than muscle, putting the athlete at risk in midlife for high blood pressure, cardiovascular disease, and type 2 diabetes. It is important for athletes to recognize the genetic limitations related to their body build, as persons who are naturally slender cannot add as much muscle tissue to their bodies as those who are built more solidly.

The safest way to gain weight and build muscle tissue is to consume 1.5 to 1.75 grams of protein per kilogram of body weight per day and participate in strength training. The most effective form of strength training is thought to be multiple sets of weight lifting with a relatively high number of repetitions (8–15) per set. Athletes should avoid the use of dietary supplements in building muscle, particularly steroids, which have been shown to be harmful to health in both males and females.

### *Use of ergogenic aids*

**Ergogenic aids** are drugs or dietary supplements taken to improve athletic performance or endurance by providing energy or adding muscle tissue. The most common ergogenic aids used are anabolic or androgenic steroids (male sex hormones), steroid precursors, growth hormone, creatine (an organic acid stored in the body that supplies energy to muscle cells), and **ephedra**, an herb sometimes called by its Chinese name, ma huang. Some ergogenic aids are illegal to use in competition.

Medical and nutritional professionals are concerned about the use of ergogenic aids among young athletes for two major reasons. The first is that these drugs and supplements, first used by adult athletes in the 1980s, are now being used by children as young as 10 or 12. The second is that creatine and anabolic steroids may produce long-term adverse effects on the body even though they do produce gains in body mass and strength, while steroid precursors, ephedra, and growth hormone pose a good many risks to health without any proof that they enhance athletic performance.

The ADA's position statement says, "Nutritional ergogenic aids should be used with caution, and only after careful evaluation of the product for safety, efficacy, potency, and whether or not it is a banned or illegal substance."

## Precautions

Consultation with a qualified sports nutritionist is a sound practice for anyone in any age group who is heavily involved in any sport, whether amateur or professional. Specific precautions:

- Consultation should be individualized, as people vary in their energy needs, sweating rates, body composition, etc.
- Any female athlete who stops having menstrual periods (amenorrhea) or has only scanty periods (oligomenorrhea) should be evaluated for disordered eating.
- Nutritional advice should be given by a registered dietitian or physician, not by a coach. The American Academy of Pediatrics notes that "most coaches do not have an adequate nutritional background to counsel an athlete about weight loss."
- Coaches should avoid discussing weight loss with young athletes (with the exception of sports requiring weigh-ins before competition), as such discussions often lead to the athlete's use of harmful weight-loss practices.
- Athletes should not take any dietary supplement without consulting their physician and a nutritionist.
- Athletes following a vegetarian or vegan diet require special attention to protein and iron intake.

## Interactions

Some herbal dietary supplements used by athletes are known to interact with prescription medications, such as **St. John's wort** (*Hypericum perforatum*) and ephedra (*Ephedra sinica*), often used to promote weight loss; valerian (*Valeriana officinalis*), often taken for insomnia; cayenne (*Capsicum frutescens*), **ginseng** (*Panax ginseng*), and cordyceps (*Cordyceps sinensis*), taken internally to increase carbohydrate **metabolism** or increase endurance; and Siberian ginseng (*Eleutherococcus senticosus*) and **echinacea** (*Echinacea angustifolia*), taken to boost the immune system. Some of these drug interactions are potentially serious. Athletes should not take any herbal remedies, including those marketed specifically to athletes, without consulting their physician and a nutritionist.

## Complications

There are no complications associated with nutritional monitoring of athletes by qualified professionals. The AAP, however, recommends seeking nutritional information and assessment from dietetics professionals, not from team coaches or personal trainers.

## Parental concerns

Parental concerns about sports nutrition are age-related in most cases. Parents of young children should be aware of the ways in which children's hydration requirements during athletic activity differ from those of adults. Parents of adolescents who are heavily involved in sports should acquaint themselves with the signs of unhealthy eating or dieting practices in high school or college-age athletes.

### *Hydration needs in young children*

Young children are more susceptible to heat-related illnesses than adults during exercise for several reasons: they produce more heat relative to body mass for the same intensity of exercise; they have a lower cardiac output than adults at any exercise level; they have a higher threshold for rise in body temperature before beginning to sweat; and they have a lower sweating capacity than adults, which makes it harder for them to dissipate body heat through evaporation. Children also have a less efficient thirst mechanism than adults, which means that they are more likely to become dehydrated during exercise because they do not feel as intense a need to drink liquids. Orange- or grape-flavored drinks are often a good way to rehydrate children because they will increase their fluid intake when the beverage is flavored.

### *Female athlete triad*

Parents should watch for indications of the female athlete triad, such as missing three or more menstrual periods; an unusual number of stress fractures; an excessive amount of time spent exercising or working out; a tendency to wear baggy or concealing clothes even in warm weather; and a restricted eating pattern. Adopting a vegetarian or vegan diet may indicate the onset of an eating disorder in a female athlete.

### *Doping*

Doping in sports refers to the practice of taking anabolic steroids and other substances forbidden by international sports organizations. The word is derived from the Dutch word for an alcoholic drink consumed by Zulu warriors to give them energy before a battle. In the early twentieth century, doping referred primarily to the illegal drugging of race horses, but has been applied to human athletes since the 1920s.

In the 1970s, testing of athletes' blood samples focused largely on steroid use, but in the 1980s and 1990s, new tests had to be devised to detect evidence of blood doping. Blood doping refers to the use of blood transfusions or a hormone called erythropoetin (EPO) in order to increase the level of hemoglobin in an athlete's blood, and therefore its oxygen-carrying capacity. The use of EPO in such endurance sports as marathon running or cycling increases the athlete's risk of heart disease if it is used to raise blood hemoglobin levels above 13.0 g/dL.

Newer forms of doping include the use of modafinil (Provigil), a drug ordinarily used to treat narcolepsy (a sleep disorder), and gene doping. Gene doping is defined by the World Anti-Doping Agency, an organization founded in 1999, as "the non-therapeutic use of cells, genes, genetic elements, or of the modulation of gene expression, having the capacity to improve athletic performance." One possible technique of gene doping would be the use of a synthetic gene that could last for years and produce high amounts of naturally occurring muscle-building hormones.

### *Vegetarian and vegan diets*

It is possible for an athlete to maintain strength and overall health on a vegetarian diet provided that a variety of plant-based sources of protein are consumed on a daily basis and energy intake is adequate. Vegetarian and especially vegan athletes are at risk of inadequate creatine and **iron** intake, however, as well as insufficient amounts of **zinc**, **vitamin $B_{12}$**, **vitamin D**, and **calcium**. Iron deficiency will eventually affect athletic performance, as will low levels of creatine. Coaches and trainers should be aware that sudden adoption of a vegetarian or vegan diet in an athlete who was previously eating meat and fish may indicate the onset of an eating disorder.

## Resources

### BOOKS

American Psychiatric Association. *Diagnostic and Statistical Manual of Mental Disorders*, fourth edition, text revision. Washington, DC: American Psychiatric Association, 2000.

American Society of Health-System Pharmacists (ASHP). *AHFS Drug Handbook*, 2nd ed. Philadelphia: Lippincott Williams & Wilkins, 2003.

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**ORGANIZATIONS**

American Academy of Pediatrics (AAP). 141 Northwest Point Blvd., Elk Grove Village, IL 60007. Telephone: (847) 434-4000. Website: http://www.aap.org.

American College of Sports Medicine (ACSM). P. O. Box 1440, Indianapolis, IN 46206-1440. Telephone: (317) 637-9200. Website: http://www.acsm.org.

American Council on Exercise (ACE). 4851 Paramount Drive, San Diego, CA 92123. Telephone: (858) 279-8227. Website: htpp://www.acefitness.org.

American Dietetic Association (ADA). 120 South Riverside Plaza, Suite 2000, Chicago, IL 60606-6995. Telephone: (800): 877-1600. Website: http://www.eatright.org.

American Society of Health-System Pharmacists. 7272 Wisconsin Avenue, Bethesda, MD 20814. Telephone: (301) 657-3000. Website: http://www.ashp.org.

Dietitians of Canada/Les diététistes du Canada (DC). 480 University Avenue, Suite 604, Toronto, Ontario, Canada M5G 1V2. Telephone: (416) 596-0857. Website: http://www.dietitians.ca.

Gatorade Sports Science Institute (GSSI). 617 West Main Street, Barrington, IL 60010. (800) 616-4774. Website: http://www.gssiweb.org. The GSSI website has a useful online library of over a hundred articles on various aspects of sports nutrition, training and performance, and sports medicine, including material on specific sports.

Herb Research Foundation (HRF). 4140 15th Street, Boulder, CO 80304. Telephone: (303) 449-2265. Website: http://www.herbs.org.

National Center for Health Statistics (NCHS). Telephone: (800) 311-3435. Website: http://www.cdc.gov/nchs/.

National Strength and Conditioning Association (NSCA). 1885 Bob Johnson Drive, Colorado Springs, CO 80906. Telephone: (800) 815-6826 or (719) 632-6722. Website: http://www.nsca-lift.org.

Sports, Cardiovascular, and Wellness Nutritionists (SCAN). SCAN is a dietetic practice group (DPG) of the American Dietetic Association. Telephone: (800) 249-2875 or (847) 441-7200. Website: http://www.scandpg.org.

U. S. Food and Drug Administration (FDA). 5600 Fishers Lane, Rockville, MD 20857-0001. Telephone: (888) INFO-FDA. Website: http://www.fda.gov/default.htm.

World Anti-Doping Agency (WADA). Stock Exchange Tower, 800 Place Victoria, Suite 1700, P.O. Box 120, Montreal, Quebec, Canada H4Z 1B7. Telephone (514) 904-9232. Website: http://www.wada-ama.org.

Rebecca J. Frey, PhD

# St. John's wort

## Definition

St. John's wort (also sometimes called Saint John's wort) is the common name for any member of a group of annual or long-living perennial herbs and shrubs with attractive five-petaled golden-yellow flowers. It is used by some people as a way to decrease the symptoms

**St. John's wort flowers.** *(Photo Researchers, Inc. Reproduced by permission.)*

## KEY TERMS

**Anticoagulants**—Blood thinners.

**Antiseptic**—Medicine used to control infection.

**Astringent**—Substance that brings tissues together.

**Extract**—A compound in which something has been taken out so that it is now in a more purified state.

**Placebo**—An inactive substance (such as a sugar pill) used as a control in experiments.

**Perennial**—Reoccurring, as a plant that comes back for more than one growing season.

**Rhizome**—An underground creeping stem.

of anxiety, depression, and various sleep disorders. St. John's wort is classified in the kingdom Plantae, division Magnoliophyta, class Magnoliopsida, and order Malpighiales. It is usually classified within the family Hypericaceae but is also sometimes found within the family Clusiaceae. Its genus is *Hypericum*.

When St. John's wort is used to refer to the herb used to treat illnesses such as depression, it is the species informally called Common St. John's wort. Sometimes also called Goat weed, hypericum, and Klamath weed, it is the most plentiful species of St. John's wort in the world. It is classified as genus/species *Hypericum perforatum*. As a perennial herb, St. John's wort has the ability to produce complicated underground creeping stems, called rhizomes. Its above-ground stems are straight and upright, branched within its upper half, and able to grow up to one meter (three feet) in height.

Besides *H. perforatum*, St. John's wort can also refer to the other species of St. John's wort including scrubby St. John's wort (*Hypericum prolificum*), great St. John's wort (*Hypericum ascyron*), and Jerusalem star, or rose of Sharon (*Hypericum calycimum*). In all, about 370 species of the genus *Hypericum* are found around the world.

Supposedly, the plant genus (*Hypericum*) was given its name—from the Greek words hyper (above) and eikon (picture)—in reference to John the Baptist, the first century A.D. Jewish religious leader. The exact reason for the naming is in question. Some of the possible reasons for its name include: the blooming of its yellow flowers in June around the time of John the Baptist's birth; the presence of the flower at a feast of John the Baptist; and the hanging of the flower over pictures in houses to supposedly protect against evil on St. John's day.

### Purpose

St. John's wort has been used for centuries to medically treat mental disorders such as depression and anxiety. The ancient Greek civilization is known to have used it for this purpose. Early Native Americans used it as anti-inflammatory (to control inflammation), antiseptic (to control infection), and astringent (to bring tissues together) medicines. The flowers of the plant have been used to treat depression, anxiety, and insomnia; sedate people; as a treatment for malaria; and a balm for burns, insect bites, and wounds. In recent history, parts of the plant have been used within herbal tea.

However, it is also considered a poisonous weed in over twenty countries. St. John's wort is considered a toxic weed that invades more productive plants and flowers. When eaten by domesticated animals, such as cows and horses, it can cause problems in the central nervous system, abortion in pregnant females, and even death.

Today, the flowers of the St. John's wort contains hypericin, a chemical that supposedly has anti-inflammatory and antidepressant properties. The *Hypericum* extract, which is obtained from *H. perforatum* is used in the United States as a popular herbal medicine (alternative to standard medicine) for the treatment of mild depression. In the United States, according to the National Institutes of Health (NIH), St. John's wort is one of the leading herbal products sold. This sales volume

is in large part due to the fact that, according to the NIH, depression affects nearly 19 million U.S. citizens annually, about 6% of the population.

The part of the St. John's wort used within such products are the flowers. They are reduced down to concentrated extracts; that is, specific non-essential substances that are removed to leave behind desired chemicals in a concentrated form. St. John's wort is sold in most countries as over-the-counter medicines in capsules and tablets, and as prepared herbal tea bags (in which boiling **water** is added to the dried herb and steeped). In other countries, such as Germany, it is used for mild depression more frequently than artificially made medically approved antidepressants.

The composition of St. John's wort and how it works is not well known nor understood. Some scientific evidence suggests it is useful for treating mild to moderate depression. Other recent reports state that it has no effect for treating major depression of moderate severity.

## Description

The St. John's wort plant is easily identified by its leaves and flowers. The toothless, stalkless, narrow, oblong leaves are yellowish-green in color, opposite to each other, and have tiny translucent spots scattered throughout the tissues and obvious black dots on the lower surface. When held up to light, the leaves appear to be *perforated*, which gives them their Latin species name *perforatum*. The leaves also contain glands that contain oil. The flowers are clustered with five petals. Each flower is about 12 to 20 millimeters (0.47 to 0.79 inch) long. The flowers are bright yellow in color with black dots. The five-petaled clusters grow up to 2.5 centimeters (about one inch) in diameter. The flowers bloom between April and July (late spring and early summer in the northern hemisphere). When the flowers or seed pods are crushed, a reddish purple liquid is produced.

As a genus, St. John's wort is native to the subtropical and temperate regions of Asia Minor, China, Europe, India, North America, and Russia and the other countries of the former Soviet Union. *H. perforatum* is actively cultivated in parts of southeastern Europe. It is indigenous to Europe but has been introduced into areas of the Americas.

## Precautions

The use of *H. perforatum* for the treatment of various medical problems has not been adequately documented. Previous clinical studies have largely concentrated on its effectiveness in clinically recognized depression,

Some studies show it is effective in mild to moderate depression while other studies show no benefit over placebos. Recent studies include a 2004 study called the Cochrane Review, which included 27 later studies. The results show that St. John's wort was *significantly superior* to placebos and *similarly effective* as general antidepressant medicines.

Between 1998 and 2005, numerous medical studies showed St. John's wort to be generally more effective than placebos and generally of equal effectiveness when compared to standard antidepressants, but with fewer negative side affects.

In 2002, the National Institutes of Health (NIH) funded a large and well designed research study called the Hypericum Depression Trial Study Group. Three organizations within the NIH coordinated the study: the National Center for Complementary and Alternative Medicine (NCCAM), the Office of **Dietary Supplements** (ODS), and the National Institute of Mental Health (NIMH). Three hundred, forty patients diagnosed with *major depression of moderate severity* were subjected to a double-blind placebo-controlled trial comparing St. John's wort to placebo. St John's wort was found to be no more effective than placebo.

St. John's wort has also been studied as a treatment for anxiety, obsessive-compulsive disorder, HIV (human immunodeficiency virus), atopic dermatitis (sometimes called eczema, a skin condition), and social phobia. In treatment of these illnesses, the results did not show anything conclusive about a positive affect that St. John's wort has on reducing symptoms. In all cases, there is insufficient evidence to make any recommendations.

In addition, the use of St. John's wort for such problems as premenstrual syndrome, depressed mood, seasonal depressive disorder, and somatoform (psychologically induced) disorders is controversial within the medical community.

## Interactions

Both the German Commission E, which is responsible for review of herbal and other alternative therapies, and the european scientific cooperative on phytotherapy have reviewed St. John's wort and found no interactions with other drugs.

How St. John's wort works is not known. Some studies preliminarily indicate that it might stop nerve cells in the brain from reabsorbing serotonin, a neurotransmitting chemical messenger. Other studies show

it might reduce levels of a **protein** involved in the body's immune system. There are many chemical compounds within St. John's wort. The major active ingredients in St. John's wort are believed to be hyperforin (thought to help in the treatment of depression and combat bacteria) and hypericin (believed to be an antibiotic). Flavonoids (a possible antioxidant) and tannins (might help with diarrhea, blood-clotting, and **hemorrhoids**), which are also contained in St. John's wort, could be active ingredients, too.

St. John's wort may cause increased sensitivity to artificial light and light from the Sun. It may make some people sunburn more easily than normal. Some research shows that it may cause infertility in both men and women.

Other common side effects can be anxiety, dizziness, dry mouth, fatigue and weakness, gastrointestinal symptoms, headache, sleeping disorders, muscle cramping, nausea, and restlessness. More infrequently occurring side effects include: anorexia, **constipation** or diarrhea, increased periods of blood pressure and pulse, heartburn, increased sweating, loss of hair on scalp and eyebrows, numbness, tingling and nerve pain or damage, tremors, increased sweating and flushing (marked redness in face and other body areas), and tremors.

According to the National Institutes of Heath, when St. John's wort is ingested, it can alter the way that the body uses other drugs. In some circumstances, interactions can be dangerous. Some of these drugs include: drugs that treat HIV such as indinavir (Crixivan®); drugs that fight **cancer** such as irinotecan (Campto®); drugs that lower cholesterol such as lovastatin (Mevacor®), nifedipine (Procardia®), and midazolam (Versed®); drugs that reduce the rejection of transplanted organs such as cyclosporine (Sandimmune®); drugs that strengthen contractions of the heart muscle such as digoxin (Lanoxin®); drugs that act as anticoagulants (blood thinners) such as warfarin (Coumadin®); drugs that treat depressants such as amitriptyline (Elavil®); and drugs that control thyroid conditions such as levothyroxine (Synthroid®).

## Complications

St. John's wort is generally well tolerated by the human body. Scientific studies show that the body readily accepts it at recommended doses for up to one to three months. Sometimes, if St John's wort is discontinued suddenly, there may be unfavorable withdrawal symptoms.

As with any ingested medicinal or herbal substance, there is always risk with taking too large an amount or having it react negatively with something else. Because St. John's wort is a dietary supplement the U.S. Food and Drug Administration (FDA) does not regulate it. Consequently, the strength and quality of it is not predictable within products sold by manufacturers. Products can differ from company to company, and more surprisingly, can change from batch to batch within a company. Information on labels can also be misleading because such data is not regulated by the FDA.

## Parental concerns

If children have depression, St. John's wort is not a proven therapy for its treatment—in fact, it is not a proven therapy for the treatment of any depressed person. Parents of children suspected of being depressed should contact a medical professional for assistance. Effective treatments are available. Patients should be aware that if St. John's wort is used with standard antidepressant therapies, it can cause side affects such as anxiety, confusion, headache, and nausea.

Medical professions also commonly warn pregnant or lactating women about taking St. John's wort. No adverse effects have been documented with the use of St. John's wort. However, because there are no published safety and health data, these women are advised to avoid the use of St. John's wort. Likewise, parents are advised not to give St. John's wort to their young children because of a lack of scientific evidence as to its safety.

## Resources

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William Arthur Atkins

# Subway diet

## Definition

The Subway diet is the weight-loss plan created by Jared Fogle, an obese college student who weighed 425 pounds (192.7 kilograms). The 22-year-old Fogle lost 245 pounds (111.1 kilograms) in 11 months by following a daily diet that consisted primarily of two low-fat sandwiches purchased at the Subway fast-food chain. After losing 100 pounds (45.4 kilograms), the 6-foot-2 (187.9-centimter) Fogle added walking to his daily routine. His dramatic weight loss led to Fogle's appearances in Subway commercials and his role as a motivational speaker and an advocate in the fight against **childhood obesity**.

## Origins

Jared's Fogle's unique diet led to his weight loss and international fame as the star of Subway sandwich commercials. He created the Subway diet in March of 1998. By 1999, he weighed 180 pounds (81.6 kilograms). In 2000, he began appearing in Subway TV commercials. His weight loss was illustrated by the image of the slender Fogle holding his pre-diet jeans with the 60-inch (152.4-centimeter) waist. At that time, Fogle weighed 190 pounds (86.1 kilograms). He had maintained that weight as of the spring of 2007 and wore pants with a 34-inch (86.4-centimeter) waist.

The public identified Fogle by his first name or as the "Subway Guy." The Subway diet was one component of Fogle's fame; the public also celebrated his weight loss and his campaign to educate others about the importance of diet and exercise. Fogle drew upon his life experiences when speaking about those issues to the media, on talk shows, and in presentations to schools and other groups.

### *Progressive weight gain*

Physically, Fogle's ankles and wrists had swelled with edema. His blood pressure was high, and his sleep was interrupted by apnea. Overweight people are at risk of sleep apnea, a condition where blockage causes the person to repeatedly stop breathing. Fogle realized it was time to start dieting, and he described those efforts in his 2006 book, *Jared, the Subway Guy: Winning Through Losing: 13 Lessons for Turning Your Life Around*.

### *Deciding to diet*

Fogle decided to lose weight during his junior year of college. He had moved out of the dorm and into an apartment located next to a Subway shop. While the shop was close to home, Fogle tried three other diets before creating the Subway diet. His first diet limited calories to 1,800 per day and involved extensive food preparation. The preparation was time-consuming, and he ended the diet. Next Fogle went to the store and stocked up on low-calorie and diet frozen meals. He disliked the taste of the microwaved meals and embarked on another diet. This one involved drinking diet shakes for breakfast and lunch and eating a sensible meal for dinner. Fogle thought the shakes tasted terrible. He abandoned that diet but was determined to lose weight. He researched and rejected what he called "one-size-fits-all" diets.

As spring break approached, Fogle found inspiration in Subway's "Seven Under 6 Grams of Fat" menu, a selection of seven low-fat sandwiches. In March of 1998, Fogle developed a weight loss plan that consisting basically of eating two sandwiches each day. Once he shed 100 pounds (45.4 kilograms) on his customized diet, Fogle started walking to school. He eventually established a routine of walking 1.5 miles (2.4 kilometers) each day.

By the following spring, Fogle had shed more than half of his original weight. Fame came when he encountered Ryan Coleman, a college friend who hadn't seen him in some time. Coleman was astounded about Fogle's weight loss and wrote about it for the college newspaper in April of 1999. Organizations including the Associated Press ran the story, and *Men's Health* magazine included Fogle's story under the heading "Crazy Diets That Work." That led to a

**Subway menu items with 6 grams of fat or less**

| Menu item | Serving (g) | Calories | Fat (g) | Cholesterol (mg) | Sodium (mg) | Carbohydrates (g) | Protein (g) | Dietary fiber (g) |
|---|---|---|---|---|---|---|---|---|
| Veggie Delite® Wrap | 159 | 210 | 5.0 | 0 | 610 | 37 | 7 | 3 |
| **Salads** | | | | | | | | |
| Ham | 378 | 120 | 3.0 | 20 | 840 | 14 | 12 | 4 |
| Oven roasted chicken | 392 | 140 | 2.5 | 50 | 400 | 11 | 19 | 4 |
| Roast beef | 378 | 120 | 3.0 | 15 | 480 | 12 | 13 | 4 |
| Subway Club® | 411 | 150 | 4.0 | 35 | 840 | 14 | 18 | 4 |
| Turkey breast | 378 | 110 | 2.5 | 20 | 580 | 13 | 12 | 4 |
| Turkey breast and ham | 388 | 120 | 3.0 | 25 | 790 | 14 | 14 | 4 |
| Veggie Delite® | 322 | 60 | 1.0 | 0 | 75 | 11 | 3 | 4 |
| **Sandwiches** | | | | | | | | |
| Ham, 6" | 223 | 290 | 5.0 | 20 | 1,260 | 47 | 18 | 4 |
| Chicken breast, oven roasted, 6" | 237 | 310 | 5.0 | 25 | 830 | 48 | 24 | 5 |
| Roast beef, 6" | 223 | 290 | 5.0 | 15 | 900 | 45 | 19 | 4 |
| Subway Club®, 6" | 256 | 320 | 6.0 | 35 | 1,290 | 47 | 24 | 4 |
| Sweet onion chicken teriyaki, 6" | 279 | 370 | 5.0 | 50 | 1,200 | 59 | 26 | 5 |
| Turkey breast, 6" | 223 | 280 | 4.5 | 20 | 1,000 | 46 | 18 | 4 |
| Turkey breast and ham, 6" | 233 | 290 | 5.0 | 25 | 1,210 | 47 | 20 | 4 |
| Veggie Delite® | 167 | 230 | 3.0 | 0 | 500 | 44 | 9 | 4 |
| **Mini subs** | | | | | | | | |
| Ham | 137 | 180 | 3.0 | 10 | 710 | 30 | 11 | 3 |
| Roast beef | 146 | 190 | 3.5 | 15 | 600 | 30 | 13 | 3 |
| Turkey breast | 146 | 190 | 3.0 | 15 | 670 | 31 | 12 | 3 |

Does not include the addition of salad dressings, croutons, or other condiments and fixings

*(Illustration by GGS Information Services/Thomson Gale.)*

call from the agency that did the advertising for Subway.

Fogle described his weight-loss plan in the Subway commercials, saying that he ate two low-fat sandwiches and walked. The commercials highlighted his success. However, Subway did not endorse what the chain labeled the "Jared Diet," according to a December 2000 Subway news release. The chain's promotions emphasized its low-fat offerings and urged the public to exercise.

People motivated by Fogle called Subway, initially wanting to know more about his weight-loss plan. The chain also heard from hundreds of people who said they lost weight following their own versions of Fogle's diet. In 2001, five of those "Inspired by Jared" people appeared with him in commercials. By 2002, Subway had received more than 1,000 calls and letters from people. They told the chain that Fogle's story gave them hope; some people said they lost weight on his diet. Subway identified them as "Friends of Jared." Some of those people appeared in commercials, and Subway carried their stories on its website in 2007.

Meanwhile, Fogle continued to promote Subway and to speak about the importance of diet and exercise. In 2004, he created The Jared Foundation. The nonprofit foundation based in Indiana had the goal of tackling childhood **obesity**. The foundation's objectives were to:

- Bring awareness and support initiatives that address the wide-spread epidemic of childhood obesity.
- Provide easy-to-use tools that encourage children and support parents, caregivers, schools and community organizations.
- Provide grants to organizations that are focused on fostering sustainable nutrition and exercise programs.
- Form strategic alliances with key organizations to advance the understanding and application of programs that address childhood obesity.

## Description

Jared Fogle developed a diet that amounted to approximately 1,000 calories per day. As a college student, he usually ate before his first class, which was scheduled for noon or 1 p.m. Fogle said in interviews that he ate little or no breakfast. He sometimes breakfasted on a bowl of cereal with skim milk or a piece of fruit. Otherwise, a Subway sandwich was his first meal of the day. He sometimes snacked on a piece of fruit and took a daily multivitamin. His daily diet, according to his book, *Jared, the Subway Guy: Winning Through Losing: 13 Lessons for Turning Your Life Around*, consisted of:

## KEY TERMS

**Body Mass Index**—Also known as BMI, the index determines whether a person is at a healthy weight, underweight, overweight, or obese. The BMI can be calculated by converting the person's height into inches. That amount is multiplied by itself and then divided by the person's weight. That number is then multiplied by 703. The metric formula for the BMI is the weight in kilograms divided by the square of height in meters.

**Calorie**—The nutritional term for a kilocalorie, the unit of energy needed to raise the temperature of one liter of water by one degree centigrade at sea level. A nutritional calorie equals 1,000 calories.

**Carbohydrate**—A nutrient that the body uses as an energy source. A carbohydrate provide 4 calories of energy per gram.

**Edema**—Swelling caused by caused by the build-up of fluid in the body's tissues.

**Fat**—A nutrient that the body uses as an energy source. Fats produce 9 calories per gram.

**Fiber**—A complex carbohydrate not digested by the human body. Plants are the source of fiber.

**Protein**—A nutrient that the body uses as an energy source. Proteins produce 4 calories per gram.

- Breakfast of coffee.
- Lunch of a Subway 6-inch turkey sub, a diet soda, and small bag of baked potato chips or pretzels.
- Dinner of a Subway foot-long Veggie Delite sandwich, a diet soda, and small bag of baked potato chips or pretzels.

Fogle ordered sandwiches filled with lettuce, green peppers, banana peppers, jalapeno peppers, and pickles. Fogle omitted cheese and condiments that contained fat like mayonnaise and oil. Instead, he used condiments like spicy mustard or vinegar. He alternated ordering the sandwiches on wheat or white bread, the choices that Subway offered at the time.

The sandwiches that Fogle ate were on Subway's "Seven Under 6 Grams of Fat," menu. In the spring of 2007, that list of subs consisted of a ham sandwich, roasted chicken breast, subway club, sweet onion chicken teriyaki, turkey breast, turkey breast and ham, and the Veggie Delite.

### *Nutritional information*

Sandwiches were served on wheat bread and contained lettuce, tomatoes, onions, green peppers, pickles, and olives. According to the Subway 2007 " Nutritional Guide," the 6-inch turkey breast sub was 280 calories and had 4.5 grams of total fat and 4 grams of dietary **fiber**. The Veggie Delite sandwich was 230 calories for a 6-inch sandwich. The half-foot sub had 3 grams of total fat and 4 grams of fiber. The 6-inch sandwich provided two servings of vegetables, and the footlong sub contained twice that amount. According to the nutritional guide, Subway based those portions on amounts designated by the National **Cancer** Institute.

The guide published in 2007 described the nutritional content of all Subway sandwiches and offerings that included salads, fruit, chips, and cookies. Fogle ate baked potato chips. The 1.125-ounce bag of Baked! Lay's potato chips had 130 calories and 1.5 grams of fat, according to the guide. A similar sized bag of Rold Gold Classic Tiny Twist pretzels had 110 calories and I gram of fat. Fogle drank Diet Coke, which had no calories.

Subway's guide also included information about Fresh Fit meals for children and adults. The adult version consisted of a low-fat 6-inch sub, a bag of baked chips, apple or raisins and 1% low-fat white milk, **water**, or a diet drink. The Fresh Fit for Kids meal consisted of a min-sub, a fruit juice box or 1% low-fat milk, and a bag of apples or raisins.

Subway cautioned in the guide that Fresh Fit options should not be considered a diet program. The sandwich chain and Fogle acknowledged that a nutritionally balanced diet and exercise were important components of a healthy lifestyle.

### *Exercise and weight maintenance*

Fogle began walking when he was physically able to do so. He started with walking to class and then began walking to do errands and around the large Indiana University campus. He added more exercise through activities like taking the stairs instead of the elevator. Fogle advised prospective dieters to find an activity that they enjoyed. He liked walking, and regularly walked 1.5 miles (2.4 kilometers). After reaching his goal weight, Fogle continued to walk and also participated in activities like the Heart Walk, an American Heart Association fundraiser.

Fogle weighed 190 pounds (86.1 kilograms) when he began doing the Subway commercials in 2000. He had maintained that weight as of the spring of 2007. Fogle said he maintained that weight by walking and limiting his daily food intake to 2,000 calories. His

food selections include smaller portions of items like pizza. Furthermore, he ate Subway sandwiches several times each week. Fogle said he enjoyed the sweet onion chicken teriyaki sub, a sandwich added to the menu after he ended his diet. It contained 370 calories and 5 grams of fat, according to the Subway nutrition guide.

## Function

The Subway diet was created by an obese man who was motivated to lose weight. After rejecting traditional diets, Jared Fogle developed a weight-loss plan based on the low-fat menu at the Subway sandwich shop. The low-fat subs were also low-calorie, and Fogle came up with his own version of portion control. The man who once ate an entire pizza limited himself to two sandwiches a day. While his plan was very restrictive, Fogle demonstrated that people who ate at fast-food restaurants could make healthy choices.

## Benefits

The benefits of the Subway diet start with convenience. The dieter buys prepared food, knowing that is low in fat and calories. Subway provides nutritional information, and the dieter doesn't need to purchase, clean, and cut vegetables. The weight-loss plan is based on portion control, and the dieter eats vegetables, bread, and turkey. Lean meats like poultry, vegetables, and grains like are among the recommended foods in the *Dietary Guidelines for Americans 2005* produced by the U.S. Department of Agriculture (USDA) and the Department of Health and Human Services (HHS).

The federal guidelines also advocate physical activity as an important component of shedding pounds and maintaining a healthy weight. Jared Fogle's weight-loss plan included exercise. He created the diet because he liked fast food and enjoyed eating bread. On his diet, he didn't have to give up either.

## Precautions

Fogle also advised people to consult with a doctor and a dietitian before starting a diet. He said in interviews that he discussed his weight-loss plan with a dietitian. In addition, Fogle's health was monitored by his physician father. Several times during the diet, Jared received a full check-up and blood work was done.

## Risks

The Subway diet provided 980 calories based on the consumption of a six-inch turkey sub, a footlong Veggie Delite, a bag of baked potato chips, and a bag of pretzels. This is below the daily limit of 1,200 calories prescribed for dieters by the medical community. A person who consumes less than 1,200 calories per day could miss out on nutrients like **iron**, **calcium**, and **protein**. In addition, the **calorie restriction** could cause the dieter's **metabolism** to slow.

Jared Fogle was obese, and his diet was medically supervised. His food choices included lean meat and vegetables. However, a diet based on the repeated consumption of only certain foods could also lead to vitamin and/or mineral deficiency.

### QUESTIONS TO ASK YOUR DOCTOR

- How much weight should I lose?
- What health conditions would prevent me from starting a low-fat diet?
- What is the minimum amount of calories that I should eat each day to lose weight?
- What is the maximum amount of fat grams I should I eat each day?
- Can I lose weight by following another version of the Subway diet, basing a low-calorie and low-fat plan on items sold in fast-food restaurants?
- Am I physically able to begin an exercise program?
- What is the best type of exercise for me?
- How long should I do this exercise?
- How many times a week should I exercise?
- What do I need to know to prevent injuries while exercising?

## Research and general acceptance

### *Research*

Popular weight-loss plans like the Subway diet are evaluated in terms of scientific principles about nutrition. The evaluation takes into account factors such as the types of foods on the diet, whether foods are restricted, and total calorie content. Standard for evaluating food choices on diets include the *Dietary Guidelines for Americans 2005*. The federal guidelines recommended that people consume a variety of foods within each of the five food groups: fruits, vegetables, calcium-rich foods like milk and cheese, grains, and proteins.

Both Jared Fogle and a Subway Corporate dietitian acknowledged that some elements were missing from the weight-loss plan designed by the Indiana college student. "It's great that it worked for him,

but I would rather he had eaten a balanced breakfast and more fruits and vegetables," dietitian Lanette Roulier said in a December 2000 news release. She pointed out that people's dietary needs varied, and advised the public to consult with a physician and/or dietitian before starting a weight-loss program. A restrictive diet of only two sandwiches a day is not nutritionally sound. Jared Fogle eliminated fruit and dairy products from his diet. He missed out on the fiber in fruit and nutrients like **vitamins** A and C. The diet also lacked the calcium found in dairy products. However, the sandwiches provided fiber and vitamins. Poultry like turkey was among the lean proteins recommended in the USDA guidelines. The federal guide also advised people to limit fat and to participate in regular physical activity. Fogle did both.

Another issue of the diet was that Fogle skipped breakfast. The morning meal provides energy for the day. Eating a healthy breakfast helps children to concentrate in school, according to the American Dietetic Association. Research indicates that the morning meal may also help adults concentrate. In addition, dieters who skip breakfast may later become hungry and overeat.

Furthermore, the Subway website in 2007 contained a caution in the section about the "Friends of Jared." Subway noted that the weight losses depicted on the site were the result of exercise and a balanced, reduced-calorie diet that included the low-fat sandwiches. Results weren't typical, according to the notice, and people were advised to consult their physicians before starting a weight-loss plan.

Fogle acknowledged the deficiencies of his weight-loss plan. However, the plan helped him shed hundreds of pounds, weight that he managed to keep off through a combination of eating in moderation and exercising.

Moreover, a public-health advocacy group in 2002 praised the Subway chain and Fogle for having "helped lead the way to healthier fast food." That commendation came from the Center for Science in the Public Interest (CSPI), which rated Subway's low-fat subs as among the nation's best fast foods. CSPI's goals include advocating for nutrition and health.

### *General acceptance*

The Subway diet was popular for a time when Fogle's commercials aired during the early 2000s. The Subway website in 2007 carried information about 15 "Friends of Jared," people who incorporated Subway sandwiches and exercise into their weight-loss regimens.

After Fogle's weight loss, he continued to represent Subway as an advocate of a healthy diet and exercise. He made about 200 public appearances annually, a schedule that continued in 2007. His message to people, particularly school children, was to avoid the pitfalls that caused childhood obesity. Fogle's story and oversized jeans illustrated the factors contributing to the obesity epidemic.

According to the CDC, the prevalence of obesity in people between the ages of 20 and 74 increased from 15% during 1976 through 1980 to 32.9% in the time from 2003 to 2004. The prevalence in younger overweight Americans during those years also rose during that time from:

- 5% to 13.9% for children aged 2 to 5 years.
- 6.5% to 18.8% for those aged 6-11 years.
- 5% to 17.4% for youths ages 12-19 years.

CDC attributed the weight increase to factors such as poor eating habits and lack of physical activity. While Fogle's biography provided a perspective on a growing trend, his story also demonstrated that people could successfully lose weight and keep it off.

## Resources

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### ORGANIZATIONS

American Dietetic Association, 120 South Riverside Plaza, Suite 2000, Chicago, IL 60606. (800) 877-1600. <http://eatright.org>.

Center for Science in the Public Interest 1875 Connecticut Ave. N.W., Ste. 300, Washington, D.C. 20009. (202) 332-9110. <http://www.cspinet.org>.

Subway Restaurant Headquarters. 325 Bic Drive, Milford, CT 06461-3059. (800) 888-4848. <http://www.subway.com>.

The Jared Foundation, Inc. 89 Southwind Lane, Greenwood, IN 46142. (317) 626-3755. <http://www.jaredfoundation.org>.

**OTHER**

Centers for Disease Control and Prevention National Center for Chronic Disease Prevention and Health Promotion. *Physical Activity and Good Nutrition: Essential Elements to Prevent Chronic Diseases and Obesity At A Glance 2007*. <http://www.cdc.gov/nccdphp/publications/aag/dnpa.htm> (April 9, 2007).

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Liz Swain

Sugar *see* **Hyperactivity and sugar**

Sugar substitutes *see* **Artificial sweeteners**

Surgical weight loss procedures *see* **Bariatric surgery**

# Suzanne Somers weight loss plan

## Definition

The Suzanne Somers Weight Loss Plan is a guide to losing weight that does not limit caloric intake, but instead focuses on the correct foods in the correct combinations. It also focuses on reducing sugar and carbohydrate intake.

## Origins

Suzanne Somers is best known as a television actress. She was born on October 16th, 1946 and grew up in Northern California. She was the third of four children. She is best known for her role as Chrissy from 1977-1981, on the sitcom "Three's Company" on ABC. She also starred on the sitcom "Step By Step" on ABC and CBS in the 1990s. She has endorsed many well know fitness and exercise products over the years including the popular Thigh-Master.

Somers says that her diet philosophy is based on the way the she learned to eat during a trip to France. At that time she was introduced to the idea of eating groups of foods together for better **metabolism** and digestion. She reportedly used this information to stop her cycle of diet and weight gain and slim down for good. She also says that she has consulted many different diet and nutrition professionals; however, she herself has no formal training in nutrition.

## Description

Suzanne Somers' diet focuses on three main components: eliminating some foods, separating certain foods, and combining certain foods. Somers also emphasizes eating fresh foods and generally staying away from foods that are packaged or processed. The diet does not require counting calories and does not specify portion sizes. Instead, Somers believes that if a dieter eats the correct foods in the correct combinations, the dieter will be able to eat three meals a day and eat until comfortably full, while still losing weight. She does not believe that being hungry is necessary for losing weight.

The main foods that Somers believes should be completely, or nearly completely, eliminated are sugars and starches. Somers also says that anything that the body converts to sugar should be eliminated or significantly restricted. This means that any foods that have sugar in any form, including processed white sugar, brown sugar, or maple syrup, need to be eliminated. Most **carbohydrates** and starchy vegetables such as corn are also on the list of foods that Somers refers to as "funky foods" and believes should be eliminated from the diet. She believes it is especially important to stay away from simple carbohydrates. Simple carbohydrates are those that are easily broken down by the body, and are often found in heavily processed foods. Common simple carbohydrates include white rice and white flour.

Somers does believe in eating sweet tasting things however, and suggests using any form of sugar substitute. She also sells her own brand of artificial sugar replacement called Somersweet, and provides recipes that are intended to be made with Somersweet or other **artificial sweeteners**. Other foods that need to be eliminated during the main phases of the diet are all forms of alcohol. Alcohol is allowed in small quantities, along with chocolate and other sugars and starches, during the maintenance period of the diet.

In addition to eliminating foods, the diet focuses on separating and combing foods. Somers divides foods into four categories. These categories are: proteins/fats,

## KEY TERMS

**Diabetes mellitus**—A condition in which the body either does not make or cannot respond to the hormone insulin. As a result, the body cannot use glucose (sugar). There are two types, type 1 or juvenile onset and type 2 or adult onset.

**Dietary supplement**—A product, such as a vitamin, mineral, herb, amino acid, or enzyme, that is intended to be consumed in addition to an individual's diet with the expectation that it will improve health.

**Mineral**—An inorganic substance found in the earth that is necessary in small quantities for the body to maintain a health. Examples: zinc, copper, iron.

**Vitamin**—A nutrient that the body needs in small amounts to remain healthy but that the body cannot manufacture for itself and must acquire through diet.

vegetables, carbohydrates, and fruits. These groups have rules about when to eat them, which groups should be always be eaten together, and which should never be eaten together.

If a meal is going to include proteins or **fats**, such as any kind of meat, then it must be eaten with a vegetable. A meal with **protein** or fat can never be eaten with carbohydrates. This means that many desserts are not allowed because although butter and shortening are allowed, the dieter cannot eat them with any form of starch, which eliminates many desserts such as cookies and cakes.

If a meal contains carbohydrates, it cannot contain any form of protein or fat. This means if the meal contains whole grain bread, it cannot contain any meat. Meals containing carbohydrates must also contain vegetables. This means that whole grain pasta tossed with vegetables is allowed, but the dieter may not include any olive oil or butter on the pasta.

There are three other rules for the diet. If the dieter eats any kind of fruit it must be eaten alone, not with any other food type, and it should be eaten on an empty stomach. If a dieter is going to eat a meal or snack of the protein/fat category he or she must wait at least three hours before eating another meal or snack if that meal or snack is going to be from the carbohydrate category. The dieter is not allowed to skip meals while on this diet.

The Suzanne Somers weight loss plan allows all variety of fats to be eaten during the diet. This includes foods such as cream cheese, butter, and sour cream that may not usually be thought of as diet foods. Meat products of all varieties are also allowed. Most fruits are allowed, although not bananas, because they are high in carbohydrates. Many vegetables are allowed, although not carbohydrate heavy vegetables such as corn, beets, or squash. The diet plan has three stages, which are called Level 1, Almost Level 1, and Level 2.

### *Level 1*

Level 1 is for dieters who are just beginning the diet. This is the most strict period of the diet. During this stage no alcohol is allowed, nor are foods such as avocados, nuts, olives, or **soy**.

### *Almost Level 1*

Almost level 1 is for dieters who have been following Suzanne Somers diet for some time. When the dieter is beginning to see significant results he or she can move to this level. The idea behind this level is that these dieters can eat some foods or combinations of foods that are not optimal on a very occasional basis without compromising their weight loss goals.

### *Level 2*

This is the level for dieters who have reached their goal weight and are looking to maintain this weight. This maintenance phase allows some foods in moderation that were forbidden during the early phases of the diet. The allowed foods now include alcohol and soy. Also during this phase the dieter can sometimes make combinations of foods forbidden during other phases, such as some carbohydrates with fats. Eating in a way not allowed by the other phases of the plan is intended to be done only in moderation and only on an occasional basis.

Suzanne Somers Weight Loss Plan is a plan that focuses almost exclusively on food, with only a minor focus on exercise and stress reduction techniques. There are also some encouraging words from Somers herself. She has produced many different cookbooks that are designed for use while on the diet and tell the dieter which level of the diet each recipe is appropriate for. Because it can often be difficult for busy dieters to find the time to cook meals that are fresh, good tasting, and follow the diet's recommendations, Suzanne Somers also offers a wide variety of convenience products specifically designed to be used while on her diet. These include supplements, shakes, and bars. She also offers many prepackaged foods such as steaks, apple

chips, and sauces. For all of her products she provides information on what level of the diet they are appropriate for and what category they fall under.

## Function

The Suzanne Somers Weight Loss Plan is intended to create a changed set of eating habits that last a lifetime. The intended outcome of the diet is weight loss, but the diet does not have a defined end. Instead, it is intended that the dieter follow the level 2 recommendations for weight maintenance throughout his or her life. The diet is also intended to provide better general heath through the emphasis on preparing and eating fresh foods instead of processed foods, which are often high in **sodium** and low in nutrients.

## Benefits

There are many health benefits associated with weight loss. These include a decreased risk of type II diabetes and cardiovascular disease. For people who already have these or other obesity-related diseases and conditions, the symptoms may decrease in severity, or in some cases, resolve altogether with significant weight loss. In general the risk of these diseases increases as the degree of **obesity** increase, as do the average severity of the symptoms, so those who are the most obese can potentially gain the most in health benefits from significant weight loss.

There are also many different health benefits that result from a diet that includes a variety of fresh fruits and vegetables, and a lower quantity of processed or pre-prepared foods. Fresh fruits and vegetables and whole grains provide many different **vitamins** and **minerals** that are beneficial to general health. These vitamins and minerals are often lost or greatly reduced during processing. Processing can also add large quantities of sodium. Lower sodium intake can also have health benefits.

## Precautions

Anyone thinking of beginning a new diet should consult a medical practitioner. Requirements of calories, fat, and nutrients can differ significantly from person to person, depending on gender, age, weight, and many other factors such as the presence of disease or conditions. Pregnant or **breastfeeding** women should be especially cautious because deficiencies of vitamins or minerals can have a significant negative impact on a baby. Because the Suzanne Somers Weight Loss Plan severely limits some foods, it is especially important to ensure that daily requirements of vitamins and minerals are being met.

## QUESTIONS TO ASK THE DOCTOR

- Is this diet the best diet to meet my goals?
- Does this diet pose any special risk for me that I should be aware of?
- Would a multivitamin or other dietary supplement be appropriate for me if I were to begin this diet?
- Is this diet appropriate for my entire family?
- Is it safe for me to follow this diet over a long period of time?
- Are there any sign or symptoms that might indicate a problem while on this diet?

## Risks

There are some risks associated with any diet. It is often difficult to get enough of all required vitamins and minerals when eating a limited variety of foods. The Suzanne Somers diet does provide many different foods that are available to eat, and the restrictions are not as severe as with many other diets. However because the diet forces the dieter to choose what kinds of food are going to be eaten during each meal, the potential for problems may increase if the same sorts of foods are chosen for every meal. Anyone beginning a diet may want to consult their physician about whether taking a vitamin or supplement might help them reduce the risk of vitamin or mineral deficiency.

There are also some risks associated with diets that allow the dieter to eat as much fat, red meat, and animal products, such as eggs and butter, as are desired. These foods, eaten in large quantities, are frequently associated with cardiovascular problems such as heart disease. Following good dietary practices as outlined by the **United States Department of Agriculture's MyPyramid** which suggests eating limited amounts of meat and mostly lean meats, may help to reduce these risks.

## Research and general acceptance

There has been no scientific research on Suzanne Somers' diet program. There is also no evidence that the idea of food grouping actually results in weight loss, better metabolism, or better digestion. Research has been done on the many benefits of weight loss. These documented benefits include lower risk of type II diabetes and heart disease, and reduced severity of symptoms. There is a growing body of research investigating the effects of a diet that has large amounts of

red meat, fats, and animal products and a low amount of carbohydrates. Evidence shows that this kind of diet can result in higher levels of cholesterol and an increased risk of heart disease even if weight loss is occurring. Although this diet is not as severe in this regard as some diets, the evidence may still be relevant.

The Suzanne Somers diet does not make specific recommendations for exercises, although it does encourage the dieter to be active. As of 2007, the U.S. Center for Disease Control recommended a minimum of 30 minutes per day of light to moderate exercise for healthy adults. Following the recommendations of this diet may not meet these requirements.

## Resources

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### ORGANIZATIONS

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Helen M. Davidson

Swedish diet *see* **Scandinavian diet**

Sweeteners *see* **Artificial sweeteners**

# T

The Zone diet *see* **Zone diet**

## Thiamin

### Definition

Thiamin, also spelled thiamine and previously known as vitamin $B_1$, is a micronutrient essential for the **metabolism** of **carbohydrates** that converts sugar into energy for the body and for normal nerve and heart function. Thiamine deficiency causes a condition known as beriberi or beri-beri. The initial symptoms are very vague. The first indication of thiamine deficiency may be simple fatigue. As the condition becomes more advanced, there is a wide range of symptoms, affecting many organ systems. These include, but are not limited to chest pains, memory loss, muscle cramps and weakness. In more advanced cases, muscle atrophy and heart failure may be present.

### Purpose

Thiamin has several important functions. It works with other B-group **vitamins** to help release energy from the food we eat and it keeps nerves and muscle tissue healthy. In the form of thiamin pyrophosphate (TPP), it plays an essential role as a cofactor in key reactions breaking down food and converting carbohydrate into energy for the body (carbohydrate metabolism). Like other B-complex vitamins, thiamin is also considered an anti-stress vitamin because it is believed to enhance the activity of the immune system and increase the body's ability to resist stressful conditions.

Thiamin also plays a therapeutic role in the prevention or treatment of the following diseases:

- alcoholism
- Alzheimer's disease
- Crohn's disease
- congestive heart failure
- depression
- epilepsy
- fibromyalgia
- AIDS
- multiple sclerosis

### Description

Thiamin is a micronutrient, meaning a nutrient needed in very small amounts, found in a variety of animal and plant foods. It is a water–soluble vitamin that it is eliminated in urine when not needed by the body. Food must therefore supply it continuously. It belongs to a group of other water–soluble vitamins that are often present together and called *B-complex*. The other members of the vitamin B complex are **riboflavin**, **niacin**, **pantothenic acid**, **biotin**, pyridoxine, folic acid, inositol, and **vitamin $B_{12}$**. Important sources of thiamin are vegetables, wholegrain products, and nuts. The best sources are yeasts and liver and pork meat. Some specific good food sources of thiamin include (per 1 cup serving or as indicated):

- romaine lettuce (0.05 mg)
- asparagus, boiled (0.22 mg)
- spinach, boiled (0.17 mg)
- tuna (0.57 mg per 4 oz–serving)
- celery, raw (0.06 mg)
- green peas, boiled (0.41 mg)
- tomato (0.11 mg)
- eggplant, cooked (0.08 mg)
- brussels sprouts, boiled (0.17 mg per cup)
- baked beans, canned with pork (0.6 mg)
- cabbage, boiled (0.09 mg)
- watermelon (0.12 mg)
- red peppers, raw (0.06 mg per cup)
- carrots, raw (0.12 mg)

**Thiamin**

| Age | Recommended Dietary Allowance (mg) |
|---|---|
| Children 0–6 mos. | 0.2 |
| Children 7–12 mos. | 0.3 |
| Children 1–3 yrs. | 0.5 |
| Children 4–8 yrs. | 0.6 |
| Children 9–13 yrs. | 0.9 |
| Boys 14–18 yrs. | 1.2 |
| Girls 14–18 yrs. | 1.0 |
| Men 19≥ yrs. | 1.2 |
| Women 19≥ yrs. | 1.1 |
| Pregnant women | 1.4 |
| Breastfeeding women | 1.4 |

| Food | Thiamin (mg) |
|---|---|
| Sunflower seeds, ½ cup | 1.64 |
| Beans, baked, canned with pork, 1 cup | 0.60 |
| Tuna, 4 oz. | 0.57 |
| Sesame seeds, ½ cup | 0.56 |
| Beans, black, cooked, 1 cup | 0.42 |
| Peas, green, boiled, 1 cup | 0.41 |
| Beans, navy, cooked, 1 cup | 0.37 |
| Peas, split, cooked, 1 cup | 0.37 |
| Corn, cooked, 1 cup | 0.36 |
| Lentils, cooked, 1 cup | 0.33 |
| Beans, lima, cooked, 1 cup | 0.30 |
| Beans, kidney, cooked, 1 cup | 0.28 |
| Oats, whole grain, cooked, 1 packet | 0.26 |
| Asparagus, boiled, 1 cup | 0.22 |
| Brussels sprouts, boiled, 1 cup | 0.17 |
| Spinach, boiled, 1 cup | 0.17 |
| Squash, winter, baked, 1 cup | 0.17 |
| Pineapple, 1 cup | 0.14 |
| Carrots, raw, 1 cup | 0.12 |
| Watermelon, 1 cup | 0.12 |
| Oranges, 1 whole | 0.11 |
| Tomato, 1 cup | 0.11 |
| Broccoli, steamed, 1 cup | 0.09 |
| Beans, green, boiled, 1 cup | 0.09 |
| Cabbage, boiled, 1 cup | 0.09 |
| Eggplant, cooked, 1 cup | 0.08 |
| Squash, summer, cooked, 1 cup | 0.08 |
| Kale, boiled, 1 cup | 0.07 |
| Beans, baked, canned with pork, 1 cup | 0.06 |
| Celery, raw, 1 cup | 0.06 |
| Red peppers, raw, 1 cup | 0.06 |
| Turnip greens, cooked, 1 cup | 0.06 |
| Romaine lettuce, 1 cup | 0.05 |
| Cauliflower, boiled, 1 cup | 0.05 |

mg = milligram

*(Illustration by GGS Information Services/Thomson Gale.)*

- summer squash, cooked (0.08 mg)
- winter squash, baked (0.17 mg)
- turnip greens, cooked (0.06 mg)
- broccoli, steamed (0.09 mg)
- green beans, boiled (0.09 mg)
- corn, cooked (0.36 mg)
- kale, boiled (0.07 mg per cup)
- lentils, cooked (0.33 mg)
- navy beans, cooked (0.37 mg)
- lima beans, cooked (0.30 mg)
- kidney beans, cooked (0.28 mg)
- black beans, cooked (0.42 mg per cup)
- oats, whole grain, cooked (0.26 mg per packet)
- pineapple (0.14 mg)
- oranges, each (0.11 mg)
- cauliflower, boiled (0.05 mg)
- split peas, cooked (0.37 mg)
- sesame seeds (0.56 mg per 1/2 cup)
- sunflower seeds (1.64 mg per 1/2 cup)

The Recommended Dietary Allowance (RDA) for thiamin is:

- infants: (0–6 months): 0.2 mg
- infants: (7–12 months): 0.3 mg
- children (1–3 y): 0.5 mg
- children (4–8 y): 0.6 mg
- children (9–13 y): 0.9 mg
- adolescents (14–18): males, 1.2 mg, females, 1.0 mg
- adults: males, 1.2 mg, females, 1.1 mg
- pregnancy: 1.4 mg
- lactation: 1.4 mg

Thiamin in nutritional supplements can be found in multivitamins, B-complex vitamins, or can be sold individually. It may be labeled as thiamine hydrochloride or thiamine mononitrate and is available in a variety of forms including tablets, softgels, and lozenges, including chewable and liquid drops. Two fat-soluble forms of thiamin are also used. They are thiamin propyl disulfide and thiamin tetrahydrofurfuryl disulphide, and are sometimes used in treatment of thiamin deficiency because they follow a different route of absorption into the body than water-soluble thiamin.

## Precautions

Oral thiamin is generally nontoxic, but stomach upset can occur with excessive intake. Thiamin deficiency may result from a deficiency in the diet. People whose diet consists mainly of polished white rice are at risk, because polishing removes almost all of the vitamins. Alcoholics, who often substitute alcohol for food, are also at high risk of developing thiamin deficiency. Symptoms include fatigue, irritability, memory impairment, appetite loss, sleep disturbances, abdominal discomfort, and weight loss. Severe thiamin deficiency, called beriberi, is characterized by nerve, heart, and brain abnormalities. One form, called dry beriberi, causes nerve and muscle abnormalities. Symptoms include prickling felt in the toes, a burning

## KEY TERMS

**Amino acid**—Organic (carbon-containing) molecules that serve as the building blocks of proteins.

**Alzheimer's disease**—A progressive, incurable condition that destroys brain cells, gradually causing loss of intellectual abilities, such as memory, and extreme changes in personality and behavior.

**Antibiotic**—Drug that kills bacteria and other germs.

**Antidepressants**—Drugs used primarily to treat depression.

**B-group vitamins**—Group of eight water-soluble vitamins that are often present as a single, vitamin complex in many natural sources, such as rice, liver and yeast.

**Carbohydrate**—Any of a group of organic compounds that includes sugars, starches, celluloses, and gums and serves as a major energy source for the body.

**Chemotherapy**—Treatment of cancer with drugs.

**Cofactor**—A compound that is essential for the activity of an enzyme.

**Crohn's disease**—Inflammatory disease that usually occurs in the last section of the small intestine (ileum), causing swelling in the intestines. It can also occur in the large intestine.

**Diuretic**—A substance that increases the flow of urine from the body.

**Enzyme**—A biological catalyst, meaning a substance that increases the speed of a chemical reaction without being changed in the overall process. Enzymes are proteins and vitally important to the regulation of the chemistry of cells and organisms.

**Epilepsy**—A disorder of the brain that results in recurrent, unprovoked seizures.

**Fat-soluble vitamins**—Vitamins, such as A, D, E and K that are found in fat or oil-containing foods, and which are stored in the liver, so that daily intake is not really essential.

**Fibromyalgia**—Widespread musculoskeletal pain and fatigue disorder for which the cause is still unknown.

**Metabolism**—The sum of the processes (reactions) by which a substance is assimilated and incorporated into the body or detoxified and excreted from the body.

**Micronutrients**—Nutrients needed by the body in small amounts. They include vitamins and minerals.

**Multiple sclerosis**—A chronic degenerative disease of the central nervous system in which gradual destruction of myelin occurs in patches throughout the brain or spinal cord, interfering with the nerve pathways and causing muscular weakness, loss of coordination and speech and visual disturbances.

**Protein**—Biological molecules that consist of strings of smaller units called amino acids, the "building blocks" of proteins. In proteins, amino acids are linked together in sequence as polypeptide chains that fold into compact shapes of various sizes. Proteins are required for the structure, function, and regulation of the body's cells, tissues, and organs, and each protein has unique functions.

**Recommended dietary allowance (RDA)**—The levels of intake of essential nutrients judged on the basis of scientific knowledge to be adequate to meet the nutrient needs of healthy persons by the Food and Nutrition Board of the National Research Council/National Academy of Sciences. The RDA is updated periodically to reflect new knowledge. It is popularly called the Recommended Daily Allowance.

**Vitamin**—A group of organic micronutrients, present in minute quantities in natural foodstuffs, that are essential to normal metabolism.

**Water-soluble vitamins**—Vitamins that are soluble in water and which include the B-complex group and vitamin C. Whatever water-soluble vitamins are not used by the body are eliminated in urine, which means that a continuous supply is needed in food.

sensation in the feet, very severe at night, pain, weakness, and wasting of leg muscles. The other form, wet beriberi, involves the heart and circulatory system and leads to heart abnormalities. Symptoms include a high output of blood from the heart, a fast heart rate, and dilation of blood vessels, making the skin warm and moist. Because the heart cannot maintain the high output, it becomes stressed and heart failure may occur, as well as abnormal fluid accumulation in the legs (edema) and in the lungs (congestion). If untreated, it leads to shock and death.

### Interactions

Thiamin is known to interact with the following medications and should not be taken at the same time:

- Antiacids. These medications may lower thiamin levels in the body by decreasing absorption and increasing excretion or metabolism.
- Tetracycline. Tetracyline is an antibiotic and thiamin taken either alone or in combination with other B vitamins interferes with its absorption by the body and action in the body.
- Antidepressants. Thiamin supplements may improve the action of antidepressants such as nortriptyline, especially in elderly patients. Other medications in this class of drugs include desimpramine and imipramine.
- Chemotherapy drugs. Laboratory studies suggest that thiamin may prevent the activity of chemotherapy drugs, but effects are not yet understood in people. Patients undergoing chemotherapy for cancer, especially people receiving fluorouracil-containing drugs, are usually advised not take large doses of vitamin $B_1$ supplements.
- Diuretics. Diuretics, especially furosemide, which belongs to a class of drugs called loop diuretics, may reduce the levels of thiamin in the body.
- Digoxin. Laboratory studies also suggest that digoxin, a drug used to treat heart conditions, may lower the ability of heart cells to absorb and use thiamin, especially if digoxin is combined with furosemide.
- Scopolamine. Thiamin may help reduce some of the side effects associated with scopolamine, a drug used to treat motion sickness.

Thiamin can also interact with food substances. Foods and beverages that may inactivate thiamin include those containing sulfites and tea, coffee and decaffeinated coffee. Consumption of betel nuts may also reduce thiamin activity due to chemical inactivation, and may lead to symptoms of thiamin deficiency. Tobacco use also decreases thiamin absorption and may lead to decreased levels in the body.

## Aftercare

All forms of thiamin deficiency are treated with supplements. If severe deficiency results in a medical emergency, it is treated with high doses of thiamin for several days. When alcoholics must be fed intravenously, they are often given supplements as a preventive measure. Doses for conditions, such as severe beriberi or alcoholism, are administered by a health care practitioner in an appropriate clinical setting. The symptoms of beriberi may recur years after apparent recovery.

## Complications

Brain abnormalities due to thiamin deficiency are complications that occur mainly in alcoholics. They may develop when a chronic thiamin deficiency is suddenly worsened by a rapid decrease in the thiamin levels by an alcoholic binge or by a sudden increase in thiamin requirements when a malnourished alcoholic is fed intravenously. Brain abnormalities may develop in two stages: an early stage (Korsakoff's syndrome) and a later stage (Wernicke's encephalopathy). Together, they are called the Wernicke-Korsakoff syndrome. Korsakoff's syndrome causes memory loss, and Wernicke's encephalopathy causes mental confusion, difficulty walking, and eye problems. If Wernicke's encephalopathy is not treated, symptoms may lead to coma and even death. As for excessive thiamin intake complications, rare hypersensitivity/allergic reactions have occurred with supplementation.

## Parental concerns

Parents should refrigerate fresh produce and keep milk and grains away from strong light because vitamins are easily destroyed and washed out during food preparation and storage. Vitamin supplements should also be stored at room temperature in a dry place.

Taking thiamin for a long period of time can result in an imbalance of other B-complex vitamins. This is why it is generally recommended to take a B-complex vitamin with thiamin. Because of the potential for side effects and interactions with medications, thiamin supplements should also be taken only under the supervision of a knowledgeable health care provider.

### Resources

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**ORGANIZATIONS**

American Dietetic Association (ADA). 120 South Riverside Plaza, Suite 2000, Chicago, IL 60606-6995. 1-800/877-1600. <http://www.eatright.org>.
American Society for Nutrition (ASN). 9650 Rockville Pike, Bethesda, MD 20814. (301) 634-7050. <http://www.nutrition.org>.
U.S. Department of Agriculture, Food and Nutrition Information Center. National Agricultural Library, 10301 Baltimore Avenue, Room 105, Beltsville, MD 20705. (301) 504-5414. <http://www.nal.usda.gov>.

Monique Laberge, Ph.D.



**KEY TERMS**

**Dietary supplement**—A product, such as a vitamin, mineral, herb, amino acid, or enzyme, that is intended to be consumed in addition to an individual's diet with the expectation that it will improve health.

**Mineral**—An inorganic substance found in the earth that is necessary in small quantities for the body to maintain a health. Examples: zinc, copper, iron.

**Vitamin**—A nutrient that the body needs in small amounts to remain healthy but that the body cannot manufacture for itself and must acquire through diet.

# 3-day diet

## Definition

There are a variety of three-day diets that circulate from person to person and on the Internet. They tend to promise weight loss of 10 lb (4.5 kg) or more in just three days.

## Origins

The origins of the three-day diet are unclear. Some people believe that they go back to the 1980s when these kinds of diets were faxed from person to person. Three-day diets go by many different names, including the fax diet, Army diet, Navy diet, Cleveland Clinic diet, and many others. Often they are just referred to as three-day diets. Although many versions of this diet claim to have been created by one medical institution or another, no medical institutions have ever been known to come forward to claim responsibility for, or even to recommend, one of these diets. Many institutions that have these diets named after them, such as the British Heart Foundation or the Cleveland Clinic, go out of their way to inform dieters that the diet did not originate where its title claims.

The most common form of three-day diet on the Internet involves eating a large quantity of tuna and various vegetables during the day, with ice cream each evening. This diet seems to be similar to, or the same as, the three-day diet sold online by 3daydiets.net. It is unclear, however, if they are the developer of the diet, as they do not claim specifically to be.

## Description

There are many versions of three-day diets circulating, all with the promise of bringing dieters significant weight loss in just three days. There are many variations in what dieters may and may not eat during these three days. One diet even calls for dieters to drink only **water** for the first day. On the second day dieters may eat fruit, and drink only fruit juice, and on the third day dieters may eat only vegetables, and drink only vegetable juice.

The most common three-day diet, and the one that seems to be the most popular, is a three-day diet with a meal plan that instructs dieters what to eat for breakfast, lunch, and dinner. The specifics of the plan vary, as do what dieters are allowed to drink while on the plan. Some versions allow anything, others specify just water and diet soda in addition to the coffee and tea called for in the meal plan. Many require that dieters drink at least four glasses of water daily. Some allow diet soda to be substituted for the water. A common version of the three-day diet meal plan is:

### *Day 1*

Breakfast: black tea or coffee, 1/2 a grapefruit, 1 piece of toast with 1 Tablespoon of peanut butter. Some version specify 1/3 of a grapefruit, some call for artificial sweetener to be added to the coffee, some allow grapefruit juice to be substituted for the grapefruit.

Lunch: 1/2 cup tuna, 1 piece dry toast, black coffee or tea. Some versions call for tuna in water, some call for artificial sweetener with the coffee or tea.

Dinner: 3 ounces lean meat, 1 cup green beans, 1 cup carrots, 1 apple, 1 cup vanilla ice cream. Some versions specify a low fat ice cream, other do not. Some versions call for 1 cup of beets instead of carrots.

*Day 2*

Breakfast: 1 egg, 1 slice dry toast, 1/2 banana, black coffee or tea. Some versions require artificial sweetened in the coffee or tea. It is not generally specified how the dieter should prepare the egg. Some versions call for a whole banana.

Lunch: 1 cup cottage cheese and six crackers. Some versions allow dieters to choose between 1 cup of cottage cheese and 1 cup of tuna. Some require six crackers, some allow eight. Most versions call for Saltine brand crackers.

Dinner: two hot dogs, 1 cup broccoli, 1/2 cup carrots, 1/2 banana, 1/2 cup vanilla ice cream. Some versions specify beef franks. Some call for 1 cup of cabbage instead of 1 cup of broccoli. Some versions require low fat ice cream.

*Day 3*

Breakfast: one apple, 1 ounce cheddar cheese, five Saltine brand crackers, black tea or coffee. Some versions allow or require artificial sweetener.

Lunch: one hard-boiled egg, one slice dry toast. Some versions allow black coffee or tea (with or without artificial sweetener) with this meal, others do not.

Dinner: 1 cup tuna, 1 cup carrots, 1 cup cauliflower, 1 cup melon, and 1/2 cup vanilla ice cream. Some versions call for 1/2 a cantaloupe instead of 1 cup of melon. Some versions require low fat ice cream.

There are other versions of the above three-day diet, with some specifying even more alternatives for the dieter, including an orange instead of grapefruit, cottage cheese instead of tuna, and various vegetable substitutions. Most versions tell dieters to use lemon, salt and pepper, mustard, vinegar, herbs, **soy** sauce, ketchup, Worcestershire sauce, and other seasonings to add flavoring to food during the diet, but nothing containing fat, such as butter. Most versions of the diet are very specific in saying that dieters have to follow the rules exactly to see the promised weight loss.

## Function

The three-day diet usually promises that dieters will be able to lose 10 pounds in three days if the diet is followed exactly. Often the diet claims that this will result because the combination of foods called for by the diet causes some kind of increased **metabolism** that will burn pounds of fat. It is never made clear exactly what kind of reaction this is supposed to be, or how it is supposed to work. Often the diet says the dieter can repeat the diet after a few days of regular eating. Some version of three-day diets allow for as few as two days of normal eating, others require up to four or five. The three-day diets are intended to provide a dieter with extreme weight loss in a very short time and are not intended to change the dieters lifestyle or overall eating habits. Usually the diets go so far as to tell a dieter to eat whatever he or she was eating before the diet once the diet is over. The diets only caution is not to overeat. No exercise recommendations are made with three-day diets. Weight loss is supposed to come from increased metabolism and lowered calorie intake alone.

## Benefits

There are many benefits to weight loss if it achieved at a moderate pace through healthy eating and exercise. Three-day diets, however, are not considered moderately paced and do not include exercise, or a well-balanced diet. Although the diets claim that a dieter can lose 10 pounds in three days, weight loss is likely to come mainly from lost water weight. There may be some psychological benefit to quick weight loss, but this is likely to be undone if the weight is gained back quickly after the diet is over.

## Precautions

Anyone thinking of beginning a new diet should consult a physician or other medical professional. Daily requirements of calories, fat, and nutrients can differ significantly from person to person depending on age, weight, sex, and other factors. Talking to a doctor can help a dieter determine which diet is safe for that dieter's individual needs, and a doctor can help a dieter choose a diet that fits in well with his or her long-term weight loss goals. Pregnant or **breast-feeding** women should be especially cautious when thinking of beginning a new diet because when a baby is receiving nutrients from its mother, what the mother eats can have a significant impact on the growth and development of the baby.

## Risks

There are some risks associated with any diet, but diets that severely limit calories or the variety of foods that dieters may eat tend to be more risky than well-

## QUESTIONS TO ASK THE DOCTOR

- Is this diet safe for me?
- Is this diet the best diet to meet my goals?
- Do I have any dietary requirements this diet might not meet?
- Would a multivitamin or other dietary supplement be appropriate for me if I were to begin this diet?
- Is it safe for me to follow this diet over an extended period of time?
- Are there any sign or symptoms that might indicate a problem while on this diet?

balanced, moderately calorie-reduced diets. The most common three-day diet requires dieters to eat only about 1,000 calories a day, with some versions that have been analyzed consisting of at as few as 700 calories per day. This is too few for most people to maintain good health. A diet that contains fewer than 800 calories per day is considered a very low calorie diet. Very low calorie diets carry high risks of side effects, such as **gallstones** and cardiovascular problems. Very low calorie diets are only intended for the extremely obese who are experiencing significant medical problems due to **obesity**. These diets are carried out under the close supervision of physicians. They are not intended, or safe for, dieters to follow on their own.

Dieters who follow a three-day diet may find that any weight lost is gained back as soon as the diet is over, and may even find that more weight is gained that was lost. Having a very low caloric intake makes the dieter's metabolism slow down because the body thinks that it is starving. Then when a normal number of calories are reintroduced into the diet, the body wants to store extra fat in case there is a period of starvation again. This natural defense mechanism of the body against starvation can cause dieters who alternatively eat very few calories and then return to normal eating to gain large amounts of fat over time, even while they are trying to diet. Very low calorie diets pursued over only a few days also promote **binge eating** at the end of the diet.

Many of the versions of three-day diets, especially those intended for fasting, carry a high risk of vitamin and mineral deficiency. The body needs food from each of the food groups every day for good health. Drinking only fruit juices, or eating any very limited variety of foods, can make it nearly impossible for a dieter to get all of the nutrients required for good health. Any dieter considering this kind of diet should consult a physician about an appropriate multivitamin or supplement to help reduce this risk of deficiency. Multivitamins and **dietary supplements** carry their own risks, and can not replace a healthy, well-balanced diet.

### Research and general acceptance

Three-day diets are not generally accepted as healthy, effective ways to lose weight for the long term. Although no scientific studies have been carried out to determine the effectiveness of common three-day diets, experts suggest that anything that promises dieters 10 lb (4.5 kg) of weight loss in three days is unlikely to be taking off fat. Instead, dieters are probably losing water weight, with possibly a little fat loss and some muscle mass loss through the reduced caloric intake.

The United States Department of Agriculture makes recommendations for a healthy diet in its MyPyramid food guidelines. MyPyramid gives recommendations about how many servings of each food group are required daily for good health. These recommendations can be found at <http://www.MyPyramid.gov.> Any diet that will produce sustainable, healthy weight loss should follow these guidelines and include foods from each food group every day. Sustainable diets should not be extremely restrictive of any food group, or be extremely calorie-reduced.

Many studies have shown that exercise and diet are more effective at producing weight loss when done together than either is done alone. Three-day diets do not usually have any exercise recommendations. Instead, they generally claim that a combination of foods will magically melt away fat without the dieter having to expend any effort. Healthy weight loss plans should include both a diet and an exercise component. As of 2007, the Centers for Disease Control recommended that adults get a minimum of 30 minutes of light to moderate exercise each day for good health.

### Resources

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#### ORGANIZATIONS

American Dietetic Association. 120 South Riverside Plaza, Suite 2000, Chicago, Illinois 60606-6995. Telephone: (800) 877-1600. Website: <http://www.eatright.org>

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## KEY TERMS

**Dietary supplement**—A product, such as a vitamin, mineral, herb, amino acid, or enzyme, that is intended to be consumed in addition to an individual's diet with the expectation that it will improve health.

# 3-hour diet

## Definition

The 3-Hour diet is based on the concept that weight loss is best achieved by eating small amounts frequently, in this case, every three hours.

## Origins

The 3-Hour diet was originated by Jorge Cruise in the mid-2000s, Cruise was an overweight child who went on to lose weight, shape up, and become a self-proclaimed weight-loss expert. He has no formal nutrition training.

Cruise is the author of the *New York Times* bestseller *8 Minutes in the Morning,* an exercise and diet program, and *The 3-Hour Diet*. He is a columnist for *USA Weekend Magazine* and is the diet and fitness editor for *Good Housekeeping* magazine. Cruise has discussed his diet and fitness philosophy on many television talk shows and is the weight-loss coach on AOL. He maintains a Web site at <http://www.jorgecruise.com>

## Description

The 3-Hour diet is a diet regimen based on the philosophy that the timing of meals is more important than the type of food eaten in those meals. Cruise says the body's basal (baseline) metabolic rate (BMR) can be increased by eating every three hours. Keeping the metabolic rate high is desirable because this makes the body burn more calories.

The three basic rules of the 3-Hour diet are:

- Eat breakfast within one hour of arising.
- Eat every three hours after that.
- Stop eating three hours before going to bed.

The 3-hour diet requires three meals alternating with two snacks at regular three-hour intervals. Certain foods are recommended, but the diet does not provide a day-by-day meal plan. Cruise also recommends drinking eight glasses of **water** daily. On the diet, **caffeine** is not limited, but dieters must drink two glasses of water for every cup of coffee. This offsets the dehydrating effect of caffeine, Cruise says. Alcohol is to be drunk only rarely. However, the diet does allow occasional fast food and some frozen or processed foods. One key to success on the 3-Hour diet is planning meals and snacks ahead of time. Knowing what they will eat for the next meal helps dieters stick to the diet.

The 3-Hour diet is not a low carbohydrate, high **protein**, or very **low fat diet**. Meals are required to consist of a reasonable balance of **carbohydrates**, protein, and **fats**. The emphasis is on choosing appropriate foods and on strict portion control. Although Cruise claims people can eat anything they want and still lose weight on his diet, in reality, by following the diet correctly, an individual is limited to about 1,450 calories a day. Many nutritionists consider this an appropriate calorie intake for slow, steady weight loss. Cruise claims that people following the 3-Hour Diet will lose 2 lb (0.9 kg) per week, and that they can target the spots on the body where they can lose fat. The diet is intended to last 28 days, with a repeat cycle for people who need to lose more weight.

The exercise aspect of the 3-Hour diet is somewhat confusing. Cruise initially claims that exercise is not a part of this weight-loss program and that the 3-Hour diet is good for individuals with arthritis or limited mobility. However, he also says that building muscle mass is important in weight loss because even at rest a pound of muscle burns twice as many calories as a pound of fat. This occurs because metabolic activity is higher in muscle cells. Ultimately Cruise does suggest exercises to go along with the 3-Hour diet, and they are generally not appropriate for people with sore joints or mobility limitations.

The final piece to the 3-Hour diet is motivation. In his book, Cruise devotes considerable space to a 28-day success planner. The planner helps dieters plan meals, and is filled with motivational quotations, dieting tips, and visualization exercises that encourage the dieter to picture a slimmer, happier version of him or herself. Cruise also maintains Web site where for a fee ($5 per week in 2007), dieters get access to additional

expert advice, meal plans, diet and exercise tips, and motivational exercises.

## Function

Jorge Cruise claims that his 3-Hour diet will reprogram the body's BMR and allow people to lose 2 lb a week. According to Cruise, if the body goes too long without food, what he calls the starvation protection mechanism kicks in. When this happens, the body begins to conserve energy, use fewer calories, and burn less fat. It is true that starvation causes the body to take action to conserve metabolic fuel. However, as a review of *The 3-Hour Diet* on the American Dietetic Association Web site points out, there is no scientific proof that going three hours between meals causes the body to think that it is starving or that eating every three hours will change the BMR.

Cruise also claims that dieters can target specific parts of the body from which to lose inches. There is no research to show that this is true, although specific exercises may build muscle and tone certain spots.

## Benefits

The 3-Hour diet benefits dieters by providing a blueprint for relatively low calorie, balanced meals. People who are mindless or unconscious eaters often benefit from eating on a schedule. The 3-hour approach also helps to curb binge-eating behavior. Because they are required to eat at prescribe times, dieters do not get so hungry that they gorge themselves at the next meal. Nighttime eaters also benefit from the prohibition against eating three hours before going to bed. Another benefit of this diet is that it uses regular supermarket food, which keeps the cost reasonable. There are no required fees to participate.

One common complaint about the diet is that meal plans and menus are limited unless the dieter joins the optional fee-based Web site associated with the diet. Membership to the Web site is sold in 13-week blocks. Another complaint is that the dieter is strongly encouraged to buy Jorge Cruise **dietary supplements** to take while on the diet.

## Precautions

As with any diet, people should discuss with their physician the pros and cons of the 3-Hour diet based on their individual circumstances.

## Risks

There appear to be few risks to following this diet.

### QUESTIONS TO ASK THE DOCTOR

- Is this diet the best diet to meet my weight-loss goals?
- Would a multivitamin or other dietary supplement be appropriate for me if I were to begin this diet?
- Will this diet meet my long-term dietary needs?
- Does this diet pose any special risks for me that I should be aware of?
- Can my whole family follow this diet?
- Do you have any experience with the long-term success of this diet?

## Research and general acceptance

The 3-Hour diet did not appear until the mid-2000s and as of 2007, no scholarly research has been done on it. There has been some research on the effects of eating many small meals instead of three large ones on dieting success. The results have been mildly favorable. Many weight-loss professionals support the idea of distributing calories across five or six meals during the day.

No research has been done on the "resetting" of BMR by eating small, frequent meals. The consensus among nutritionists is that people who lose weight on the 3-Hour diet do so more because calories are restrict to under 1,500 a day than because of any specific value in the 3-hour timing of meals. The timing may, however, help people to change their eating behaviors in constructive ways.

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**ORGANIZATIONS**

American Dietetic Association. 120 South Riverside Plaza, Suite 2000, Chicago, Illinois 60606-6995. Telephone: (800) 877-1600. Website: <http://www.eatright.org>

JorgeCruise.com, Inc. PO Box 6220, San Diego, CA 92166. Office Telephone: 619) 523-3035 Customer Support Line: (877) 465-6743 Fax: (619) 374-2004. Website: <http://www.3hourdiet.com>

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# TLC diet

## Definition

Although there are several diets that will result in lowered LDL cholesterol, the National Cholesterol Education Program (NCEP) set forth guidelines for medical professionals to follow when instructing patients on a medical nutrition option for lowering cholesterol. Termed the TLC diet or the Therapeutic Lifestyle Changes Diet it emphasizes heart healthy lifestyle choices.

The Therapeutic Lifestyle Changes diet (TLC) is a cholesterol lowering diet that refers to a cholesterol-lowering treatment that lowers a person's low-density lipoprotein (LDL) level and raises their high-density lipoprotein (HDL) level enough to reduce their risk of a heart attack or other chronic disease caused by hardening of the arteries.

### The TLC diet follows these dietary guidelines:

- Less than 7% of the day's total calories from saturated fat.
- 25-35% of the day's total calories from fat.
- Less than 200 milligrams of dietary cholesterol a day.

**TLC diet tips**

**Meat, Poultry, Fish, Dry Beans, Eggs, and Nuts**

- Limit the total amount of meat to 5 ounces or less per day
- Choose chicken and turkey without skin or remove skin before eating
- Eat fish, like cod, that has less saturated fat than either chicken or meat
- Dry peas and beans and tofu (bean curd) are great meat substitutes
- Limit egg yolks to no more than 2 yolks per week, including egg yolks in baked goods
- Substitute egg whites for whole eggs

**Milk, Yogurt, and Cheese**

- Eat 2 to 3 servings per day of low-fat or nonfat dairy products
- Choose varieties that have 3 grams of fat or less per ounce, including low-fat (1%) or nonfat cottage cheese
- Buy frozen desserts that are lower in saturated fat, like ice milk, low-fat frozen yogurt, sorbets
- Try low-fat or nonfat sour cream or cream cheese blends

**Fats and Oils**

- Replace saturated fats with unsaturated fat and limit the total amount of fats or oils
- Use liquid vegetable oils that are high in unsaturated fats (canola, corn, olive, peanut, safflower, sesame, soybean, sunflower oils)
- Use margarine made with unsaturated liquid vegetable oils as the first ingredient
- Limit butter, lard, fatback, and solid shortenings
- Buy light or nonfat mayonnaise and salad dressing

**Fruits and Vegetables**

- Eat at least 3 to 5 servings of fruits and vegetables each day
- Buy fruits and vegetables to eat as snacks, desserts, salads, side dishes, and main dishes
- Add a variety of vegetables to meat stews or casseroles or make a vegetarian main dish
- Snack on raw vegetables (carrots, broccoli, cauliflower, lettuce)
- Season with herbs, spices, lemon juice, vinegar, fat free or low-fat mayonnaise or salad dressing

**Breads, Cereals, Rice, Pasta, and Other Grains**

- Eat 6 to 11 servings of foods from this group each day
- Choose whole grain breads and rolls
- Buy dry cereals, most are low in fat, and limit high fat granola, muesli, and oat bran types made with coconut or coconut oil and nuts
- Buy pasta and rice to use as entrees and eliminate the high fat sauces (butter, cheese, cream)
- Limit sweet baked goods that are made with lots of saturated fat

**Sweets and Snacks**

- Choose sweets and snacks only every now-and-then
- Buy snack foods low in fat
- Some sweets and snacks may be low in fat, but most are not low in calories
- To reduce sodium intake, look for low sodium or unsalted varieties

*(Illustration by GGS Information Services/Thomson Gale.)*

- Limit sodium intake to 2400 milligrams or less per day.
- Just enough calories to achieve or maintain a healthy weight and reduce your blood cholesterol level.

### *The NCEP classifies blood cholesterol levels as:*

- Total Cholesterol less than 200 mg/dL, desirable; 200–239 mg/dL borderline-high; 240 mg/dL and above high.
- LDL Cholesterol less than 100 mg/dL as optimal or ideal; 100–129 mg/dL near optimal/above optimal;

130–159 mg/dL borderline-high; 160–189 mg/dL high; 190 mg/dL and above very high.

- HDL Cholesterol less than 40 mg/dL as a major heart disease risk factor; 60 mg/dL and above gives some protection against heart disease.

## Origins

Cholesterol is a waxy substance found only in foods of animal origin such as poultry, beef, fish, eggs, and dairy products. Cholesterol can be made from the liver and thus is not needed in the diet for normal cellular processes. Cholesterol must be combined with **fats**, proteins, and lipoproteins, before it can be transported through the body within the blood. There are many different lipoproteins that vary in size, function and composition. One of which is low-density lipoprotein (LDL). Commonly referred to as the "bad" cholesterol, it composes relatively two-thirds of total circulating blood cholesterol. Because the LDL transports cholesterol through the bloodstream, in high levels, it is associated with plaque deposits on the walls of the arteries resulting in a higher risk for cardiovascular events. High-density lipoprotein (HDL) referred to as the "good" cholesterol, scavenges excess cholesterol from the blood and brings it back to the liver for excretion. Research! shows that higher levels of HDL levels are related to lower levels of certain cardiovascular events. Another class of lipoproteins, the very-low-density-lipoproteins (VLDL), is responsible for carrying **triglycerides** through the bloodstream.

Evidence is clear that the major dietary contributors to elevated cholesterol are saturated fat, trans fat, **dietary cholesterol**, and an imbalance in caloric intake and energy expenditure resulting in weight gain. In some cases elevated cholesterol may be due to an underlying medical condition or certain prescribed medications as listed below, but not limited to:

- Hypothyroidism
- Nephrotic syndrome
- Chronic liver disease
- Cholestasis
- Monoclonal gammopathy
- Cushing's syndrome
- Oral contraceptive use
- Anorexia nervosa
- Acute intermittent porphyria
- Protease inhibitor use

Other factors known to influence a persons blood cholesterol level include:

### KEY TERMS

**Cholesterol**—A soft, waxy substance found among the lipids (fats) in the bloodstream and in all your body's cells.

**Lipoprotein Particle**—A lipoprotein particle is composed of an outer shell of phospholipid, which renders the particle soluble in water; a core of fats called lipid, including cholesterol and a surface apoprotein molecule that allows tissues to recognize and take up the particle.

**Lipoproteins**—Their density characterizes types of lipoproteins- high-density lipoprotein (HDL), low-density lipoprotein (LDL), very-low-density lipoprotein (VLDL).

**Hypercholesterolemia**—The presence of an abnormal amount of cholesterol in the cells and plasma of the blood is associated with the risk of atherosclerosis.

**Hyperlipidemia**—Presence of excess lipids in the blood.

**Coronary Heart Disease**—A progressive reduction of blood supply to the heart muscle due to narrowing or blocking of a coronary artery.

- Heredity. Genetic factors play a large role in the amount of cholesterol in a person's blood.
- Age.As a person ages, their cholesterol level tends to rise gradually.
- Sex. Men tend to have higher LDL and lower HDL than premenopausal women.
- Menopause. After menopause, estrogen levels fall and women's LDL cholesterol levels tend to rise.
- Weight. As weight rises, so does cholesterol. Usually LDL levels rise as HDL levels lower.
- Smoking. Smoking can lower a persons HDL levels.
- Exercise. Regular exercise raises a persons HDL levels. As well as help in weight loss or maintenance.
- Alcohol. Studies suggest that no more than one drink for women and two drinks for males may help in raising HDL levels.

In November 1985, in order to standardize the medical approach to treating high cholesterol blood levels, The National Heart, Lung, and Blood Institute (NHLBI) launched the National Cholesterol Education Program (NCEP). The overall goal of the NCEP is to "reduce illness and death from **coronary heart disease** (CHD) in the United States by reducing the percent of Americans with high blood cholesterol".

In their first approach, the NCEP designed the Step 1 and Step 2 diet to lowering cholesterol. Designed as an initial diet for people with high dietary cholesterol, the Step I diet restricted total fat to no more than 30% of total calories, saturated fat to no more than 10% of total calories, and cholesterol to less than 300 mg/day. If this approach did not result in a lowering of cholesterol or for people post-myocardial infraction or at high risk of one, the Step II diet goals were instituted. They recommended less than 7% of total calories for saturated fat and less than 200 mg/day of cholesterol.

For the general population, the NCEP still recommends a diet following the Step 1 recommendations. However, in May of 2001, the NCEP issued the Third Report of the Expert Panel on Detection, Evaluation, and Treatment of High Blood Cholesterol in Adults (Adult Treatment Panel III [ATP III]) which recommended the new TLC dietary therapy for subgroups of people with specific medical conditions and risk factors listed below:

High LDL cholesterol or other lipid disorders, coronary heart disease or other cardiovascular disease **diabetes mellitus**, insulin resistance or metabolic syndrome.

Soon after the report was issued, health organizations such as The American Heart Association (AHA) began to accept and endorse these recommendations. Now a majority of organizations have incorporated the TLC diet into materials on dietary and lifestyle change for people with high blood cholesterol.

## Description

The three cornerstones of the TLC lifestyle modification diet are:

- Dietary Changes. Reduction of saturated fat, trans-fat, and cholesterol within the diet. Addition of plant stanols and sterols. Increased consumption of soluble fiber.
- Weight Management. Weight loss can help lower LDL and is especially important for those with a cluster of risk factors that includes high triglyceride and/or low HDL levels. For those with a large waist measurement (more than 40 inches for men and more than 35 inches for women) it is important to lose weight to decrease the risk for developing heart disease.
- Physical Activity. Regular physical activity, at least 30 minutes on most, if not all, days is recommended every day of the week. Physical activity can help raise HDL and lower LDL and is important for those with high triglyceride and/or low HDL levels who are overweight with a large waist measurement.

The TLC eating plan is one that advises less than 7% of calories from saturated fat and less than 200 mg of dietary cholesterol per day. There should be no more than 25-35% or less of total daily calories coming from total fat intake. A limit of 2400 mg of day of **sodium** is recommended. The TLC diet recommends weight maintenance and avoidance of weight gain through caloric homeostasis. If LDL cholesterol is not lowered through reduction of saturated fat and cholesterol intakes, then it is suggested that the amount of soluble **fiber** in the diet be increased.

The TLC Program is adjusted using a set of four categories that are based on ones heart disease risk profile to set LDL goals and treatment steps. For a person who has heart disease or diabetes, they are considered a category I, carrying the highest risk. For persons free of those conditions, their needs are based upon their personal risk of having a heart attack in the next 10-years based upon the Framingham Heart Study. The higher a persons risk category, the more important it is for them to lower their LDL and control any other heart disease risk factors (including smoking and high blood pressure) they have.

## Function

The TLC diet is prescribed for people who need to reduce their risk for heart disease. The main goal in treating high cholesterol via the TLC program is to lower a persons LDL level. Research has proven that a lowering of LDL levels can prevent or decrease the risk of heart attacks and reduce deaths from heart disease in both men and women. The TLC program can decelerate, stop, or reverse the buildup of plaque. When followed, it can also lower the cholesterol content in unstable plaques, making them less likely to burst and cause a heart attack. For those who have already experienced a myocardial infraction, the diet can reduce the risk of another heart attack, possibly prolonging life.

## Benefits

By following the TLC lifestyle approach, a person is following a healthful lifestyle that has a synergistic effect on other disease risks. The TLC program has been shown to help control other risk factors for heart disease such as high blood pressure, overweight/obesity, and diabetes, as well as decreasing the possibility of the blood to form clots. Research has shown that for every 10-percentage points cholesterol is reduced, the risk of death from heart disease drops by 15

percent. For those who take cholesterol-lowering medications, following the TLC program can ensure that they take the lowest dose needed to achieve results.

### Precautions

Along with a qualified physician, making sure that qualified professionals who can assist with safe dietary and lifestyle changes should include registered dietitians, doctors, nurses, psychologists, and exercise physiologists.

### Risks

According to the NCEP Guidelines, all adults 20 years of age and older should have their total cholesterol as well as HDL-cholesterol measured every five years.

### Risks

***Positive Risk factors for heart disease:***

- Male greater than 45 years of age
- Female greater than 55 years of age
- Female with premature menopause without estrogen replacement
- Family history of premature coronary heart disease having definite myocardial infarction or sudden death before age 55 in father or other first-degree male relative, or mother before age 65 years of age
- Currently smoking or history of cigarette smoking
- Blood pressure greater than 140/90 mmHg or on antihypertensive medications
- HDL cholesterol less than 35 mg/dl
- LDL cholesterol greater than 130 mg/dl
- Diabetes Mellitus

### Research and general acceptance

Scores of research articles support a direct relationship between LDL cholesterol levels and the rate of coronary heart disease (CHD) in a person. Within-population studies such as the Framingham and MRFIT studies and between-population studies, most notably the Seven Countries study support this research as well. Studies on familial Hypercholesterolemia, a genetic disorder characterized by high levels of LDL cholesterol, have an exceedingly high rate of premature atherosclerosis. The majority of research from experimental animals, laboratory investigations, epidemiology, and genetic forms of hypercholesterolemia indicate that elevated low-density lipoprotein (LDL) cholesterol is a major cause of CHD. In addition, clinical trials demonstrate a reduction of coronary heart disease risk when low-density lipoprotein-lowering therapy is instituted. For these reasons, the NCEP Expert Panel on Detection, Evaluation, and Treatment of High Blood cholesterol in Adults (Adult Treatment Panel III) continues to identify elevated low-density lipoprotein cholesterol as the primary target of cholesterol-lowering therapy.

### QUESTIONS TO ASK YOUR DOCTOR

- When should I start having my cholesterol level checked?
- What is my risk of developing heart disease?
- When should cholesterol-lowering drugs be used?
- When I begin making changes, when can I cut my dosage of cholesterol lowering drugs?
- When should I expect to see a difference in my cholesterol profile?
- How long should I try the TLC diet before medication is prescribed?

### Resources

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National Diabetes Information Clearinghouse http://diabetes.niddk.nih.gov/

Tobacco Information and Prevention Source TIPS. <http://www.cdc.gov/tobacco/index.htm>.

Megan C.M. Porter, RD, LD

Total Wellbeing diet *see* **CSIRO total well-being diet**

# *Trans* fatty acids

## Definition

*Trans* fatty acids are unsaturated fatty acids with at least one double bond in the *trans* configuration. Unsaturated fatty acids are derived metabolically from saturated fatty acids by the abstraction of pairs of hydrogen atoms from adjacent methylene groups. The removal of a pair of hydrogen atoms gives rise to a double bond. The remaining hydrogen atoms can either be on the same side of the fatty acid molecule, in which case the double bond has the *cis* geometrical configuration, or on opposite sides giving the *trans* configuration. *Trans* fatty acids occur naturally in a small amounts in a few foods, however, the majority are formed during the partial hydrogenation of vegetable oils. This process converts vegetable oils into semi-solid **fats** for use in margarines, commercial cooking, and manufacturing processes. There is strong evidence that the consumption of *trans* fatty acids from industrial sources increases the risk of **coronary heart disease** (CHD).

## Purpose

Whereas the presence of a *cis* bond in a fatty acid molecule affects the linearity of the fatty acid chain, making it fold back on itself, a *trans* bond has minimal effect on the conformation of the chain, making its physical properties more closely resemble those of a saturated fatty acid. The molecules of a *trans* fatty acid are able to pack together more closely than those of a *cis* isomer and this is reflected in differences in melting points. The melting point of the saturated fatty acid stearic acid (chain length of 18 carbons) is 157.28°F (69.6°C), the melting point of oleic acid (chain length of 18 carbons with one *cis* bond) is 55.76°F (13.2°C), whereas the melting point of eladic acid, the *trans* isomer of oleic acid, is 111.2°F (44.0°C). For this reason, partially hydrogenated vegetable oils are used extensively by the food industry, as their high *trans* fatty acid content gives the oils a longer shelf life and an increased stability during deep-frying. Their semi-solidity can be customized to enhance the palatability of baked goods and sweets.

## Description

### *Sources and consumption of trans fatty acids in the United States diet*

The average consumption of industrially produced *trans* fatty acids in the United States is between 2 to 3% of total calories consumed. The major sources of *trans* fatty acids in the American diet are deep-fried foods, bakery products, packaged snack foods, margarines, and crackers. Naturally occurring *trans* fatty acids are found in meats and dairy products from cows, sheep, and other ruminant animals; they are produced in the forestomach of the animal where polyunsaturated fatty acids of plant origin, such as linoleic acid and linolenic acid, can undergo partial or complete hydrogenation by the action of symbiotic anaerobic bacteria present in the ruminant stomach. These naturally occurring *trans* fatty acids are consumed in much smaller amounts, approximately 0.5% of total energy intake.

**Trans fatty acids**

| Food | g/Serving | g/100g | % of total fatty acids | % of daily energy intake for 2000 kcal diet |
|---|---|---|---|---|
| Breaded fish burger | 5.6 | 3.4 | 28 | 2.5 |
| Breaded chicken nuggets | 5.0 | 4.9 | 25 | 2.3 |
| French fries | 4.7–6.1 | 4.2–5.8 | 28–36 | 2.1–2.3 |
| Pie | 3.9 | 3.1 | 28 | 1.8 |
| Danish or sweet roll | 3.3 | 4.7 | 25 | 1.5 |
| Pancakes | 3.1 | 2.0 | 21 | 1.4 |
| French fries, frozen | 2.8 | 2.5 | 30 | 1.3 |
| Doughnuts | 2.7 | 5.7 | 25 | 1.2 |
| Crackers | 2.1 | 7.1 | 34 | 0.9 |
| Enchilada | 2.1 | 1.1 | 12 | 0.9 |
| Cookies | 1.8 | 5.9 | 26 | 0.8 |
| Cakes | 1.7 | 2.7 | 16 | 0.8 |
| Tortilla (corn) chips | 1.6 | 5.8 | 22 | 0.7 |
| Popcorn, microwave | 1.2 | 3.0 | 11 | 0.5 |
| Burrito | 1.1 | 0.9 | 12 | 0.5 |
| Pizza | 1.1 | 0.5 | 9 | 0.5 |
| Brownie | 1.0 | 3.4 | 21 | 0.5 |
| Granola bar | 1.0 | 3.7 | 18 | 0.5 |
| Hard (stick) margarine | 0.9–2.5 | 6.2–16.8 | 15–23 | 0.4–1.1 |
| Muffin | 0.7 | 1.3 | 14 | 0.3 |
| Breakfast bar | 0.6 | 1.3 | 15 | 0.3 |
| Tortillas | 0.5 | 1.8 | 25 | 0.2 |
| Soft (tub) margarine | 0.3–1.4 | 1.9–10.2 | 5–14 | 0.1–0.6 |
| Chocolate bar | 0.2 | 0.6 | 2 | 0.1 |
| Peanut butter | 0.1 | 0.4 | 1 | 0.05 |

**Typical fatty acid content of foods produced or prepared with partially hydrogenated vegetable oils in the United States.** *(Illustration by GGS Information Services/Thomson Gale.)*

### *trans fatty acids from ruminant sources*

The predominant *trans* isomer in ruminant animals is vaccenic acid, from which conjugated linolenic acid (CLA) can be formed. It is possible to change the *trans* fatty acid content of ruminant products by altering the animals' feed although levels of *trans* fatty acids in meat and milk are already relatively low, between 1 and 8% of total fat content. With respect to CLA, it is considered desirable to increase levels in foods rather than to

## KEY TERMS

**Atherosclerosis**—The initial stage of CHD where excess cholesterol in the blood is deposited in the walls of arteries causing them to harden and narrow.

**Conjugated linolenic acid**—A fatty acid suggested to have health benefits.

**HDL cholesterol**—A carrier of cholesterol in the blood, high levels of which are associated with decrease risk of CHD.

**Hydrogenation**—The addition of hydrogen atoms to carbon double bonds to make them in to single bonds.

**LDL cholesterol**—A carrier of excess cholesterol in the blood, high levels of which are associated with increase risk of CHD.

**Monounsaturated fatty acid**—A fatty acid molecule with one double bonds, known to be beneficial to health when consumed in moderate amounts.

**Polyunsaturated fatty acid**—A fatty acid molecule with two or more double bonds, known to be beneficial to health when consumed in moderate amounts.

**Saturated fatty acid**—A fatty acid molecule with no double bonds, known to be detrimental to health when consumed in large amounts.

**Tumor necrosis factor**—A substance that is part of an inflammatory system and used as a marker to measure inflammation.

decrease levels. This is due to the suggested health benefits of CLA in humans, such as reduced insulin sensitivity and improved immune function, although the evidence remains inconclusive.

There is no association between intake of *trans* fatty acids from ruminant sources and risk of CHD and in fact some studies have shown non-significant trends towards an inverse association. The absence of an positive association of *trans* fatty acids from ruminant sources compared with from industrial sources may be due to lower levels of intake (less than 0.5% of total energy intake), different biological effects of different isomers, or the presence of other factors in meat and diary products that outweigh any effects of the small amount of *trans* fatty acids they contain. Further research in these areas is needed although it would seem that *trans* fatty acids from ruminant sources do not pose a threat to public health.

## Precautions

### *The physiological effects of trans fatty acids from industrial sources*

The main effects of *trans* fatty acids are on serum lipid levels. Numerous controlled dietary trials have been conducted to evaluate the effect of isocaloric replacement of saturated or *cis* unsaturated fatty acids with *trans* fatty acids. The data from many of these studies has been used in a number of large meta-analyses, all of which strongly indicate that compared with saturated or *cis* unsaturated fatty acids, the consumption of *trans* fatty acids raises levels of low density lipoprotein (LDL) cholesterol, reduces levels of high density lipoprotein (HDL) cholesterol and increases the ratio of total cholesterol to HDL cholesterol, all of which are powerful risk factors from CHD.

There is substantial evidence to show that *trans* fatty acids also promote systemic inflammation. In a large trial of women, greater intake of *trans* fatty acids was associated with increased activity of the tumour necrosis factor (TFN) system, a biomarker used to measure inflammation. Among those with a higher **body mass index** (BMI), a greater intake of *trans* fatty acids was also associated with other inflammatory substances. The presence of inflammation is an independent risk factor for atherosclerosis, sudden death from cardiac causes, **diabetes mellitus**, and heart failure. Thus the inflammatory effects of *trans* fatty acids contribute further to overall CHD risk.

The risk to health of consuming *trans* fatty acids from industrial sources has been recognized and acknowledged by the United States government. The Food and Drug Administration (FDA) made it compulsory from 2006, for nutrition labels for all conventional foods and supplements to indicate the content of *trans* fatty acids. In addition, the Department of Agriculture has made a limited intake of *trans* fatty acids a key recommendation of the new food pyramid guidelines, following the recommendations of the Dietary Guidelines Advisory Committee that intake of *trans* fatty acids should be less than 1% of total energy. Furthermore, action is being taken at local levels; the New York City Department of Health and Mental Hygiene has asked 20,000 restaurants and 14,000 food suppliers to eliminate partially hydrogenated oils from kitchens and to provide foods free from industrially produced *trans* fatty acids. Although the elimination of these *trans* fatty acids may be challenging, experience in other countries, such as Denmark, indicates that these fats can largely be replaced by *cis* unsaturated fats without increasing the cost or availability of foods.

Health care providers should advise consumers about how to minimize the intake of *trans* fatty acids, consumers should be able to recognize and avoid products containing *trans* fatty acids and restaurants and food manufacturers should use alternative fats in food production and preparation. These measures should ensure a reduction in *trans* fatty acid consumption and result in substantial health benefits particularly a reduction in the incidence of CHD.

## Complications

### *Trans fatty acid intake and risk of disease*

***TRANS* FATTY ACID INTAKE AND CHD.** On a per calorie basis, *trans* fatty acids increase the risk of CHD more than any other macronutrient, conferring a substantially increased risk even at low levels of consumption (between 1 to 3% of total energy intake). Even a small rise in energy intake from *trans* fatty acids can cause a large increase risk. A meta-analysis of four prospective cohort studies that included data from 140,000 subjects showed a 23% increase in CHD incidence when energy intake from *trans* fatty acids increased by just 2%. So dramatic is the impact of *trans* fatty acids on CHD risk, another study showed that the positive association between levels of *trans* fatty acids in adipose tissue (a biomarker for dietary intake) and CHD risk was diminished after 1996, when *trans* fatty acids where eliminated from margarines sold in Australia and the population's consumption levels decreased.

The potential benefits of reducing of reducing consumption of *trans* fatty acids from industrial sources on the incidence of CHD in the United States has been calculated. On the basis of predicted changes in total and HDL cholesterol, CHD events could be reduced by between 3 and 6 percent. If the influence of *trans* fatty acids on other risk factors such as inflammatory effects is considered, CHD events could be reduced by 10–19% (equivalent to between 72,000 and 228,000 CHD events each year). This reduction could be even greater, if healthier *cis* unsaturated fatty acids, including **omega-3 fatty acids**, are used to replace *trans* fatty acids.

***TRANS* FATTY ACID INTAKE AND DIABETES.** The association between risk of diabetes and *trans* fatty acid intake is less clear. Three prospective studies have investigated this relationship and in two of the studies, consumption of *trans* fatty acids was not significantly associated with increased risk of diabetes. However, in a study of nearly 85,000 female nurses a strong positive association was found. The nurses were followed for 16 years, information of dietary intake was periodically updated and self-reported diabetes was validated. The conclusions of no association in the first two studies may be explained by the relatively low intake in one cohort of male health professionals (average intake of 1.3% energy).

## Parental concerns

Parents should eliminate all sources of *trans* fatty acids from industrial sources from their **children's diets** as these have no intrinsic health value above their energy value. Therefore their consumption is linked with considerable potential harm and no apparent benefit. As adverse effects are seen at even low levels of intake, between 1 and 3% of total energy (2–7g per day for a person consuming 2,000 calories), it seems complete or near complete avoidance of *trans* fatty acids should be advised in order to minimize health risks.

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American Dietetic Association (ADA). 120 South Riverside Plaza, Suite 2000, Chicago, IL 60606-6995. Phone: (800) 877-1600. Website: http://www.eatright.org.

American Heart Association. National Center, 7272 Greenville Avenue, Dallas, TX 75231. Phone: 1-800-242-8721. Website: http://www.americanheart .org.

Centre for Science in Public Interest. 1875 Connecticut Ave. N.W. Suite 300, Washington, D.C. 20009. Phone: (202) 332-9110. Website: http://www.cspinet.org.

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# Traveler's diarrhea

## Definition

Traveler's diarrhea is an increase in loose, watery stools that often occurs when travelers from industrialized countries travel to developing or underdeveloped countries. Traveler's diarrhea has many nicknames such as Montezuma's revenge, Tut's tummy, or tourista.

## Description

Traveler's diarrhea is a common disease. It is a form of **food poisoning** caused by consuming **water** or food contaminated with bacteria, viruses, or parasites that attack the digestive system. Normally the disease is mild and does not require professional medical care, but it can alter the plans of travelers' and make them quite miserable for a few days.

Every year, more than 60 million people travel from industrialized countries to developing or underdeveloped countries. Of these, as many has half (estimates range from 20–55%, with most near the higher end) will develop traveler's diarrhea. Other estimates suggest that 50,000 cases of traveler's diarrhea occur each day. The likelihood of getting traveler's diarrhea depends primarily on the traveler's destination. The World Health Organization (WHO) has designated countries as either high, moderate, or low risk for traveler's diarrhea based on their degree of hygiene and public sanitation. Only traveler's, not natives, tend to be affected in high and moderate risk countries. People living in those countries are exposed to the organisms that cause traveler's diarrhea from childhood and their bodies develop ways to combat or tolerate them.

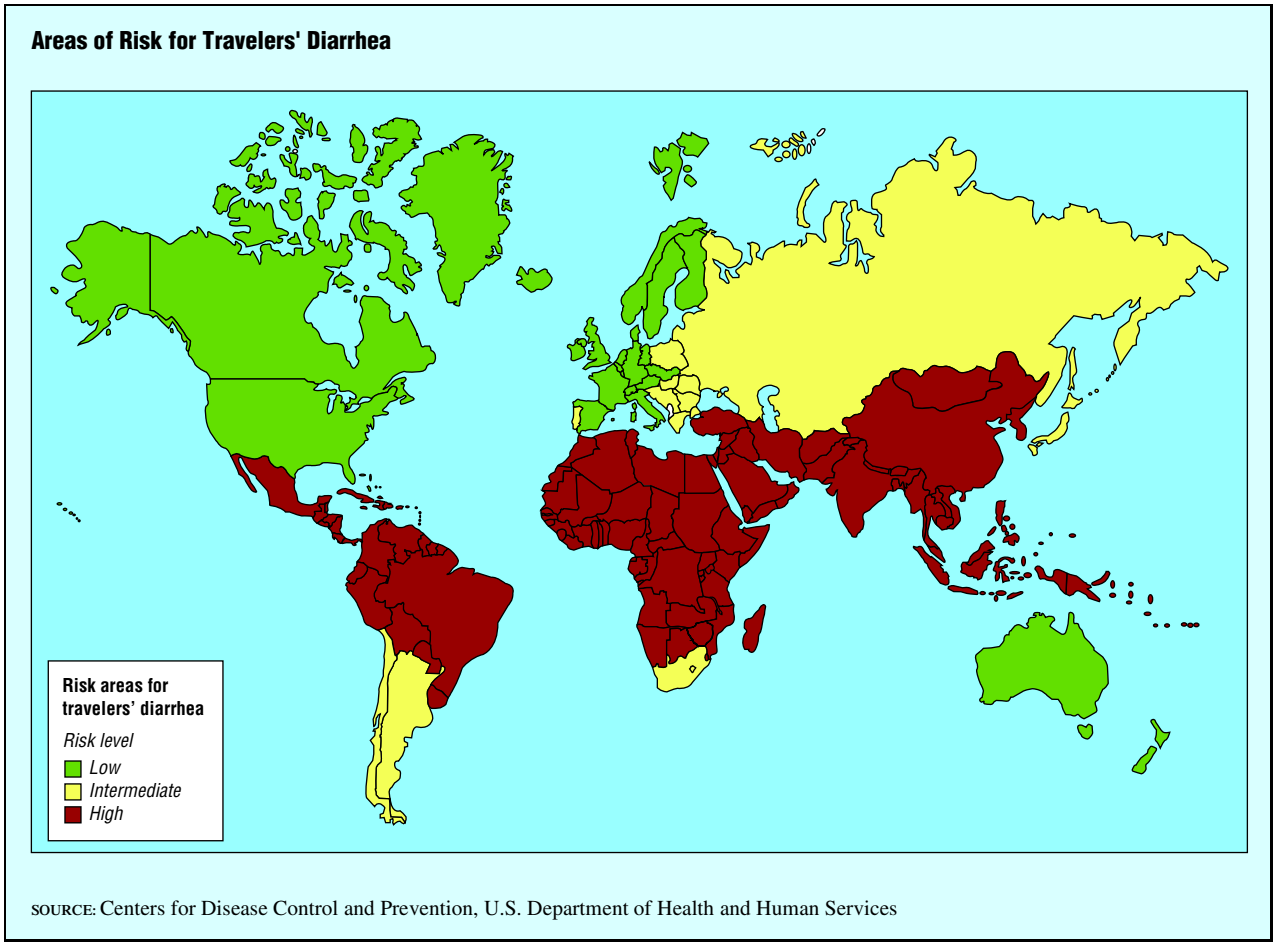
Destinations designated as high risk destinations where there is more than a 50% chance of getting traveler's diarrhea include:

- Mexico
- all of Latin America
- northern and central South America, including Brazil, Venezuela, Colombia, Bolivia, Guyana, and Surinam
- Most of Africa except South Africa
- Most of the Middle East, including Saudi Arabia, Turkey, Iran, and Iraq
- Most of Asia, excluding the former Russian republics, but including China, India, Thailand, Bangladesh, Viet Nam, Korea, Malaysia, and the Pacific Islands north of Australia

Intermediate risk destinations include:

- the countries of Eastern and Southern Europe such as Poland, Romania, Croatia, the Czech Republic, Portugal, Greece, and the Balkan countries
- most islands of the Caribbean
- Argentina
- South Africa
- Israel

Low risk countries are industrialized countries that have in place reliable systems for treating sewage and drinking water. These include:




*(Illustration by GGS Information Services/Thomson Gale.)*

## KEY TERMS

**Feces**—waste from the bowels; stool

- United States
- Canada
- Most countries in Northern and Western Europe including the Scandinavian countries, Great Britain, France, Spain, Austria, and Germany
- New Zealand
- Australia
- Japan

### Demographics

People of any age, race, or gender can get traveler's diarrhea, although peak rates occur among travelers in their twenties. There is no clear explanation of why this group is more likely to get traveler's diarrhea. Some experts have suggested it this finding is related more to the travel habits of young adults rather than to any biological explanation. Traveler's diarrhea is more common in warm months and during the rainy season than at other times of the year.

Although everyone gets traveler's diarrhea, young children, the elderly, pregnant women, and people with weakened immune systems such as those with HIV/AIDS often have more severe and long-lasting cases than other groups. People with inflammatory bowel syndrome, diabetes, and who are taking drugs that reduce the acidity of the stomach (e.g. antacids, Tagamet, Prilosec, Nexium) also are likely to have severe infections.

### Causes and symptoms

Traveler's diarrhea is a general term for nausea, vomiting, and diarrhea that many people develop when they travel to areas where the sanitation and food preparation

standards are less stringent than those in their home area. Drinking water contaminated with feces or eating foods prepared with contaminated water often causes the disease. This includes fruit and salad vegetables that have been washed in contaminated water. The organisms causing traveler's diarrhea can also be transferred to food by food handlers who have washed their hands in contaminated water or are infected. Eating raw or undercooked meat and seafood can also cause symptoms of traveler's diarrhea. Eating food bought from street vendors increases the chances of getting sick with traveler's diarrhea. In high-risk countries, eating in restaurants is no guarantee that conditions are sanitary and that the food will not be contaminated.

Many different organisms can cause traveler's diarrhea. According to the United States Centers for Disease Control (CDC), about 85% of all cases are caused by bacteria. Another 10% are caused by parasites, and the remaining 5% by viruses. In practical terms, this means that no single treatment will cure every case of traveler's diarrhea.

Symptoms of traveler's diarrhea caused by bacteria—nausea, diarrhea, abdominal cramps, and sometimes vomiting and fever— come on suddenly, most often during the first week of travel. The most common cause of traveler's diarrhea is infection with the bacteria *Enterotoxigenic Escherichia coli* (ETEC). *E. coli* are a larger genus of bacteria many of which are found in the intestines of mammals. Some subtypes of *E. coli* are helpful. In humans they help with digestion and the absorption of nutrients in the intestines. Many other subtypes of *E. coli* are neither helpful nor harmful. Some, such as ETEC and *Enteroaggregative E. coli* (EAEC), can cause unpleasant digestive upset. Both these types of *E. coli* cause watery diarrhea and abdominal cramps but little or no fever.

*Campylobacter* are a genus of bacteria that are a more common cause of traveler's diarrhea in Asia than in other parts of the world. Some members of this genus cause bloody diarrhea and fever. *Campylobacter* bacteria are found in contaminated water, but they are also found in almost all raw poultry, even in developed countries such as the United States and Canada. Cooked food can be contaminated if it is placed on an unwashed surface that previously held raw poultry. *Shigella* are another common genus of bacteria that, like *Campylobacter* cause bloody diarrhea, nausea, vomiting, fever, and abdominal cramps.

*Giardia lambia* is the most common parasite to cause traveler's diarrhea. Symptoms of traveler's diarrhea caused by parasites take longer to appear than do symptoms caused by bacterial or viral infections. Often symptoms persist for several weeks, much longer than the 3–5 days that most bacteria-caused traveler's diarrhea lasts.

Viruses cause only a small amount of traveler's diarrhea, although they are the largest cause of gastrointestinal upsets in the United States and other industrialized countries. Their symptoms are similar to those caused by bacterial infections.

The main symptom of traveler's diarrhea is frequent loose, watery stools that begin fairly abruptly. Stools may or may not contain blood, depending on the organism causing the disease. Diarrhea may lead to **dehydration**. Other common symptoms that appear along with the diarrhea are nausea, vomiting (in about 15% of people), bloating, abdominal cramps, and fever. Traveler's diarrhea usually lasts only 3–5 days even without treatment except for disease caused by parasites, which tends begin more slowly and to linger longer.

## Diagnosis

Diagnosis is made on the basis of signs and symptoms. Laboratory tests are usually not done unless there are unexpected complications.

## Treatment

In addition to drinking fluids, over-the-counter medications such as bismuth subsalicylate (Pepto-Bismol) and loperamide (Imodium) help give the individual more control over their bowel movements. However, these medications should not be used if by people who have blood in their stool or who have a high fever and bismuth subsalicylate should not be used by people allergic to aspirin.

Although bacteria cause most traveler's diarrhea, antibiotics are not usually prescribed to prevent the disease. They may, however, be used to treat traveler's diarrhea. The specific antibiotic depends on symptoms such as whether the stool is bloody and whether diarrhea is accompanied by fever or vomiting. Ciprofloxacin (Cipro), azithromycin (Zithromax) and rifaximin (Xifaxan) are the antibiotics most often prescribed. Medical care may be difficult to obtain in underdeveloped countries. Depending on where they plan to travel, individuals may want to discuss the possibility of traveler's diarrhea with their doctor before leaving home and take along a supply of antibiotics, over-the-counter medications, and oral rehydration salts to be used as needed.

Although most traveler's diarrhea clears up within a few days, medical care should be sought if severe symptoms continue for more than two or three days, if a high fever develops, if there is blood in the

stool, or if the individual shows signs of dehydration. Infants and children need prompt medical care if they appear to be dehydrated, disoriented, lethargic, have a fever over 102°F (39°C), or have uncontrolled vomiting and diarrhea.

## Nutrition/Dietetic concerns

The greatest health risk accompanying traveler's diarrhea is dehydration. This is a potentially serious problem in infants and small children who can become dehydrated from vomiting and diarrhea within hours. A main goal of treatment is to keep the individual from becoming dehydrated. Infants, children, the elderly, and others who are losing large amounts of fluid from diarrhea should be given an oral rehydration solution. Oral rehydration solutions have the proper balance of salts and sugars to restore fluid and electrolyte balance. In industrialized countries, already-mixed oral rehydration solutions are available in cans or bottles at supermarkets and pharmacies. In the rest of the world, dry packets of WHO oral rehydration salts are available. The contents of the packet are mixed with 1 L of clean (i.e. boiled or purified) water. This solution can be given to young children in small sips as soon as vomiting and diarrhea start. Children may continue to vomit and have diarrhea, but some of the fluid will be absorbed. In the past, parents were told to withhold solid food from children who had diarrhea. New research indicates that it is better for children should to be allowed to eat solid food should they want it, even though diarrhea continues.

Older children and adults can stay hydrated by drinking liquids that they know are uncontaminated, such as bottled water, bottled fruit juice, caffeine-free soft drinks, hot tea, or hot broth. Normally 2–3 quarts (2–3 L) should be drunk in the first 24 hours after diarrhea starts, moving to solid food as symptoms improve.

## Prognosis

Although traveler's diarrhea can make anyone feel miserable, most people recover from the disease within 3 to 5 days with nothing worse than disrupted travel plans. About 20% of travelers are sick enough to stay in bed for at least one day, and in about 10% of people the symptoms last more than a week. People with compromised immune systems, kidney disease, or who are very young or elderly may be sicker longer than other individuals. People who develop diarrhea a few days after returning home from an area where traveler's diarrhea is common should take into consideration that they may have brought a parasitic infection home with them.

## Prevention

It is difficult to prevent all traveler's diarrhea, although with care, the chances of getting sick can be reduced. Some common sense preventative measures include the following:

- Avoid tap and well water including ice cubes in drinks.
- Avoid raw peeled fruits and raw vegetables.
- avoid unpasteurized milk, dairy products (e.g. ice cream, yogurt) and unpasteurized fruit juices.
- Do not buy food from street vendors.
- Wash hands often in uncontaminated water.
- Choose hot drinks such as coffee or tea or canned or bottled drinks

## Resources

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United States Centers for Disease Control and Prevention (CDC). 1600 Clifton Road, Atlanta, GA 30333. Telephone: (800) 311-3435 or (404) 639-3534. Website: lt;http://www.cdc.gov>

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# Triglycerides

## Definition

Triglycerides are a form of fat, consisting of three molecules ("tri") of a fatty acid combined with one molecule of the alcohol glycerol. Triglycerides serve as the backbone of many types of lipids (**fats**). Triglycerides are produced by the liver as well as are ingested as part of the diet. Fats in foods are digested and changed to triglycerides.

## Purpose

Triglycerides have several purposes in physiology. Triglycerides travel through the circulatory system and are either utilized immediately or are stored in adipose tissue, thereby serving as the most abundant form of stored energy in the body. Triglycerides can serve as this important storage medium because of their hydrophobicity, which allows them to be stored as droplets, without contact with **water** molecules. Often a typical human body may contain several months of fuel stored in the form of triglycerides. When physiological conditions dictate the need to use the triglycerides, hormones or a neurotransmitter signal their release. This release may be in response to exercise, stress, or fasting. An enzyme called lipase breaks down the triglyceride molecule into a glycerol molecule and three fatty acids before release from the adipose tissue. These breakdown products are transported within the circulatory system to the tissues that need them for energy.

In addition to serving as a source of energy, triglycerides carry the fat-soluble **vitamins** (including **vitamin K**, an important nutrient in normal blood coagulation). Triglycerides also provide thermal insulation and contribute to the structure of membranes by the formation of a lipid bilayer.

Triglycerides combine with a blood **protein** to form chemicals referred to as high-density and low-density lipoproteins. These lipoproteins contain cholesterol, another substance related to fats.

**Triglyceride levels**

| | |
|---|---|
| Normal | Less than 150 mg/dL |
| Borderline-high | 150–199 mg/dL |
| High | 200–499 mg/dL |
| Very high | 500 mg/dL or above |

SOURCE: National Heart, Lung and Blood Institute, National Institutes of Health, U.S. Department of Health and Human Services

*(Illustration by GGS Information Services/Thomson Gale.)*

## Description

It is not yet clear whether high triglyceride levels act as a predictor of the risk for heart disease and heart attacks, especially in persons with normal levels of cholesterol. Some health care professionals feel that elevated triglycerides are a marker for other risk factors that do impact the risk of heart disease, that is, high levels of triglycerides are usually associated with low levels of high density lipoproteins, usually referred to as the "good" cholesterol.

However, there are some indications that high triglycerides may serve as a predictor for heart disease, especially in women. In a study involving postmenopausal women (aged 48 to 76 years old) conducted by a research group from the Center for Clinical and Basic Research in Ballerup, Denmark, it was found that women who had an enlarged waist and elevated levels of triglycerides had almost a five-fold increased risk of fatal cardiovascular events compared to women without those traits. The women at risk deposited fat centrally in their intra-abdominal compartment, rather than in their hips, thighs, and buttocks.

The mechanism of how triglycerides might affect heart health is not fully known, but it appears that elevated levels of triglycerides may allow increased blood clot formation and may slow the natural breakdown of clots after they have formed. However, high levels of triglycerides may mean an increased risk of diabetes, and very high levels of triglycerides may increase the risk of inflammation of the pancreas, resulting in pancreatitis.

Triglyceride levels are evaluated through blood testing.A fatty meal that is high in triglycerides will cause a short term increase in blood triglyceride levels. Therefore, before testing, a person should refrain from eating food for eight to ten hours before the test and not drink alcohol for 24 hours before the test. Some medications may interfere with test results, and the health care provider may request that the person cease taking the medications before testing. For example, oral

## KEY TERMS

**Adipose tissue** — A type of connective tissue that contains stored cellular fat.

**Malnutrition** —Poor nutrition because of an insufficient or poorly balanced diet or faulty digestion or utilization of foods

**Malabsorption** —Poor absorption of nutrients by the intestinal tract

**Pancreas**—A long, irregularly-shaped gland near the stomach that secretes a digestive fluid into the intestine through one or more ducts and that secretes the insulin, glucagen, and somatostatin into the bloodstream.

**Polycystic ovary syndrome**—A condition in which cysts in the ovary interfere with normal ovulation and menstruation

contraceptives, estrogen, and cholestyramine (a drug used to treat high cholesterol levels) may increase blood triglyceride levels, while **vitamin C** (ascorbic acid) asparaginase (an enzyme used in the treatment of **cancer**) and various drugs to treat high levels of blood lipids may decrease blood triglyceride levels. Triglyceride levels can also be affected by the menstrual cycle, time of day, and recent exercise. A person should have two or three tests, one week apart, for the most accurate results.

The normal range of blood triglyceride levels depends on age and gender, with women naturally having higher levels, especially when pregnant. As people age and gain weight, triglyceride levels usually increase. According to the guidelines promulgated by the National Cholesterol Education Program, a division of the National Heart, Lung, and Blood Institute, a normal fasting level for adults is less than 150 milligrams per deciliter (mg/dl), with levels below 101 considered desirable. Levels of 150 - 199 mg/dl are considered borderline high, levels of 200 - 499 mg/dl are considered high, with levels greater than 500 mg/dl considered very high. Such high levels may indicate liver disease (cirrhosis), underactive thyroid activity, uncontrolled diabetes, pancreatitis, kidney disease, or a diet too low in protein and too high in **carbohydrates**.

Extremely low levels of triglycerides (less than 10 mg/dl) may indicate malnutrition, malabsorption, a diet too low in fat, or an overactive thyroid.

High triglyceride levels may be due to several causes, including:

- Lifestyle factors
- Weight gain
- Lack of exercise
- Smoking
- Skipping meals
- Eating large portions of food at one time
- Dietary factors
- Excessive intake of alcohol, saturated and trans fats, sugar, starch, and calories
- Medical conditions
- Medicines, including birth control pills, steroids, and diuretics
- Illnesses, including poorly controlled diabetes, insulin resistance (a precursor to diabetes), polycystic ovary syndrome (PCOS), hypothyroidism, kidney disease, and liver disease
- Age

Hereditary may also play a role in elevated levels of triglycerides. Familial **hypertriglyceridemia** is a common inherited disorder in which the level of triglycerides in a person's blood is higher than normal. This disorder is an autosomal dominant disorder, that is, if one parent has an abnormal gene and the other parent a normal gene, there is a 50% chance each child will inherit the abnormal gene and therefore the dominant trait. Some people with this condition also have high levels of very low density lipoprotein (VLDL), the "bad" cholesterol. **Obesity**, hyperglycemia (high blood glucose levels), and high levels of insulin are often associated with this condition and may result in even higher triglyceride levels.

Familial hypertriglyceridemia is not usually detected until puberty or early adulthood. Symptoms include a mild-to-moderate increase in blood triglyceride levels and premature coronary artery disease. Persons with this condition are also at increased risk for pancreatitis.

Familial hypertriglyceridemia occurs in about 1 in 500 individuals in the United States. Risk factors are a family history of hypertriglyceridemia or a family history of heart disease before the age of 50. If triglyceride levels cannot be not controlled by dietary and lifestyle changes, medication may be needed. Nicotinic acid and gemfibrozil have been shown to effectively reduce triglycerides in persons with familial hypertriglyceridemia. Screening family members for elevated levels of triglycerides may help to detect the disease early.

A nutritionist or dietitian may be consulted to help develop a dietary plan to help control triglyceride levels. In general, to lower or prevent high levels of triglycerides, a person should:

- Lose weight
- Get regular exercise
- Eat less sugar and sugar-containing foods
- Eat smaller meals and snacks throughout the day, rather than consuming two or three large meals
- Drink less alcohol (even small amounts of alcohol has been shown to elevate triglycerides)
- Limit fat in the diet to less than 35% of daily calories
- Avoid deep-fried foods
- Substitute monounsaturated and polyunsaturated fats, such as those found in canola or olive oils, for saturated fats
- Use a prescription medicine, as directed by the health care provider, to decrease the production of triglycerides by the liver
- Instead of eating meats high in saturated fats, consume fish high in omega-3 fatty acids, such as salmon, lake trout, herring, sardines, albacore tuna, or mackerel (about 10 to 15 grams of fish oil a day is recommended - 15 grams of fish oil can be obtained from an 8-ounce serving of fish

Other good food choices include fruits (but not fruit juices, which are high in sugar), vegetables, whole grain breads and cereals, lean protein sources, such as lean meats, poultry without skin, eggs, egg substitute or egg white, cooked dried beans, lentils, peas, nuts, and low-fat **soy** products, fat-free or 1% milk products, nuts such as almonds, walnuts, and peanuts), avocados, and sugar-free products.

One approach to successfully changing the diet to reduce blood triglyceride levels is to make changes in stages. For example, individuals could cut fat intake to 30% for one month (current American levels are approximately 40%) and then return to their health care provider to see if there has been an improvement in their triglyceride levels. If the level of decreases was not satisfactory, the individuals could further restrict their fat intake to 25% and again be evaluated after one month. If no improvement is noted, the fat intake should be lowered to 20% for two months. At this level of fat intake, it is likely that most calories are being obtained from complex carbohydrates, and a reduction in triglyceride levels should be seen.

### Complications

Other risk factors for **coronary heart disease** can increase the hazards from high levels of triglycerides. Therefore a person with high levels should in addition to making dietary changes should also control high blood pressure and avoid cigarette smoking. Dietary management is important even when drugs are used to control triglyceride levels.

### Parental concerns

If a child is suspected to have familial hypertriglyceridemia, the child should be tested for elevated levels of triglycerides. If the disorder is present, appropriate steps should be taken to help the child lower his or her triglyceride levels.

#### Resources

**BOOKS**

Sprecher, Dennis. *What You Should Know about Triglycerides: The Missing Link in Heart Disease*. New York, NY: Harper Torch Publishers, 2000.

Welson, Linda T. (Ed.) *Triglycerides and Cholesterol Research* Hauppauge, NY: Nova Science Publishers, Inc., 2006

**ORGANIZATIONS**

American Heart Association National Center, 7272 Greenville Avenue, Dallas, TX 7523. Telephone: 800-242-8721. Website: [www.americanheart.org]

Judith L. Sims

## Trim Kids

### Definition

*Trim Kids*, also known as Committed to Kids (CTK), is a twelve-week behavioral weight management program for adolescents. The program integrates behavior modification, nutrition education, and exercise to promote lifestyle changes that carry into adulthood. Parental involvement is crucial as parents must provide limitations and support to help their child achieve weekly goals.

### Origins

A team of health professionals led by Dr. Melinda Sothern researched **childhood obesity** at the Committed to Kids Pediatric Weight-Management Program at Louisiana State University Health Sciences Center. The team consisted of Dr. Sothern, an exercise psychologist, Dr. T. Kristian von Almen, a research psychologist, and Heidi Schumacher, a registered dietician. After fifteen years of research and implementation of the program, the team published *Trim Kids*. *Trim Kids* provides the materials necessary for parents to use the program at home. CTK follows the same twelve-week schedule, but is led by certified,

## KEY TERMS

**Behavior modification**—Changing an individual's behavior through positive and negative responses to achieve a desired result.

**Dietician**—A health professional who specializes in food and nutrition.

**Exercise psychologist**—A health professional who specializes in behaviors related to physical activity.

**Target heart rate**—A method using pulse measurements to monitor progress while exercising. A target heart rate is typically 50-85% of an individual's maximum heart rate.

trained health professionals at hospitals, schools, and community centers across the country.

## Description

*Trim Kids* begins with an overview of the program in regard to expectations of participants, educational components, and fundamental behavior modifications for lifelong healthy living.

The program identifies what it means to be overweight and environmental factors more likely to cause **obesity** in children. A child's level of obesity is broken down into three categories: at-risk, moderate, or severe. A child's pediatrician should be consulted to determine the appropriate level.

The three components used to help children achieve their weight loss goals are nutrition education, increased physical activity, and behavior modification. These components must be used and embraced together for long-term success.

In addition, information on how to start moving away from fattening foods and introducing healthy alternatives is included along with the basics of physical activity and exercise. The primary behavior modifications that impact the entire family are also discussed.

### *The Twelve-Week Program*

*Trim Kids* is very structured program. The following four sections comprise core areas addressed every week:

- Time to Stop and Think: A summary of information and behavior modifications to be covered that week.
- Time to Get Active: Introduces new fitness information and exercises appropriate to the child's program level.
- Time to Dine: Provides nutritional education, weekly menu, shopping list, and recipes each week.
- Time to Sum Up: Review of the record forms completed throughout the week and challenges or improvements to highlight.

**WEEK 1.** The first week engages the family by having parents introduce the program, identify their role as a coach, and discuss methods for recording progress. The child's level in the program is determined this week.

Trim Kids is divided into four levels:

- Level 1-Red: Severe obesity
- Level 2-Yellow: Moderate obesity due to diet, behavior, and/or fitness
- Level 3-Green: Overweight, at-risk for obesity
- Level 4-Blue: Program goal, maintaining healthy lifestyle

A pediatrician should determine the appropriate level for the program. They can provide guidance in regard to safe exercises, dietary restrictions, and additional medical support required.

The behavioral change at this stage focuses on having the child monitor their eating and activities. Allowing the child to recognize and record when, how much, and why they eat or exercise is shown to positively impact their progress.

**WEEK 2.** Nutrition is discussed at length in the second week. Families learn about portion control, healthy food choices, and involving the child in food selection. Lifestyle changes include eating slower, trying new foods, limiting portions, and eliminating sugary drinks.

**WEEK 3.** The third week stresses the importance of parents being good role models for their children. Parents must be willing to make the same types of changes to their diet and fitness levels they ask of their child. In addition, family members identify what prompts them to eat and learn about stimulus control as well as tricks for avoiding social scenarios that lead to overindulgence.

The Moderate-Intensity Progressive Exercise Program (MPEP) is introduced in the fitness section. MPEP Step is simply modifying an individual's posture so they walk quickly with their head up and shoulders back. This posture makes an individual look taller, thinner, and more confident—all traits that usually lead to more energy and activity.

**WEEK 4.** The theme for week four is motivation and optimistic reinforcement. Tips for getting kids up and moving without arguing and how to respond

when they do not cooperate help maintain a constructive focus on the goals. A variety of indoor activities offer options to keep kids moving on days they have to stay inside.

**WEEK 5.** The fifth week explores how new behaviors are acquired, the ABCs of behavior change (Antecedents, Behavior, Consequences), and the difference between hunger and **cravings**. Kids learn how to tune into their bodies by understanding **metabolism**, monitoring their target heart rate, and recognizing activity limitations.

**WEEK 6.** The midpoint of the program teaches kids how to improve their self-esteem and self-image. This is accomplished primarily by learning to speak positively instead of having negative thoughts that foster inactivity and poor eating habits.

**WEEK 7.** In the seventh week, methods for relaxation are introduced to help both parents and kids handle stress that often develops when making life changes. This week is also an opportunity to evaluate overall success meeting weekly goals and make adjustments where necessary.

**WEEK 8.** During the eighth week parents are encouraged to hold family meetings on a regular basis. The meetings provide a forum to discuss how everyone is handling the changes taking place. Reinforcing positive behaviors and recognizing the family's success helps maintain commitment. It is equally important to be aware of challenging program components and ask for input on how the family can remain on track.

**WEEK 9.** Week nine invites parents to talk with their child about responding to social and emotional pressures that prompt unhealthy habits. Support suggestions are offered to parents who may begin experiencing burnout. Connecting with other parents and children seeking a healthy lifestyle provides a positive support network as well as playmates and education exchanges.

**WEEK 10.** Week ten addresses the topic of traveling while on the program. Recommendations for eating healthy on the road and remaining active are presented. Tips for notifying friends and family of the new eating habits when visiting are provided as well.

**WEEK 11.** The eleventh week begins concluding the program and setting kids up for success on their own. Parents learn how to recognize the difference between lapse, relapse, and collapse of a child's healthy lifestyle. It is normal for a child to lapse, but relapse and collapse require revaluating the situation and recommitting to the program goals.

**WEEK 12.** In the final week, the child's pediatrician evaluates progress made. Depending on the child's initial program level they may either graduate to the next level or remain at the current level. If the child has not yet reached the final level (Blue), the program repeats for twelve week increments until the weight loss goal is achieved. Children who do not make any progress during the twelve weeks must choose to recommit to their desire for a healthier lifestyle.

The ultimate goal of Trim Kids is to modify behaviors for healthy living. Kids who reach the Blue level continue to commit to the program guidelines in order to maintain their weight loss and improved fitness. Success is sustained more often when the entire family stays dedicated as well.

## Function

The Trim Kids program is designed for children between the ages of seven and seventeen. It is a structured twelve week plan that requires parent participation. Parents act as coaches to educate their children about healthy eating habits, nutrition information, and how to be more active. Behavior modification is an essential component of the program. Through self-assessments, children learn to recognize why, how, and what they eat. By teaching them how to respond to eating triggers with healthy alternatives, parents instill weight management tools they can use throughout life.

Involving the entire family in the program also lends to its success. The obese child is surrounded by a support system and is less isolated in regard to the lifestyle changes. *Trim Kids* teaches parents how to shop for healthy food and be positive role models to their children. The program encourages all family members to try new foods, eliminate unhealthy snacks, and find ways to be active together. The authors recommend that parents give credit to the child for inspiring the other family members to adopt a healthy lifestyle as well.

By integrating a series of small changes into a child's routine, they are able to make big progress toward their weight loss goals. Modifications include drinking **water** instead of sugary drinks, walking around instead of sitting while talking on the phone, exercising or stretching during commercial breaks, and eating smaller portions. Cutting a few calories and exercising a few extra minutes throughout the day adds up quickly over the weeks. Since these changes are not as dramatic as most adult weight loss programs, kids are more likely to stick with them.

## Benefits

After fifteen years of hands-on research and implementation of the twelve week plan, the authors present concise information in a straightforward, repetitive layout week after week. The step-by-step format makes it simple to follow. In addition, forms for recording physical activity, food intake, goals, and strength/flexibility workouts are included.

The program facilitates changes in eating habits by providing weekly menus, shopping lists, and recipes. A table of food portions and their food unit (carbohydrate, **protein**, fat, vegetable) is a useful tool for preparing and serving meals.

In regard to physical activity, participants are educated about fitness topics such as body composition, muscular strength, flexibility, endurance, and how to find their target heart rate. Each week a new exercise is introduced with recommended goals based on program level. Frequent, moderate activity is emphasized as it is developmentally more appropriate for children. Ideas for indoor activities and family outings provide variety and prevent burnout.

A key aspect of the program is behavior modification. Issues with self-image, self-esteem, peer pressure, and stress are highlighted. Guidelines and suggestions are provided for both parents and children to address common tempting social scenarios such as parties, vacations, and holidays. Parents learn how to encourage their child's progress by acknowledging their own role in the child's obesity, modeling the desired behaviors, offering positive reinforcement, and providing choices.

## Precautions

*Trim Kids* is designed for use at home in conjunction with supervision by a pediatrician. As with any weight loss program, it is important to speak with a physician regarding any health issues, dietary restrictions, or physical activity limitations before starting. If participating in the CTK program, make sure facilitators are trained and certified by the Committed to Kids Weight-Management Program training team.

Due to the nature of this program, full participation of all family members is required. Parents need to be familiar with the program and clearly present expectations to everyone involved. Reservations or aversion to the program should be handled prior to starting.

### QUESTIONS TO ASK YOUR DOCTOR

- What is your experience with this program?
- Is there a local Committed to Kids Program Weight-Management Program?
- Are there exercise limitations or dietary restrictions for my child?

## Risks

There are no major risks associated with this weight loss program when followed as directed under a physician's supervision.

## Research and general acceptance

Success at the CTK weight-management clinic at Louisiana State University (LSU) was the catalyst for the Trim Kids at-home program. CTK has been part of the LSU Health Sciences Center for over fifteen years. Dr. Sothern and her team of psychologists, dieticians, and exercise physiologists continue to research childhood obesity at CTK clinics and refine the Trim Kids program. Research findings from the clinic are published often in medical journals. However, research on the program from an outside perspective is not readily available.

The National Cancer Institute approved the CTK/Trim Kids program as a research tested intervention program (RTIP). This means the research program was funded and has been peer-reviewed as well as published in a peer-reviewed journal. RTIPs undergo evaluation and receive scoring in six different areas. A summary of the program combined with the program scores allows individuals to make comparisons and find additional resources. Trim Kids received high scores in all areas except Research Integrity. Research on the program is considered weak with only some confidence in research results.

According to a 2006 article in *Journal of Adolescent Health* weight management programs for children, including CTK, lack the necessary data to prove them effective. Despite this, CTKs multidisciplinary team approach to preventing and treating obesity in children is implemented in numerous schools, hospitals, and community centers.

Although research is primarily limited to information generated at LSUs CTK clinic, their accomplishments are hard to deny. Over 1,000 kids have

completed the program; of those, ninety percent achieved short-term success while nearly seventy percent maintained long-term success with their weight management.

## Resources

### BOOKS


Sothern, M. et al. *Handbook of Pediatric Obesity: Clinical Management*. Boca Raton, FL.: Taylor and Francis Publishers, 2006.

Sothern, M., et al. *Trim Kids: The Proven Plan that has Helped Thousands of Children Achieve a Healthier Weight*. New York, NY: Harper Collins Publishers, 2001.


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Warner, Jennifer. "10 Ways to Raise Food-Smart Kids." *WebMD*. May 16, 2006. <http://children.webmd.com/guide/10-ways-to-raise-food-smart-kids>.


Stacey L. Chamberlin

# U

## Ulcers

### Definition

An ulcer is any area of skin or mucous membrane that erodes, causing the tissue to degenerate. In common use, ulcers refer to disorders such as these that occur in the upper digestive tract. They may be called gastric ulcers, peptic ulcers, or simply ulcers.

### Description

Gastric ulcers refer to those that occur in the lining of the stomach. Peptic ulcers also can develop in the lower part of the esophagus, the stomach, the first part of the small intestine (duodenum), and the second part of the small intestine (jejunum).

Duodenal and gastric ulcers are the most common types. About 80% of all ulcers occur in the digestive tract and are called duodenal ulcers. Gastric ulcers account for about 16% of peptic ulcers. While it was once believed that stress and eating spicy foods caused ulcers, it was later discovered that most ulcers are caused by a bacterial infection. Some foods can aggravate ulcer symptoms.

The body makes strong acids to digest food. A thin lining protects the stomach and intestines from these acids. But if something damages the lining, the acids can reach the stomach and duodenal walls. Ulcers can get larger and cause bleeding.

### Demographics

One in 10 Americans will develop an ulcer at some time in their lives. The American Gastroenterological Association estimates that four million Americans have peptic ulcer disease. Ulcers can occur at any age, but are more common as people get older, particularly in people over age 60. In fact, as many as one-half of people over age 60 may have an ulcer. At least two-thirds of ulcers are believed to be caused by bacteria and most of the remaining ulcers are caused by use of non-steroidal anti-inflammatory drugs (NSAIDS). Many people are infected with the bacterium that causes ulcers although ulcers may not actually develop from the bacterium.

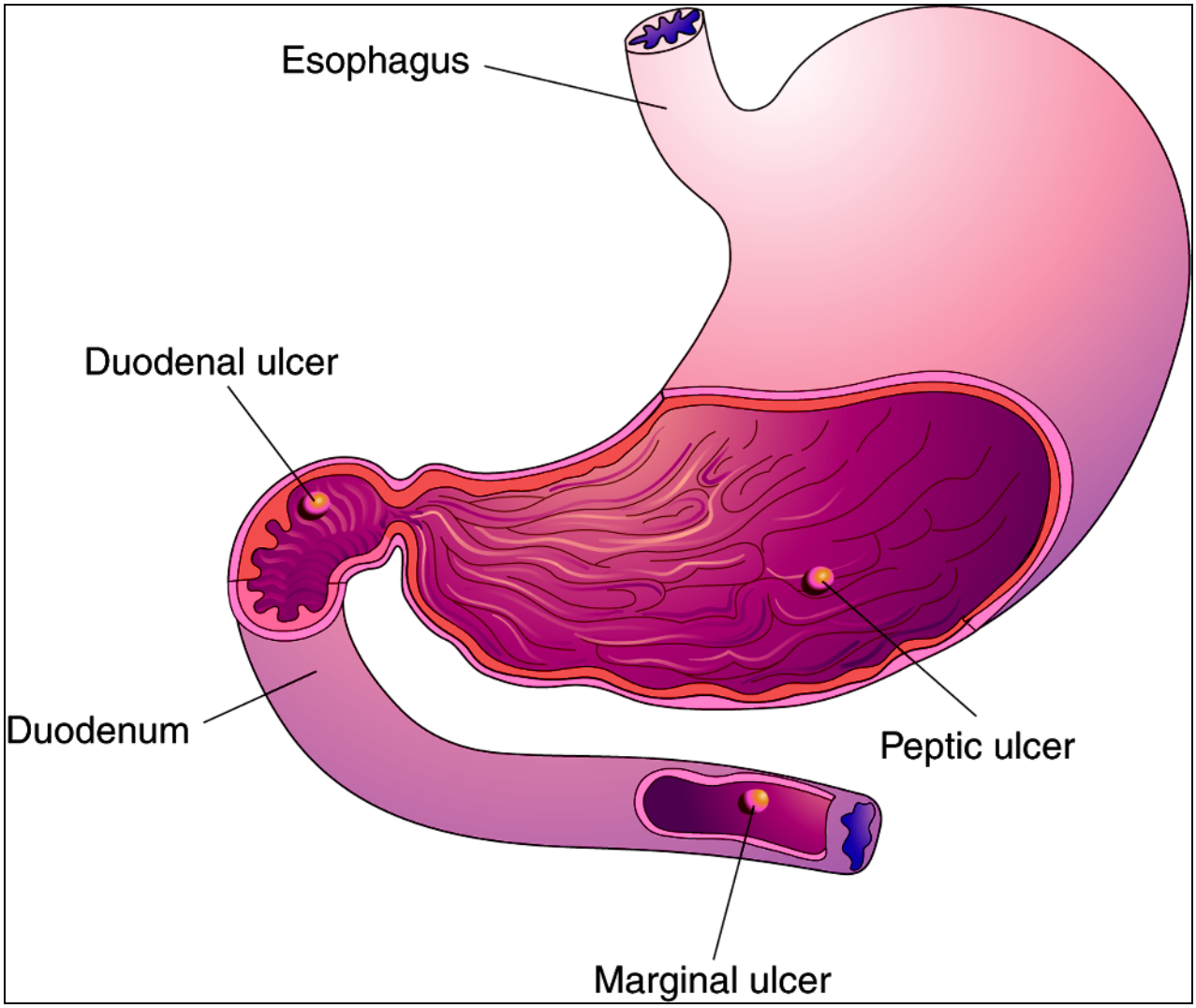
### Causes and symptoms

The bacterium that causes peptic ulcers is called *Helicobacter pylori*, or *H. pylori*. Although the discovery that *H. pylori* was the major cause of ulcers only occurred in the 1990s, it is believed that the bacterium has been around in humans' digestive tracts for at least 60,000 years. The exact source of *H. pylori* and the way in which it is transmitted from one person to another is not known. Theories include transmission through **water**, saliva, and person-to-person contact. Researchers also do not yet know why some people with the infection develop ulcers while others do not. They believe it may be due to characteristics of the infected person, the type of *H. pylori*, and other possible factors.

Use of NSAIDs is the second most common cause of ulcers. These drugs include aspirin, ibuprofen, and naproxen. Frequent and long-term use of these drugs to reduce pain and inflammation may lead to ulcers, as these drugs also weaken the lining of digestive walls. Many older people use these drugs frequently to help relieve pain and inflammation from arthritis, which may help explain the higher number of older adults with peptic ulcers.

The most common symptom of a peptic ulcer is a burning sensation that occurs in the stomach between the breastbone and belly button. Although the pain can occur at any time, it often is worse between meals when the stomach is more likely to be empty. The pain often is described as a dull ache and it may be severe enough to cause waking during the night. The pain may last minutes or several hours and may come and go. Sometimes, the pain goes away after eating.

Other symptoms of ulcers include a feeling of fullness more quickly than normal during a meal, general loss of




**Common sites of ulcers in the human stomach.** *(Illustration by Electronic Illustrators Group/Thomson Gale.)*

appetite, a bloating or heavy feeling in the stomach, upset stomach or nausea and vomiting, weight loss, and blood in the stool. In some cases, blood is the first and only symptom of an ulcer.

Once an ulcer bleeds and continues bleeding without proper treatment, a person may become anemic and weak.

## Diagnosis

The physician will note symptoms and history and will perform one or more of several tests available to detect peptic ulcer disease.

### *H. pylori* breath test

This is a safe and simple laboratory test that is used to detect active *H. pylori* infection. It involves breathing into a balloon-like bag, then drinking a small amount of a clear solution and breathing into the bag again 20 to 30 minutes later. The air that is breathed into the bag the second time is tested for an increase in carbon dioxide. The test involves some preparation, such as avoiding antibiotics and acid-relieving medications for weeks before the test. No eating or drinking is allowed one hour before the test, but the procedure lasts only about 30 minutes and normal diet can be resumed immediately following the test. This test also is effective at monitoring treatment, since a patient can be retested to determine if *H. pylori* antibodies are still present a month or more later.

### *Fecal occult blood test*

The fecal occult blood test is used to detect tiny or invisible blood in the stool, or feces. It may be used to

## KEY TERMS

**Anemia, anemic**—Anemia is the condition in which the blood's hemoglobin, which is the part of the blood rich in iron, decreases.

**Antibodies**—Proteins in the immune system that help fight disease.

**Peptic**—A description that relates to digestion.

detect ulcers, screen for colorectal **cancer**, or a number of other diseases. The test requires collection of three stool samples that should be taken one day apart. The samples are returned to the physician's office or a laboratory and are examined under a microscope for signs of blood. Certain foods and medicines affect test results and should not be eaten or used about two to three days before beginning the test.

### *Upper GI series*

An upper gastrointestinal (GI) series is an x-ray examination that helps diagnose problems in the esophagus, stomach, and duodenum. It may be the first test a physician orders to detect an ulcer. Clearly showing the inside lining of these organs requires drinking a thick, white liquid called barium. The barium coats the linking and as it moves through the digestive system, the radiologist can follow the milkshake-like liquid on images, using a machine called a fluoroscope. The resulting images detect some ulcers, but not all of them. The procedure takes one to two hours or longer if imaging the small intestine as well. No food or drink is allowed after midnight the night before the examination so the stomach will be empty for the procedure. The barium can cause **constipation** and a white-colored stool for a few days following the procedure.

### *Upper GI endoscopy*

Upper GI endoscopy uses a thin, flexible, lighted tube to help see inside the esophagus, stomach, and duodenum. In some cases, the endoscopy may follow the upper GI series. In other cases, the physician may perform the endoscopy first. The physician sprays the throat with a numbing agent before inserting the tube to help prevent gagging. Pain medication and sedatives also help patients relax during the procedures. The camera at the end of the tube transmits pictures that allow the physician to carefully examine the lining of the organs. The scope also has a device that blows a small amount of air, which can open folds of tissue so the physician can more easily examine the stomach lining and look for ulcers. No eating or drinking will be allowed for eight to 10 hours before the procedure.

## Treatment

The treatment of *H. pylori* infection is called "triple therapy", since a combination approach is used. Two antibiotics, often clarithromycin and amoxicillin, are prescribed for about two weeks. In addition, use of bismuth subsalicylate (a common brand name is Pepto Bismol) will be used along with the antibiotics. Follow-up tests should be ordered to be certain that the *H. pylori* has cleared up.

Other medicines help treat ulcers and their symptoms. Acid blockers and proton pump inhibitors reduce the amount of acid made in the stomach. This helps relieve pain and promotes healing of ulcers. These drugs are available by prescription or over = the-counter and are sold as ranitidine (Zantac), famotidine (Pepcid), cimetidine (Tagamet), and nizatidine (Axid).

If an ulcer has erupted to the point that it has bled, treatment of anemia may require **iron** supplements. An ulcer that has caused a perforation or obstruction in the stomach to develop may require surgery. The surgery will remove the ulcer or the ulcer can be covered with tissue from another part of the intestine. Other options may be to tie off the bleeding vessel or to cut off the nerve supply to the base of the stomach.

## Nutrition/Dietetic concerns

The old school of though about spicy foods causing ulcers has been shown to be untrue. But those who have ulcers may still need to watch what they eat to relieve symptoms of peptic ulcer disease. The effect of diet on ulcers varies for everyone, but certain foods and drinks can worsen pain. Drinking coffee can increase pain, whether it contains **caffeine** or is decaffeinated. Tea, chocolate, chili powder, mustard seed, meat extracts, black pepper, and nutmeg are other foods and spices that may cause discomfort for those with ulcers. With proper use of medications, dietary restrictions should not be necessary, except to ease symptoms.

People with ulcers should avoid alcoholic beverages. Eating a balanced diet is advised. Avoiding large meals in one setting may help relieve feelings of bloating and fullness. It is best to eat small, frequent meals when having ulcer pain. The American Gastroenterological Association recommends eating food that has been properly prepared and only drinking water from clean, safe sources to help prevent ulcers.

## Prognosis

The prognosis for recovery from ulcers is good for most patients. Very few ulcers fail to respond to current treatments, particularly since discovery of *H. pylori*. If the bacterium is eliminated, an individual most likely will not have ulcer recurrence. Most patients who develop complications such as perforation will recover without problems, even if emergency surgery is necessary.

## Prevention

Until more is learned about the transmission of *H. pylori*, it is unlikely that individuals can totally prevent infection with the bacterium. Careful hand washing after using the restroom and before eating may help prevent infection. Other prevention techniques are to eat only properly prepared food and to drink water from clean, safe sources. Restricting use of NSAIDs or discussing appropriate use of these medicines with a physician may help lessen risk of ulcers. Smoking and drinking alcohol damage the lining of the digestive tract, so eliminating these behaviors also will help prevent peptic ulcers. Cigarette smoking also increases risk of ulcer bleeding and stomach perforation and can cause some medications to fail. Avoiding certain foods such as coffee and various spices may help ease ulcer symptoms. But will not prevent ulcers.

### Resources

#### ORGANIZATIONS

American College of Gastroenterology. P.O. Box 342260, Bethesda, MD 20827. (301) 263-9000. <http://www.acg.gi.org >

American Gastroenterological Association. 4930 Del Ray Ave., Bethesda, MD 20814. (301) 654-2055. <http://www.gastro.org>

National Digestive Diseases Information Clearinghouse. 2 Information Way, Bethesda, MD 20892. (800) 891-5389. <http://digestive.niddk.nih.gov>

Teresa G. Odle

# USDA food guide pyramid (MyPyramid)

## Definition

The United States Department of Agriculture (USDA) food pyramid, called MyPyramid to distinguish it from earlier versions, contains recommendations on diet and exercise based on the Dietary Guidelines for Americans 2005.

## Purpose

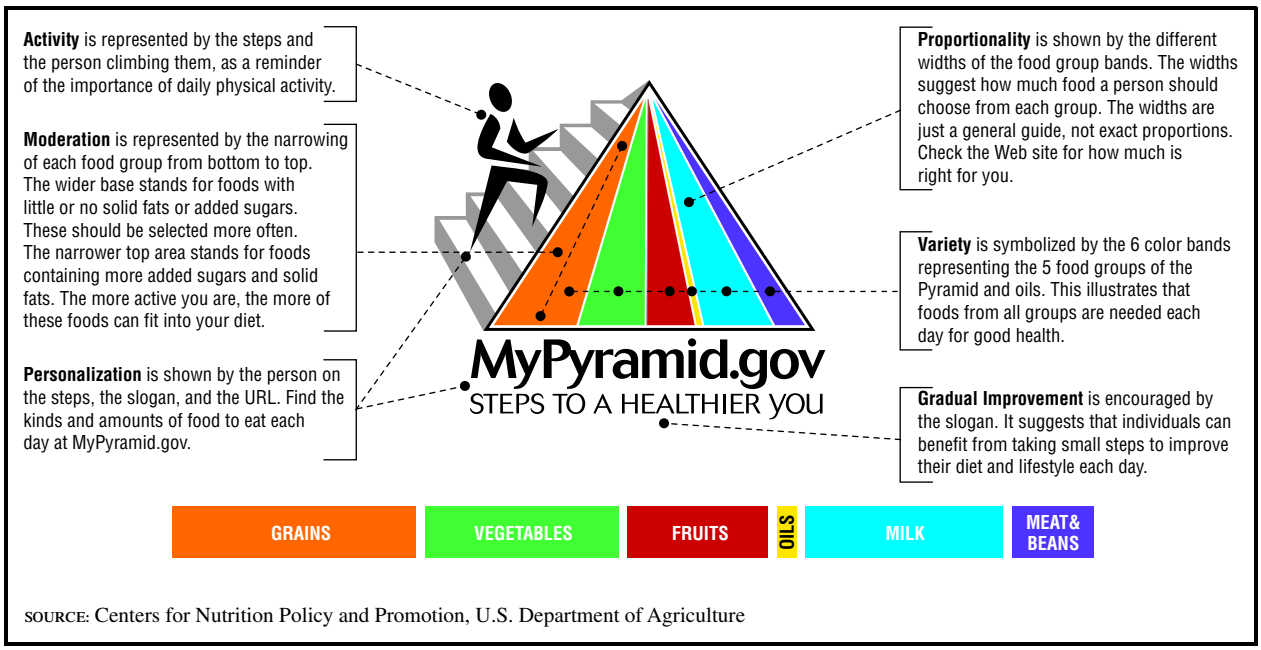
MyPyramid is intended to help Americans become more aware of what they eat and what their nutrient requirements are. It is designed to help people learn how to eat a healthy diet, live an active lifestyle, and maintain or gradually move in the direction of a healthy weight that will reduce the risk of weight-related diseases. Unlike earlier diet and nutrition guidance, MyPyramid can personalize dietary recommendations based on the individual's height, weight, age, gender, activity level and weight goals.

## Description

MyPyramid, released in 2005, is the most recent in a series of publications designed to provide Americans with broad dietary recommendations that will promote health. More than one hundred years ago in 1894, the USDA published its first set of national nutrition guidelines. The first food guide followed this in 1916. In this first food guide, the author, a nutritionist, introduced the idea of food groups. The five food groups defined in the food guide were milk and meat, cereals, fruits and vegetables, **fats** and fatty foods, and sugars and sugary foods. The guide made recommendations about eating food from each food group to remain healthy.

In 1941, the Food and Nutrition Board of the National Academy of Sciences published the first Recommended Dietary Allowances (RDAs). The RDAs were based on the amount of each vitamin or mineral that was needed to prevent symptoms of the corresponding nutrient-deficiency disease. Two years later, the United States was in World War II. During this time certain foods (e.g. butter, sugar) were rationed and others were scarce. In order to help people eat a healthy diet during rationing, the USDA published new nutritional guidelines. Not long after World War II ended, the guidelines were again modified. The post-World War II guidelines introduced the basic four food groups: milk, meats, fruits and vegetables, and grains. These four food groups served as the foundation for nutrition education until the 1970s. During the 1970s, the USDA added a fifth dietary category, foods that should be used in moderation. This new restricted foods category included fats, sweets, and alcoholic beverages.

The first pyramid graphic designed to explain the concepts behind the basic food groups appeared in 1988. It was intended show graphically that people




**MyPyramid is used to personalize dietary recommendations based on an individual's height, weight, age, gender, activity level and weight goals, and is intended to help Americans become more aware of what they eat and their nutrient requirements.** *(Illustration by GGS Information Services/Thomson Gale.)*

should eat a variety of foods in differing amounts of food from all of the four groups and consume only small amounts from the fifth group of restricted foods. The need for physical activity was not illustrated anywhere in this pyramid, nor was it shown in the 1992 version called the Food Guide Pyramid.

The 2005 MyPyramid was a major revision of the Food Guide Pyramid. It was designed to illustrate recommendations found in the Dietary Guidelines for Americans 2005 released by the USDA in January 2005. MyPyramid introduced both new graphics and the previously ignored concept that physical activity had to be taken into account when planning a healthy diet. On one side of the pyramid, each food group is represented by a vertical band of color ascending to the peak of the pyramid. The bands are of varying width, illustrating the relative proportions of each food group that should be consumed daily. On the other side of the pyramid, a figure climbs stairs, illustrating the interconnectedness between diet and exercise.

These were not the only changes incorporated into MyPyramid. There were other new features.

- Fruits and vegetables are listed as separate categories.
- Emphasis is placed on eating whole grains rather than highly processed refined grains.
- Quantities of food are defined in familiar measures such as cups or ounces, rather than as serving sizes.
- Physical activity is incorporated into a healthy eating plan.
- One-size-fits-all dietary guidance was abandoned. A Web-based feature allows individuals to personalize dietary recommendations by entering their height, weight, age, gender, and level of daily physical activity. The program then calculates how many calories should be consumed daily and makes recommendations on how these should be distributed among the different food groups.
- A new category called discretionary calories was introduced. These are calories that can be consumed after other food group requirements have been met.
- A Web-based tracker allows individuals to assess their food intake and physical activity level and track their energy balance (calories taken in compared to calories burned) for an entire year.
- Educational information is available on three levels: child, adult, and healthcare professional.

### *Using personalized MyPyramid recommendations*

To make use of the information in MyPyramid, individuals must first know whether they are considered thin, average, overweight, or obese. The National Institutes of Health and the World Health Organization classify weight based on **body mass index** (BMI). For instructions on how to calculate BMI, and a

## KEY TERMS

**Amaranth**—A grain with tiny seeds native to Central and South America.

**B-complex vitamins**—A group of water-soluble vitamins that often work together in the body. These include thiamine ($B_1$), riboflavin ($B_2$), niacin ($B_3$), pantothenic acid ($B_5$), pyridoxine ($B_6$), biotin ($B_7$ or vitamin H), folate/folic acid ($B_9$), and cobalamin ($B_{12}$).

**Body Mass Index (BMI)**—A calculation that uses weight and height measurements to determine an individual's "fatness."

**Bran**—The outer layer of cereal kernel that contains fiber and nutrients. It is removed during the refining process.

**Germ**—In grains, the center part of the grain kernel that contains vitamins and minerals not found in the rest of the kernel. It is removed from refined (white) flour.

**Quinoa**—High-protein grain native to South America (pronounced keen-wah).

**Triticale**—Man-made hybrid plant that combines wheat and rye and that produces a higher protein flour.

**Type 2 diabetes**—Sometime called adult-onset diabetes, this disease prevents the body from properly using glucose (sugar).

discussion of its limitations, see the body mass index entry.

For adults of both genders over age 20, weight is classified as follows:

- BMI below 18.5: Underweight
- BMI 18.5–24.9: Normal weight
- BMI 25.0–29.9: Overweight
- BMI 30 and above: Obese

The weight of children ages 2–20 is also based on BMI, but the classification is different. Instead of classifying weight as a BMI range, a child's BMI is compared to that of other children of the same age and sex. Children are then assigned a percentile based on their BMI. The weight categories for children are:

- Below the 5th percentile: Underweight
- 5th percentile to less than the 85th percentile: Healthy weight
- 85th percentile to less than the 95th percentile: At risk of overweight
- 95th percentile and above: Overweight

Many chronic diseases are more likely to develop when an individual's BMI is outside the normal weight/health weight range. Individuals whose BMI is too high or too low can personalize the MyPyramid dietary recommendations so that if they follow them, their BMI will gradually move toward the normal/healthy weight range.

### *MyPyramid recommendations*

MyPyramid makes recommendations in seven categories: grains, vegetables, fruits, milk, meat and beans, oils, discretionary calories, and physical activity. MyPyramid assumes that people will eat from all food categories. The personalized recommendations about quantities to eat for each group do not take into consideration special diets for people with diabetes or other diseases.

**GRAINS.** Wheat, rice, oats, barley, and cornmeal are common grains in the American diet. Less familiar grains include buckwheat (also called kasha), amaranth, quinoa, sorghum, millet, rye, and triticale. Pasta, bread, oatmeal, breakfast cereals, grits, crackers, tortillas and other foods made from grains are part of this group.

Grains are divided into two categories, whole grains and refined grains. MyPyramid recommends that at least half of the grains an individual eats daily are whole grains. In whole grain, the whole kernel including bran and germ of the grain seed, is used or ground into flour. Examples of whole-grain products include whole-wheat flour, cracked wheat (bulgur), brown rice, wild rice, whole cornmeal, oatmeal, whole wheat bread, whole wheat pasta, whole wheat cereal such as muesli, and popcorn.

Refined grains have the bran, or seed coating, and the germ, or center of the kernel, removed during processing. This produces softer flour and removes oils from the grain. This slows the spoilage process and increases the shelf life of refined grain products. However, refining also removed dietary **fiber**, **iron**, and B-complex **vitamins**. Products made with refined grain often have B vitamins and iron added to replace some of what was lost by removing the germ and bran. These products are labeled "enriched." Examples of refined grain products include white flour, degermed cornmeal, white rice, couscous, crackers, flour tortillas, grits, pasta, white bread, and corn flake cereal. Some products are made with a mixture of whole grain and refined grain flours too improve texture and taste but retain some nutrients.

**VEGETABLES.** Any vegetable or any 100% vegetable juice is part of the vegetable group. This group is subdivided into different types of vegetable. MyPyramid recommends that people eat vegetables from all five subgroups over the course of a week. The subgroups are:

- dark green vegetables–spinach, kale, watercress, turnip greens, bok choy, broccoli, collard greens, and similar vegetables.
- orange vegetables–carrots, sweet potatoes, butternut squash, pumpkin, acorn squash, etc.
- dry beans and peas–black beans, navy beans, pinto beans, kidney beans, lima beans, black-eyed peas, chickpeas, lentils, tofu (bean curd), etc.
- starchy vegetables–potatoes, corn, fresh lima beans, green peas.
- other vegetables–artichokes, cauliflower, mushrooms, bean sprouts, onions, eggplant, peppers, tomatoes, celery, iceberg lettuce, and vegetables not other categories.

**FRUITS.** Fruits can be fresh, canned, frozen, or dried. One hundred percent fruit juice also counts as fruit. Virtually all fruit is included in this group including citrus fruits, berries, melons, and common fruits such as apples, bananas, and pears, Raisins (dried grapes) and other dried fruit also are part of the group.

**MILK.** Non-fat, low-fat, and whole milk all have about the same amount of **calcium**, the most important mineral in milk. Non-fat and low fat milk are the preferred choices in this group. Other foods in the milk group include yogurt, cheese, and desserts made with milk such as ice cream and pudding. When foods like ice cream or full-fat cheese or sweetened yogurt are chosen, the extra calories from fat and sugar should be subtracted from the daily discretionary calories. People who are lactose intolerant can choose lactose-reduced and lactose-free products. Cream cheese and butter contain only small amounts of calcium and are not part of this group.

**MEAT AND BEANS.** This group provides most of the **protein** in diet. Vegetarians and vegans can choose plant-based sources of protein. However, people who do not eat meat need to make sure they are getting adequate amounts of iron. See the entry on iron for more information. The meat group contains several subgroups. People should try to eat less red meat and more fish, poultry, and dried beans. Meat should be trimmed of all visible fat and baked, broiled, or grilled. If fat is added in cooking, it should be counted as oil or discretionary calories. This group includes:

- meat–beef, pork, lamb, game meats such as venison and rabbit, organ meats such as liver and kidney, and lean cold cuts.
- poultry–chicken and ground chicken, turkey and ground turkey, duck, goose, and pheasant.
- eggs–all types. Egg yolks are high in cholesterol, but egg whites are not.
- Dry beans and peas. This is the same as the list under vegetables. Dried beans and peas can be counted either in the vegetable group or the meat group.
- fish and shelfish-catfish, salmon, halibut, tuna, and all other finned fish, shellfish such as clams, shrimp, crabs and lobster, canned fish such as sardines and anchovies.
- seeds and nuts- almonds, peanuts, walnuts, and all other nuts, sunflower seeds, sesame seeds, pumpkin seeds.

**OILS.** Oils are liquid at room temperature. Fats are solid at room temperature. Oils are preferred because they contain less saturated fat and *trans* fat. Diets high in saturated fat and *trans* fat are associated with an increased risk of cardiovascular disease.

Oils come from plant sources and include olive oil, canola oil, corn oil, safflower oil, and oil blends. Fats come mainly from animal sources and include butter, lard (pork fat), tallow (beef fat), and chicken fat. Stick margarine and shortening are made of vegetable oils that are treated to make them solid. This process, called hydrogenation, increases the amount of saturated fat and *trans* fat they contain, making them less desirable sources of fat. Also palm oil and coconut oil, although liquid at room temperature, are not recommended because they are unusually high in saturated fat and *trans* fat. Avocados, nuts, olives, and some fish, such as salmon, are high in oils. Processed foods such as mayonnaise, salad dressings, and oil-packed tuna are also high in oil. See the entry on **fat replacers** for more information about fats and oils in processed foods.

**DISCRETIONARY CALORIES.** Discretionary calories are extra calories that remain after all the food group requirements have been met. The amount varies depending on how active a person is and their age and gender. MyPyramid calculates discretionary calories based on the personalized information each individual enters in the Web-based MyPyramid Plan. These calories can be used to increase the amount of food eaten in any group or for things like sugary treats, sauces, or alcoholic beverages that are not included in any of the food groups. Be aware, however, that the number of discretionary calories is usually small, especially for people who are not very active.

**PHYSICAL ACTIVITY.** MyPyramid recommends at least 30 minutes of moderate or vigorous physical activity every day in addition to a person's normal daily routine. Moderate and vigorous activity will increase the heart rate. Movement, such as casual walking while shopping, that does increase heart rate does not count toward the 30 minutes of activity.

Moderate activity includes:

- brisk walking
- hiking
- year work and gardening
- dancing
- golfing while not using a golf cart
- easy bicycling
- light weight training

Vigorous activity includes:

- running or jogging
- brisk or hard bicycling
- lap swimming
- aerobic exercising
- power walking
- many competitive sports (tennis, basketball, etc.)
- heavy yard work such as chopping wood
- heavy weight training

## Precautions

MyPyramid is designed for healthy people. It does not take into account special diets for people who have diabetes, **hypertension**, gluten intolerance, or other allergies, or those who have diseases such as **cancer** or AIDS that alter the nutrient requirements of the body. People with special conditions should follow the advice of their healthcare provider.

## Parental concerns

MyPyramid is designed to apply only to children over age two. Because they are growing so rapidly, children younger than that have special dietary needs, including increased fat intake. Parents of children age two and younger should follow the dietary advice of their pediatrician.

## Resources

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### ORGANIZATIONS

American Dietetic Association. 120 South Riverside Plaza, Suite 2000, Chicago, Illinois 60606-6995. Telephone: (800) 877-1600. Website: <http://www.eatright.org>

American Council for Fitness and Nutrition. P.O. Box 33396, Washington, DC 20033-3396. Telephone: (800) 953-1700 Website:<http://www.acfn.org>

United States Department of Agriculture. 1400 Independence Avenue, S.W., Room 1180, Washington, DC 20250. Website: <http://www.usda.gov/wps/portal/usdahome>

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# V

## Veganism

### Definition

Veganism (pronounced VEE-ganism), which is sometimes called strict **vegetarianism** or pure vegetarianism, is a lifestyle rather than a diet in the strict sense. The term itself was coined in 1944 by Donald Watson, a British vegan frustrated by the fact that most vegetarians saw nothing amiss with consuming eggs or dairy products. He derived vegan from combining the first three and the last two letters of the word vegetarian, maintaining that veganism represents "the beginning and the end of vegetarian." The Vegan Society, which Watson and Elsie Shrigley co-founded in England during World War II, defines veganism as of 2007 as "a philosophy and way of living which seeks to exclude—as far as is possible and practical—all forms of exploitation of, and cruelty to, animals for food, clothing, or any other purpose." November 1, the anniversary of the foundation of the Vegan Society, is observed annually as World Vegan Day.

In terms of food consumption, vegans exclude all meat, dairy, fish, fish, poultry, and egg products from the diet, deriving their **protein** from such sources as beans, tofu and other **soy** products, nuts, seeds, and whole grains. Vegans go further than most other vegetarians, however, in avoiding items of dress, cosmetics, other products for personal use, or jewelry made from animal products. These would include items made of fur, leather, silk, or wool; jewelry set with pearls, mother-of-pearl, or inlays of white shell or spiney oyster shell (commonly found in Native American jewelry); any food that contains honey, whey, rennet, or gelatin; any cosmetics containing beeswax, glycerin, or lanolin; any cosmetics or personal care products that are tested on animals; soap made with animal rather than vegetable fat; any item made of wood that has been finished with shellac (which is made from a resin secreted by scale insects); and toothpaste containing **calcium** extracted from animal bones. Vegans also typically avoid zoos, circuses, rodeos, and other activities that they regard as exploiting animals for human amusement.

The numbers of adult vegans in the United States and the United Kingdom vary somewhat depending on the particular population survey or poll. According to a 2002 poll conducted by *Time* magazine and CNN, 4% of American adults define themselves as vegetarians, and 5% of these vegetarians say that they are vegans, which comes to about 0.2% of the adult American population. Charles Stahler reported in an article in *Vegetarian Journal* in 2006, however, that a poll conducted by Harris Interactive indicated that vegans comprise about 1.3% of the adult population in the United States, or 2.4 million adults. He estimated that about half the vegetarians in Canada and the United States are vegans, which is considerably higher than the percentage given by *Time* in 2002. The American Dietetic Association (ADA) and the Dietitians of Canada (DC) accept Stahler's estimate that somewhere between 40% and 50% of vegetarians in North America are vegans. In the United Kingdom, the UK Food Standards Agency stated in 2002 that approximately 0.25% of British adults are vegans. *The Times* (London) reported in 2005, however, that there are at least 250,000 vegans in Britain, which represents about 0.4% of the adult population.

### Origins

Although the term veganism was not used before the twentieth century, people have practiced vegan lifestyles for thousands of years. Veganism is not, however, natural to human beings, based on the evolutionary evidence. Archaeological findings indicate that prehistoric humans were not vegans, but obtained about a third of their daily calories from meat or other animal products. The structure of the human digestive tract suggests that humans evolved as omnivores (animals that feed on both plant and animal substances), as human intestines are relatively short in comparison

## KEY TERMS

**Ahimsa**—A Sanskrit word for non-killing and non-harming, adopted by the American Vegan Society as its official watchword. The AVS notes that the six letters in ahimsa stand for the basic principles of veganism: Abstinence from animal products; Harmlessness with reverence for life; Integrity of thought, word, and deed; Mastery over oneself; Service to humanity, nature, and creation; and Advancement of understanding and truth.

**Glycerin**—A sweet syrupy alcohol obtained from animal fats. It is often used in cough syrups and other liquid medications to give them a smooth texture.

**Lactovegetarian**—A vegetarian who uses milk and cheese in addition to plant-based foods.

**Lanolin**—A greasy substance extracted from wool, often used in hand creams and other cosmetics.

**Omnivore**—An animal whose teeth and digestive tract are adapted to consume either plant or animal matter. The term does not mean, however, that a given species consumes equal amounts of plant and animal products. Omnivores include bears, squirrels, opossums, rats, pigs, foxes, chickens, crows, monkeys, most dogs, and humans.

**Ovolactovegetarian**—A vegetarian who consumes eggs and dairy products as well as plant-based foods. The official diet recommended to Seventh-day Adventists is ovolactovegetarian.

**Ovovegetarian**—A vegetarian who eats eggs in addition to plant-based foods.

**Pepsin**—A protease enzyme in the gastric juices of carnivorous and omnivorous animals that breaks down the proteins found in meat. Its existence in humans is considered evidence that humans evolved as omnivores.

**Quinoa**—A species of goosefoot that originated in the high Andes and is raised as a food crop for its edible seeds, which have an unusually high protein content (12–18 percent). Quinoa is considered a pseudo-cereal rather than a true cereal grain because it is not a grass.

**Rennet**—An enzyme used to coagulate milk, derived from the mucous membranes lining the stomachs of unweaned calves.

**Tempeh**—A food product made from whole fermented soybeans that originated in Indonesia. It can be used as a meat substitute in vegan dishes or sliced and cooked in hot vegetable oil.

**Textured vegetable protein (TVP)**—A meat substitute made from defatted soybean flour formed into a dough and cooked by steam while being forced through an extruder. It resembles ground beef in texture and can replace it in most recipes. TVP is also known as textured soy protein or TSP.

**Tofu**—Bean curd; a soft food made by coagulating soy milk with an enzyme, calcium sulfate, or an organic acid, and pressing the resulting curds into blocks or chunks. Tofu is frequently used in vegetarian or vegan dishes as a meat or cheese substitute.

**Vegan**—A vegetarian who excludes all animal products from the diet, including those that can be obtained without killing the animal. Vegans are also known as strict vegetarians or pure vegetarians.

**Whey**—The watery part of milk, separated out during the process of making cheese.

with the lengthy intestines found in herbivores (plant-eating animals). Like the stomachs of other carnivores (meat-eating animals) and omnivores, the human stomach secretes pepsin, an enzyme necessary for digesting the proteins found in meat rather than plant matter. The human mouth contains pointed teeth (canines and incisors) adapted for tearing meat as well as teeth with flat crowns (molars) for chewing plant matter. In addition to the anatomical evidence, anthropologists have not discovered any primitive societies in the past or present whose members maintained good health and consumed a vegan diet.

The earliest motivation for what would now be called veganism is religious faith and practice. The book of Daniel in the Old Testament, for example, written some time between the sixth and second centuries BC, describes Daniel and his three companions summoned to the court of King Nebuchadnezzar of Babylon as refusing the rich food and drink offered them by the king. In Daniel 1:12, the Hebrew youths tell the master of the palace, "Please test your servants for ten days. Let us be given vegetables to eat and **water** to drink." At the end of the trial period, the four youths are found to be in better health than those who had eaten the "royal rations" (Daniel 1:15). During this same time period, the followers of the philosopher and mathematician Pythagoras (c. 582–507 BC) in ancient Greece practiced an ascetic lifestyle that

included a vegan diet and abstaining from animal bloodshed, including sacrifices to the Greek gods.

In Asia, the Jain **religion**, which is an ascetic offshoot of Hinduism that began in the sixth century BC, still requires followers to adopt a vegan diet; they may also not eat roots because to do so kills the plant. Most Jains fast on holy days and at other times throughout the year, as they believe that fasting strengthens self-control as well as protecting the believer from accumulating bad karma.

Mainstream Christianity in both its Eastern (Greek-speaking) and Western (Latin-speaking) forms has never required ordinary laypeople to adopt a vegan diet as a year-round practice. Some monastic communities, however, have practiced a vegetarian lifestyle since the fourth century AD, and a few monastic groups and individual ascetics are vegans. Since the formation of vegan societies in the United Kingdom and North America, some Christian laypeople have chosen to join them. One Christian denomination that was formed in the United States in the nineteenth century, namely the Seventh-day Adventist Church, has expected its members to be vegetarians since its beginning. Although most Adventists follow the denomination's official diet, which is ovolactovegetarian, a significant proportion of the members are vegans.

Most people who have become vegans since World War II, however, do so out of concern for the environment or compassion for animals. The statement of the American Vegan Society (AVS), founded in 1960, is a typical expression of these convictions: "Veganism is compassion in action. It is a philosophy, diet, and lifestyle. Veganism is an advanced way of living in accordance with Reverence for Life, recognizing the rights of all living creatures, and extending to them the compassion, kindness, and justice exemplified in the Golden Rule." The official slogan of the AVS, "Ahimsa Lights the Way," refers to the Sanskrit word for not killing and not harming other living creatures.

Many members of New Age groups, as well as some atheists and agnostics, practice a vegan lifestyle out of respect for nature or for the earth, even though they would not consider themselves religious in the conventional sense. One group that broke from the Vegan Society in England in 1984, founded by its former secretary, Kathleen Jannaway, and her husband Jack, is called the Movement for Compassionate Living (MCL), and emphasizes "the use of trees and vegan-organic farming to meet the needs of society for food and natural resources" as well as promoting " simple living and self-reliance as a remedy against the exploitation of humans, animals and the Earth."

## Description

In the past, planning a nutritionally adequate vegan diet was difficult because the standard food choice guides in use in Canada and the United States had not been designed for vegetarians in general, let alone vegans. Although the 1992 revisions of the familiar U.S. Department of Agriculture (USDA) food guide pyramid and Canada's Food Guide to Healthy Eating (CFGHE) were the first to consider overnutrition as a serious health problem and emphasized the importance of plant foods in the diet, they did not include guidelines for planning vegetarian diets. In 2003 the ADA and DC jointly issued "A New Food Guide for North American Vegetarians," intended to accommodate the needs of vegans as well as those of less strict vegetarians. The 2003 document notes that "... any guide aimed at vegetarians must consider the needs of vegans. Studies also indicate that a substantial percentage of vegan women ... have calcium intakes that are too low, which suggests that calcium deserves special attention in vegetarian food guides. With few exceptions, vegetarian food guides have not provided appropriate guidelines for vegans."

Vegans vary considerably in their patterns of food intake; as a result, there is no one specific diet regimen that could be called vegan. Most vegan cookbooks contain a chapter on nutritional guidelines, including daily calorie requirements; protein, calcium, and vitamin contents of various foods; and sample menus intended to make the point that a vegan diet does not have to be monotonous or flavorless. A table of vegan menus in an article available from the Vegetarian Resource Group is titled "Sample Menus Showing How Easy It Is to Meet Protein Needs"

- Breakfast: 1 cup oatmeal (6 g protein); 1 cup soymilk (9 g); 1 bagel (9 g).
- Lunch: 2 slices whole wheat bread (5 g); 1 cup vegetarian baked beans (12 g).
- Dinner: 5 ounces firm tofu (11 g); 1 cup cooked broccoli (4 g); 1 cup cooked brown rice or quinoa (5 g); 2 tbsp almonds (4 g).
- Snack: 2 tbsp peanut butter (8 g); 6 crackers (2 g).
- Breakfast: 2 slices whole wheat toast (5 g); 2 tbsp peanut butter (8 g).
- Lunch: 6 ounces soy yogurt (6 g); 1 baked potato (4 g); 2 tbsp almonds (4 g).
- Dinner: 1 cup cooked lentils (18 g); i cup cooked bulgur wheat (6 g)
- Snack: 1 cup soymilk (9g)

The first set of menus provides a total of 75 grams of protein, adequate for a male vegan weighing 160 pounds. The second set provides a total of 60 grams of protein, adequate for a female vegan weighing 130 pounds.

## Function

The vegan lifestyle is adopted by people in developed countries primarily for ethical or religious reasons rather than economic necessity—although some nutritionists do point out that plant-based foods are usually easier on the household food budget than meat. On the other hand, the ADA notes that soy milk, used by many vegans as a source of calcium and protein, is considerably more expensive than cow's milk. Another more recent reason for veganism is the growing perception that plant-based diets are a form of preventive health care for people at increased risk of such diseases as heart disease, type 2 diabetes and some forms of **cancer**. Adolescents, however, are more likely to adopt vegan diets as a weight reduction regimen or in some cases as an ethical way to protest their parents' patterns of dress or food comsumption; one Swedish study of vegan youth concluded that veganism was "a new type of status passage." In a very few cases, adolescents adopt veganism to camouflage an existing eating disorder, as noted by the ADA.

## Benefits

The benefits of a vegan diet are similar to the health benefits of less strict vegetarian diets: lowered blood pressure, lower rates of cardiovascular disease and stroke, lower blood cholesterol levels, and lowered risks of colon and **prostate** cancer are associated with a vegan diet. Most people lose weight on a vegan diet, especially in the first few months; moreover, weight loss is usually greater on a vegan diet than on a vegetarian diet permitting dairy products. In addition, most vegans have lower body mass indices (an important diagnostic criterion of **obesity**) than their meat-eating counterparts. Vegan diets also appear to lower the risk of developing type 2 (adult-onset) diabetes.

## Precautions

As with adoption of any vegetarian diet, people considering a vegan diet should consult a registered dietitian as well as their primary physician before starting their new lifestyle. The reason for this precaution is the strictness of vegan regimens as well as the variations in height, weight, age, genetic inheritance, food preferences, level of activity, geographic location, and preexisting health problems among people. A nutritionist can also help design a diet that a vegan will enjoy eating as well as getting adequate nourishment and other health benefits.

It is particularly important for pregnant or nursing women, or for families who wish to raise their children as vegans, to consult a dietitian as well as a pediatrician. There is some helpful and nutritionally sound information on the Vegetarian Resource Group website regarding meeting protein requirements during pregnancy, the protein needs of infants, and "feeding vegan children."

## Risks

The longstanding concern expressed by nutritionists and other health professionals about vegan diets is the risk of nutritional deficiencies, particularly for such important nutrients as protein, **minerals** (**iron**, calcium, and **zinc**), **vitamins** (**vitamin D**, **riboflavin**, **vitamin $B_{12}$**, and **vitamin A**), **iodine**, and n-3 fatty acids. The 2003 vegetarian food guide published by the ADA and DC recommends that vegans in all age groups should take supplements of vitamin $B_{12}$ and vitamin D, or use foods fortified with these nutrients. It is particularly important for pregnant women to maintain an adequate intake of vitamin $B_{12}$, as a lack of this vitamin can cause irreversible neurological damage in the infant. In addition, some studies indicate that vegans are at increased risk of **osteoporosis** and bone fractures compared to either meat-eaters or less strict vegetarians because their average calcium intake is lower.

The ADA states simply that "Unsupplemented vegan diets do not provide vitamin $B_{12}$. Dairy products and eggs supply vitamin $B_{12}$; however, depending on food choices, some lacto-ovo-vegetarians may have inadequate intakes [of these nutrients] as well [as vegans]. The Institute of Medicine has recommended that all people over the age of 50, regardless of type of diet, take vitamin $B_{12}$ in the form found in supplements and fortified foods for optimal absorption. Vitamin $B_{12}$ is well-absorbed from fortified nondairy milks and from breakfast cereals, as well as from supplements. Because vitamin $B_{12}$ absorption is inversely related to dosage, a daily supplement of at least 5 mg or a weekly supplement of 2,000." Vitamin D supplements are recommended and may be particularly important for vegans living in northern latitudes or other situations in which they receive little sun, because this vitamin is synthesized in the skin during exposure to sunlight. The ADA notes that "Many fortified nondairy milks and breakfast cereals provide [vegans with] vitamin D, although the form used to fortify cereals is often not vegan."

## QUESTIONS TO ASK YOUR DOCTOR

- Have you ever supervised a patient on a vegan diet?
- What is your opinion of veganism compared to less strict forms of vegetarianism?
- Do you agree with the ADA and Institute of Medicine guidelines?
- Have you ever treated a patient with a health problem related to a calcium or vitamin $B_{12}$ deficiency from following a vegan diet?

In addition to nutritional concerns, there is some evidence that vegan diets may actually increase the risk of breast cancer in women, particularly in those who use large amounts of soy-based products. Soybeans contain phytoestrogens, or plant estrogens, which have been implicated in breast cancer. The plant estrogens in soy-based products may also explain why committed vegans have a disproportionate number of female babies, and why these girls have a higher rate of precocious puberty than girls born to nonvegetarian mothers.

### Research and general acceptance

Studies of the role of vegetarian diets of all types in preventing disease go back to the 1960s, when the National Institutes of Health (NIH) and the National Cancer Institute (NCI) began to study members of the Seventh-day Adventist Church. NIH findings indicate that Adventist men live on average seven years longer than men in the general population, and Adventist women eight years longer than their non-Adventist counterparts.

Studies of vegans as a subpopulation of vegetarians are fewer in number than those of less strict vegetarians; however, the emphasis in medical research has shifted in the early 2000s from concern about nutritional deficiencies in people following these diets to the role of plant-based diets in preventing or treating chronic diseases. In this regard vegan diets and lifestyles appear to be beneficial. One 2005 study of 64 overweight postmenopausal women found that a vegan diet brought about a significant weight loss and improved insulin sensitivity (an important factor in evaluating the patient's risk of developing type 2 diabetes), despite the lack of prescribed limits on food portion size or calorie intake. Two studies published in 2004 comparing a group of overweight adults on a vegan diet with a control group following a National Cholesterol Education Program Step II Diet showed that the low-fat vegan diet was as acceptable to the subjects as the Step II diet, and was equally effective in promoting weight loss. Those on the vegan diet, however, told the researchers that the vegan diet was harder to prepare than their normal meals.

In terms of general acceptance, vegan diets differ from less strict vegetarian regimens in being more difficult to follow and in causing more social friction with nonvegans. Some vegetarians who are not vegans have noted that evaluating foods, clothing, cosmetics, and other items as not containing animal products often requires considerable knowledge of production methods as well as the derivation of the ingredients. In addition, such items as vitamins, **dietary supplements**, and prescription medications may be processed using non-vegan ingredients (gelatin for capsules, glycerin in some liquid medications), and these are not always listed on the packaging. The complications of replacing animal-derived ingredients in some recipes and the difficulty of finding restaurants offering dishes acceptable to vegans also contribute to a widespread perception of veganism as a potentially problematic lifestyle.

### Resources

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### ORGANIZATIONS

American Dietetic Association (ADA). 120 South Riverside Plaza, Suite 2000, Chicago, IL 60606-6995. Telephone: (800): 877-1600. Website: http://www.eatright.org.
American Vegan Society (AVS). 56 Dinshah Lane, P. O. Box 369, Malaga, NJ 08328. Telephone: (856) 694-2887. Website: http://www.americanvegan.org/index.htm.
Dietitians of Canada/Les diététistes du Canada (DC). 480 University Avenue, Suite 604, Toronto, Ontario, Canada M5G 1V2. Telephone: (416) 596-0857. Website: http://www.dietitians.ca.
Movement for Compassionate Living (MCL). 105 Cyfyng Road, Ystalyfera, Swansea SA9 2BT, United Kingdom. No telephone. Website: http://www.mclveganway.org.uk/.
Seventh-day Adventist Dietetic Association (SDADA). 9355 Telfer Run, Orlando, FL 32817. Website: http://www.sdada.org. SDADA is an official affiliate of the ADA.
The Vegan Society. Donald Watson House, 7 Battle Road, St. Leonards-on-Sea, East Sussex, TN37 7AA, United Kingdom. Telephone: 01424 427393. Website: http://www.vegansociety.com. The oldest organized vegan group, founded in 1944.
Vegetarian Resource Group (VRG). P.O. Box 1463, Dept. IN, Baltimore, MD 21203. Telephone: (410) 366-VEGE. Website: http://www.vrg.org/index.htm. Publishes *Vegetarian Journal*, a quarterly periodical that contains many articles of interest to vegans.

Rebecca J. Frey, PhD

# Vegetarianism

## Definition

Vegetarianism refers to the practice of excluding meat, poultry, and fish from the diet. The word was coined in 1847, when the Vegetarian Society of the United Kingdom—the oldest organized vegetarian group in the world—was founded in Ramsgate, Kent. The Society, which has included George Bernard Shaw and Mahatma Gandhi among its members, chose the word *vegetarian* for its name because it is derived from

**Vegetarian diet**

| Servings | Foods | Calcium-rich foods |
|---|---|---|
| Fats (2 servings) | 1 tsp. oil, mayonnaise, soft margarine | |
| Fruits (2 servings) | 1 med. piece of fruit<br>½ cooked or cut-up fruit<br>½ cup fruit juice<br>¼ cup dried fruit | ½ cup fortified fruit juice |
| Vegetables (4 servings) | ½ cup cooked vegetables<br>1 cup of raw vegetables<br>½ cup vegetable juice | 1 cup cooked or 2 cups raw bok choy, broccoli, collards, Chinese cabbage, kale, mustard greens or okra<br>½ cup fortified tomato juice |
| Legumes, nuts, and other protein-rich foods (5 servings) | ½ cup cooked beans, peas or lentils<br>½ cup tofu or tempeh<br>2 tbsp. nut or seed butter<br>1 egg | ½ cup cow's milk or yogurt or fortified soy milk<br>¾ oz. cheese<br>½ cup tempeh or calcium-set tofu<br>½ cup cooked soybeans<br>¼ cup soynuts |
| Grains (6 servings) | 1 slice bread<br>½ cup cooked grain or cereal<br>1 oz. ready to eat cereal | 1 oz. calcium-fortified cereal |

**Based on the 2003 American Dietetic Association pyramid and the Dietitians of Canada rainbow. The recommended servings and foods are intended to accommodate the needs of vegans as well as those of less strict vegetarians.** *(Illustration by GGS Information Services/Thomson Gale.)*

the Latin *vegetus*, which means "lively" or "vigorous," and because it suggests the English word *vegetable*. Vegetarianism is better understood as a lifestyle rather than a diet in the strict sense, as there are many specific plant-based diets that could be called vegetarian.

There are several distinctive subgroups of vegetarians:

- Vegans: Sometimes called strict vegetarians, vegans are people who exclude all animal products from their diet or clothing, whether or not they involve the death of an animal. Vegans will not use honey or dairy products, for example, and will not wear clothing made of wool, silk, fur, or leather, or use bedding stuffed with down.
- Ovolactovegetarians: Vegetarians in this category will use eggs, milk, and other dairy products on the grounds that these foods are not obtained by killing animals.
- Ovovegetarians: Vegetarians who will include eggs in the diet but not milk or milk products.
- Lactovegetarians: Vegetarians who will use milk and milk products but not eggs.
- Semivegetarians or pesce/pollo vegetarians: People who include fish or chicken in the diet but also seek to minimize their consumption of animal protein.
- Fruitarians: Vegetarians who eat only fruits, nuts, seeds, and other plant matter that can be harvested without harming the plant.
- Flexitarians: Persons who prefer a vegetarian diet but are willing to eat meat, fish, or chicken on exceptional occasions.
- Freegans: Anti-consumerist vegans who seek to avoid participating in any practices they regard as exploitative of other people or the environment, in addition to excluding meat and animal products from their diet. Freegans obtain their food by growing it themselves, by barter, or by foraging in refuse bins and restaurant trash receptacles for discarded food. This practice is called "dumpster diving" in the United States and "skipping" in the United Kingdom.

## Origins

Vegetarianism is a lifestyle that has emerged in various civilizations around the world at different points in history out of different sets of motives, which will be described in the historical order of their appearance. Archaeological findings indicate that prehistoric humans were not vegetarians but obtained about a third of their daily calories from meat or other animal products. The structure of the human digestive tract suggests that humans evolved as omnivores (animals that feed on both plant and animal substances), as human intestines are relatively short in comparison with the lengthy intestines found in herbivores (plant-eating animals). Like the stomachs of other carnivores (meat-eating animals) and omnivores, the human stomach secretes pepsin, an enzyme necessary for digesting the proteins found in meat rather than plant matter. The human mouth contains pointed teeth (canines and incisors) adapted for tearing meat as well as teeth with flat crowns (molars) for chewing plant matter. In addition to the anatomical

evidence, anthropologists have not discovered any primitive societies in the past or present whose members maintained good health and consumed a purely vegetarian diet. All contemporary indigenous groups that are healthy include fish or dairy products in their diet, and most eat meat, even if only in small amounts or on rare occasions.

### *Religious vegetarianism*

Religious belief is the oldest historical motive for vegetarianism. Hinduism is the earliest of the world's major religions known to have encouraged a vegetarian lifestyle. As of the early 2000s, Hinduism accounts for more of the world's practicing vegetarians—70 percent—than any other faith or political conviction. Different Hindus, however, explain their commitment to vegetarianism in different ways. Some associate vegetarianism with the doctrine of *ahimsa*, or nonviolence, which forbids the shedding of animal as well as human blood. Others believe that animals have souls, and that those who kill them will acquire bad karma and suffer in their next reincarnation. Last, some Hindus believe that their gods will not accept nonvegetarian offerings.

The Jain **religion**, which is an ascetic offshoot of Hinduism that began in the sixth century BC, requires followers to adopt a vegan diet; they may also not eat roots because to do so kills the plant. Most Jains fast on holy days and at other times throughout the year, as they believe that fasting strengthens self-control as well as protecting the believer from accumulating bad karma.

In ancient Greece, the followers of the philosopher and mathematician Pythagoras (c. 582–507 BC) practiced an ascetic lifestyle that included a vegetarian diet and abstaining from animal bloodshed, including sacrifices to the Greek gods. Neoplatonist philosophers of the third and fourth centuries AD revived the Pythagorean notion that vegetarianism helps to purify the soul. As a result of the association of a plant-based diet with Pythagoras, European Christians in the sixteenth and seventeenth centuries who practiced vegetarianism were often called Pythagoreans.

Mainstream Christianity in both its Eastern and Western forms has never made year-round vegetarianism mandatory for laypeople; however, there is a long tradition of monastic vegetarianism going back at least as far as the Desert Fathers in the third and fourth centuries AD. In addition, many Christians abstain from meat during certain seasons of the church year (Lent and Advent). One reason for vegetarian diets in some of the monastic orders is the belief that eating meat increases temptations to anger and violence. Another reason, found more commonly among evangelical Protestants, is the interpretation of Genesis 1:29 and other Bible passages as meaning that God originally intended humans to be vegetarians, and that God wants his present-day followers to be responsible stewards of the earth. The Christian Vegetarian Association (CVA), which welcomes Roman Catholics as well as mainstream and evangelical Protestants, was founded in 1999.

One Christian denomination that was formed in the United States in the nineteenth century, namely the Seventh-day Adventist Church, has expected its members to be vegetarians since its beginning. Members of the church have been studied by the National Institutes of Health (NIH) and the National Cancer Institute (NCI) since 1960. NIH findings indicate that Adventist men live on average seven years longer than men in the general population, and Adventist women eight years longer than their non-Adventist counterparts.

Many members of New Age groups, as well as some atheists and agnostics, practice vegetarian or vegan lifestyles out of respect for nature or for the earth, even though they would not consider themselves religious in the conventional sense.

### *Environmental vegetarianism*

The application of scientific methods to agriculture in the eighteenth and nineteenth centuries also allowed people to calculate for the first time the cost to the environment of raising animals for meat. As early as the 1770s, the English clergyman William Paley had already urged a vegetarian lifestyle on the grounds that an acre of land used to raise fruits and vegetables could support twice the number of people as an acre used to graze animals. A common ethical argument for vegetarianism in the early 2000s is that 40% of the world's grain goes to feed animals raised for meat rather than to feed people, and that world hunger could be eliminated if even half this grain could be redistributed to undernourished populations. According to the North American Vegetarian Society (NAVS), 15 vegans can be fed on the same amount of land needed to feed one person consuming a meat-based diet.

### *Animal rights vegetarianism*

Commitment to a vegetarian diet as a way to reduce the suffering of animals—sometimes called compassion-based vegetarianism—emerged during the mid-nineteenth century, a period that also witnessed the foundation of the first groups devoted to animal welfare. The Royal Society for the Prevention of Cruelty to Animals (RSPCA) was given its charter by

## KEY TERMS

**Carnivore**—An animal whose diet consists mostly or entirely of meat. Cats, wolves, snakes, birds of prey, frogs, sharks, spiders, seals, and penguins are all carnivores.

**Dietitian**—A health care professional who specializes in individual or group nutritional planning, public education in nutrition, or research in food science. To be licensed as a registered dietitian (RD) in the United States, a person must complete a bachelor's degree in a nutrition-related field and pass a state licensing examination. Dietitians are also called nutritionists.

**Factory farming**—A term that refers to the application of techniques of mass production borrowed from industry to the raising of livestock, poultry, fish, and crops. It is also known as industrial agriculture.

**Freegan**—A vegan who obtains food outside the mainstream economic system, most often by growing it, bartering for it, or scavenging for it in restaurant or supermarket trash bins.

**Fruitarian**—A vegetarian who eats only plant-based products, as fruits, seeds, and nuts, that can be obtained without killing the plant.

**Herbivore**—An animal whose diet consists primarily or entirely of plant matter. Herbivorous animals include deer, sheep, cows, horses, elephants, giraffes, and bison.

**Lactovegetarian**—A vegetarian who uses milk and cheese in addition to plant-based foods.

**Obligate carnivore**—An animal that must have meat in its diet to maintain health. Cats are obligate carnivores, although humans and most breeds of dogs are not.

**Omnivore**—An animal whose teeth and digestive tract are adapted to consume either plant or animal matter. The term does not mean, however, that a given species consumes equal amounts of plant and animal products. Omnivores include bears, squirrels, opossums, rats, pigs, foxes, chickens, crows, monkeys, most dogs, and humans.

**Ovolactovegetarian**—A vegetarian who consumes eggs and dairy products as well as plant-based foods. The official diet recommended to Seventh-day Adventists is ovolactovegetarian.

**Ovovegetarian**—A vegetarian who eats eggs in addition to plant-based foods.

**Pepsin**—A protease enzyme in the gastric juices of carnivorous and omnivorous animals that breaks down the proteins found in meat. Its existence in humans is considered evidence that humans evolved as omnivores.

**Pesce/pollo vegetarian**—A term used to describe semivegetarians; that is, people who avoid the use of red meat but will include fish (*pesce* in Italian) or chicken (*pollo* in Italian) in the diet. Other terms for semivegetarians include *piscitarian* or *fishetarian* for those who eat only fish but not chicken, and *pollovegetarian* or *pollotarian* for those who add chicken but not fish to their vegetarian diet.

**Textured vegetable protein (TVP)**—A meat substitute made from defatted soybean flour formed into a dough and cooked by steam while being forced through an extruder. It resembles ground beef in texture and can replace it in most recipes. TVP is also known as textured soy protein or TSP.

**Tofu**—Bean curd; a soft food made by coagulating soy milk with an enzyme, calcium sulfate, or an organic acid, and pressing the resulting curds into blocks or chunks. Tofu is frequently used in vegetarian dishes as a meat or cheese substitute.

**Vegan**—A vegetarian who excludes all animal products from the diet, including those that can be obtained without killing the animal. Vegans are also known as strict vegetarians.

Queen Victoria in 1840, seven years before the organization of the Vegetarian Society. The American Society for the Prevention of Cruelty to Animals (ASPCA) was founded in New York City by Henry Bergh in 1866. In addition to ongoing concern about maltreatment of household pets and working animals, the advent of so-called factory farming in the twentieth century has intensified the revulsion many people feel regarding the use of animals for human dietary consumption and clothing.

## Description

### *The 2003 vegetarian food guide*

Vegetarianism entered the medical mainstream in 2003 when the American Dietetic Association (ADA) and the Dietitians of Canada (DC) jointly issued "A New Food Guide for North American Vegetarians." This document contained the first major revisions of the familiar U.S. Department of Agriculture (USDA) food guide pyramid (originated 1912, modified in 1942

and 1992) and Canada's Food Guide to Healthy Eating (CFGHE; originated 1942, modified in 1992) intended for vegetarians. While the 1992 food guides were the first to consider overnutrition as a serious health problem, and emphasized the importance of plant foods in the diet, they did not include guidelines for planning vegetarian diets. The 2003 food guide borrowed the general concept of food groups from the older guides, but reclassified foods into five plant-based groups:

- Grains: The foundation of the vegetarian diet. Whole grains are best, but enriched refined grains are also acceptable.
- Vegetables and fruits: The ADA and DC recommend that vegetarians choose both vegetables and fruits rather than using only one or the other.
- Legumes, nuts, and other protein-rich foods: Legumes include soy milk and tofu. Dairy products used by ovo- and lactovegetarians also fall into this category, as do meat substitutes.
- Fats: Vegetarians who do not eat fish require plant-based sources of n-3 fats.
- Calcium-rich foods: Adult vegetarians require eight servings from this category each day. Each serving, however, counts toward one of the other food choices, as calcium-rich foods can be found across the other food groups.

The minimum number of servings per food group in this diet would provide about 1400 or 1500 calories per day. Nonsedentary adults can meet higher energy needs by choosing more servings from any of the basic five groups. Sweets and alcohol should be used only sparingly.

**Dietary supplements** are recommended for vegetarians over 50 and for vegans, based on studies conducted by the Institute of Medicine (IOM). These guidelines are described more fully under Risks below.

### *Some specific vegetarian diets*

Vegetarian diets can accommodate a wide variety of regional and ethnic cuisines as well as different philosophical or religious approaches. The following are only a few of the possible choices:

**MEDITERRANEAN DIET.** In its origin, the **Mediterranean diet** was not a purely vegetarian diet. It is, however, sparing in its use of red meat and eggs, and low in its use of fish and poultry. It can thus be easily adapted to a vegetarian or pesce/pollo vegetarian diet. The Mediterranean diet is high in its use of whole grains, fruits, nuts, and high-fiber vegetables; it appeals to many people because of its wide choice of flavorful foods.

**MACROBIOTIC DIET.** The **macrobiotic diet**, which was brought to Europe and North America from Japan in the 1960s, is associated with the Eastern concepts of yin and yang as well as with the elimination of animal products from the diet. This diet also involves such changes in eating habits as chewing each mouthful of food at least 50 times, drinking liquids only when thirsty, avoiding the use of aluminum cookware, and cooking foods on a wood stove rather than using electrical appliances.

**ORNISH DIET.** Developed by a medical doctor to reverse the signs of heart disease, the Ornish diet has also been popularized as a weight-loss program. It is a strict low-fat, **high-fiber diet** that excludes red meat, poultry, and fish, although persons following this diet may use limited amounts of egg whites, fat-free milk, and other fat-free dairy products.

**SEVENTH-DAY ADVENTIST DIET.** Seventh-day Adventists (SDAs) have followed vegetarian dietary regimens since the denomination was first organized in 1863. The diet recommended by the church's General Conference Nutrition Council (GCNC) in the early 2000s is an ovolactovegetarian diet high in whole-grain breads and pastas, fresh vegetables and fruits; moderate use of nuts, seeds, and low-fat dairy products; and limited use of eggs. Some SDAs prefer a vegan diet. The church has its own professional organization for dietitians, which is affiliated with the ADA, and encourages all its members to follow the ADA guidelines for vegetarians.

### *Tips for starting a vegetarian diet*

The ADA offers the following suggestions for persons considering vegetarianism:

- List all the meatless dishes that you already like to eat. Pizza, chili, vegetable soups, salads, bean casseroles, Oriental stir-fried vegetables, and pasta dishes are common favorites.
- Look through some vegetarian cookbooks and copy the recipes that appeal to you.
- Check out natural food stores and try some of their products.
- Visit ethnic restaurants—Chinese, Japanese, Thai, Indian, Vietnamese, or Middle Eastern are good choices—and sample some of their meatless dishes.
- Try meat substitutes (sometimes called meat analogues or "mock meat") made from textured vegetable protein (TVP) or tofu (bean curd). Veggie burgers, veggie hot dogs, and imitation sausage are popular items of this type.

## Function

Vegetarian diets are adopted by people in developed countries primarily for ethical or religious reasons rather than economic necessity—although some nutritionists do point out that plant-based foods are usually easier on the household food budget than meat. Another more recent reason is the growing perception that plant-based diets are a form of preventive health care for people at increased risk of such diseases as heart disease, type 2 diabetes and some forms of cancer. Adolescents, however, are more likely to adopt vegetarian diets as a weight reduction regimen.

## Benefits

The long-term NIH study of Seventh-day Adventists began to report in the 1970s and 1980s that lowered blood pressure, lower rates of cardiovascular disease and stroke, lower blood cholesterol levels, and lowered risks of colon and **prostate** cancer are associated with a vegetarian diet. In particular, SDAs were only half as likely to develop type 2 (adult-onset) diabetes as were nonvegetarian Caucasians. Although it is possible to gain weight on a vegetarian diet, most people lose weight, especially in the first few months; and most vegetarians have lower body mass indices (an important diagnostic criterion of **obesity**) than their meat-eating counterparts.

Several studies carried out in Germany and Austria reported in 2006 that vegetarian diets appear to be effective in lowering the risk of rheumatoid arthritis, **osteoporosis**, kidney disease, **gallstones**, diverticulitis, and dementia as well as heart attacks, stroke, and diabetes.

In addition to lowering the risk of chronic degenerative diseases, vegetarian diets have also been shown to be useful in treating **constipation** in adults and children, and dysmenorrhea (painful menstrual periods) in women of childbearing age.

## Precautions

The ADA strongly recommends that people consult a registered dietitian as well as their primary physician before starting a vegetarian diet. The reason for this precaution is the variety of vegetarian regimens as well as the variations in height, weight, age, genetic inheritance, food preferences, level of activity, geographic location, and preexisting health problems among people. A nutritionist can also help design a diet that a new vegetarian will enjoy eating as well as getting adequate nourishment and other health benefits.

### QUESTIONS TO ASK YOUR DOCTOR

- What are the potential benefits for a person of my age, sex, and lifestyle in adopting a vegetarian diet? A semivegetarian diet?
- What are the potential health risks, if any, for me as an individual?
- Have you treated other patients who are vegetarians?
- What specific types of vegetarian diets would you recommend? Have you tried any of them yourself?
- Will I need any dietary supplements if I adopt a vegetarian diet?

## Risks

The longstanding concern about vegetarian diets is the risk of nutritional deficiencies, particularly for such important nutrients as **protein**, **minerals** (**iron**, **calcium**, and **zinc**), **vitamins** (**vitamin D**, **riboflavin**, **vitamin $B_{12}$**, and **vitamin A**), **iodine**, and n-3 fatty acids. The 2003 vegetarian food guide recommends that vegetarians over 50 years of age as well as vegans in all age groups should take supplements of vitamin $B_{12}$ and vitamin D, or use foods fortified with these nutrients. Vitamin D supplements are particularly important for vegans living in northern latitudes or other situations in which they receive little sun exposure.

In addition to nutritional concerns, there is some evidence that vegetarian diets may actually increase the risk of breast cancer in women, particularly in those who use large amounts of soy-based products. Soybeans contain phytoestrogens, or plant estrogens, which have been implicated in breast cancer. The plant estrogens in soy-based products may also explain why vegetarians have a disproportionate number of female babies, and why these girls have a higher rate of precocious puberty than girls born to nonvegetarian mothers.

## Research and general acceptance

### *General acceptance*

Vegetarianism is accepted by all mainstream medical associations and professional nutritionists' societies, and positively recommended by some. The position statement jointly adopted by the ADA and DC in 2003 states: "It is the position of the American Dietetic Association and Dietitians of Canada that appropriately planned vegetarian diets are healthful,

nutritionally adequate and provide health benefits in the prevention and treatment of certain diseases.... Well-planned vegan and other types of vegetarian diets are appropriate for all stages of the life cycle, including during pregnancy, lactation, infancy, childhood and adolescence."

The ADA has a professional subgroup called the Vegetarian Nutrition Dietary Practice Group, or DPG, which publishes a quarterly newsletter called *Vegetarian Nutrition Update*, available to nonmembers of the ADA for an annual subscription fee of $25. The Vegetarian Nutrition DPG also has its own website at http://www.vegetariannutrition.net/index.htm, with articles available to the public on vegetarian diets and cancer prevention, treatment of rheumatoid arthritis, **sports nutrition**, pregnancy, and vegan diets for children.

Once considered an eccentricity, vegetarianism is widely accepted by the general public in developed countries as a legitimate dietary option in the early 2000s. The ADA and DC state that about 2.5% of adults (defined as people over 18 years of age) in the United States and 4% of Canadian adults follow vegetarian diets. The Vegetarian Resource Group (VRG), a nonprofit research organization, conducted a poll in 2006. It estimated that 2.3% of adults in the United States—4.7 million people—are vegetarians, with a third to a half of this group being vegans. In addition, the VRG notes that 30 to 40% of American adults choose vegetarian dishes over meat dishes at least some of the time. Other interesting details from the 2006 poll:

- People between 45 and 54 years of age are almost twice as likely to be vegetarians as people between 18 and 24 years of age.
- The Northeast has the highest percentage of vegetarians in the general population, with the South having the lowest.
- People who have graduated from college are twice as likely to be vegetarians as those who did not complete high school.
- Hispanics are more likely to be vegetarians than either Caucasians or African Americans.
- There is no correlation between household income and a vegetarian lifestyle as of the early 2000s; people at all income levels seem to be equally likely to become vegetarians.

Most opposition to vegetarianism in developed countries is interpersonal rather than scientific or political, as some vegetarians develop a sense of moral or spiritual superiority to nonvegetarians and make themselves socially unpopular by criticizing or lecturing others for continuing to eat meat. NAVS advises new vegetarians, "Be cheerful about your choices [but] remember to let people come to their own dietary conclusions."

### *Research*

As has been noted in Europe as well as the United States, the emphasis in medical research on vegetarian diets has shifted in the early 2000s from concern about nutritional deficiencies in people following these diets to the role of vegetarianism in preventing or treating chronic diseases. It was the NIH's studies of Seventh-day Adventists that first indicated that vegetarian diets lower the risk of heart disease, stroke, and type 2 diabetes. The Adventist Health Study received new funding in 2003 for its continuation. As of early 2007, the NIH is conducting five additional clinical trials to evaluate the advantages of vegetarian diets in managing uremia in the elderly, cardiovascular disease, type 2 diabetes, high blood pressure, and postmenopausal disorders in women as well as treating obesity.

One area of concern, however, is in veterinary medicine—namely, the trend among some pet owners to put dogs and cats on vegetarian diets, often with homemade foods. Cats in particular are at risk of malnutrition and eventual blindness on a vegetarian or vegan diet because they are obligate carnivores (must have meat in the diet). Their bodies cannot form taurine (an amino acid), thiamine, retinol (a form of vitamin A essential to healthy eye tissue), and vitamin $B_{12}$—all micronutrients found primarily in meat. The Vegetarian Society (UK) has an information sheet warning against putting cats on a vegetarian diet, while the American Veterinary Medical Association (AVMA) strongly urges vegetarian pet owners to consult their veterinarian before offering either dogs or cats vegetarian pet food.

## Resources

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Pelletier, Kenneth R., MD. *The Best Alternative Medicine*, Chapter 3, "Food for Thought." New York: Fireside Books, 2002. A good summary of recent studies of the health benefits of vegetarianism.

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**OTHER**

*Indian Vegetarian Cooking Videos*, vol. 1 and vol. 2. Simple step-by-step demonstrations of vegetarian cooking in the Indian tradition by a registered dietitian. Nutritional information is provided for the recipes in the videos. To order, call (757) 464-0786 or e-mail Vegdiets@AOL.com.

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**ORGANIZATIONS**

American Dietetic Association (ADA). 120 South Riverside Plaza, Suite 2000, Chicago, IL 60606-6995. Telephone: (800): 877-1600. Website: http://www.eatright.org.

American Vegan Society (AVS). 56 Dinshah Lane, P. O. Box 369, Malaga, NJ 08328. Telephone: (856) 694-2887. Website: http://www.americanvegan.org/index.htm.

Christian Vegetarian Association (CVA). P.O. Box 201791, Cleveland, OH 44120. Telephone: (216) 283-6702. Website: http://www.all-creatures.org/cva/.

Dietitians of Canada/Les diététistes du Canada (DC). 480 University Avenue, Suite 604, Toronto, Ontario, Canada M5G 1V2. Telephone: (416) 596-0857. Website: http://www.dietitians.ca.

North American Vegetarian Society (NAVS). P.O. Box 72, Dolgeville, NY 13329. Telephone: (518) 568-7970. Website: http://www.navs-online.org.

Seventh-day Adventist Dietetic Association (SDADA). 9355 Telfer Run, Orlando, FL 32817. Website: http://www.sdada.org. SDADA is an official affiliate of the ADA.

Vegetarian Resource Group (VRG). P.O. Box 1463, Dept. IN, Baltimore, MD 21203. Telephone: (410) 366-VEGE. Website: http://www.vrg.org/index.htm. Publishes *Vegetarian Journal*, a quarterly periodical.

Vegetarian Society of the United Kingdom. Parkdale, Dunham Road, Altrincham, Cheshire, England WA14 4QG. Telephone: 0161 925 2000. Website: http://www.vegsoc.org. The oldest organized vegetarian group, founded in 1847.

Rebecca J. Frey, PhD

# Vitamin A

## Definition

Vitamin A is a fat-soluble organic compound that the body needs to remain healthy. Humans cannot make vitamin A, so they must get it from foods in their diet. Vitamin A is sometimes called retinol.

## Purpose

Vitamin A affects many different systems of the body. It is especially important to maintaining good vision, a healthy immune system, and strong bones. Vitamin A also helps turn on and off certain genes (gene expression) during cell division and differentiation. Getting the correct amount—not too little and not too much—of vitamin A is essential for health. People who get too little vitamin A have vision defects, are more likely to have damaged cells in the lining of

**Vitamin A**

| Age | Recommended Dietary Allowance | | Tolerable Upper Intake Level | |
|---|---|---|---|---|
| Children 0–6 mos. | 1,330 IU | 400 RAE | 2,000 IU | 600 RAE |
| Children 7–12 mos. | 1,670 IU | 500 RAE | 2,000 IU | 600 RAE |
| Children 1–3 yrs. | 1,000 IU | 300 RAE | 2,000 IU | 600 RAE |
| Children 4–8 yrs. | 1,330 IU | 400 RAE | 3,000 IU | 900 RAE |
| Children 9–13 yrs. | 2,000 IU | 600 RAE | 5,610 IU | 1,700 RAE |
| Boys 14–18 yrs. | 3,000 IU | 900 RAE | 9,240 IU | 2,800 RAE |
| Girls 14–18 yrs. | 2,310 IU | 700 RAE | 9,240 IU | 2,800 RAE |
| Men 19≥ yrs. | 3,000 IU | 900 RAE | 10,000 IU | 3,000 RAE |
| Women 19≥ yrs. | 2,310 IU | 700 RAE | 10,000 IU | 3,000 RAE |
| Pregnant women 19≥ yrs. | 2,500 IU | 750 RAE | 10,000 IU | 3,000 RAE |
| Breastfeeding women 19≥ yrs. | 4,300 IU | 1,300 RAE | 10,000 IU | 3,000 RAE |

| Food | Vitamin A (retinol) |
|---|---|
| Beef liver, cooked, 3 oz. | 27,185 IU |
| Chicken liver, cooked, 3 oz. | 12,325 IU |
| Skim milk, vitamin A fortified, 1 cup | 500 IU |
| Butter, 1 tbsp. | 325 IU |
| Egg, 1 whole | 300 IU |
| Whole milk cheddar cheese, 1 oz. | 280 IU |
| Whole milk, 1 cup | 250 IU |

| Food | Vitamin A (provitamin A carotenoid) |
|---|---|
| Spinach, cooked, ½ cup | 11,460 IU |
| Kale, cooked, ½ cup | 9,560 IU |
| Carrot, raw, unpeeled, 1 whole (7.5") | 8,670 IU |
| Cantaloupe, 1 cup | 5,410 IU |
| Spinach, raw, 1 cup | 2,800 IU |
| Papaya, 1 cup | 1,530 IU |
| Carrot, raw, peeled, sliced, ½ cup | 1,285 IU |
| Mango, 1 cup | 1,260 IU |
| Tomato juice, 6 oz. | 820 IU |
| Cereal, vitamin A fortified, 1 serving | 500–770 IU |

IU = International Unit
RAE = retinol activity equivalents

*(Illustration by GGS Information Services/Thomson Gale.)*

body cavities, and are more susceptible to infection. People who get too much vitamin A have weaken bones that tend to break easily and have a chronic feeling of illness, including headache, nausea, irritability, fatigue, and muscle and joint pain. Women who get too much vitamin A may have disrupted menstrual cycles. Excess vitamin A can also cause birth defects in a developing fetus.

## Description

Vitamin A was the first fat-soluble vitamin to be discovered. In 1913, two groups of American scientists experimenting with animal feed almost simultaneously discovered a substance essential to health that was present in whole milk but absent in fat-free milk. They called this "fat-soluble factor A," later renamed vitamin A. Today scientists know that vitamin A is found in food that comes from both animal and plants, is used by many systems in the body besides vision, and comes in several different forms.

### *Vitamin A from animal sources*

Vitamin A found in food that comes from animals is in the form of a compound called retinol or preformed vitamin A. Sometimes retinol is called "true" vitamin A because it can be used by the body without any chemical changes. It can also be converted into retinoic acid, a compound involved in the control of gene expression. About 80% of the retinol in an individual's diet is absorbed by the body.

Good sources of retinol include beef or chicken liver, whole eggs, whole milk, and cheese made with whole milk. Some manufactured foods such as breakfast cereals and fat-free milk are fortified with vitamin A in the form of retinol. **Dietary supplements** of vitamin A and multivitamin tablets or capsules also contain this form of vitamin A. Americans who eat meat get about 70% of the vitamin A in their diet from animal sources.

### *Vitamin A from plant sources*

Vitamin A found in plants is called provitamin A carotenoid. Provitamins cannot be directly used by the body but can be chemically convert into usable **vitamins**. **Carotenoids** are a family of more than 560 compounds, some of which can be converted into retinol. The carotenoids that can be converted into retinol by humans are mainly bets-carotene, alpha-carotene, and beta-cryptoxanthin. Of these, beta-carotene is converted twice as efficiently as alpha-carotene or beta-cryptoxanthin. However it takes 12 micrograms (mcg) of beta-carotene to equal the activity of 1 mcg of retinol. Carotenoids are found in yellow and orange vegetables and in some deep green vegetables where their orange color is not noticeable. Good sources of provitamin A carotenoid include carrots, cantaloupe, apricots, mango, papaya, spinach, and kale. Vegans (people who do not eat any animal products) must be especially careful to get enough of these vegetables.

### *Vitamin A's role in health*

Almost everyone living in the developed world gets enough vitamin A to maintain health from their normal diet. The same is not true in the developing world where famine and limited food choices often prevent individuals, especially children, from getting enough vitamin A and other nutrients. When too little

## KEY TERMS

**Cell differentiation**—The process by which stem cells develop into different types of specialized cells such as skin, heart, muscle, and blood cells.

**Fat-soluble vitamin**—A vitamin that dissolves in and can be stored in body fat or the liver.

**Provitamin**—A substance that the body can convert into a vitamin.

**Vitamin**—A nutrient that the body needs in small amounts to remain healthy but that the body cannot manufacture for itself and must acquire through diet.

vitamin A is in the diet, the effects can be seen in many different systems.

**VISION.** The first function of vitamin A to be well understood was its role in maintaining good vision. Much of the research that explained how vitamin A was critical to vision was done by Harvard scientist George Wald (1906–1997), who won the Nobel Prize in 1967 for his work. When light enters the eye, it is absorbed by cells lining the retina at the back of the eye. This activates a chain of events that results in vision. Vitamin A (in the form of retinol) is part of a pigment in the retina called rhodopsin that absorbs the light. Without enough vitamin A, the eye does not detect low levels of light. People with this deficiency develop night blindness. They can see well in bright light, but cannot see in dim light. Night blindness was known in early Egyptian, Chinese, and Greek cultures, all of whom discovered independently that eating liver (an excellent source of retinol) would cure the disorder. Night blindness disappears almost immediately when vitamin A is added to the diet. If left untreated, however, dry eye (xeropthalmia) and permanent blindness can occur because of damage to the cornea, the clear covering of the eye.

**SKIN.** Vitamin A helps skin (epithelial) cells to remain healthy. Skin disorders such as acne can be treated by prescription drugs such as tretinoin (Avita, Renova, Retina-A) and isotretinoin (Accutane) that contain synthetic Vitamin A. Vitamin A supplements are also often given to burn victims to help them grow large amounts of new skin.

**RESISTANCE TO INFECTION.** Vitamin A is necessary for proper functioning of the immune system. The cells that line the throat, lungs, intestine, bladder, and other internal cavities are the first line of defense against bacteria and viruses entering the body. These cells need vitamin A to grow normally and form a continuous barrier against invading microorganisms. When these cells br eak down, it is easier for bacteria and viruses to infect the body. In addition, vitamin A is needed for the proper development white blood cells that fight infection. However vitamin A taken in excess of recommended amounts does not appears to benefit the immune system.

**CANCER PREVENTION.** There are mixed results from research on whether Vitamin A can help prevent **cancer**. The prescription drug All-Trans-Retinoic Acid (ATRA, Vesanoid) has been proved successful in increasing survival time for individuals with acute promyelocytic leukemia. This drug contains retinoic acid, a derivative of retinol. Research results on whether vitamin A is helpful in preventing or treating skin cancer and breast cancer are unclear. Clinical trials are underway to determine safety and effectiveness of vitamin A in a variety of situations. Individuals interested in participating in a clinical trial at no charge can find a list of open trials at <http://www.clinicaltrials.gov>.

### *Normal vitamin A requirements*

The United States Institute of Medicine (IOM) of the National Academy of Sciences has developed values called **Dietary Reference Intakes** (DRIs) for vitamins and **minerals**. The DRIs consist of three sets of values. The Recommended Dietary Allowance (RDA) defines the average daily amount of the nutrient needed to meet the health needs of 97–98% of the population. The Adequate Intake (AI) is an estimate set when there is not enough information to determine an RDA. The Tolerable Upper Intake Level (UL) is the average maximum amount that can be taken daily without risking negative side effects. The DRIs are calculated for children, adult men, adult women, pregnant women, and **breastfeeding** women.

RDAs for vitamin A are measured in both weight (micrograms) and international units (IU). The IU measurement is what is used on dietary supplement labels. Vitamin A comes in two different forms, preformed retinol from animal sources and provitamin A carotenoid from plant sources. These forms have different activity levels. To adjust for this, dietitians have developed an equivalency measure called the Retinol Activity Equivalent. This allows a direct comparison between the two sources of vitamin A.

For vitamin A from food:

- 1 RAE = 1 mcg retinol
- 1 RAE = 12 mcg beta-carotene
- 1 RAE = 24 mcg any other provitamin A carotenoid
- 1 RAE = about 3 IU

The following are the RDAs and ULs for vitamin A for healthy individuals:

- children birth–6 months: RDA 1,330 IU or 400 RAE; UL 2,000 IU or 600 RAE
- children 7–12 months: RDA 1,670 IU or 500 RAE; UL 2,000 IU or 600 RAE
- children 1–3 years: RDA 1,000 IU of 300 RAE; UL 2,000 IU or 600 RAE
- children 4–8 years: RDA 1,330 IU of 400 RAE; UL 3,000 IU or 900 RAE
- children 9–13 years: RDA 2,000 IU or 600 RAE; UL 5,610 IU or 1,700 RAE
- boys 14–18 years: RDA 3,000 IU or 900 RAE; UL 9,240 IU or 2,800 RAE
- girls 14–18 years: RDA 2,310 IU or 700 RAE; UL 9,240 IU or 2,800 RAE
- men age 19 and older: RDA 3,000 IU or 900 RAE; UL 10,000 IU or 3,000 RAE
- women age 19 and older: RDA 2,310 IU or 700 RAE; UL 10,000 IU or 3,000 RAE
- pregnant women age 19 and older: RDA 2,500 IU or 750 RAE; UL 10,000 IU or 3,000 RAE
- breastfeeding women age 19 and older: RDA 4,300 IU or 1,300 RAE; UL 10,000 IU or 3,000 RAE

The following list gives the approximate vitamin A (retinol) content for some common animal foods:

- beef liver, 3 ounces cooked: 27,185 IU
- chicken liver, 3 ounces cooked: 12,325 IU
- whole milk, 1 cup: 250 IU
- skim milk fortified with vitamin A, 1 cup: 500 IU
- whole milk cheddar cheese, 1 ounce: 280 IU
- egg, 1 whole: 300 IU
- butter, 1 tablespoon: 325 IU

The following list gives the approximate vitamin A (provitamin A carotenoid) content for some common plant foods:

- carrot, 1 whole raw: 8,670 IU
- carrot, 1/2 cup raw: 1,285 IU
- cantaloupe, 1 cup: 5,410 IU
- kale, 1/2 cup cooked: 9,560 IU
- spinach, 1/2 cup cooked: 11,460 IU
- spinach, raw, 1 cup: 2,800
- papaya, 1 cup: 1,530 IU
- mango, 1 cup: 1,260 IU
- tomato juice, 6 ounces: 820 IU
- breakfast cereal fortified with vitamin A, 1 serving: 500–770 IU
- adult multivitamin, 1 tablet or capsule: usually 5,000 IU (The UL of vitamin A has recently been reduced—see vitamin A excess below—so manufacturers may begin reducing this amount.)

## Precautions

### *Vitamin A excess*

Vitamin A is definitely a vitamin where more is not better, and excesses can be seriously harmful to health. It is a fat-soluble vitamin that is stored in the liver. Over time vitamin A can build up to dangerous levels and cause liver damage. Vitamin A excess can also cause birth defects. For this reason, certain prescription acne medications that contain synthetic vitamin A (e.g. tretinoin Avita, Renova, Retina-A, isotretinoin, Accutane) should not be taken by pregnant women or women who have the chance of becoming pregnant. Pregnant women should discuss their vitamin needs with their healthcare provider.

Acute vitamin A excess usually occurs when a person takes vitamin A in large quantities as a dietary supplement. Acute excess can cause nausea, vomiting, blurred vision, headache, drowsiness, and altered mental states. Chronic vitamin A excess occurs when vitamin A builds up in the body gradually. Symptoms include loss of appetite, dry skin, hair loss, insomnia, fatigue, irritability, diarrhea, menstrual irregularities, bone pain, and reduced growth rate in children.

Too much vitamin A activates the cells that break down bone (osteoclasts) and interferes with the activities of **vitamin D**, a vitamin involved in building and preserving bone. Studies have linked high levels of retinol in the blood with increased risk of hip fracture among people over age 50. Most multivitamins contain 5,000 IU of vitamin A. This amount is based on 1968 RDAs, which have now been revised downward. Since the risk of **osteoporosis** (bone weakening) is greatest in the elderly, some experts question the value of a daily multivitamin for people over age 55.

### *Vitamin A deficiency*

Vitamin A deficiency is not a problem for healthy people in most industrial countries. However, the following groups in these countries have a greater likelihood of developing vitamin A deficiency:

- strict vegans, especially vegan children, who eat no animal products
- people with gastrointestinal diseases such as Crohn's disease, celiac disease, or inflammatory bowel disease that interfere with the absorption of nutrients from the intestine

- people with disorders of the pancreas that interfere with the absorption of nutrients
- people with anorexia nervosa (self-starvation)
- people with alcoholism

In the developing world, especially parts of Africa and Southeast Asia, vitamin A deficiency is common. The World Health Organization (WHO) estimates between 100 and 140 million children are at high risk of developing vitamin A deficiency and that each year 250,000–500,000 children become blind because of inadequate vitamin A in their diet. These children also have up to a 50% higher risk of dying from measles, diarrhea, malaria, and similar infections. These risks are lowered when vitamin A is added to the diet. WHO recommends that malnourished and at risk children under age five to receive a high-dosage capsule of vitamin A every six months as a safe and cost-effective way to prevent blindness and other problems associated with vitamin A deficiency in children. The excess vitamin A from the supplement is stored in the liver and released gradually as it is needed by the body.

## Interactions

Vitamin A may interact with the following medications:

- antacids, which may be more effective in when used in combination with vitamin A
- birth control pills, which increase the level of vitamin A in a woman's blood
- blood thinning medicine such as warfarin (Coumadin), whose effect may be enhanced by long-term use of vitamin A
- cholesterol-lowering drugs, which may reduce the body's ability to absorb vitamin A
- orlistat, a weight-loss drug marketed as Xenical or Alli that prevents fat from being absorbed and olestra, substance used to replace fat in some foods. These may decrease the amount of vitamin A absorbed from the intestine.
- Alcohol, which increases the likelihood of vitamin A excess possibly because regular use of alcohol damages the liver and interferes with vitamin A storage

## Complications

Vitamin A is safe when taken in amounts listed above as recommended by the Institute of Medicine. Too much or too little vitamin A results in side effects listed above in the Precautions section.

## Parental concerns

Parents should be aware that the RDA and UL for vitamins and minerals are much lower for children than for adults. Accidental overdose may occur if children are give adult vitamins or dietary supplements.

## Resources

### BOOKS

Gaby, Alan R., ed. *A-Z Guide to Drug-Herb-Vitamin Interactions Revised and Expanded 2nd Edition: Improve Your Health and Avoid Side Effects When Using Common Medications and Natural Supplements Together*. New York: Three Rivers Press, 2006.

Lieberman, Shari and Nancy Bruning. *The Real Vitamin and Mineral Book: The Definitive Guide to Designing Your Personal Supplement Program,* 4th ed. New York: Avery, 2007.

Pressman, Alan H. and Sheila Buff. *The Complete Idiot's Guide to Vitamins and Minerals,* 3rd ed. Indianapolis, IN: Alpha Books, 2007.

Rucker, Robert B., ed. *Handbook of Vitamins*. Boca Raton, FL: Taylor & Francis, 2007.

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Wolf, George. "A History of Vitamin A." *The FASEB Journal, 10, no. 9 (1996): 1102-8.*

### ORGANIZATIONS

American Dietetic Association. 120 South Riverside Plaza, Suite 2000, Chicago, Illinois 60606-6995. Telephone: (800) 877-1600. Website: <http://www.eatright.org>

Linus Pauling Institute. Oregon State University, 571 Weniger Hall, Corvallis, OR 97331-6512. Telephone: (541) 717-5075. Fax: (541) 737-5077. Website: <http://lpi.oregonstate.edu>

Office of Dietary Supplements, National Institutes of Health. 6100 Executive Blvd., Room 3B01, MSC 7517, Bethesda, MD 20892-7517 Telephone: (301)435-2920. Fax: (301)480-1845. Website: <http://dietary-supplements.info.nih.gov>

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Thakore, Jigna. "Vitamin A Deficiency." emedicine.com, May 12, 2006. <http://www.emedicine.com/med/topic2381.htm>
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Tish Davidson, A.M.

Vitamin $B_5$ *see* **Pantothenic acid**

# Vitamin $B_6$

## Definition

Vitamin $B_6$ is a water-soluble organic compound that the body needs to remain healthy. Humans cannot make vitamin $B_6$, so they must get it from foods in their diet. Vitamin $B_6$ is sometimes called pyridoxine.

## Purpose

Vitamin $B_6$ has a broad range activities and is necessary for the correct functioning of many systems in the body. It plays a role in the transmission of nerve impulses, formation and functioning of red blood cells, formation of new cells skin and other cells, and conversion of stored **carbohydrates** into energy. It aids in the production of DNA (genetic material) and, along with vitamin $B_{12}$ and folic acid (vitamin $B_9$), it helps regulate the levels of an amino acid (homocysteine) in the blood thought to be linked to heart disease.

## Description

Vitamin $B_6$ is not a single compound. It has three different forms: pyrodoxine, pyridoxal, pyridoxamine, and three derivatives of these forms. All forms of vitamin $B_6$ are converted in the body into the same active molecule, pyridoxal 5'-phosphate (PLP). Vitamin $B_6$ is a water-soluble vitamin. Unlike the fat-soluble **vitamins** A, D, E, and K, it is not stored in the body but is excreted in urine.

**Vitamin $B_6$**

| Age | Recommended Dietary Allowance (mg) | Tolerable Upper Intake Level (mg) |
|---|---|---|
| Children 0–6 mos. | 0.1 (AI) | Not established |
| Children 7–12 mos. | 0.3 | Not established |
| Children 1–3 yrs. | 0.5 | 30 |
| Children 4–8 yrs. | 0.6 | 40 |
| Children 9–13 yrs. | 1.0 | 60 |
| Boys 14–18 yrs. | 1.3 | 80 |
| Girls 14–18 yrs. | 1.2 | 80 |
| Adults 19–50 yrs. | 1.3 | 100 |
| Men 51≥ yrs. | 1.7 | 100 |
| Women 51≥ yrs. | 1.5 | 100 |
| Pregnant women | 1.9 | 100 |
| Breastfeeding women | 2.0 | 100 |

| Food | Vitamin $B_6$ (mg) |
|---|---|
| Cereal, 100% fortified, ¾ cup | 2.0 |
| Potato, baked, med. with skin | 0.70 |
| Banana, 1 med. | 0.68 |
| Chicken or turkey breast, roasted, 4 oz. | 0.64 |
| Cod, baked or broiled, 4 oz. | 0.52 |
| Salmon, baked or broiled, 4 oz. | 0.52 |
| Cereal, 25% fortified, ¾ cup | 0.50 |
| Beef tenderloin, lean, 4 oz. | 0.49 |
| Halibut, baked or broiled, 4 oz. | 0.45 |
| Pork loin, lean, 3 oz. | 0.42 |
| Spinach, fresh, cooked, ½ cup | 0.22 |
| Watermelon, 1 cup | 0.22 |
| Carrots, raw, 1 cup | 0.18 |
| Tuna, canned, 3 oz. | 0.18 |
| Green peas, ½ cup | 0.17 |
| Peanut butter, smooth, 2 tbsp. | 0.15 |
| Spinach, frozen, cooked, ½ cup | 0.14 |

AI = Adequate Intake
mg = milligram

*(Illustration by GGS Information Services/Thomson Gale.)*

### *Normal vitamin $B_6$ requirements*

The United States Institute of Medicine (IOM) of the National Academy of Sciences has developed values called **Dietary Reference Intakes** (DRIs) for vitamins and **minerals**. The DRIs consist of three sets of numbers. The Recommended Dietary Allowance (RDA) defines the average daily amount of the nutrient needed to meet the health needs of 97–98% of the population. The Adequate Intake (AI) is an estimate set when there is not enough information to determine an RDA. The Tolerable Upper Intake Level (UL) is the average maximum amount that can be taken daily without risking negative side effects. The DRIs are calculated for children, adult men, adult women, pregnant women, and **breastfeeding** women.

The IOM has not set RDA or UL values for vitamin $B_6$ in children under one year old because of incomplete scientific information. Instead, it has set

## KEY TERMS

**Amino acid**—Molecules that are the basic building blocks of proteins.

**Coenzyme**—Also called a cofactor, a small non-protein molecule that binds to an enzyme and catalyzes (stimulates) enzyme-mediated reactions.

**Conventional medicine**—Mainstream or Western pharmaceutical-based medicine practiced by medical doctors, doctors of osteopathy, and other licensed health care professionals.

**Dietary supplement**—A product, such as a vitamin, mineral, herb, amino acid, or enzyme, that is intended to be consumed in addition to an individual's diet with the expectation that it will improve health.

**Enzyme**—A protein that change the rate of a chemical reaction within the body without themselves being used up in the reaction.

**Neurotransmitter**—A chemical released by a nerve cell that transmits information to another cell.

**Vitamin**—A nutrient that the body needs in small amounts to remain healthy but that the body cannot manufacture for itself and must acquire through diet.

**Water-soluble vitamin**—A vitamin that dissolves in water and can be removed from the body in urine.

AI levels for this age group. AI and RDA levels are measured in milligrams (mg).

The following are the RDAs and ULs for vitamin $B_6$ for healthy individuals:

- children birth–6 months: AI 0.1 mg; UL not established
- children 7–12 months: 0.3 mg; UL not established
- children 1–3 years: 0.5 mg; UL 30 mg
- children 4–8 years: 0.6 mg; UL 40 mg
- children 9–13 years: 1.0 mg; UL 60 mg
- boys 14–18 years: 1.3 mg; UL 80 mg
- girls 14–18 years: 1.2 mg; UL 80 mg
- adults 19–50 years: 1.3 mg; UL 100 mg
- men age 51 and older: 1.7 mg; UL 100 mg
- women age 51 and older: 1.5 mg<; UL 100 mg/item
- pregnant women: 1.9 mg; UL 100 mg
- breastfeeding women: 2.0 mg; UL 100 mg

### *Sources of vitamin $B_6$*

Vitamin $B_6$ is found in many foods including meat, milk, potatoes, dark green vegetables, fortified breakfast cereals and fortified grains and flour. Heating and freezing foods reduces their vitamin $B_6$ content. As much as 60–80% of the vitamin $B_6$ in vegetables is lost when they are canned, and about 40% is lost in canned fruit. Processing grains and meat also causes the loss of vitamin $B_6$.

The following list gives the approximate vitamin $B_6$ content for some common foods:

- spinach, fresh, cooked, 1/2 cup: 0.22 mg
- spinach, frozen, cooked 1/2 cup: 0.14 mg
- potato, baked, medium with skin: 0.70 mg
- carrots, raw 1 cup: 0.18 mg
- green peas, 1/2 cup: 0.17 mg
- peanut butter, smooth, 2 Tablespoons: 0.15 mg
- banana, 1 medium: 0.68 mg
- watermelon, 1 cup: 0.22 mg
- salmon, baked or broiled, 4 ounces: 0.52 mg
- cod, baked or broiled, 4 ounces: 0.52 mg
- halibut, baked or broiled, 4 ounces: 0.45 mg
- tuna, canned, 3 ounces: 0.18
- chicken or turkey breast, roasted, 4 ounces: 0.64
- pork loin, lean, 3 ounces: 0.42 mg
- beef tenderloin, lean, 4 ounces: 0.49 mg
- breakfast cereal, 3/4 cup, fortified 100%: 2.0 mg
- breakfast cereal, 3/4 cup, fortified 25%: 0.5 mg

### *Vitamin $B_6$'s role in health*

Vitamin $B_6$ was discovered in the 1930s and is one of the best studied of the vitamins. Few vitamins and minerals have such a broad and diverse range of activity in the body.

**VITAMIN $B_6$ AS A COENZYME.** Enzymes are proteins that regulate chemical reactions within the body. Coenzymes are molecules that join with enzymes making it possible for reactions to take place. Vitamin $B_6$ has been identified as being involved in more than 100 enzyme reactions. Some of these reactions include:

- making neurotransmitters. Neurotransmitters are molecules that carry information from one nerve to the next. Vitamin $B_6$ is directly involved in the formation of the neurotransmitter serotonin in the brain and indirectly involved in the production the neurotransmitters dopamine, epinephrine, norepinephrine, melatonin, and gamma-aminobutyric acid (GABA). Inadequate amounts of these neurotransmitters are associated with mood changes such as depression and poor functioning of the nervous system.

- hemoglobin function. Hemoglobin is the molecule in red blood cells that carries oxygen throughout the body. Vitamin $B_6$ appears to increase the efficiency of hemoglobin, although the how this happens is not clear.
- using stored glycogen. Glycogen is a special carbohydrate stored in the liver and in muscles. Physical activity causes glycogen to be broken down into glucose (sugar) that is used for energy. Vitamin $B_6$ is one of several B vitamins that are essential to this process.
- making new nucleic acids. DNA, the protein that genes are made of, and RNA, a related protein, are made of nucleic acids. Whenever cells divide to form new cells, more DNA and RNA are needed. Because vitamin $B_6$ is needed to create nucleic acids, it plays a role in cell division and wound healing.
- turning genes on and off. Vitamin $B_6$ joins with other molecules to activate and inactivate different genes. The exact mechanism by which this takes place is unclear.
- regulation of homocysteine. Increased levels of homocysteine, an amino acid that is released when protein is broken down, appears to be associated with increased damage to blood vessels and increased risk of heart disease. Vitamin $B_6$, probably working with folic acid and vitamin $B_{12}$, lowers the level of homocysteine in the blood. However, large doses of $B_6$ alone do not appear to reduce heart disease.

Other health claims have also been proposed for vitamin $B_6$. These include relieving premenstrual symptoms, boosting the immune system, improving mental functioning in the elderly, decreasing the likelihood of developing kidney stones, treating depression, treating carpal tunnel syndrome, treating morning sickness in pregnant women, treating drug-induced movement disorders in people with schizophrenia, treating attention deficit-hyperactivity disorder (ADHD) in children and treating autism. None of the studies done using vitamin $B_6$ to treat these disorders have produced conclusive results that satisfy the practitioners of conventional medicine. Clinical trials are currently underway to determine safety and effectiveness of **vitamin E** in a variety of situations. Individuals interested in participating in a clinical trial at no charge can find a list of open trials at <http://www.clinicaltrials.gov>.

### *Vitamin $B_6$ deficiency*

Vitamin $B_6$ deficiency is uncommon in the United States. It can result from a few rare genetic disorders. People with alcoholism are at higher risk for developing vitamin $B_6$ deficiency, as are the elderly and people taking certain prescription drugs (see Interactions below). Internationally, malnutrition and lack of a varied diet are the greatest causes of vitamin $B_6$ deficiency. Symptoms are slow to appear and include skin inflammation, inflammation of the tongue, **ulcers** in the mouth, irritability, depression, and confusion. These symptoms have many other causes besides vitamin $B_6$ deficiency and should be evaluated by a physician.

## Precautions

Few precautions are necessary when taking vitamin $B_6$, although pregnant and breastfeeding women should avoid taking large amounts as a dietary supplement. Even at high doses, few side effects are reported, but include nausea, vomiting, and breast soreness. Very high doses (above 200 mg/day) taken over a long period can result in loss of feeling in the arms and legs and problems with balance. These symptoms usually go away after several months when vitamin $B_6$ supplementation is stopped. The UL is 50 times higher than the RDA, but no health benefits have been confirmed from taking large daily supplements of vitamin $B_6$.

## Interactions

Vitamin $B_6$ reduces the effectiveness of tetracycline antibiotics, the seizure drug phenytoin, and levodopa used to treat Parkinson's disease.

Tuberculosis drugs cycloserine and isoniazid (INH), penicillamine (used to treat rheumatoid arthritis) and theophylline (used to treat asthma) reduce the level of vitamin $B_6$ in the blood. Vitamin $B_6$ supplementation may be required on he advice of a physician

Interactions with herbal remedies are unknown.

## Complications

No complications are expected when vitamin $B_6$ is used in the recommended amounts. The complications resulting from insufficient or excess use are discussed above.

## Parental concerns

Parents should be aware that the RDA and UL for vitamins and minerals are much lower for children than for adults. Accidental overdose may occur if children are given adult vitamins or **dietary supplements**.

## Resources

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**ORGANIZATIONS**

American Cancer Society. 1599 Clifton Road NE, Atlanta GA 30329-4251. Telephone: 800 ACS-2345. Website: <http://www.cancer.org>
American Dietetic Association. 120 South Riverside Plaza, Suite 2000, Chicago, Illinois 60606-6995. Telephone: (800) 877-1600. Website: <http://www.eatright.org>
Linus Pauling Institute. Oregon State University, 571 Weniger Hall, Corvallis, OR 97331-6512. Telephone: (541) 717-5075. Fax: (541) 737-5077. Website: <http://lpi.oregonstate.edu>
Office of Dietary Supplements, National Institutes of Health. 6100 Executive Blvd., Room 3B01, MSC 7517, Bethesda, MD 20892-7517 Telephone: (301)435-2920. Fax: (301)480-1845. Website: <http://dietary-supplements.info.nih.gov>

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Vitamin $B_9$ *see* **Folate**



# Vitamin $B_{12}$

## Definition

Vitamin $B_{12}$ is a water-soluble organic compound that the body needs to remain healthy. The only organisms that can make vitamin $B_{12}$ are bacteria, fungi, yeast, molds, and algae. Humans must get it from foods in their diet. Vitamin $B_{12}$ is sometimes called cobalamin.

## Purpose

Vitamin $B_{12}$ plays major roles in developing healthy red blood cells, creating new deoxyribose nucleic acid (DNA, genetic material), and in maintaining the health of nerve cells. It is also involved in making certain nutrients available to the body.

## Description

Vitamin $B_{12}$ is one of the least understood **vitamins**. Although some of its effects were experimentally discovered in the 1930s, Vitamin $B_{12}$'s structure was not determined until the 1960s. Questions still remain about some of its functions. Vitamin $B_{12}$ is different from other vitamins in several ways. It is the only vitamin not made by any plant or animal, but only by microorganisms. It is the only vitamin to contain the metal cobalt (thus the name cobalamin), and it is the only vitamin that must combine with another substance, called the intrinsic factor (IF), before it can be absorbed by the body.

Although vitamin $B_{12}$ is made only by microorganisms, it is found in association with animal **protein**. In nature, it comes in a variety of chemical forms that the body converts into two active forms of $B_{12}$. Most $B_{12}$ **dietary supplements** contain the form called cyanocobalamin. $B_{12}$ is included in over-the-counter multivitamins and in vitamin-B-complex supplements. It is also sold as a stand-alone dietary supplement and in an injectable form available only by prescription.

When people eat animal protein-beef, fish, pork, chicken, eggs, milk, cheese-the stomach is stimulated to secrete hydrochloric acid and enzymes that break down the protein and release vitamin $B_{12}$. $B_{12}$ then binds with IF, which is made in the stomach. Vitamin $B_{12}$ cannot be absorbed into the body unless it is combined with IF. Therefore, either an absence of $B_{12}$ in diet or inability of the stomach to make IF can result in $B_{12}$ deficiency.

Some fermented bean products such as tofu, tempeh, natto, tamari, and miso may or may not contain

**Vitamin $B_{12}$**

| Age | Recommended Dietary Allowance |
|---|---|
| Children 0–6 mos. | 400 ng (AI) |
| Children 7–12 mos. | 500 ng (AI) |
| Children 1–3 yrs. | 900 ng |
| Children 4–8 yrs. | 1.2 mcg |
| Children 9–13 yrs. | 1.8 mcg |
| Children 14–18 yrs. | 2.4 mcg |
| Adults 19≥ yrs. | 2.4 mcg |
| Pregnant women | 2.6 mcg |
| Breastfeeding women | 2.8 mcg |

| Food | Vitamin $B_{12}$ (mcg) |
|---|---|
| Mollusks or clams, cooked, 3 oz. | 84 |
| Calf's liver, cooked, 4 oz. | 41 |
| Cereal, 100% fortified, 3/4 cup | 6.0 |
| Salmon, baked or broiled, 4 oz. | 3.3 |
| Beef, top sirloin, broiled, 3 oz. | 2.4 |
| Cheeseburger, fast food, double patty | 1.9 |
| Shrimp, steamed or broiled, 4 oz. | 1.7 |
| Taco, fast food, 1 large | 1.6 |
| Cereal, 25% fortified | 1.5 |
| Tuna, white, canned in water, 3 oz. | 1.0 |
| Milk, 1 cup | 0.9 |
| Ham, canned or roasted, 3 oz. | 0.6 |
| Chicken breast, roasted, ½ breast | 0.3 |
| Egg, 1 whole, cooked | 0.3 |

AI = Adequate intake
mcg = microgram
ng = nanogram

*(Illustration by GGS Information Services/Thomson Gale.)*

vitamin $B_{12}$ depending on which bacteria were used to ferment these products. Nutritional yeast also may or may not contain vitamin $B_{12}$ depending on the type of yeast used. Consumers should read labels of these products carefully. The best source of vitamin $B_{12}$ for people who do not eat meat or animal products is fortified breakfast cereal. Cereals can be fortified at various strengths, ranging from in amounts ranging from 100% of the daily requirement to 25% of the daily requirement. The label must contain information about vitamin fortification.

### *Vitamin $B_{12}$'s role in health*

Vitamin $B_{12}$ is crucial to the development of healthy red blood cells. As red blood cells mature, they need new DNA. In the absence of adequate vitamin $B_{12}$, the new DNA is defective. This results in red blood cells that are too large and poorly shaped. These malformed cells have a reduced ability to carry oxygen and result in pernicious anemia or megaloblastic anemia.

Vitamin $B_{12}$ also is necessary to maintain healthy nerves. Nerves are covered with a fatty sheath called myelin. The myelin covering is necessary for effective transmission of nerve impulses. When vitamin $B_{12}$ is absent, the myelin sheath does not form correctly.

Proteins in the diet are broken down into small molecules called amino acids that are then used by the body to build new proteins. Vitamin $B_{12}$ helps make amino acid available to the body. High levels of one particular amino acid, homocysteine, are associated with increased risk of heart disease. Vitamin $B_{12}$, along with **vitamin $B_6$** and folic acid help reduce the level of homocysteine in the blood. Vitamin $B_{12}$ is also thought to play a role in making **carbohydrates** and **fats** available to the body. Clinical trials are underway to determine safety and effectiveness of vitamin $B_{12}$ in a variety of situations. Individuals interested in participating in a clinical trial at no charge can find a list of open trials at <http://www.clinicaltrials.gov>.

### *Normal vitamin $B_{12}$ requirements*

The United States Institute of Medicine (IOM) of the National Academy of Sciences has developed values called **Dietary Reference Intakes** (DRIs) for vitamins and **minerals**. The DRIs consist of three sets of numbers. The Recommended Dietary Allowance (RDA) defines the average daily amount of the nutrient needed to meet the health needs of 97–98% of the population. The Adequate Intake (AI) is an estimate set when there is not enough information to determine an RDA. The Tolerable Upper Intake Level (UL) is the average maximum amount that can be taken daily without risking negative side effects. The DRIs are calculated for children, adult men, adult women, pregnant women, and **breast-feeding** women.

The IOM has not set RDAs for vitamin $B_{12}$ in children under one year old because of incomplete scientific information. Instead, it has set AI levels for this age group. No UL levels have been set for any age group because no negative (toxic) side effects have been found with $B_{12}$, even when people have taken many hundreds of times the RDA for years. RDAs for vitamin $B_{12}$ for people three years and older are measured in micrograms (mcg).

The following are the RDAs and IAs for vitamin $B_{12}$ for healthy individuals:

- children birth–6 months: AI 400 nanograms
- children 7–12 months: AI 500 nanograms
- children 1–3 years: RDA 900 nanograms
- children 4–8 years: RDA 1.2 mcg
- children 9–13 years: RDA 1.8 mcg
- people 14 years and older: RDA 2.4 mcg

## KEY TERMS

**Amino acid**—Molecules that are the basic building blocks of proteins.

**Dietary supplement**—A product, such as a vitamin, mineral, herb, amino acid, or enzyme, that is intended to be consumed in addition to an individual's diet with the expectation that it will improve health.

**Enzyme**—A protein that change the rate of a chemical reaction within the body without themselves being used up in the reaction.

**Vitamin**—A nutrient that the body needs in small amounts to remain healthy but that the body cannot manufacture for itself and must acquire through diet.

**Water-soluble vitamin**—A vitamin that dissolves in water and can be removed from the body in urine.

- pregnant women: RDA 2.6 mcg;
- breastfeeding women: RDA 2.8 mcg

### *Sources of vitamin $B_{12}$*

Vitamin $B_{12}$ is found in food that comes from animals, including meat, fish, poultry, eggs, milk, and cheese. It is also added to fortified breakfast cereals and is found in some fermented bean products. Heating or cooking foods does not reduce their vitamin $B_{12}$ content very much.

The following list gives the approximate vitamin $B_{12}$ content for some common foods:

- calf's liver, cooked, 4 ounces: 41 mcg
- salmon, baked or broiled, 4 ounces: 3.3 mcg
- shrimp, steamed or boiled, 4 ounces: 1.7 mcg
- mollusks or clams, cooked, 3 ounces: 84 mcg
- tuna, white, canned in water, 3 ounces: 1.0 mcg
- beef, top sirloin, broiled, 3 ounces: 2.4 mcg
- cheeseburger, fast food, double patty: 1.9 mcg
- taco, fast food, 1 large: 1.6 mcg
- ham, canned or roasted, 3 ounces: 0.6 mcg
- chicken breast, roasted, 1/2 breast: 0.3mcg
- milk, 1 cup: 0.9 mcg
- egg, 1 whole, cooked: 0.3 mcg
- breakfast cereal, fortified 100%, 3/4 cup: 6.0 mcg
- breakfast cereal, fortified 25%, 3/4 cup: 1.5 mcg

### *Vitamin $B_{12}$ deficiency*

Vitamin $B_{12}$ deficiency is hard to determine, and there is little agreement on how many people are vitamin $B_{12}$ deficient. This is partly because the body can store 5–10 year's worth of vitamin $B_{12}$, so symptoms of deficiency are slow to show up, especially in adults. Researchers estimate that anywhere from 300,000–3 million Americans are vitamin $B_{12}$ deficient.

Most meat-eating Americans get enough vitamin $B_{12}$ from diet alone. However, the elderly are at higher risk than younger people of developing mild vitamin $B_{12}$ deficiency. Other people at greater risk of vitamin $B_{12}$ deficiency include:

- vegans who eat no animal products
- breastfed babies of vegan mothers
- people who have had part of their stomach or intestine removed
- people with diseases that interfere with the absorption of nutrients such as Crohn's disease, celiac disease, or ulcerative colitis.
- people with alcoholism
- people with liver or kidney damage
- people with HIV/AIDS

Symptoms of vitamin $B_{12}$ deficiency include shaky movements, loss of balance, muscle weakness and spasms, vision problems, reduced mental functioning, and changes in mood and mental state. These symptoms are quite general and have many other causes besides vitamin $B_{12}$ deficiency.

## Precautions

Breast-fed infants of strict vegan mothers are particularly likely to develop vitamin $B_{12}$ deficiency, as they have little or no $B_{12}$ stored in their bodies at birth. Failure to get enough $B_{12}$ during the infancy and childhood can result in permanent damage to the nervous system. Vegan mothers should consult a pediatrician about appropriate Vitamin $B_{12}$ supplementation.

Individuals with the eye disorder Leber's optic atrophy should not use vitamin $B_{12}$ supplements. High levels of $B_{12}$ will accelerate degeneration of the optic nerve, leading to blindness.

Folic acid may mask vitamin $B_{12}$ deficiency. Folic acid supplements will reverse anemia symptoms, but they do not stop nerve damage caused by $B_{12}$ deficiency. Permanent nerve damage may result. People with suspected folic acid deficiency who begin taking folic acid supplements should also be evaluated for vitamin $B_{12}$ deficiency.

## Interactions

Many drugs used to treat **gastroesophageal reflux disease** (GERD) such as omeprazole (Prilosec), lansoprazole (Prevacid), cimetidine (Tagamet), famotidine (Pepsid), nizatidine (Axid), or ranitidine (Zantac) decrease the amount of hydrochloric acid secreted by the stomach. In turn, this may limit the amount of $B_{12}$ available from food, but not from dietary supplements. Antacid abuse may also limit the absorption of $B_{12}$.

Metaformin (Fortamet, Glucophage, Glucophage XR, Riomet), a drug used to treat diabetes, may indirectly decrease vitamin $B_{12}$ absorption by altering **calcium metabolism**. When metaformin is taken for a long time (years), the risk of megaloblastic anemia and cardiovascular disease may increase.

Nitrous oxide ("laughing gas") can inactivate the cobalamin form of vitamin $B_{12}$. Nervous system symptoms can develop in people exposed to nitrous oxide if they already have with low vitamin $B_{12}$ levels. This is unlikely to occur with people who have normal levels of $B_{12}$.

## Complications

No complications are expected from taking vitamin $B_{12}$.

## Parental concerns

Parents whose children are vegetarians should be concerned that they are getting enough vitamin $B_{12}$. The nervous system grows rapidly in children and $B_{12}$ is essential to its proper development. Nervous system damage caused by a lack of $B_{12}$ is usually irreversible in children.

### Resources

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#### ORGANIZATIONS


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Office of Dietary Supplements, National Institutes of Health. 6100 Executive Blvd., Room 3B01, MSC 7517, Bethesda, MD 20892-7517 Telephone: (301)435-2920. Fax: (301)480-1845. Website: <http://dietary-supplements.info.nih.gov>


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# Vitamin C

## Definition

Vitamin C, also called ascorbic acid or antiscorbutic vitamin, is a water-soluble organic compound needed to prevent scurvy. Scurvy is marked by beeding gums and bone malformation in children. Humans cannot make or store vitamin C, so they must get a steady supply of it from foods in their diet.

## Purpose

Vitamin C is a powerful antioxidant that helps protect cells from damage. Vitamin C also is needed to make and repair collagen, move fat into cells where it can be converted into energy, and make neurotransmitters. There are also disputed claims that vitamin C, taken in large quantities as a dietary supplement, can prevent

**Vitamin C**

| Age | Recommended Dietary Allowance (mg) | Tolerable Upper Intake Level (mg) |
|---|---|---|
| Children 0–6 mos. | 40 (AI) | Not established |
| Children 7–12 mos. | 50 (AI) | Not established |
| Children 1–3 yrs. | 15 | 400 |
| Children 4–8 yrs. | 25 | 650 |
| Children 9–13 yrs. | 45 | 1,200 |
| Boys 14–18 yrs. | 75 | 1,800 |
| Girls 14–18 yrs. | 65 | 1,800 |
| Men 19≥ yrs. | 90 | 2,000 |
| Women 19≥ yrs. | 75 | 2,000 |
| Men who smoke | 125 | 2,000 |
| Women who smoke | 110 | 2,000 |
| Pregnant women 18≤ yrs. | 80 | 1,800 |
| Pregnant women 19≥ yrs. | 85 | 2,000 |
| Breastfeeding women 19≥ yrs. | 120 | 2,000 |

| Food | Vitamin C (mg) |
|---|---|
| Pepper, red bell, raw, ½ cup | 141 |
| Papaya, 1 | 94 |
| Strawberries, 1 cup | 82 |
| Orange juice, ¾ cup | 75 |
| Orange, 1 med. | 70 |
| Broccoli, steamed, ½ cup | 62 |
| Grapefruit juice, ¾ cup | 60 |
| Grapefruit, ½ med. | 44 |
| Cauliflower, boiled, ½ cup | 27 |
| Potato, baked, 1 med. | 26 |
| Tomato, 1 med. | 23 |

AI = Adequate Intake
mg = milligram

*(Illustration by GGS Information Services/Thomson Gale.)*

**cancer**, heart disease, the common cold, cataracts, and many other diseases.

High dose vitamin C may be used to treat or prevent urinary tract infections. High levels of vitamin C increase the acidity of urine, creating an unhospitable environment for bacteria growing in the urinary tract.

## Description

Long before people knew what vitamin C was, they understood that eating certain foods, especially citrus fruit, would prevent a severe disease called scurvy. Vitamin C turned out to be the essential health-promoting compound in these foods. This vitamin was isolated in the early 1930s, and by 1934, a synthetic version of vitamin C was produced by the pharmaceutical company Hoffman-La Roche.

All animals need Vitamin C, but most animals can make their own. However, humans, along with apes, guinea pigs, and a few other animals, have lost that ability. In humans, this occurs because of a gene mutation that controls an enzyme needed to make vitamin C. As a result, humans are completely dependent on getting enough of the vitamin from foods in their diet. In addition, vitamin C cannot be stored in the body. It is a water-soluble vitamin, and any amount that cannot be used immediately is excreted in urine. Vitamin C is not evenly distributed throughout the body. The adrenal glands, pituitary gland, thymus, retina, brain, spleen, lungs, liver, thyroid, testicles, lymph nodes, kidney, and pancreas all contain much higher levels of vitamin C than are found in circulating blood.

### *Vitamin C's role in health*

Vitamin C functions as an antioxidant and as a coenzyme. Molecules called free radicals are formed during normal cell **metabolism** and with exposure to ultraviolet light or toxins such as cigarette smoke. Free radicals cause damage by reacting with **fats** and proteins in cell membranes and genetic material. This process is called oxidation. **Antioxidants** like vitamin C are compounds that attach themselves to free radicals so that it is impossible for the free radical to react with, or oxidize, other molecules. In this way, antioxidants protect cells from damage. The antioxidant properties of vitamin C are the basis for many of the controversial health claims made for it.

Vitamin C also functions as a coenzyme. Coenzymes are small molecules that make it possible for metabolic activities to occur in cells. They are needed to break down food into its building-block molecules, build up new molecules from these building blocks, and convert nutrients into energy in cells. Vitamin C functions as a coenzyme in reactions that create collagen. Collagen is a **protein** that is found in cartilage, ligaments, tendons, bones, skin, and blood vessels. Vitamin C also is required to make the neurotransmitters dopamine, norepinephrine (noradrenaline), and epinephrine (adrenaline). Neurotransmitters are molecules that carry chemical messages from one nerve to another. Epinephrine is also made in the adrenal gland in response to stress. It prepares the body for a fight or flight response. Vitamin C may also be involved in cholesterol metabolism.

### *Normal vitamin C requirements*

The United States Institute of Medicine (IOM) of the National Academy of Sciences has developed values called **Dietary Reference Intakes** (DRIs) for **vitamins** and **minerals**. The DRIs consist of three sets of numbers. The Recommended Dietary Allowance (RDA) defines the average daily amount of the nutrient needed to meet the health needs of 97–98% of the population. The Adequate Intake (AI) is an estimate set when there is not enough information to determine an RDA. The Tolerable Upper Intake Level (UL) is the average maximum amount that can be

## KEY TERMS

**Alzheimer's disease**—An incurable disease of older individuals that results in the destruction of nerve cells in the brain and causes gradual loss of mental and physical functions.

**Antioxidant**—A molecule that prevents oxidation. In the body antioxidants attach to other molecules called free radicals and prevent the free radicals from causing damage to cell walls, DNA, and other parts of the cell.

**Coenzyme**—Also called a cofactor, a small non-protein molecule that binds to an enzyme and helps regulate enzyme-mediated reactions.

**Collagen**—A long fiber-like protein found in skin, bones, blood vessels, and connective tissue such as tendons and ligaments.

**Conventional medicine**—Mainstream or Western pharmaceutical-based medicine practiced by medical doctors, doctors of osteopathy, and other licensed health care professionals.

**Dietary supplement**—A product, such as a vitamin, mineral, herb, amino acid, or enzyme, that is intended to be consumed in addition to an individual's diet with the expectation that it will improve health.

**Enzyme**—A protein that change the rate of a chemical reaction within the body without themselves being used up in the reaction.

**Neurotransmitter**—One of a group of chemicals secreted by a nerve cell (neuron) to carry a chemical message to another nerve cell, often as a way of transmitting a nerve impulse. Examples of neurotransmitters include acetylcholine, dopamine, serotonin, and norepinephrine.

**Osteoporosis**—A condition found in older individuals in which bones decrease in density and become fragile and more likely to break. It can be caused by lack of vitamin D and/or calcium in the diet.

**Placebo**—A pill or liquid given during the study of a drug or dietary supplement that contains no medication or active ingredient. Usually study participants do not know if they are receiving a pill containing the drug or an identical-appearing placebo.

**Toxin**—A general term for something that harms or poisons the body.

**Vitamin**—A nutrient that the body needs in small amounts to remain healthy but that the body cannot manufacture for itself and must acquire through diet.

**Water-soluble vitamin**—A vitamin that dissolves in water and can be removed from the body in urine.

taken daily without risking negative side effects. The DRIs are calculated for children, adult men, adult women, pregnant women, and **breastfeeding** women.

The IOM has not set RDAs for vitamin C in children under one year old because of incomplete scientific information. Instead, it has set AI levels for this age group. RDAs and ULs for vitamin C are measured in milligrams (mg). The RDAs and ULs set by the IOM are highly controversial. They are set at a level based on preventing scurvy. Many researchers believe that doses hundreds of times higher are needed to prevent certain chronic diseases. They argue that large doses of vitamin C have minimal side effects and that RDAs and ULs should be much higher. These researchers suggest of anywhere from 400–3,000 mg per day for health adults.

The following lit gives the daily RDAs and IAs and ULs for vitamin C for healthy individuals as established by the IOM.

- children birth–6 months: AI 40 mg; UL not established; All vitamin C should come from breast milk, fortified formula, or food.
- children 7–12 months: AI 50 mg; UL not established; All vitamin C should come from breast milk, fortified formula, or food.
- children 1–3 years: RDA 15 mg; UL 400 mg
- children 4–8 years: RDA 25 mg; UL 650 mg
- children 9–13 years: RDA 45 mg; UL 1,200 mg
- boys 14–18 years: RDA 75 mg; UL 1,800 mg
- girls 14–18 years: RDA 65 mg; UL 1,800 mg
- men age 19 and older: RDA 90 mg; UL 2,000 mg
- women age 19 and older: RDA 75 mg; UL 2,000 mg
- men who smoke: RDA 125 mg; UL 2,000 mg
- women who smoke: RDA 110 mg; UL 2,000 mg
- pregnant women 18 years and younger: RDA 80 mg; UL 1,800 mg
- pregnant women 19 years and older: RDA 85 mg; UL 2,000 mg
- breastfeeding women 19 years and older: RDA 120 mg; 2,000 mg

Vitamin C is the most commonly taken dietary supplement taken by Americans. As a single-ingredient supplement, it is available as tablets, capsules, and powder. It is found in multivitamin and antioxidant supplements. It is also combined with minerals such as **calcium** (e.g. Ester-C) to make it less acidic and thus less irritating to the stomach in large doses. Vitamin C can be made synthetically or derived from corn or palm oil (ascorbyl palmate). There is little evidence that one form is more effective than another. Vitamin C is added to some skin creams, throat lozenges, energy drinks, and energy bars, and to some processed foods. In 2007, the two largest American soft drink manufacturers announced that they were going to produce carbonated drinks fortified with vitamins and minerals, including vitamin C.

Vitamin C deficiency produces a disease called scurvy. From the earliest times, scurvy was a problem for sailors on long voyages where there was no way to store fresh fruits and vegetables. In 1746, a doctor in the British navy proved that eating lemons and oranges could prevent scurvy among sailors. Early Spanish explorers planted orange trees in Florida and the Caribbean so that they would have a source of oranges to prevent scurvy on their long voyages back to Europe. Today scurvy occurs infrequently. As little as 10 mg per day of vitamin C can prevent the disease. People with alcoholism, elderly individuals on extremely restricted diets, and malnourished infants in developing countries are at higher risk for developing scurvy. Symptoms include fatigue, easy bruising, excessive bleeding, hair loss, sore gums, tooth loss, and joint pain. Left untreated, death can occur, usually through sudden cardiac attack. Smoking increases the body's need for vitamin C, but is not, by itself, a cause of scurvy.

### *Sources of vitamin C*

People need a continuous supply of vitamin C from their diet because of the role it plays in many metabolic processes. Vitamin C is found in many foods. Good natural sources of vitamin C include citrus fruits and their juices, papaya, red bell peppers, broccoli, and tomatoes.

Vitamin C is unstable and is lost when food is exposed to air, temperature changes, and **water**. About one-quarter of the vitamin C content of vegetables is lost by brief boiling, steaming, or freezing and thawing. Canning fruits and vegetables reduces their vitamin C content by about one-third, as does longer cooking at higher temperatures. However, both the American Cancer Society and the American Heart Association recommend that people meet their vitamin C (and many other vitamin requirements) through a healthy diet that includes eating a minimum of 5 servings of fruits and vegetables daily.

The following list gives the approximate vitamin C content for some common foods:

- orange, 1 medium: 70 mg
- orange juice, 3/4 cup (6 ounces): 75 mg
- grapefruit, 1/2 medium: 44 mg
- grapefruit juice, 3/4 cup (6 ounces): 60 mg
- strawberries, 1 cup: 82 mg
- papaya, 1: 94 mg
- tomato, 1 medium: 23 mg
- red bell pepper, 1/2 cup raw: 141 mg
- broccoli, steamed, 1/2 cup: 62 mg
- cauliflower, boiled, 1/2 cup: 27 mg
- potato, 1 medium, baked: 26 mg

### *Controversial health claims for vitamin C*

Controversy about vitamin C centers on its usefulness in preventing or treating disease when taken in very large quantities as a dietary supplement. Most of these claims have not been substantiated by well-designed, well-controlled studies. Many are still being investigated in government-sponsored clinical trials. Individuals interested in participating in a clinical trial at no charge can find a list of open trials at http://www.clinicaltrials.gov.

**COLDS.** Nobel prize-winning chemist Linus Pauling popularized the idea that large doses (1,000 mg or more) of vitamin C daily, will prevent, shorten the duration, or reduce the severity of symptoms of the common cold. More than 30 trials have compared colds in people taking up to 2,000 mg of vitamin C daily and those taking a placebo (pill with no nutritional value). These studies found no difference in the number or severity of colds in the two groups, with one exception. Skiers, marathon runners, and soldiers training in Arctic conditions who took vitamin C supplements had 50% fewer colds than people who took no extra vitamin C. All the people who benefited from taking vitamin C supplements were putting their bodies under extreme stress. It appears that for elite athletes and others under physical stress, **dietary supplements** of vitamin C may be of value in preventing colds.

**CANCER.** Cancer is thought to arise because of damage to cells caused by free radicals. Health claims that vitamin C prevents cancer are based on its antioxidant properties. Many studies have shown that people who eat a diet low in fats and high in fresh fruits and vegetables have a lower risk of developing cancer, especially cancer

of the mouth, esophagus, stomach, colon, and lung. It is not clear that the benefit of this diet is due to vitamin C. Study results using dietary supplements of vitamin C are mixed. The American Cancer Society recommends increasing healthy foods in the diet to reduce cancer risk rather than taking a dietary supplement.

**CARDIOVASCULAR HEALTH.** Because vitamin C is involved in the production of collagen in blood vessels, researchers have examined the relationship between vitamin C intake and cardiovascular health. Some studies found no benefit to vitamin C supplementation, while others reported that a relatively low dose of vitamin C reduced the risk of death from strokes. Vitamin C does not reduce blood levels of cholesterol. The American Heart Association recommends that to improve cardiovascular health individuals should increase their intake of vitamin C (and other vitamins and mineral) by increasing the amount of fresh vegetables in their diet. Research continues in this area.

**CATARACTS.** Cataracts are the leading cause of vision impairment worldwide. They develop, usually in older individuals, because of changes in the proteins in the lens of the eye. Initial studies suggested that vitamin C could prevent these changes because of its antioxidant properties. A recent a 7-year follow-up study found vitamin C supplements to be of no benefit in preventing cataracts.

**OTHER HEALTH CLAIMS.** Claims have been made that vitamin C can treat or prevent lead poisoning, high blood pressure (**hypertension**), asthma, Alzheimer's disease, attention deficit **hyperactivity** disorder (ADHD), infertility, macular degeneration, premature birth, stomach **ulcers**, autism, and many other diseases and disorders. None of these health claims have been proved to the satisfaction of practitioners of conventional medicine.

## Precautions

People who smoke cigarettes need more vitamin C than those who do not. People with cancer also seem to need more vitamin C.

Large doses of vitamin C as a dietary supplement may cause indigestion or diarrhea that stops when the dose is reduced.

## Interactions

Vitamin C has few interactions with drugs or other vitamins. Large doses of vitamin C increase the amount of **iron** absorbed from food in the small intestine. In healthy people, this does not cause any problems and may be beneficial.

Large daily doses of vitamin C may interfere with the absorption of **vitamin $B_{12}$**.

## Complications

Vitamin C can be taken in enormous doses without any serious side effects. At very high doses, it causes diarrhea. Some researchers who believe that large doses of vitamin C prevent disease think that the appropriate daily dose is an amount just slightly less than the amount that causes diarrhea. This amount varies considerably form person to person.

## Parental concerns

Generally, parents should have few concerns about children getting either too much or too little Vitamin C. Vitamin C is safe for women to take during pregnancy and while breastfeeding. It passes into breast milk. Children under age one should not be given a dietary supplement containing vitamin C; their needs should be met through the foods the eat.

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American Cancer Society. 1599 Clifton Road NE, Atlanta GA 30329-4251. Telephone: 800 ACS-2345. Website: <http://www.cancer.org>

American Heart Association. 7272 Greenville Avenue, Dallas, TX 75231. Telephone: (800) 242-8721. Website: <http://www.americanheart.org>

American Dietetic Association. 120 South Riverside Plaza, Suite 2000, Chicago, Illinois 60606-6995. Telephone: (800) 877-1600. Website: <http://www.eatright.org>

Linus Pauling Institute. Oregon State University, 571 Weniger Hall, Corvallis, OR 97331-6512. Telephone: (541) 717-5075. Fax: (541) 737-5077. Website: <http://lpi.oregonstate.edu>

Vitamin C Foundation. P. O. Box 73172, Houston, TX 77273. Telephone: (888) 443-3634 or (281) 443-3634. Website: <www.vitamincfoundation.org/found.htm>

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# Vitamin D

## Definition

Vitamin D is a fat-soluble steroid compound that the body needs to remain healthy. In some ways, vitamin D is not a true vitamin because the skin can make vitamin D when exposed to sunlight. However, if the body does not make enough vitamin D, additional amounts must be acquired through diet.

## Purpose

The main role of vitamin D is to regulate amount of **calcium** circulating in the blood. Calcium is a mineral acquired through diet that is involved in building bones, muscle contraction, and nerve impulse transmission. Vitamin D helps regulate the absorption of calcium from the small intestine. Too little vitamin D can cause weak, brittle, deformed bones. There is also evidence that vitamin D plays a role in controlling cell differentiation and may help to protect the body from developing some types of **cancer**.

**Vitamin D**

| Age | Adequate intake | | Tolerable Upper Intake Level | |
|---|---|---|---|---|
| Children 0–12 mos. | 200 IU | 5 mcg | 1,000 IU | 25 mcg |
| Children 1–18 yrs. | 200 IU | 5 mcg | 2,000 IU | 50 mcg |
| Adults 19–50 yrs. | 200 IU | 5 mcg | 2,000 IU | 50 mcg |
| Adults 51–70 yrs. | 400 IU | 10 mcg | 2,000 IU | 50 mcg |
| Adults 71≥ yrs. | 600 IU | 15 mcg | 2,000 IU | 50 mcg |
| Pregnant women | 200 IU | 5 mcg | 2,000 IU | 50 mcg |
| Breastfeeding women | 200 IU | 5 mcg | 2,000 IU | 50 mcg |

| Food | Vitamin D (IU) |
|---|---|
| Cod liver oil, 1 tbsp. | 1,360 |
| Salmon, cooked, 3.5 oz. | 360 |
| Mackerel, cooked, 3.5 oz. | 345 |
| Tuna, canned in oil, 3 oz. | 200 |
| Milk, fortified, 1 cup | 100 |
| Orange juice, fortified, 1 cup | 100 |
| Cereal, fortified, 1 serving | 40 |
| Egg, 1 whole | 20 |

IU = International Unit
mcg = microgram

*(Illustration by GGS Information Services/Thomson Gale.)*

## Description

Vitamin D exists in several forms, two of which are important to humans. Vitamin D2, called ergocalciferol, is made by plants. Vitamin D2 can be manufactured synthetically by irradiating yeast. This type of vitamin D is most often found in **dietary supplements** and foods fortified with vitamin D. Vitamin D3, called cholecalciferol, is made naturally by the skin when it is exposed to ultraviolet rays in sunlight. Neither vitamin D2 nor D3 is active in the body. Both must be converted, first in the liver and then in the kidney, into an active form of vitamin D (1alpha, 25-dihydroxyvitamin D). Vitamin D in this topic means the active form of vitamin D.

### *Vitamin D's role in health*

Although Vitamin D has been known to play a role in bone health for many years, only recently have researchers begun to explore its effects on cell differentiation and the immune system.

**BONE HEALTH.** The role of vitamin D and calcium are closely connected. The body needs calcium to build bones and teeth, contract muscles, transmit nerve

## KEY TERMS

**Cell differentiation**—The process by which stem cells develop into different types of specialized cells such as skin, heart, muscle, and blood cells.

**Fat-soluble vitamin**—A vitamin that dissolves in and can be stored in body fat or the liver.

**Hormone**—A chemical messenger that is produced by one type of cell and travels through the bloodstream to change the metabolism of a different type of cell.

**Mineral**—An inorganic substance found in the earth that is necessary in small quantities for the body to maintain a health. Examples: zinc, copper, iron.

**Osteoporosis**—A condition found in older individuals in which bones decrease in density and become fragile and more likely to break. It can be caused by lack of vitamin D and/or calcium in the diet.

**Placebo**—A pill or liquid given during the study of a drug or dietary supplement that contains no medication or active ingredient. Usually study participants do not know if they are receiving a pill containing the drug or an identical-appearing placebo.

**Steroid**—A family of compounds that share a similar chemical structure. This family includes the estrogen and testosterone, vitamin D, cholesterol, and the drugs cortisone and prendisone.

**Vitamin**—A nutrient that the body needs in small amounts to remain healthy but that the body cannot manufacture for itself and must acquire through diet.

impulses, and help blood to clot. Vitamin D helps the body get the calcium it needs by increasing the amount of calcium absorbed in the small intestine. Vitamin D is an active part of the feedback loop that maintains a normal level of calcium in the blood.

To maintain health, the amount of calcium in the blood must stay within a very narrow range. When the amount of calcium in the blood falls below normal, the drop is sensed by the parathyroid glands. The parathyroid glands are four separate clusters of specialized cells in the neck. Low blood calcium levels stimulate the parathyroid glands to secrete parathyroid hormone (PTH). PTH travels through the bloodstream and stimulates the kidney to increase the conversion of vitamin D2 and D3 into its active form. Active vitamin D is released into blood and stimulates the cells lining the small intestine to increase the amount of calcium that they absorbed from digesting food. Vitamin D also causes the kidney to conserve calcium so that less is lost in urine. If these actions do not return the level of calcium in the blood to normal, vitamin D activates cells called osteoclasts that break down bone and return calcium from the bone to the bloodstream. People who do not have enough vitamin D absorb less calcium from the food they eat. To make up for this, calcium is taken from their bones and the bones weaken and break more easily.

**CANCER PREVENTION AND TREATMENT.** Vitamin D also helps regulate cell differentiation. During development, cells divide over and over again. At some point, they are triggered to specialize (differentiate) into different types of cells, for example, skin, muscle, blood, or nerve cells. Vitamin D joins with other compounds to turn on and off more than 50 different genes that stop cell growth and start cell differentiation.

One characteristic of cancer cells is that they grow wildly, dividing many times more than normal cells without differentiating. Since vitamin D can stimulate cells to stop dividing and begin differentiating, researchers are investigating whether vitamin D can protect people from getting certain cancers, especially colon, **prostate**, skin, and breast cancer. The research has produced mixed results. Some studies found that vitamin D protected against colon cancer, while other found it offered no protection. The official position of the American Cancer Society described in their 2006 Nutrition and Physical Activity Guidelines states, "There is a growing body of evidence from population studies (not yet tested in clinical trials) that vitamin D may have helpful effects on some types of cancer, including cancers of the colon, prostate, and breast." However, the American Cancer Society makes no recommendations on the amount of vitamin D needed to have a beneficial effect. Clinical trials are underway to determine safety and effectiveness of vitamin D in a variety of situations. Individuals interested in participating in a clinical trial at no charge can find a list of open trials at <http://www.clinicaltrials.gov>.

**OTHER DISORDERS.** Vitamin D has been proved to successfully to treat a few other disorders. Psoriasis, a skin disorder, often responds to ointments that contain synthetic vitamin D3 when other treatment options have failed. When the parathyroid glands fail to function or are removed during surgery, vitamin D supplements help make up for the lack of PTH. Supplements are also used to treat rare inherited familial hypophosphatemia and Fanconi syndrome-related

hypophosphatemia. Both of these are characterized by abnormally low levels of phosphate in the blood.

### *Normal vitamin D requirements*

The United States Institute of Medicine (IOM) of the National Academy of Sciences has developed values called **Dietary Reference Intakes** (DRIs) for **vitamins** and **minerals**. The DRIs consist of three sets of numbers. The Recommended Dietary Allowance (RDA) defines the average daily amount of the nutrient needed to meet the health needs of 97–98% of the population. The Adequate Intake (AI) is an estimate set when there is not enough information to determine an RDA. The Tolerable Upper Intake Level (UL) is the average maximum amount that can be taken daily without risking negative side effects. The DRIs are calculated for children, adult men, adult women, pregnant women, and **breastfeeding** women.

The IOM has not set RDA values for vitamin D because of incomplete scientific information and variability in the amount of vitamin D the body makes when the skin is exposed to sunshine. Instead, it has set AI and UL levels. Recently the UL level has become somewhat controversial and has been challenged by some researchers as being set too low. AI and UL levels are measured in both weight (micrograms or mcg) and international units (IU). The IU measurement is the measurement used on dietary supplement labels. For vitamin D, 1.0 mcg equals 40 IU.

The following are the AIs and ULs for vitamin D for healthy individuals:

- infants 0–12 months: AI 200 IU or 5 mcg; UL 1,000 IU or 25 mcg
- children 1–18 years: AI 200 IU or 5 mcg; UL 2,000 IU or 50 mcg
- adults 19–50 years: AI 200 IU or 5 mcg; UL 2,000 IU or 50 mcg
- adults 51–70 years: AI 400 IU or 10 mcg; UL 2,000 IU or 50 mcg
- adults 71 years and older: AI 600 IU or 15 mcg; UL 2,000 IU or 50 mcg
- pregnant and breastfeeding women: AI 200 IU or 5 mcg; UL 2,000 IU or 50 mcg

Exposing the face, arms, and legs to sunshine for 15 minutes three or four times a week meets the dietary requirements for vitamin D for people with fair skin much of the time. However, people who live north of 40° latitude (approximately a line that extends from Philadelphia to San Francisco) may not get enough sun exposure to meet their dietary needs during winter months. Dark-skinned people may need to spend triple the amount of time in the sun as fair-skinned people to synthesize adequate amounts of vitamin D, since the increased amount melanin pigment in dark skin slows vitamin D production. Using sunscreen with an SPF of 8 or higher also slows the production of vitamin D in the skin.

Vitamin D is not found in large amounts in many foods. However, since the 1930s vitamin D has been added to about 99%: of all milk, and to some breakfast cereals, bread, orange juice, and infant formula. In addition, the Food and Drug Administration requires all foods containing olestra, a compound that reduces fat absorption, to be fortified with the fat-soluble vitamins A, D, E, and K.

The following list gives the approximate vitamin D content for some common foods:

- cod liver oil, 1 Tablespoon: 1,360 IU
- salmon, cooked, 3.5 ounces: 360 IU
- mackerel, cooked, 3.5 ounces: 345 IU
- tuna, canned in oil, 3 ounces: 200 IU
- milk, any type fortified, 1 cup: 100 IU
- orange juice, fortified, 1 cup: 100 IU
- cereal, fortified, 1 serving: 40 IU (average, serving sizes vary)
- egg, 1 whole: 20 IU

## Precautions

### *Vitamin D deficiency*

Vitamin D deficiency results in rickets in children and osteomalacia in adults. Rickets is a condition in which the bones do not harder because of a lack of calcium deposited in them. Instead they remain soft and become deformed. Osteomalacia is a weakening of bones in adults that occurs when they are broken down (demineralized) and calcium in the bones is returned to the blood. Vitamin D deficiency also can cause joint and muscle pain, and muscle spasm. Less severe cases can result in **osteoporosis** in older adults.

The vitamin D fortification program, along with the popularity of daily multivitamins, has greatly reduced the number of people in the United States who are vitamin D deficient. However some groups remain at risk of vitamin D deficiency. These include:

- infants who are exclusively breastfed. Breast milk provides only about 25 UL of vitamin D per quart (liter). The American Academy of Pediatrics recommends vitamin D supplements beginning no later than 2 months of age for babies who are only fed breast milk.
- institutionalized or homebound people who rarely go outside. One study found that 60% of nursing home patients were vitamin D deficient.

- people living in northern latitudes who cover almost all their body for much of the year due to climate or religious requirements
- people with gastrointestinal diseases such as Crohn's disease, celiac disease, or inflammatory bowel disease that interfere with the absorption of nutrients from the intestine
- people with disorders of the pancreas that interfere with the absorption of nutrients
- people with anorexia nervosa (self-starvation)
- people who have had part of their stomach or intestine surgically removed for weight loss or other reasons

### *Vitamin D excess*

Vitamin D excess in healthy individuals occurs only when large quantities of vitamin D are taken as a dietary supplement over several months. This can result in high calcium levels in the blood (hypercalcemia). Symptoms of vitamin D excess include nausea, vomiting, excessive thirst, weakness, and high blood pressure. Calcium deposits may develop in the kidneys, blood vessels, heart, and lungs. The kidneys may be permanently damaged and eventually fail completely.

## Interactions

Research suggests that the following types of medications may increase the available amount of vitamin D in the body. People taking these drugs should not take a vitamin D supplement without consulting their healthcare provider.

- birth control pills
- hormone replacement therapy/estrogen replacement therapy
- isoniazid (INH) used to treat tuberculosis
- thiazide diuretics

Research suggests that the following types of medications may decrease the available amount of vitamin D in the body. People taking these drugs should discuss with their healthcare provider whether a vitamin D supplement is right for them.

- antacids taken daily for long periods
- calcium-channel blockers used to treat heart conditions and high blood pressure
- certain cholesterol-lowering medications that block fat absorption
- phenobarbitol and similar anticonvulsants
- mineral oil taken on a daily basis
- orlistat, a weight loss drug marketed as Xenical or Alli

## Complications

No complications are expected when vitamin D is used in the recommended amounts. The complications resulting from insufficient or excess use are discussed above.

## Parental concerns

Parents should be aware that the RDA and UL for vitamins and minerals are much lower for children than for adults. Accidental overdose may occur if children are give adult vitamins or dietary supplements.

### Resources

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#### ORGANIZATIONS

American Dietetic Association. 120 South Riverside Plaza, Suite 2000, Chicago, Illinois 60606-6995. Telephone: (800) 877-1600. Website: <http://www.eatright.org>

Linus Pauling Institute. Oregon State University, 571 Weniger Hall, Corvallis, OR 97331-6512. Telephone: (541) 717-5075. Fax: (541) 737-5077. Website: <http://lpi.oregonstate.edu>

Office of Dietary Supplements, National Institutes of Health. 6100 Executive Blvd., Room 3B01, MSC 7517, Bethesda, MD 20892-7517 Telephone: (301)435-2920. Fax: (301)480-1845. Website: <http://dietary-supplements.info.nih.gov>

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**Vitamin E**

| Age | Recommended Dietary Allowance | | Tolerable Upper Intake Level | |
|---|---|---|---|---|
| Children 0–6 mos. | 6.0 IU (AI) | 4 mg (AI) | Not established | |
| Children 7–12 mos. | 7.5 IU (AI) | 5 mg (AI) | Not established | |
| Children 1–3 yrs. | 9.0 IU | 6 mg | 300 IU | 200 mg |
| Children 4–8 yrs. | 10.5 IU | 7 mg | 450 IU | 300 mg |
| Children 9–13 yrs. | 16.5 IU | 11 mg | 900 IU | 600 mg |
| Children 14–18 yrs. | 22.5 IU | 15 mg | 1,200 IU | 800 mg |
| Adult 19≥ yrs. | 22.5 IU | 15 mg | 1,500 IU | 1,000 mg |
| Pregnant women | 22.5 IU | 15 mg | 1,500 IU | 1,000 mg |
| Breastfeeding women | 28.5 IU | 19 mg | 1,500 IU | 1,000 mg |

| Food | Vitamin E (IU) | Vitamin E (mg) |
|---|---|---|
| Wheat germ oil, 1 tbsp. | 30.5 | 20.3 |
| Almonds, roasted, 1 oz. | 11 | 7.4 |
| Sunflower oil, 1 tbsp. | 8.5 | 5.6 |
| Hazelnuts, roasted, 1 oz. | 6.5 | 4.3 |
| Peanut butter, fortified, 1 oz. | 6 | 4.2 |
| Safflower oil, 1 tbsp. | 6 | 4.6 |
| Avocado, 1 med. | 5 | 3.4 |
| Olive oil, 1 tbsp. | 3 | 1.9 |
| Peanuts, roasted, 1 oz. | 3 | 2.2 |
| Spinach, raw, ½ cup | 3 | 1.8 |
| Spinach, cooked, ½ cup | 2.5 | 1.6 |
| Kiwi, 1 med. | 1.5 | 1.1 |
| Mango, sliced, ½ cup | 1.5 | 0.9 |

AI = Adequate Intake
IU = International Unit
mg = milligram

*(Illustration by GGS Information Services/Thomson Gale.)*

# Vitamin E

## Definition

Vitamin E is a fat-soluble organic compound that the body needs to remain healthy. Humans cannot make vitamin E, so they must get it from foods in their diet. Vitamin E comes in eight forms. The most biologically active form in humans is alpha-tocopherol. Most vitamin E in **dietary supplements** is synthetically manufactured alpha-tocopherol.

## Purpose

Vitamin E is one of the more poorly understood and controversial **vitamins**. Its exact functions are not completely clear. Vitamin E is an antioxidant. **Antioxidants** help protect the body against damage caused by free radicals. Free radicals are formed during normal metabolic processes. The quantity of free radicals in the body may also be increased by exposure to environmental toxins, ultraviolet light, and radiation. Free radicals have a strong tendency to react with and damage other compounds, especially those in DNA (genetic material) and certain **fats** (lipids) in cell membranes. Antioxidants prevent this damage by reacting with free radicals to neutralize them. The damage that free radicals cause to cells is believed to play a role in the development of certain diseases, especially **cancer**. Many of the health claims for vitamin E are based on its antioxidant properties.

## Description

Vitamin E is a collection of eight different, but closely related, compounds. These are alpha-, beta-, gamma-, and delta-tocopherol and alpha-, beta-, gamma-, and delta-tocotrienol. Each of these compounds has a different degree of activity in humans. Alpha-tocopherol is the most active form. Vitamin E in dietary supplements is usually a synthetic compound called alpha-tocopherol acetate. Synthetic alpha-tocopherol is sometimes labeled dl-alpha-tocopherol.

### *Normal vitamin E requirements*

The United States Institute of Medicine (IOM) of the National Academy of Sciences has developed values called **Dietary Reference Intakes** (DRIs) for vitamins and **minerals**. The DRIs consist of three sets of numbers. The Recommended Dietary Allowance (RDA) defines the average daily amount of the

nutrient needed to meet the health needs of 97–98% of the population. The Adequate Intake (AI) is an estimate set when there is not enough information to determine an RDA. The Tolerable Upper Intake Level (UL) is the average maximum amount that can be taken daily without risking negative side effects. The DRIs are calculated for children, adult men, adult women, pregnant women, and **breastfeeding** women.

The IOM has not set RDA or UL values for vitamin E in children under one year old because of incomplete scientific information. Instead, it has set AI levels for this age group. Recently the UL level has become somewhat controversial and has been challenged by some researchers as being set too high. AI and UL levels are measured in both weight (milligrams or mg) and international units (IU). The IU measurement is the measurement used on dietary supplement labels. For the alpha-tocopherol form of vitamin E, 1 mg equals about 1.5 IU.

The following are the AIs, RDAs, and ULs for alpha-tocopherol for healthy individuals:

- infants birth–6 months: AI 6 IU or 4 mg
- infants 7–12 months: AI 7.5 IU or 5 mg
- children 1–3 years: RDA 9 IU of 6 mg; UL 300 IU or 200 mg
- children 4–8 years: RDA 10.5 IU or 7 mg; UL 450 IU or 300 mg
- children 9–13 years: RDA 16.5 IU or 11 mg; UL 900 IU or 600 mg
- children 14–18 years: RDA 22.5 IU or 15 mg; UL 1,200 IU or 800 mg
- adults age 19 and older: RDA 22.5 IU or 15 mg; UL 1,500 IU or 1,000 mg
- pregnant women: RDA 22.5 IU or 15 mg; UL 1,500 IU or 1,000 mg
- breastfeeding women: RDA 28.5 IU or 19 mg; UL 1,500 IU or 1,000 mg

### *Sources of vitamin E*

Vitamin E is found in limited amounts in a small number of foods. These include some oils, nuts, and green leafy vegetables. Vitamin E is also added to some breakfast cereals, which say "fortified with vitamin E" on the label. In addition, the Food and Drug Administration requires all foods containing olestra, a compound that reduces fat absorption, to be fortified with the fat-soluble vitamins A, D, E, and K.

The following list gives the approximate vitamin E (alpha-tocopherol) content for some common foods:

## KEY TERMS

**Antioxidant**—A molecule that prevents oxidation. In the body antioxidants attach to other molecules called free radicals and prevent the free radicals from causing damage to cell walls, DNA, and other parts of the cell.

**Dietary supplement**—A product, such as a vitamin, mineral, herb, amino acid, or enzyme, that is intended to be consumed in addition to an individual's diet with the expectation that it will improve health.

**Fat-soluble vitamin**—A vitamin that dissolves in and can be stored in body fat or the liver.

**Retina**—The layer of light-sensitive cells on the back of the eyeball that function in converting light into nerve impulses.

**Vitamin**—A nutrient that the body needs in small amounts to remain healthy but that the body cannot manufacture for itself and must acquire through diet.

- wheat germ oil, 1 Tablespoon: 30.5 UL or 20.3 mg
- olive oil, 1 Tablespoon: 3 UL or 1.9 mg
- sunflower oil, 1 Tablespoon: 8.5 UL or 5.6 mg
- safflower oil, 1 Tablespoon: 6 UL or 4.6 mg
- almonds, roasted, 1 ounce: 11 UL or 7.4 mg
- peanuts, roasted, 1 ounce: 3 UL or 2.2 mg
- peanut butter, fortified, 1 ounce: 6 UL or 4.2 mg
- hazelnuts, roasted, 1 ounce: 6.5 UL or 4.3 mg
- spinach, cooked 1/2 cup: 2.5 UL or 1.6 mg
- spinach, raw 1/2 cup: 3 UL or 1.8 mg
- mango, 1/2 cup sliced: 1.5 UL or 0.9 mg
- kiwi, 1 medium: 1.5 UL or 1.1 mg
- avocado, 1 medium: 5 UL or 3.4 mg
- multivitamin: 30–60 IU or 20–40 mg
- vitamin E dietary supplement: 400–800 IU or 270–530 mg

### *Vitamin E's role in health*

Vitamin E's role in health not completely clear, but experts do agree on what happens when vitamin E is absent from the diet. Vitamin E deficiency results in damage to the nerves, especially the nerves of the hands and feet, loss of coordination, a poor sense of balance, and muscle weakness. The retina of the eye can also be damaged, resulting in loss of vision. Signs

of vitamin E deficiency often take years to develop in adults; the results are seen much sooner in children.

Almost all healthy people living in the developed world get enough vitamin E through diet to prevent symptoms of vitamin E deficiency from developing. There is some debate, however, about the frequency with which deficiencies exist that do not produce obvious symptoms (subclinical deficiencies). Those at greatest risk for vitamin E deficiency include:

- severely premature infants who weigh less that 3 lb 4 oz (1,500 g) at birth
- people with gastrointestinal diseases such as Crohn's disease, cystic fibrosis, or inflammatory bowel disease that interfere with the absorption of fat from the intestine
- people who have had part of their stomach or intestine surgically removed for weight loss or other reasons
- people eating very low fat diets for an extended time
- people with anorexia nervosa (self-starvation)
- people with the rare inherited disorders abetalipoproteinemia and ataxia and vitamin E deficiency (AVED), both of which prevent normal use of vitamin E

Controversy about vitamin E centers on its use as a dietary supplement to help prevent or treat disease. Many health claims are based on the antioxidant properties of vitamin E. Initially, it appeared that large doses of vitamin E could help prevent heart disease and some cancers. Then in 2004, researchers at the Johns Hopkins University School of Medicine re-analyzed the data (a meta-analysis) from 19 major clinical trials that included more than 136,000 individuals. They found that taking 400 IU or more of vitamin E daily increased a person's risk of death by about 4%. However, some experts have questioned the validity of the Johns Hopkins analysis. The role of vitamin E is further complicated by the fact that it comes in many forms, and researchers are not completely clear on what, if any, roles the different forms play in maintaining human health. Clinical trials are currently underway to determine safety and effectiveness of vitamin E in a variety of situations. Individuals interested in participating in a clinical trial at no charge can find a list of open trials at http://www.clinicaltrials.gov.

**CARDIOVASCULAR DISEASE.** Since the 1940s, researchers have suggested that vitamin E might protect against heart disease. This theory is based on its activity as an antioxidant. Because vitamin E oxidizes (neutralizes) LDL or "bad" cholesterol, researchers have suggested that large doses of vitamin E may slow or prevent the build-up of material on the walls of arteries and thus help prevent cardiovascular disease.

Results of studies testing this idea are mixed. Several large studies followed healthy people who took vitamin E and looked for a correlation between the amount of vitamin E in their diet and whether they were diagnosed with heart disease or died of a heart attack. Two studies found that people who got least 7 mg of alpha-tocopherol daily from food were about one-third less likely to die from heart disease than those people who consumed 5 mg of less of alpha-tocopherol. On the other hand, another large, well-designed study (the Heart Outcomes Prevention Evaluation) found no cardiovascular benefit to large doses of vitamin E. A well-controlled study (the CHAOS study) done in Great Britain found that when people who already had heart disease were given large doses (400 IU or 800 IU) of Vitamin E, the rate of non-fatal heart attacks dropped dramatically, but that the overall death rate from heart disease did not change.

The official position of the American Heart Association published in its "Diet and Lifestyle Recommendations Revision 2006" is that "Antioxidant supplements have not been shown to be helpful in preventing heart disease and are not recommended in these guidelines." The recommendations specifically mention the possibility of "an increased risk of heart failure and the possibility of increased total mortality (death) from high dose vitamin E supplements." More research needs to be done in this area.

**CANCER.** The antioxidant activities of vitamin E are also thought to help protect against the development of cancer by removing free radicals that damage cell membranes and DNA. Vitamin E is also believed to neutralize nitrosamines. Nitrosamines are known carcinogens found in tobacco and smoked meats. Much of the evidence for the action of vitamin E on cancer comes from animal studies. The results of human studies are inconclusive and often confusing. According to the American Cancer Society, there is some evidence that vitamin E may have a protective effect against coon, rectal, bladder, and **prostate** cancer, but not other cancers. There is no evidence that vitamin E slows the growth of cancer once it has already developed, and some conflicting evidence about whether it interferes with the effectiveness of chemotherapy and radiation therapy. Research on the relationship of vitamin E and cancer continues.

**CATARACTS.** Cataracts form on the lens of the eye, making it cloudy and reducing vision. They are thought to form because proteins in the lens are oxidized. Ten studies have been done to see if the

antioxidant properties of vitamin E are effective in preventing cataracts. Five studies found a protective effect, while five others found no effect.

## Precautions

There is a great deal of debate about how much vitamin E is too much. The UL for healthy adults in the United States is 1,500 IU daily. However, some experts feel this is too high, especially since it is based on research done in the 1950s. They argue that UL should be lower since the Johns Hopkins study found that daily amounts over 400 IU increased the death rate and protective effects of larger doses of vitamin E are still unproven. In the United Kingdom, the recommended daily limit of vitamin E is 800 UI.

Large doses of vitamin E increase the chance of bleeding. People who are taking blood-thinning medications such as warfarin (Coumadin), heparin, and clopidogrel (Plavix) should discuss the use of vitamin E with their healthcare providers. Other people who should be wary of taking vitamin E as a dietary supplement are those who are **vitamin K** deficient, who have liver damage, and those with a history of bleeding **ulcers**. Vitamin E supplementation should be stopped about one month before surgery because of the increased risk of bleeding. Other possible, but uncommon, side effects of vitamin E supplementation include nausea, vomiting, diarrhea, damage to the retina, breast soreness, fatigue, emotional disturbances, and thyroid hormone disturbances.

## Interactions

Vitamin E may interact with the following:

- When taken with blood-thinning drugs, vitamin E may increase the likelihood of bleeding.
- When taken with nonsteroidal anti-inflammatory (NSAIDs) drugs such as ibuprofen (Motrin, Advil) or naproxen (Aleve, Naprosyn), vitamin E may increase the likelihood of bleeding.
- Cholestyramine (Questran) and colestipol (Colestid) may decrease vitamin E absorption.
- Orlistat (Xenical, Alli) decreases Vitamin E absorption.
- Olestra, a fat substitute in foods, decreases the absorption of vitamin E.

## Complications

No complications are expected when vitamin E is used in the recommended amounts. The complications resulting from insufficient or excess use are discussed above.

## Resources

### BOOKS


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### ORGANIZATIONS


American Cancer Society. 1599 Clifton Road NE, Atlanta GA 30329-4251. Telephone: (800) ACS-2345. Website: http://www.cancer.org.

American Heart Association. 7272 Greenville Avenue, Dallas, TX 75231. Telephone: (800) 242-8721. Website: http://www.americanheart.org.

American Dietetic Association. 120 South Riverside Plaza, Suite 2000, Chicago, Illinois 60606-6995. Telephone: (800) 877-1600. Website: http://www.eatright.org/

Linus Pauling Institute. Oregon State University, 571 Weniger Hall, Corvallis, OR 97331-6512. Telephone: (541) 717-5075. Fax: (541) 737-5077. Website: http://lpi.oregonstate.edu/

Office of Dietary Supplements, National Institutes of Health. 6100 Executive Blvd., Room 3B01, MSC 7517, Bethesda, MD 20892-7517 Telephone: (301)435-2920. Fax: (301)480-1845. Website: http://dietary-supplements.info.nih.gov/


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# Vitamin K

## Definition

Vitamin K is a fat-soluble organic compound that the body needs to remain healthy. Although bacteria in the human intestine make some vitamin K, it is not nearly enough to meet the body's needs, so people must get most of their vitamin K from foods in their diet.

## Purpose

The liver needs vitamin K to make factors that regulate blood clotting. Vitamin K may also play a role in maintaining strong bones and preventing **osteoporosis**.

## Description

Vitamin K is not a single substance but a collection of chemically similar compounds called naphthoquinones. Vitamin $K_1$, called phylloquinone, is the natural form of vitamin K. It is found in plants and is the main source of vitamin K in the human diet. Vitamin $K_2$ compounds, called menaquinones, are made by bacteria that live in the human intestine. Researchers originally thought that bacteria in the gut provided a substantial percentage of human vitamin K needs, but more recent research suggests that these bacteria provide only a small amount and that people should get most of their vitamin K from diet. Vitamin $K_1$ is manufactured synthetically and sold many brand names as a dietary supplement. Vitamin K is also included in many multivitamins. In addition, a synthetic water-soluble form of vitamin K called $K_3$ or menadione is not allowed in **dietary supplements** in the United States because of its association with serious side effects.

**Vitamin K**

| Age | Adequate intake (mcg/day) |
|---|---|
| Children 0–6 mos. | 2 |
| Children 7–12 mos. | 2.5 |
| Children 1–3 yrs. | 30 |
| Children 4–8 yrs. | 55 |
| Children 9–13 yrs. | 60 |
| Children 14–18 yrs. | 75 |
| Men 19≥ yrs. | 120 |
| Women 19≥ yrs. | 90 |
| Pregnant women 18≤ yrs. | 75 |
| Breastfeeding women 18≤ yrs. | 75 |
| Pregnant women 19≥ yrs. | 90 |
| Breastfeeding women 19≥ yrs. | 90 |

| Food | Vitamin K (mcg) |
|---|---|
| Kale, cooked, ½ cup | 530 |
| Spinach, cooked, ½ cup | 445 |
| Swiss chard, cooked, ½ cup | 285 |
| Turnip greens, cooked, ½ cup | 265 |
| Parsley, fresh, 2 tbsp. | 120 |
| Brussels sprouts, cooked, ½ cup | 110 |
| Broccoli, cooked, ½ cup | 77 |
| Asparagus, cooked, ½ cup | 46 |
| Celery, raw, ½ cup | 18 |
| Carrots, raw, ½ cup | 8 |
| Milk, 2%, 1 cup | 5 |
| Miso, 1 oz. | 4 |

mcg = microgram

*(Illustration by GGS Information Services/Thomson Gale.)*

### *Normal vitamin K requirements*

The United States Institute of Medicine (IOM) of the National Academy of Sciences has developed values called **Dietary Reference Intakes** (DRIs) for **vitamins** and **minerals**. The DRIs consist of three sets of numbers. The Recommended Dietary Allowance (RDA) defines the average daily amount of the nutrient needed to meet the health needs of 97–98% of the population. The Adequate Intake (AI) is an estimate set when there is not enough information to determine an RDA. The Tolerable Upper Intake Level (UL) is the average maximum amount that can be taken daily without risking negative side effects. The DRIs are calculated for children, adult men, adult women, pregnant women, and **breastfeeding** women.

The IOM has not set RDA values for vitamin K because of incomplete scientific information. Instead, in 2000, it set AI levels for all age groups. AI and levels for vitamin K are measured in by weight (micrograms or

## KEY TERMS

**Coenzyme**—Also called a cofactor, a small non-protein molecule that binds to an enzyme and catalyzes (stimulates) enzyme-mediated reactions.

**Dietary supplement**—A product, such as a vitamin, mineral, herb, amino acid, or enzyme, that is intended to be consumed in addition to an individual's diet with the expectation that it will improve health.

**Enzyme**—A protein that change the rate of a chemical reaction within the body without themselves being used up in the reaction.

**Fat-soluble vitamin**—A vitamin that dissolves in and can be stored in body fat or the liver.

**Osteoporosis**—A condition found in older individuals in which bones decrease in density and become fragile and more likely to break. It can be caused by lack of vitamin D and/or calcium in the diet.

**Vitamin**—A nutrient that the body needs in small amounts to remain healthy but that the body cannot manufacture for itself and must acquire through diet.

mcg). No UL levels have been set for vitamin K. Large amounts of vitamin $K_1$ do not appear to cause blood clotting or other side effects. However, $K_3$ is associated with health risks especially to children. It is banned by the United States Food and Drug Administration.

The following are the AIs for vitamin K for healthy individuals:

- children birth–6 months: 2 mcg
- children 7–12 months: 2.5 mcg
- children 1–3 years: 30 mcg
- children 4–8 years: 55 mcg
- children 9–13 years: 60 mcg
- children 14–18 years: 75 mcg
- men age 19 and older: 120 mcg
- women age 19 and older: 90 mcg
- pregnant and breastfeeding women age 18 and younger: 75 mcg
- pregnant and breastfeeding women age 19 and older: 90 mcg

### *Sources of vitamin K*

Vitamin K is found in the largest quantities in green, leafy vegetables. The following list gives the approximate vitamin $K_1$ content or some common foods. Little vitamin K is lost during cooking, but more is lost when foods are frozen.

- parsley, fresh, 2 Tablespoons: 120 mcg
- spinach, cooked 1/2 cup: 445 mcg
- kale, cooked, 1/2 cup: 530 mcg
- turnip greens, cooked, 1/2 cup: 265 mcg
- Swiss chard, cooked, 1/2 cup: 285 mcg
- brussels sprouts, cooked 1/2 cup: 110 mcg
- broccoli, cooked, 1/2 cup: 77 mcg
- asparagus, cooked, 1/2 cup: 46 mcg
- celery, raw, 1/2 cup: 18 mcg
- carrots, raw, 1/2 cup: 8 mcg
- miso, 1 ounce: 4 mcg
- milk, 2% 1 cup: 5 mcg
- dietary supplements: 10–120 mcg

### *Vitamin K's role in health*

Vitamin K is necessary for normal blood clotting (coagulation). In the liver, it is converted into more than half a dozen coenzymes that are essential to the complex cascade of events that result in the formation of a blood clot.

Vitamin K is routinely given to newborns in order to prevent bleeding known as hemorrhagic disease of the newborn (HDN) or vitamin K deficiency bleeding (VKDB) that can occur during the early weeks of life. Although this type of bleeding occurs only in 0.25–1.7% of untreated newborns, it can be fatal. Since 1961, the American Academy of Pediatrics has recommended that all newborns receive a single 0.5–1.0 mg injection of vitamin K1 immediately after birth. As of 2007, there was no equivalent oral (by mouth) supplement available in the United States. A few researchers have questioned whether this early injection of vitamin K increases the risk of developing childhood **cancer**. In the view of the American Academy of Pediatrics, well-designed research does not support this link.

There is some growing evidence that vitamin K plays a role in maintaining strong bones. Certain proteins that regulate the cells (osteoblasts) that deposit **calcium** and other minerals in bone appear to be dependent on vitamin K. If this is true, vitamin K may play a role in preventing osteoporosis. Clinical trials are currently underway to determine safety and effectiveness of vitamin K in a variety of situations. Individuals interested in participating in a clinical trial at no charge can find a list of open trials at http://www.clinicaltrials.gov.

### *Vitamin K deficiency*

Vitamin K deficiency is extremely rare in healthy people. It can, however, occur in individuals who have disorders that interfere with the absorption of nutrients from the intestine. Signs of vitamin K deficiency include easy bruising, excessive bleeding, and slow clotting. People who are at higher risk for vitamin K deficiency include:

- people with gastrointestinal diseases such as Crohn's disease, cystic fibrosis, inflammatory bowel disease, or ulcerative colitis
- people who have had part of their stomach or intestine surgically removed for weight loss or other reasons
- people with liver damage
- people with alcoholism
- people who take high doses of antibiotics over a long period.

## Precautions

People who are taking blood-thinning drugs, especially warfarin (Coumadin), should discuss their vitamin K needs with their healthcare provider. They may need to restrict their intake of vitamin K. The purpose of blood-thinning drugs is to keep the blood from forming clots in the veins and arteries. Since vitamin K helps blood to clot, high levels of vitamin K in the diet may work against blood-thinning drugs and reduce their effect. Individuals taking these drugs are encouraged to keep their daily intake of vitamin K steady at or slightly below the IA level. In addition, they should have their international normalized ratio (INR) and prothrombin time (PT), both measures of blood clotting potential, checked regularly.

Injections of vitamin $K_3$ (menadione) are banned in the United States because they can cause liver damage and rupture of red blood cells in infants and children.

## Interactions

In addition to interfering with blood-thinning drugs mentioned above, vitamin K may interact with the following:

- Some broad-spectrum antibiotics (antibiotics that kill a wide variety of bacteria) may decrease the amount of vitamin $K_2$ produced in the intestines.
- Aspirin (salicylates) taken in high doses over a long time may increase the body's need for vitamin K.
- Cholestyramine (Questran) and mineral oil may decrease vitamin K absorption.
- Quinine may increase the body's need for vitamin K
- Orlistat (Xenical, Alli) is likely to decrease Vitamin K absorption.
- Vitamin K may decrease the effectiveness of blood thinning herbs such as American ginseng (*P. quinquefolius*), alfalfa (*Medicago sativa*), and angelica (*Angelica archangelica*).
- Olestra, a compound that reduces fat absorption, decreases the absorption of vitamin K. The FDA requires all foods containing olestra to be fortified with the fat-soluble vitamins A, D, E, and K.

## Aftercare

## Complications

No complications are expected from vitamin K, especially when most of the vitamin K comes from dietary sources. However, pregnant and breastfeeding women should avoid taking vitamin K supplements. In addition, people taking blood-thinning drugs should carefully monitor their intake of vitamin K so that they do not increase the chance of developing blood clots.

### Resources

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American Cancer Society. 1599 Clifton Road NE, Atlanta GA 30329-4251. Telephone: 800 ACS-2345. Website: http://www.cancer.org.

Linus Pauling Institute. Oregon State University, 571 Weniger hall, Corvallis, OR 97331-6512. Telephone: (541) 717-5075. Fax: (541) 737-5077. Website: http://lpi.oregonstate.edu/

Office of Dietary Supplements, National Institutes of Health. 6100 Executive Blvd., Room 3B01, MSC 7517, Bethesda, MD 20892-7517 Telephone: (301) 435-2920. Fax: (301)480-1845. Website: http://dietary-supplements.info.nih.gov/

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# Vitamins

## Definition

Vitamins are organic compounds found in plants and animals that are necessary in small quantities for life and health. Thirteen different vitamins have been identified as necessary for humans. The body can make small quantities of two of these vitamins, vitamins D and K. All other vitamins must be obtained either from food or from **dietary supplements**.

## Purpose

Each of the 13 vitamins has specific functions, and taken together vitamins play a role in almost every function in the body. They help convert food to energy, and are involved processes as diverse as blood clotting, vision, reproduction, and transmission of nerve impulses.

**Essential vitamins**

| Vitamin | What it does for the body |
|---|---|
| Vitamin A (Beta Carotene) | Promotes growth and repair of body tissues; reduces susceptibility to infections; aids in bone and teeth formation; maintains smooth skin |
| Vitamin B-1 (Thiamin) | Promotes growth and muscle tone; aids in the proper functioning of the muscles, heart, and nervous system; assists in digestion of carbohydrates |
| Vitamin B-2 (Riboflavin) | Maintains good vision and healthy skin, hair, and nails; assists in formation of antibodies and red blood cells; aids in carbohydrate, fat, and protein metabolism |
| Vitamin B-3 (Niacinamide) | Reduces cholesterol levels in the blood; maintains healthy skin, tongue, and digestive system; improves blood circulation; increases energy |
| Vitamin B-5 | Fortifies white blood cells; helps the body's resistance to stress; builds cells |
| Vitamin B-6 (Pyridoxine) | Aids in the synthesis and breadown of amino acids and the metabolism of fats and carbohydrates; supports the central nervous system; maintains healthy skin |
| Vitamin B-12 (Cobalamin) | Promotes growth in children; prevents anemia by regenerating red blood cells; aids in the metabolism of carbohydrates, fats, and proteins; maintains healthy nervous sytem |
| Biotin | Aids in the metabolism of proteins and fats; promotes healthy skin |
| Choline | Helps the liver eliminate toxins |
| Folic Acid (Folate, Folacin) | Promotes the growth and reproduction of body cells; aids in the formation of red blood cells and bone marrow |
| Vitamin C (Ascorbic Acid) | One of the major antioxidants; essential for healthy teeth, gums, and bones; helps to heal wounds, fractures, and scar tissue; builds resistance to infections; assists in the prevention and treatment of the common cold; prevents scurvy |
| Vitamin D | Improves the absorption of calcium and phosphorous (essential in the formation of healthy bones and teeth) maintains nervous system |
| Vitamin E | A major antioxidant; supplies oxygen to blood; provides nourishment to cells; prevents blood clots; slows cellular aging |
| Vitamin K (Menadione) | Prevents internal bleeding; reduces heavy menstrual flow |

## Description

For centuries before vitamins were formally discovered, people knew that eating certain foods prevented certain diseases. For example, the ancient Egyptians knew that eating liver (later shown to be high in **vitamin A**) prevented night blindness. Sailors on long voyages often developed a serious disease called scurvy. James Lind, a Scottish surgeon who sailed with the British navy conducted the first controlled experiment on vitamins in 1753. He supplemented the regular diet of four groups of sailors with four different foods. The group that received oranges and lemons as supplements did not develop scurvy, while the other three groups did. Although Lind did

not know why citrus fruit was essential to health (it is high in **vitamin C**, and scurvy is caused by vitamin C deficiency), he recognized that it contained some substance that the sailors needed.

## Water-soluble vitamins

Humans need nine water-soluble vitamins. These vitamins dissolve in **water** and are not stored in the body for long periods. Most excess water-soluble vitamins are removed by the kidneys and leave the body in urine. Below is a list of the water-soluble vitamins and a very brief description of their importance to health. For details on how these vitamins function, see the specific entries for each vitamin. In general, B vitamins tend to be involved in reactions that convert nutrients to energy and reactions that synthesize new molecules. There are gaps in the numbering of the B-complex vitamins, because compounds originally named as vitamins, such as B4 (adenine), were renamed after further research showed that they did not meet the definition of a vitamin.

- Vitamin $B_1$ (thiamin): needed to convert carbohydrates to energy
- Vitamin $B_2$ (riboflavin): helps breakdown proteins, fats, and carbohydrates and make other vitamins and minerals available to the body
- Vitamin $B_3$ (niacin): helps the body process fats and proteins
- Vitamin $B_5$ (pantothenic acid): helps regulate the chemical reactions that produce energy
- Vitamin $B_6$ (pyridoxine): involved in the transmission of nerve impulses, formation and functioning of red blood cells, and creation of new cells
- Vitamin $B_{12}$ (cobalamin): necessary for healthy red blood cells, creating new deoxyribose nucleic acid (DNA), and in maintaining nerve cells
- Vitamin C (ascorbic acid): helps form cartilage and connective tissue; as an antioxidant protects cells from free radical damage
- Vitamin H (biotin): joins with enzymes that regulate the breakdown of foods and their use in the body
- Folic acid (folate): helps make new cells; important in development of the fetal nervous system

## Fat-soluble vitamins

Humans need four fat-soluble vitamins. Unlike water-soluble vitamins, fat-soluble vitamins can be stored in the body. High levels of these vitamins can cause health problems. Below is a list of the water-soluble vitamins and a very brief description of their importance to health. In general the fat-soluble vitamins have antioxidant activity that helps protect cells from damage. For details on how these vitamins function, see the specific entries for each vitamin.

- Vitamin A (retinol): needed for vision, a healthy immune system, development of the fetus, tissue repair; as an antioxidant protects cells from free radical damage
- Vitamin D (calciferol): involved in building bones, muscle contraction, and nerve impulse transmission.
- Vitamin E: (tocopherol) acts as an antioxidant to protect the body against damage caused by free radicals
- Vitamin K: needed for blood clotting

### KEY TERMS

**B-complex vitamins**—A group of water-soluble vitamins that often work together in the body. These include thiamine ($B_1$), riboflavin ($B_2$), niacin ($B_3$), pantothenic acid ($B_5$), pyridoxine ($B_6$), biotin ($B_7$ or vitamin H), folate/folic acid ($B_9$), and cobalamin ($B_{12}$).

**Dietary supplement**—A product, such as a vitamin, mineral, herb, amino acid, or enzyme, that is intended to be consumed in addition to an individual's diet with the expectation that it will improve health.

**Free radical**—A molecule with an unpaired electron that has a strong tendency to react with other molecules in DNA (genetic material), proteins, and lipids (fats), resulting in damage to cells. Free radicals are neutralized by antioxidants.

**Functional Food**—Also called nutraceuticals, these products are marketed as having health benefits or disease-preventing qualities beyond their basic supply of energy and nutrients. Often these health benefits come in the form of added herbs, minerals, vitamins, etc.

**Mineral**—An inorganic substance found in the earth that is necessary in small quantities for the body to maintain a health. Examples include zinc, copper, iron.

### *vitamin supplements*

Before the twentieth century, all vitamins had to come from food. Often individuals on limited diets with little variety developed vitamin deficiency diseases. The period from the 1920s to the 1940s was a time of active research on vitamins. Out of this research came a food fortification program in the United States that continues today. Beginning in the late 1930s, the addition of vitamins to common foods such as flour, milk, and

breakfast cereal substantially reduced vitamin deficiency diseases. Commercially manufactured vitamin supplements also began to appear, and taking a daily multivitamin supplement became popular. By 2007, more than 100 million Americans regularly took some form of vitamin supplement.

Vitamin supplements come as tablets, capsules, and elixirs (liquids). Supplements can contain a single vitamin, a group of related vitamins that work together in the body (e.g. B-complex vitamins), or a mixture of vitamins and **minerals** (e.g. **vitamin D** and **calcium** that work together to build bones). Vitamins are also added to foods that can then be labeled "fortified" or "enriched." Many so-called functional foods, or nutraceuticals, have added vitamins, minerals, and herbs.

In the United States, the Food and Drug Administration (FDA) regulates dietary supplements under the 1994 Dietary Supplement Health and Education Act (DSHEA). Under DSHEA, supplements are subject to the same regulation as food, which is much less rigorous than the regulation of prescription or over-the-counter drugs. Vitamin manufacturers do not have to prove that their products are safe or effective before they can be sold to the public. By contrast, manufacturers of conventional prescription and over-the-counter drugs must prove both safety and effectiveness in extensive humans before their product can be marketed.

In 2007, ConsumerLab, an independent testing company in New York, evaluated 21 brands of multivitamins. They found that only 10 of these multivitamins contained all the vitamins and minerals in the quantities listed on the label. In addition, some brands contained contaminants, including lead. To get the most out of vitamin supplements, consumers should

- read the label carefully to understand exactly what is in the supplement
- avoid megadoses of vitamins. The daily value (DV) given on the label should be around 100% for each vitamin.
- Look for "USP' on the label. This means that the supplement meets the strength and purity standards of the U.S. Pharmacopeia, a testing organization.
- check the expiration date
- stick with well-known brands

### *Vitamin requirements*

The United States Institute of Medicine (IOM) of the National Academy of Sciences has developed values called **Dietary Reference Intakes** (DRIs) for most vitamins and minerals. The DRIs consist of three sets of values. The Recommended Dietary Allowance (RDA) defines the average daily amount of the nutrient needed to meet the health needs of 97–98% of the population. The Adequate Intake (AI) is an estimate set when there is not enough information to determine an RDA. The Tolerable Upper Intake Level (UL) is the average maximum amount that can be taken daily without risking negative side effects. The DRIs are calculated for children, adult men, adult women, pregnant women, and **breastfeeding** women.

Experts agree that vitamin supplements are not a substitute for nutrients from food. Most healthy people in developed countries who eat a varied diet high in fruits, vegetables, and whole grains get enough vitamins and do not need a vitamin supplement, although many take a daily multivitamin as "insurance." However, some groups do tend to need either general supplementation with a multivitamin or supplementation with specific vitamins to prevent vitamin deficiency diseases. People in these groups should discuss their vitamin requirements with their healthcare provider. They include:

- the elderly, especially those on restricted diets
- vegans, because they eat no animal products
- breastfed babies of vegan mothers
- people with lactose intolerance or those who do not eat dairy products
- people with alcoholism
- people who have had part of their stomachs or intestines surgically removed
- pregnant women or those who could become pregnant
- people with diseases that interfere with vitamin metabolism
- people taking drugs that interfere with vitamin metabolism

### *Vitamin excess*

Although vitamins play an undeniable role in maintaining health, large doses of vitamins in healthy individuals can cause adverse effects. Almost all vitamin excess (hypervitaminosis) occurs because of supplementation; it is almost impossible to get too many vitamins from food. Although great deal of advertising, especially on the Internet, suggests that megadoses of certain vitamins can improve athletic performance, prevent and treat chronic disease, delay aging, and increase longevity, there is little or no evidence from independent, well-controlled human clinical trials to support these claims. One exception is high dose **niacin**, which has been used to treat high blood cholesterol levels. Althugh niacin is very safe at normal doses, the the

levels needed to lower serum cholesterol, it has been associated with liver damage and, commonly, severe facial flushing. Otherwise, excess water-soluble vitamins are removed from the body in urine. Although large doses of water-soluble vitamins rarely cause health problems, they cannot be used by the body and are a waste of money. Fat-soluble vitamins that are stored in the body can build up to very high levels and cause serious health concerns. People interested in more information about the effects of large doses of vitamins should talk to a healthcare provider.

### Precautions

Both too little and too much of any of the 13 human vitamins may cause health consequences. See entries on specific vitamins for more detailed information about potential health concerns.

### Interactions

The interactions among various vitamins, enzymes, coenzymes, drugs, and herbal supplements are complex and incompletely understood. See entries on specific vitamins for more detailed information about their interactions.

### Complications

Vitamins acquired by eating fruits and vegetables promote health. No complications are expected from vitamins in food. Vitamin supplements may cause hypervitaminosis or interact with other supplements, prescription drugs, over-the-counter drugs, and herbal supplements in ways that cause undesirable side effects. See entries on specific vitamins for more detailed information about potential complications.

### Parental concerns

Parents should encourage their children to eat a healthy and varied diet high in fruits, vegetables, and whole grains to meet their vitamin needs.

Most vitamin poisonings and deaths occur in children under age 6 as the result of accidental intake of excessive vitamin supplements. Parents should treat vitamin supplements as they would any drug and store them out of the reach of children.

### Resources

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American Dietetic Association. 120 South Riverside Plaza, Suite 2000, Chicago, Illinois 60606-6995. Telephone: (800) 877-1600. Website: <http://www.eatright.org>

Linus Pauling Institute. Oregon State University, 571 Weniger hall, Corvallis, OR 97331-6512. Telephone: (541) 717-5075. Fax: (541) 737-5077. Website: http://lpi.oregonstate.edu/

Office of Dietary Supplements, National Institutes of Health. 6100 Executive Blvd., Room 3B01, MSC 7517, Bethesda, MD 20892-7517 Telephone: (301)435-2920. Fax: (301)480-1845. Website: <http://dietary-supplements.info.nih.gov>

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Tish Davidson, A.M.

# Volumetrics

## Definition

Volumetrics is a weight-management plan that encourages dieters to control calories while eating enough food to feel satisfied. People who eat according

to the Volumetrics plan focus on eating water- and fiber-rich foods to achieve satiety, the feeling of fullness after a meal.

## Origins

Volumetrics is based on more than two decades of research by nutritionist Barbara Rolls, Ph.D., the endowed Guthrie Chair in Nutrition at Pennsylvania State University. Rolls has been president of the Society for the Study of Ingestive Behavior and the North American Association for the Study of Obesity. She was also a member of the Advisory Council of the National Institute of Diabetes and Digestive and Kidney Diseases (NIH) and a member of the National Task Force on the Prevention and Treatment of Obesity. She has also been published in a variety of peer-reviewed journals, including the *Journal of the American Dietetic Association*,*New England Journal of Medicine*, and the *American Journal of Clinical Nutrition*.

In her laboratory at Penn State, Rolls has studied dietary patterns and eating behavior. Based on her research and that of others, she has determined that the volume of food that people eat affects both how satisfied they feel and how much they eat.

Scientists like Rolls who study eating behavior have observed that over the course of a day or two, a person eats about the same weight of food. To lose weight, then, a person can lower the calories in each portion of food while maintaining the same amount of food. If a dieter eats the Volumetrics way and increases the **water** and **fiber** content in their daily food intake, he or she will still feel full. However, because the person is taking in fewer calories than before, weight loss will occur.

## Description

According to Volumetrics, the ideal weight-loss program has several elements.

- It satisfies hunger.
- It reduces calories.
- It meets a person's nutritional needs.
- It includes physical activity.

In addition, a weight-loss plan should also be enjoyable so that users feel able to sustain the healthy eating principles long-term.

Volumetrics offers detailed guidance on nutrient and fluid intake, as well as physical activity. In the 326-page publication Volumetrics: Feel Full on Fewer Calories, published in 2000, the authors make the following weight management recommendations:

### KEY TERMS

**Constipation**—Inability or difficulty passing stool.

**Diverticula**—Small pouch in the colon.

**Diverticular disorders**—Disorders that involve the development of diverticula.

**Energy density**—The calories in a given portion of food.

**Hemorrhoids**—Swollen and inflamed veins around the anus or rectum.

**Insoluble fiber**—Fiber that cannot dissolve in water; found in whole grains, breads, and cereals as well as carrots, cucumbers, zucchini, and tomatoes.

**Irritable bowel syndrome**—A chronic colon disorder that involves constipation and diarrhea, abdominal pain, and mucus in the stool.

**Satiety**—The feeling of fullness after a meal.

**Soluble fiber**—Fiber that partially dissolves in water; found in oatmeal, nuts and seeds, beans, apples, pears, and berries.

- Calories (Energy): Reduce usual intake by 500 to 1,000 calories per day, depending on weight-loss goals. This practice should lead to a healthy weight loss of 1 to 2 pounds per week.
- Fat: Limit to 20 to 30% of total calories and look for foods reduced in fat and calories.
- Carbohydrates: Carbohydrates should comprise 55% or more of total calories; it's preferable to choose carbohydrates from whole grains, vegetables, and fruits because they are more satiating.
- Fiber: Eat at least 20 to 30 grams per day from whole grains, fiber-rich breakfast cereals, and whole fruits and vegetables, as opposed to fruit juices. Fiber is key for lowering energy (calorie) density as well as increasing overall satiety.
- Sugar: Choose a diet moderate in added sugars. Rolls suggests lowering intake of sodas and other sugary drinks because these foods add calories without satiety. Use small amounts of sugar to make low-energy, nutritious foods tastier.
- Protein: About 15% of daily calories, or 0.4 grams per pound of body weight, should come from protein foods. Beans, low-fat fish, poultry without skin, and lean meats are recommended as the most satiating choices. Adequate amounts of protein are needed to prevent muscle loss and maintain metabolism.

- Alcohol: Consume with meals and limit to one drink per day for women; men should consume no more than two drinks daily.
- Water: Water consumption is a key component of the Volumetrics eating plan. It recommends women drink at least 9 cups daily, whereas men should consume 12 cups daily. Water can come from foods or beverages and should replace sugary drinks in the diet.

To manage weight, dieters should also get at least 30 minutes of moderate-intensity exercise on most, if not all, days of the week. Resistance training should be included twice a week. Rolls recommends walking at 3 to 4 miles per hour as an ideal choice for most people, even those who have substantial amounts of weight to lose. Dieters should also focus on reducing the overall amount of time they spend in sedentary pursuits, such as television watching, and increase physical activity by gardening, house cleaning, or other non-sedentary activities.

Volumetrics offers specific tips on how dieters can lower the energy (calorie) density of their food intake while maintaining satiety. For example, when choosing a sweet snack, a dieter may opt for grapes over raisins. For 100 calories, a dieter can eat nearly 2 cups of grapes, compared to only 1/4 cup of dried raisins. Choosing the grapes would be a better Volumetrics choice because a person is more likely to feel full longer due to the grapes' increased water content.

Although dieters do not need to change everything about their diets, following the Volumetrics recommendations and eating more meals and snacks lower in energy density will help a person enjoy reasonable food portions while controlling calories, Rolls says.

No foods are forbidden on the Volumetrics plan, but fried foods, sweets, and fatty foods should be limited or avoided. Volumetrics also suggests that people limit "dry" foods, such as crackers, popcorn, and pretzels, since these foods are higher in calories and provide little satiety.

A sample menu on the Volumetrics plan might include:

- Breakfast: Oatmeal: 1-1/3 cup oatmeal made with water; 1/2 medium apple;1 teaspoon cinnamon; 2 teaspoons brown sugar; 1 cup nonfat milk; 1/2 grapefruit; Coffee or tea
- Lunch: Grilled Chicken Salad: 3 ounces grilled chicken breast; 3 cups chopped Romaine lettuce; 4 slices red bell pepper; 2 tablespoons crumbled blue cheese; 1 tablespoon chopped walnuts; 2 tablespoons light dressing; 1 whole wheat pita bread; 1 cup sliced strawberries
- Snack: 1 cup Cheerios; 1/2 cup nonfat milk; 2/3 cup fresh blueberries
- Dinner: Steak Fajita: 3 ounces grilled sirloin steak; 1/2 cup green pepper; 1/2 cup onion; 1 tablespoon reduced sodium soy sauce; 2 tablespoons salsa; 1/2 cup shredded Romaine lettuce; 1/2 cup diced fresh tomato; 2 tablespoons nonfat sour cream; 1-10 inch flour tortilla; 1/2 cup corn; 1 cup diced cantaloupe

In addition to nutritional recommendations, Volumetrics provides lists of very low-energy-dense foods, low-energy-dense foods, medium-energy-dense foods, and high-energy-dense foods to help dieters decide foods to incorporate or avoid in their eating plan. In *Volumetrics: Feel Full on Fewer Calories* and other publications, Rolls includes sample menu plans based on daily caloric intake, recipes, serving size recommendations, and cooking tips and techniques.

The Volumetrics publications also address the issues of emotional eating and encourage dieters to eat a variety of foods to enhance satiety and pleasure. The authors cite a study at Tufts University in Boston that found that overweight people eat a wide variety of energy-dense foods, but normal-weight people consume a variety of foods that are lower in energy density.

Volumetrics also addresses a variety of dieting myths and common questions, such as:

- Is skipping meals OK?
- Will frequent meals help me control hunger?
- Should I avoid eating after 8 p.m.?
- Should I eat more slowly?

Volumetrics avoids gimmicks and promises of how much weight readers can lose, maintaining that "We can't guarantee that you'll lose weight and keep it off." The authors also acknowledge that "changing your eating habits is very difficult" and that "if your overeating is rooted in deep emotional causes, you will need to address these issues, perhaps with a therapist, before you are ready to adopt the eating style."

## Function

People who wish to lose weight or maintain their current weight can use the nutritional principles of Volumetrics to achieve this goal.

## Benefits

In addition to helping people lose weight, Volumetrics may also be beneficial for people with conditions that may aided by eating higher-fiber diets, such

## QUESTIONS TO ASK YOUR DOCTOR

- What are the potential benefits for a person of my age, sex, and lifestyle in adopting the Volumetrics plan?
- What are the potential health risks, if any, for me as an individual?
- Are there any health concerns associated with Volumetrics?
- Do I need to worry about vitamin, mineral, or nutrient deficiencies if I eat according to the Volumetrics plan?
- Have you had any patients who have used Volumetrics? What were their results and did they maintain weight loss over the long term?

as **hemorrhoids**, **constipation**, **irritable bowel syndrome**, and diverticular disorders. In addition, high-fiber intake, especially soluble fiber, has been linked to lower blood cholesterol levels. A reduced risk of type 2 diabetes has also been tied to consumption of a **high-fiber diet**.

### Precautions

Volumetrics encourages dieters to eat foods rich in fiber. However, people who normally eat a low-fiber diet and add too much fiber too quickly can suffer some uncomfortable side effects, including intestinal gas, abdominal bloating, cramping, and constipation.

Increasing fiber gradually to the 20 to 30 grams daily recommended by Volumetrics can help a person's digestive system to adjust to the dietary change. Drinking plenty of water also helps to keep stools soft and bulky and prevent constipation.

### Risks

There are no risks associated with the dietary recommendations made in the Volumetrics Eating Plan.

### Research and general acceptance

The principles of Volumetrics are consistent with the recommendations made by the United States Department of Agriculture and outlined in its Food Guide Pyramid. It is generally accepted by registered dietitians and nutritionists as a sensible, effective, and nutritionally balanced eating plan that promotes healthy food choices based on research and science. *Volumetrics: Feel Full on Fewer Calories* and other Volumetrics publications include references to a variety of research studies published in peer-reviewed journals.

In 2004, the Tufts University Health and Nutrition Letter named *The Volumetrics Eating Plan* one of the three best diet books on the market. In addition, the American Dietetic Association includes *The Volumetrics Eating Plan* on its 2007 Good Nutrition Reading List.

### Resources

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#### ORGANIZATIONS

American Dietetic Association. 120 South Riverside Plaza, Suite 2000, Chicago, Illinois 60606-6995. (800) 877-1600. <http://www.eatright.org>

Laboratory for the Study of Human Ingestive Behavior. Pennsylvania State University, 226 Henderson Building, University Park, PA 16802. (814) 863-8482. <http://nutrition.hhdev.psu.edu/foodlab>

USDA Food and Nutrition Information Center. National Agricultural Library, 10301 Baltimore Avenue, Room 105, Beltsville, MD 20705. (301) 504-5414. <http://fnic.nal.usda.gov/

Volumetrics Eating Plan. <http://www.volumetricseatingplan.com>

Amy L. Sutton

# W

## Warrior diet

### Definition

The Warrior diet is perhaps better described as a total exercise, nutrition, and fitness program; a diet regimen is only one part of the program. The diet is controversial on account of its proposal of a daily undereating/overeating cycle. The author of the diet claims that this daily undereating/overeating pattern is a natural biological tendency that modern humans ignore to the detriment of their long-term health. The diet's slogan is "It's when you eat that makes what you eat matter."

### Origins

The Warrior diet was designed by Ori Hofmekler (b. 1952), a former member of the Israeli Defense Force (IDF), an artist, and a contributing editor of *Penthouse* magazine for 17 years. He was health editor of *Penthouse* from 1998 to 2000. Hofmekler created the Warrior diet on the basis of his own experiences in the Israeli army and his own theories about how such warriors in ancient history as the Roman legionaries ate and trained. He stated in an interview with a bodybuilder named Mike Mahler that "I did not really come up with the idea [for the diet]; the idea came to me. It really started when I was in the Israeli Special Forces. I found out that some of my friends and I were doing much better when we reduced the eating during the day, or active time, and ate during the time when we knew that we could rest. I realized that when I ate the traditional 6 to 7 army meals plus snacks, I got more exhausted than ever. I suffered from energy crashes and my brain was not as focused and alert as I wanted it to be.... I felt a tremendous difference when I reduced drastically the amount of food I consumed during the day. Later when I went on to university and started my career as an artist, I realized that when I minimize eating during the day and have one main meal, I feel much more creative; much more alert.... After doing some research, I found out that other warriors of the past used to live like this and that is where I really got intrigued."

As Hofmekler's biography indicates, he is an artist who specializes in political satire as well as the author of a diet book. According to his art website, he graduated from the Bezalel Academy of Art and Design in Jerusalem after his army service and has received study grants from the Israel Museum and the American Israel Foundation.

### Description

#### *Nutrition*

Hofmekler bases his concept of a daily cycle of undereating and overeating on what he calls instinct rather than control. He has criticized other diets for being "designed according to some kind of theme or a goal that's based on control.... Just about every diet you can think of is about control. This [Warrior] diet is based on the assumption that your body has the instinct, like any other instinct, to control itself and to manipulate it very well." The basic human instinct, according to Homekler, is survival. The Warrior diet website states at the top of the home page, "The Warrior Diet is based on one master biological principle: Human Survival."

This human survival instinct, according to Hofmekler, was well served by the eating and exercise patterns of Paleolithic (Stone Age) people. Hofmekler believes that "The current epidemic of **obesity**, diabetes and impotence bears testimony to the fact that humans today have betrayed their biological destiny." He maintains that there are four reasons why modern people "fail to maintain primal health": they eat too many meals during the day; they eat when they are not hungry; they make poor food choices; and they do not keep a proper balance between physical activity and relaxation.

## KEY TERMS

**Autonomic nervous system**—The part of the nervous system that innervates the smooth muscle of the viscera, the heart, and glandular tissue, and governs the body's involuntary functions and responses.

**Controlled fatigue training (CFT)**—The Warrior diet's term for a structured exercise program that trains the body to resist fatigue as well as improve strength, speed, and other performance capabilities.

**Estrogens**—A group of natural steroids, produced by the ovaries in women, testes in men, and fat tissue in both sexes, that stimulate the development of female secondary sex characteristics and promote the development of the female reproductive system.

**Flavonoids**—Oxygen-containing aromatic compounds that include many common plant pigments. Flavonoids are thought to strengthen the body's immune system, reduce inflammation, and lower the risk of cardiovascular disease.

**Nutriceutical (also spelled nutraceutical)**—Any substance that is a food or a part of a food and provides medical or health benefits, including the prevention and treatment of disease. Nutriceuticals include dietary supplements and meal substitutes like those recommended by the Warrior diet a well as fortified foods and functional foods.

**Paleolithic**—The scientific term for the Stone Age, the period of human evolution when people first began to use stone tools. The Warrior diet is based on the assumption that modern humans have the same biologically programmed instincts as people in the late Paleolithic period, roughly 40,000 to 10,000 years ago.

**Parasympathetic nervous system (PSNS)**—The part of the autonomic nervous system that stimulates the secretion of saliva, speeds up peristalsis, and increases the flow of blood to the stomach and intestines.

**Sympathetic nervous system**—The part of the autonomic nervous system that speeds up heart rate, increases lung capacity, increases the flow of blood to skeletal muscles, and diverts blood flow from the digestive tract.

**Thrifty gene hypothesis**—A hypothesis proposed in 1962 by James Neel, a geneticist, to explain the epidemic of obesity in the modern world. The thrifty gene hypothesis holds that certain genes in humans maximize metabolic efficiency and food searching behavior, and that humans carrying these "thrifty" genes were more likely to survive during past periods of famine. The abundance of food in the modern world means that people with these genes are predisposed to obesity and other disorders related to overeating. The thrifty gene hypothesis has, however, been largely discarded in recent years.

According to Hofmekler's theory, a daily cycle of undereating and overeating, during which the dieter consumes no more than light snacks of raw fruits or vegetables or a light **protein** food like yogurt for 10 to 18 hours a day, exercises during this undereating period, and eats one large meal at night, awakens the basic human survival instinct. Evolution supplies the reason why people should have their daily physical workout during the undereating period, which is supposed to begin about 4 hours after the nightly main meal has been consumed. Hofmekler says that both Stone Age people and ancient cultures performed most of their physical labor during the day, ate very little until the evening, and were mentally sharper as well as in better physical condition: "Hunger is part of life and they accepted it. Some ancient cultures such as the Greeks and Romans used to train their children to go through hunger. It was something that they felt it was important to be able to handle. Even when I was in the army, I was told that I need to learn how to handle hunger. It is critical for your body to feel hungry at least once a day from both a physical, emotional, and mental standpoint. Thus, people would go through long periods without eating and maybe have small meals of fruit and veggies during the day. Then they would have a big cooked meal in the evening, which was usually a social occasion. They ate as much as they wanted from all the food groups and stayed in great shape. That is what happened and that was the warrior way."

Hofmekler maintains that the undereating phase of the daily cycle "ignites the survival engine" because "Our bodies are preprogrammed [by evolution] to activate certain survival mechanisms that are necessary to keep us alive under tough and stressful environmental conditions." Undereating stimulates certain aspects of human **metabolism** that "rebuild and strengthen brain tissue, enhance immunity, and increase

life span." Exercising while undereating, in Hofmekler's opinion, "forces the body to detoxify, burn fat and inhibit fat gain." During the undereating phase of the daily cycle, the body's survival mode is dominated by part of the autonomic nervous system (the part of the nervous system that supplies the heart, glands, and digestive tract, and governs involuntary body functions) known as the sympathetic nervous system, or SNS. The sympathetic nervous system functions to increase heart rate, increase blood flow to the skeletal muscles, and divert blood flow away from the gastrointenstinal system. Eating as little food as possible keeps the body operating under the control of the SNS, "and that's when most energy comes from fat burning." Hofmekler maintains that undereating increases the body's utilization of protein by as much as 160 percent.

The overeating part of the cycle allows the parasympathetic nervous system (PSNS), the other major component of the autonomic nervous system, to take over and regulate digestion, elimination, and other metabolic activities that slow people down and prepare them to sleep. Hofmekler believes that people do not need to count calories for their nighttime meal; rather, their instincts will tell them how much to eat. In an article titled "Your Warrior Diet Questions Answered," he states, "The Warrior principles are very simple: one meal a day at night. The Warrior diet is based on instinctual principles in which one does not have to check exact times, or for that matter, count calories or restrict macronutrients." In an interview from 1999, he told the reporter, "Your body . . . will tell you exactly what it needs [in terms of protein]. . . . It's not a diet that's ketogenic or based on suffering and you count the hours. With the Warrior diet, every day has a happy ending."

Hofmekler does not, however, trust people's instincts completely. His diet has a fairly long list of dos and don'ts:

- Avoid processed foods.
- Eat only organic foods, because ordinary supermarket produce and dairy products contain estrogens.
- Drink only filtered water, and use only filtered water in cooking.
- Minimize the consumption of foods that are wrapped or bottled in plastic containers, particularly soft plastics. Do not store food in plastic containers at home. Plastic fibers contain "estrogenic chemicals that are dangerous to our health."
- Minimize alcohol consumption because alcohol compromises the liver's ability to rid the body of estrogens.
- Eat carbohydrates last during the evening meal in order to stabilize the level of insulin in the blood.
- Cycle between high fat and high carbohydrate days in order to maximize the body's fat burning during exercise.

### *Exercise*

Hofmekler considers exercise an important part of fat burning during the undereating part of the daily cycle. He recommends whole-body workouts (squats, chin-ups, high jumps, frog jumps, kicks, sprints, and presses) rather than exercises aimed at only one part of the body, such as the abdomen or upper arms. Based on his notion that Roman soldiers had to carry 40 to 60 pounds of arms and equipment on the back and shoulders while marching 30 to 40 miles a day, he maintains that exercise should focus on building strong joints and a strong back. He also thinks that workouts should be short and intense, no longer than 20 to 45 minutes.

A key part of the Warrior diet exercise regimen is what Hofmekler calls Controlled Fatigue Training or CFT. Basically, CFT means that the person continues to exercise when they already feel fatigued, using workout sets that mimic the fight-or-flight responses that prehistoric people needed when they had to hunt or fight while they were hungry. Hofmekler maintains that humans have inherited so-called thrifty genes from their Stone Age ancestors that make them better able to survive under conditions of biological stress, and that CFT activates those genes. The slogan for CFT is "If you are not actively surviving, you are passively dying."

### *Nutriceuticals and dietary supplements*

Hofmekler markets a number of protein powders, protein bars, and **dietary supplements** intended to help the body burn fat, detoxify, rid itself of estrogenic compounds from the environment, and maintain a normal hormonal balance. Warrior Milk is a protein powder intended to be mixed with **water** or milk to form a pudding-like "treat." These products, some of which are sold through a website called Defense Nutrition, are said to be free of chemical additives, alcohol, food coloring, preservatives, or fillers.

### *Estrogen inhibitors*

As the reader may have noticed from some of the foregoing material, Hofmekler maintains that excess "estrogen mimickers" from the food supply and the environment lie at the root of most chronic disorders of modern humans, with overwhelming and sometimes

devastating consequences. It is almost impossible to avoid these estrogen mimickers. They're in the air, car emissions, detergents, paints, nail polishes, lotions, soaps, plastics, food and water. Other sources include hormone replacement therapy in women and the steroids used by some athletes. These "estrogenic chemicals" cause what Hofmekler calls "stubborn fat" that resists being burned off by exercise; allergies and recurrent sinus infections; water retention; and fatigue and mood swings, not to mention the "thickening" of women's bodies and the "softening" of men's. The answer to the surplus of estrogenic chemicals in modern life is to up one's intake of flavonoids, plant pigment compounds contained in capsules available from Defense Nutrition.

### *Training programs and certification*

Since 2005 Hofmekler has begun to offer certification programs in the Warrior diet itself and in CFT training. One seminar offered is five days in length but the website gives no details of the course contents or qualifications needed for certification.

## Function

The function of the Warrior diet is not weight loss per se, but rather improving fitness through eating patterns supposed to reduce fat, boost the immune system, stimulate the synthesis of muscle tissue, and slow down the aging process, combined with an exercise regimen focused on power and endurance. In terms of bodybuilding, Hofmekler has stated repeatedly that the goal of his diet is to make the body leaner, not necessarily more muscular. In speaking to Mahler, he noted, " . . . the 'Warrior Diet' was never meant to be a **bodybuilding diet**. It is meant to get you in much better shape. If your goal is to gain muscle, it can be done on the 'Warrior Diet.' However, it will be much more gradual. . . . part of being a warrior is having functional strength. You do not want to have quads that get in the way of running or impede fighting ability. Running is the first line of defense and should not be impeded by your thighs chaffing. Also keep in mind that women are more attracted to the lean and athletic build rather than the behemoth bodybuilding physique."

## Benefits

The Warrior diet's emphasis on "going down to the bottom of the food chain," that is, eating raw vegetables, fresh fruits, and unprocessed foods, is in line with the advice of many nutritionists. It is also possible that the exercise regimen recommended by Hofmekler might help some dieters adapt more effectively to the high stress level of modern life by becoming more physically active. The diet's claims, however, to anti-aging and "brain powering" as well as fat-burning properties have not been proven. The Warrior diet might conceivably be useful to committed bodybuilders.

## Precautions

Although it is always a good idea for people to consult a physician and a nutritionist before starting a diet, particularly if they are pregnant or nursing, below the age of 18, or have more than 30 pounds of weight to lose, consultation with a health professional is particularly important before beginning a diet that has such an unusual pattern of food intake as the Warrior diet. In addition, anyone considering an exercise program as rigorous as Hofmekler's should make sure that they do not have any previously undiagnosed cardiovascular or musculoskeletal conditions that might make the specific exercises recommended in the Warrior diet inadvisable.

Another precaution to consider is the impact of the Warrior diet's daily undereating/overeating cycle on other members of the dieter's household. A common observation among people who have tried this diet is that the meal schedule works only for people who either live alone or share housing with other people using the Warrior diet.

## Risks

Vigorous exercise during a period of minimal food intake may not be sustainable for some people. In addition, the specific exercises recommended by Hofmekler would be too strenuous for people who are not already used to some form of athletic activity.

Another risk is that those who may need to lose weight will not see any weight reduction on this diet. Since the Warrior diet emphasizes freedom from calorie counting and portion size, some people might well continue to consume more calories during the one evening meal than they can burn off during the undereating part of the daily cycle. The diet's alternation between undereating and overeating also seems inappropriate for people struggling with bulimia, **binge eating**, and other **eating disorders**, and could possibly trigger relapses.

One risk mentioned by some people who have tried this diet is its potentially high cost. The protein powders, dietary supplements, Warrior bars, and other products sold online through the Warrior diet and Defense Nutrition websites are expensive. For

## QUESTIONS TO ASK YOUR DOCTOR

- What is your opinion of the unusual daily eating cycle recommended by the Warrior diet?
- Do you know anyone who has tried this diet who is not a bodybuilder?
- If so, did they stay on this diet?
- Do you think this diet could pose risks to health for some people? Would it be safe for anyone with an eating disorder?
- What do you think of Hofmekler's focus on estrogens as a major source of health problems in adults of either sex?

example, a 30-day supply of EstroX capsules, an anti-estrogen product, costs $40 as of 2007, while a 16-day supply of Warrior Milk is $24.

### Research and general acceptance

The Warrior diet is controversial even among the bodybuilding community. With regard to research, there are no clinical studies of this diet reported in mainstream medical journals as of 2007. Hofmekler's own attitude toward scientific research is a curious mixture of skepticism about standard views of nutrition, a skewed view of history, and selective citation. In an interview from 1999, he remarked that his diet "is more of an opinion or a concept rather than *completely* [emphasis in original] scientific research, but it's based on opinions and a lot of science, which I hope to verify in the future. The idea is very simple. It's based on my own experience and somehow, because I was so interested in the effect, I did my own historical, anthropological, and scientific research. It's largely based on the romantic notion of the warrior."

One factor that inhibits Hofmekler's acceptance by the general public as well as by healthcare professionals is the poor quality of his printed materials and the many spelling and grammatical errors to be found in them. Several people who purchased *The Warrior Diet* noted not only that the paper and binding are not the best, but also that some paragraphs are printed twice. Other examples of uncorrected typos and usage problems can be found on Hofmekler's websites; the Warrior Diet site, for example, refers to Hofmekler as a "reknowned nutrition expert," while the Defense Nutrition website claims that his diet and training methods have been endorsed by "marshal artists." While it may be argued that errors of this type do not automatically invalidate Homekler's theories, they certainly do not add to his credibility.

While estrogen levels in the body are known to stimulate the growth of about 80% of breast cancers and to increase the risk of some forms of uterine **cancer**, it is doubtful that these hormones are responsible for the range of problems Hofmekler attributes to them, or that such substances as plastics can significantly affect estrogen levels in adults. In addition, some of the word-of-mouth advertising for Hofmekler's books has a macho tone that makes the reader wonder whether his concern about estrogen is symbolic. A typical example reads as follows: "Are you sick of diets that are made for forty-year-old women? When is the last time that you read a diet book that was made for men and got you excited?" Although Hofmekler claims that the Warrior diet can help women as well as men improve their physical health, it is difficult to imagine very many women finding this diet useful.

Hofmekler's use of the thrifty gene hypothesis as an explanation for the presumed eating habits of Stone Age people and ancient warriors is a weakness rather than an advantage, in that scientists have increasingly questioned whether humans have ever had a thrifty gene. To begin with, no specific candidate genes have been proposed as of 2007; recent research suggests that numerous genes, each one having only a modest effect, combine to determine a person's susceptibility to obesity. Second, most people who die during a famine die of disease rather than starvation, thus there would be little difference in mortality between lean and obese persons. Third, famines are a relatively recent phenomenon and occur only once every 100–150 years; thus most human populations would have experienced at most only 100 famines during their evolutionary history. Last, the increase in mortality during a famine rarely exceeds 10 percent. In short, famines do not provide enough of a selective advantage for a single thrifty gene to be widespread among modern humans.

One aspect of Hofmekler's system that has received some support from mainstream research is the connection between restriction of food intake and longevity. It has been known for about 70 years that limiting the food intake of laboratory rats increases both their average and their maximum life span. The benefits of **calorie restriction** have also been shown in hamsters, dogs, and fish. It is not clear, however, whether the model applies to humans, and if so, why calorie restriction might slow down the aging process. One scientist has listed several different hypotheses that have been proposed, ranging from growth retardation and reduction of body fat to alteration of

the blood glucose/insulin system and reduction of damage caused by oxidation. As of 2007 none of these hypotheses are considered proven, although the notion that calorie reduction is a low-intensity stressor that may stimulate metabolic defenses against aging is accepted by some researchers.

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#### ORGANIZATIONS

Defense Nutrition, LLC. P. O. Box 5028, Woodland Hills, CA 91365-5028. Telephone: (866) 927-3438. Website: http://www.defensenutrition.com/.

Dragon Door Publications. P.O. Box 4381, St. Paul, MN 55104. Telephone: (651) 487-2180. Website: http://www.dragondoor.com/.

Hofmekler's art website: http://www.orihofmekler.com. [No mailing address] Telephone: (917) 767-7983 or (212) 909-2793.

Warrior Diet. P. O. Box 5028, Woodland Hills, CA 91365-5028. Telephone: (866) WAR-DIET (927-3438). Website: http://www.warriordiet.com.

Rebecca J. Frey, PhD

# Water

## Definition

Water is hydrogen oxide and it is composed of two molecules of hydrogen and one molecule of oxygen. It has a molecular weight of 18.016 and is the most universal solvent known.

## Purpose

Water is the most universal solvent known. In the human body, it is capable of dissolving simple elements, ions and large organic molecules. Because of water's ability to maintain these materials in solution, the various body chemicals are capable of undergoing reactions that would not be possible in other forms.

Because water is a liquid, it can be carried through the circulatory system, reaching to all cells in the body.

## Description

Water is the most common compound in the human body, although the percentage of body water will vary from individual to individual, depending on age, gender, and general body composition. Newborn infants are about 78% body water, but this drops to

**Daily adequate intake of water**

| Age | Approximate daily intake of water (cups)* |
|---|---|
| Children 0–6 mos. | 3 |
| Children 7–12 mos. | 3⅓ |
| Children 1–3 yrs. | 5½ |
| Children 4–8 yrs. | 7 |
| Boys 9–13 yrs. | 10 |
| Girls 9–13 yrs. | 8–9 |
| Boys 14–18 yrs. | 14 |
| Girls 14–18 yrs. | 9–10 |
| Men 19≥ yrs. | 15½ |
| Women 19≥ yrs. | 11½ |
| Pregnant women | 12–13 |
| Breastfeeding women | 16 |

*Includes water contained in food, beverages, and drinking water

SOURCE: Adapted from the Dietary Reference Intakes Table, Food and Nutrition Board, Institute of Medicine, National Academies

*(Illustration by GGS Information Services/Thomson Gale.)*

## KEY TERMS

**Dehydration**—A condition of water loss caused by either inadequate intake of water or excessive loss of water as through vomiting or diarrhea.

**Hyperhydration**—Excess water content of the body.

**Hyponatremia**—Inadequate sodium levels in the body, possibly caused by loss of sodium through perspiration, diarrhea, or vomiting, and replacement of fluids with water that does not contain adequate electrolytes.

**Molecular weight**—The total of the atomic weights of the atoms in a molecule.

**Pre-loading**—Administering in advance, such as drinking water prior to exercise that is likely to cause water loss.

**Water intoxication**—A condition caused by excessive water in the body, related to hyponatremia.

65% by one year of age. Although the adult percentages are often quoted as 60% for males and 55% for females, this is strongly influenced by the amount of body fat present in the body. Since fat cells contain very little water, higher levels of body fat will reduce the overall percentage of water.

Intracellular fluid, the liquid inside individual cells, represents about two-thirds of the body's water. or about 40% of total body weight. Intracellular fluid contains both water and salts, primarily potassium, as well as enzymes and other organic molecules. Flow of water into and out of the cell is largely controlled by *osmosis*. The outermost layer of an animal cell is the cell membrane, and water can flow through the membrane from areas of low salt concentration to areas of high salt concentration. The remaining water is in the form of extracellular fluid that includes blood and cerebrospinal fluid. The most common ion of the extracellular fluid is **sodium**. Body water may be lost through various mechanisms including respiration, perspiration, and urination, and must constantly be replaced. Under the best circumstances, water levels will be completely balanced, and the intake will match the amount of water lost.

Because water can be moved through the body rapidly, people have used **diuretics** to give the illusion of weight loss. Diuretcis, both drugs and diuretic herbs, promote loss of water through the kidneys. Water loss is at best transient, and has no real benefit in terms of either health or physical appearance.

Beyond its role in general health, water can make play a major role in maintaining body weight through a program of caloric restriction. Foods that contain large amounts of water, such as fruits and vegetables, have low energy density, and so may produce sensations of satiety with low caloric intake.

Several published studies showed interesting patterns of food intake based on the water composition of foods. In one, subjects were given either food containing a high concentration of water, such as a soup of a stew, or the same solids prepared as a casserole, with water to accompany the meal. Although in each case, the total amount of both solids and water were the same, subjects ingested fewer calories when the water was incorporated into the food source. In a related study, advising people to eat foods with low energy density, that is, foods containing higher concentrations of water, was a more successful weight-loss strategy than attempts to limit portion size.

The second study evaluated the effects of pre-loading water before a meal. Subjects were asked to drink water before eating. Although subjects claimed that the quantity of water ingested had filled them up, and they had no appetite, the amount of food actually consumed after the pre-load was no different from that eaten by members of the control group. Although these studies are not definitive, they do indiate that foods with a high concentration of water, such as soups, stews, or salads, may be useful in weight loss programs by providing satiety with low levels of energy intake.

## Precautions

Failure to maintain adequate water levels can lead to **dehydration**. While this may be the result of various diseases, the initial symptoms are thirst and dry mouth. followed by lightheadedness and dizziness

Although water intake is normally very safe, excessive water intake, also known as hyperhydration, can occur, and may be fatal. Excessive water intake can lead to dilution of the sodium levels in the body, causing hyponatremia. This condition is sometimes seen in infants who may ingest too much water, either because they are given only water to drink or because excessive water is used to dilute infant formulas. Water intoxication may also result from severe vomiting or diarrhea in which the fluid is replaced with water, without replacing the **electrolytes**. Rarely, athletes who have undergone very great extertion may perspire excessively, and, if the fluid loss is replaced with water without electrolytes, may experience water intoxication. Althoug this is very rare, it did occur at the 2007 London Marathon, when temperatures were unseasonably warm that over 5,000 runners needed to be treated on site. Over 70 runners were taken to the hospital for treatment and one first-time marathoner, 22 years of age, died from hyperhydration. Voluntary hyperhydration has been reported and has been known to be fatal. On occasion, hyperhydration has been reported as part of school hazings.

Symptoms of water intoxication are similar to those of dehydration: muscle cramps, confusion, nausea, slurred speech and disorientation. Because of this, althletes may mistake water intoxication for dehydration, and drink even more water after toxicity has appeared. The goal of rehydration is to drink just enough water to replace the amount lost to perspiration. Forcing fluids can be dangerous. While sports drinks replace electrolytes, they may also provide a high level of calories. For people exercising to lose weight, an appropriate amount of water has been advocated as the most appropriate method of rehydration.

## Complications

Weight loss programs should target body fat; however, some weight-loss remedies, in an attempt to show prompt results, have incorporated diuretic drugs. These may lead to loss of body water, with the risk of dehydration.

## Parental concerns

Adolescents and teen-agers should be aware of the hazards associated with hyperhydration. Children of this age may be at risk both of excessive water intake after athletics, and also as part of school hazing rituals.

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Baby Milk Action. 34 Trumpington Street, Cambridge, CB2 1QY UK. Phone: 01223 464420; +44 1223 464420 (outside UK). <http://www.babymilkaction.org>

Mothers Against School Hazing (MASH). PO Box 14121, Baton Rouge, Louisiana 70898. <http://www.mashinc.org>.

Urgent Care Association of America. 4320 Winfield Road, Suite 200 Warrenville, IL 60555. Phone: (877) 698-2262. <http://www.ucaoa.org>.

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# Weight cycling

## Definition

Weight cycling is losing weight by dieting, regaining that weight and possibly more within a few months to a year, dieting and losing weight again, then putting the weight back on. Weight cycling is also called yo-yo dieting. It is the opposite of weight maintenance.

## KEY TERMS

**Morbidly obese**—Defines person who is 100 lb (45 kg) or more than 50% overweight and has a body mass index above 40.

**Type 2 diabetes**—Sometime called adult-onset diabetes, this disease prevents the body from properly using glucose (sugar).

### Description

At any given time, about one-third of Americans are trying to lose weight. Many of them succeed in the short term, but the number of people who can keep the weight off for more than a year is small (around 25%), and the number that make the lifestyle changes necessary to keep weight off for five or more years even smaller (less than 10%). The constant cultural pressure to be thin, both for social and health reasons, leads to a cycle of dieting and weight loss followed by weight gain, and then more dieting. The changes in weight can be as small as 5 lb (2.3 kg) or as great as 50 lb (23 kg).

Researchers generally place weight cyclers into one of three categories.

- Severe weight cyclers have lost 20 lb (9 kg) or more three or more times.
- Moderate weight cyclers have lost 10–20 lb (4.5–9 kg)three or more times.
- Mild weight cyclers have lost 5–10 lb (2.3–9 kg) three or more times.

### Demographics

More women than men are weight cyclers, just as more women than men go on diets. Weight cyclers can be of any race, ethnicity, or age. Researcher are finding that weight cycling is beginning at an earlier and earlier age, probably because of the increase in **childhood obesity**.

Most weight cyclers are overweight, defined as a **body mass index** (BMI) of 25.0–29.9, obese, defined as a BMI of 30–39.9, or morbidly obese, with a BMI of 40 or above. The majority of studies are done on people who are overweight or obese.

Adolescent girls of normal weight may also become weight cyclers because of cultural pressures to be thin and/or because they have a distorted **body image**. Actors, who may need to bulk up or slim down for a role, and athletes, who often gain weight in the off season and lose it during pre-season training are other examples of normal-weight people who may be weight cyclers. Much less research is done on normal-weight people who weight cycle than on overweight and obese people who weight cycle. Most research on normal-weight yo-yo dieters is done on adolescent girls. Many studies have found that binge-eating, where an individual uncontrollably eats abnormally large amounts of food at one sitting, is fairly common among weight cyclers.

### Causes and symptoms

Weight cycling is not a disease, but is a sign of repeated attempts and failures to maintain weight. Its cause is simple—a period of during which the individual takes in fewer calories than she uses that results in weight loss followed by a period when the individual eats more calories than she uses that results in a weight gain. However, understanding why weight cycling occurs and determining if these changing periods of calorie intake affect both future weight loss and health is complex.

In the 1980s, **obesity** researchers began asking whether these failed attempts at permanent weight loss affect the indivual's health or ability to lose weight in the future. Weight and weight cycling are difficult topics to research in humans because so many different physical and emotional factors affect the process of weight gain and loss. These include:

- genetics. Twin and family studies have shown that there is an inherited component to weight, just as there is to height. As scientists have become more adept at isolating individual genes, they have found close to 300 genes that may play a role in determining weight. Although inheritance is not necessarily destiny—plenty of thin people have obese parents and siblings—genetic influences do help explain why some people gain weight more easily than others and have more difficulty keeping off the weight they lose.
- hormones. Ghrelin is a hormone produced in the stomach that stimulates appetite. It increases before meals and decreases after meals. Leptin is a hormone produced by fat cells (adipose tissue) that has the opposite effect. It tells the brain that enough food has been consumed and that the individual should stop eating. Differences in the levels of these hormones or in the body's responsiveness to them appears to play a role in losing and regaining weight.
- emotional factors. Some people feel sick and cannot eat when they are stressed or upset. Many others turn to food for comfort. Other people eat when they are angry rather than addressing the situation that is causing the anger. Often people are able to maintain

their weight until they hit a bump in the road of life, then they turn to food to reduce their stress, starting the yo-yo cycle. Boredom, loneliness, and frustration also cause people to eat when they are not truly hungry.

- psychological factors. Many people start a diet with unrealistic expectations about how much weight they will lose, how fast the weight will come off, how much effort it will take, and how many permanent lifestyle changes they will have to make to keep the weight off. These attitudes all influence whether the individual will weight cycle. In addition, people who weight cycle are more likely to have depression and to be binge eaters with impulse-control issues.
- social factors.Many social events revolve around eating. People who feel they need to eat to please others or who have impulse-control difficulties often eat more than they intend in social situations. The trend toward super sizing restaurant portions reinforces the tendency to eat too much in social settings.
- Activity level. Studies show that people who are dieting consistently underestimate how many calories they burn in exercise. In general, the more active a person is, the easier it is for her to maintain a weight loss.
- Lack of nutritional information. Studies show that people consistently underestimate how many calories they eat and overestimate the amount of food that makes up a healthy portion. Although people who are successful in keeping weight off for many years tend not to strictly count calories, they are very aware of what and how much they eat.

### *Research on weight cycling*

Starting in the 1980s researchers began testing a theory called the "set point" theory of weight cycling. This theory suggested that each individual has a natural set point for weight to which the body always tries to return. To explain this, researchers have suggested that the body has feedback mechanisms that adjust the metabolic rate so that fat stores are maintained at a relatively constant level.

The set point theory of weight cycling was first tested on weight-cycling mice that were made obese and then put on a diet more than once. Researchers found that when mice were fed a normal diet after losing weight on a calorie-restricted diet, they gained back the weight they had lost and more, and that during a second round of dieting, it took them longer to lose the weight that they had gained. This seemed to support the set point theory. However, research needed to be done on humans to prove the theory.

Doing a well-controlled weight cycling study on humans is difficult. It is unethical to manipulate the weight of volunteers the way the weight of laboratory animals is manipulated because there are clear and undisputed health risks to being overweight. Instead, researchers must depend on volunteers who self-report weight-cycling in the past. In addition, studies must compensate for differences in age, gender, health history, activity, and other lifestyle factors that are not an issue with laboratory animals. Some of the most tightly controlled human studies were done as inpatient studies where obese individuals were put very low calorie diets (less than 450 calories per day) under medical supervision to stimulate rapid weight loss. This type of extreme dieting does not necessarily reflect the way the majority of people diet in the real world. Given the variety of factors that affect human studies of weight cycling, it is not surprising that results concerning the effect of weight cycling on health are conflicting.

Several small studies done in the mid 1990s found that metabolic rate, or the rate at which a person burns calories, decreased after weight loss, supporting the set point theory. Later, more rigorously controlled studies found that after a temporary initial decrease, metabolic rate returned to pre-weight loss values. Based on these more recent findings, the National Institutes of Health takes the position that it should not be harder to lose weight when dieting after weight cycling. However, as people age they burn calories more slowly. This natural slowing of **metabolism** may make it appear that it becomes harder and harder to lose weight after several cycles of yo-yo dieting.

Other studies have looked at whether people who gain back the same amount of weight as they have lost have a higher percentage of body fat than they did before they weight cycled. In other words, did they lose muscle, but gain back fat? Researchers have found that people gain back muscle and fat in the same proportion that they had before they dieted, but that in some people the fat is distributed differently in their body. In these people weight cycling tends to put more fat back on the stomach and less on the thighs and buttocks. This may have health implications, as people who have more fat in the stomach area are more likely to develop type 2 (adult-onset) diabetes.

Other studies have looked at the effect of weight cycling on the development of heart disease and **gallstones**, and on immune system functioning. Gallstones are hard, painful masses of cholesterol and **calcium** that form in the gallbladder and bile ducts. Some studies have found that people who weight cycle are more likely to develop gallstones. Research

continues in this area. Researchers have also found that the number of natural killer (NK) cells in the immune system tends to be lower in people who yo-yo diet. NK cells are a type of white blood cell that kills abnormal body cells (e.g. **cancer** cells) and cells that have been infected by viruses. The health implications of this are under review. Researchers also know that people who maintain a healthy weight have fewer cardiovascular problems than people whose weight goes up and down. However, so many factors differ between people who maintain a healthy weight and those who weight cycle that no clear conclusions can be drawn from this. The one thing is clea: none of these findings should discourage overweight and obese people from trying to lose weight. The documented health risks of being overweight/obese, such as an increased risk of developing type 2 diabetes, heart attack, high blood pressure, fatty liver disease, arthritis, and sleep apnea, and certain cancers, far exceed any potential health risks from weight cycling.

Research on weight cycling and weight maintenance is going on at many institutions. Individuals interested in participating in a clinical trial at no cost can find a list of research projects currently enrolling volunteers at <http://www.clinicaltrials.gov>. At the site, search under "weight maintenance."

### Nutrition/Dietetic concerns

Nutritional and dietetic concerns related to weight cycling are the same as those related to dieting and obesity in general. A nutritionist or dietitian can help plan a healthy weight-loss program and a weight maintenance program that will reduce weight cycling.

### Prognosis

Most people who lose weight gain it back. A significant number of people gain back more than they lost. This can be make the individual feel like a failure and give her an excuse to stop trying to lose weight. Even modest weight loss has health benefits. Although weight loss relapses are common, losing weight, even if it returns, is healthier than not losing it, so long as the individual follows a balanced weight-loss program.

### Prevention

Studies have found that people who successfully maintain their weight loss and do not weight cycle are those who are prepared to make changes in their lifestyle. One study found that whether dieters lost weight using a liquid diet, a formal weight-loss program such as **Weight Watchers**, or a self-constructed weight loss program, everyone who successfully kept weight off for five years or more incorporated exercise into their daily routine. They also permanently changed their eating habits to eat a lower calorie diet. Another study found that inability or unwillingness to make behavioral changes with regard to eating and exercise was the most common predictor for regaining weight lost during dieting.

### Resources

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Weight-control Information Network (WIN). 1 WIN Way, Bethesda, MD 20892-3665. Telephone: (877)946-4627 or (202) 828-1025. Fax: (202) 828-1028. Website: <http://win.niddk.nih.gov>

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## Weight Loss 4 Idiots

### Definition

Weight Loss 4 Idiots is also known as Fat Loss 4 Idiots. It is an 11 day diet based around the idea that changing the type of calories eaten each day will trick the **metabolism** into burning fat.

## Origins

The origins of Fat Loss 4 Idiots are not clear, although the idea that there are ways of "tricking" the body's metabolism into burning more calories has been around for many years. This diet was released on the internet in late 2004. The diet is owned by a company named "Internet Made Simple" which is headquartered in Newport Beach, California. The diet is mainly a downloadable meal plan created for each dieter depending on the dieter's personal food preferences. It is only available on the internet.

## Description

The idea behind the Fat Loss 4 Idiots program is that the dieter is provided with an 11 day meal plan that continually rotates the kind of calories consumed. The diet claims that this calorie-type changing will "trick" the dieter's metabolism into not only burning the calories eaten during the day, but into burning calories stored as fat as well. The diet claims that this calorie switching works because a perosn's metabolism burns calories based on how many and what type of calories were consumed in the past few days. The metabolism has no way of knowing what the person will eat today, or on any day to come. So by continually changing the types of foods eaten the metabolism will continually be "surprised." The body will then supposedly burn not only the foods provided to it during the day, but will continue to burn energy after those calories are used up. The extra energy expected to be burned is supposed to come from the body's fat stores, allowing the dieter to lose weight and fat. The diet is not clear about how this tricking of the metabolism is expected to have this effect.

Fat Loss 4 Idiots does not require counting calories, **protein** grams, **carbohydrates**, or anything else. This is part of the idea behind the diet being "idiot proof." Instead, the dieter is allowed to eat as much as desired of the foods listed on his or her meal plan, and is encouraged to eat until just full. The meal plan provides four meals per day. The meals are to be eaten at least two and a half hours apart.

The diet begins with a questionnaire about the dieter's food preferences. The 11 day meal plan designed for the dieter can then be downloaded. Although each dieter's meal plan may be different, there seem to be some general themes. Because the diet is created around the idea that the types of calories consumed need to be changed frequently, many days of the meal plan may contain a lot of one type of food, such as protein, but none of another type of food, such as dairy.

### KEY TERMS

**Diabetes mellitus**—A condition in which the body either does not make or cannot respond to the hormone insulin. As a result, the body cannot use glucose (sugar). There are two types, type 1 or juvenile onset and type 2 or adult onset.

**Dietary supplement**—A product, such as a vitamin, mineral, herb, amino acid, or enzyme, that is intended to be consumed in addition to an individual's diet with the expectation that it will improve health.

**Mineral**—An inorganic substance found in the earth that is necessary in small quantities for the body to maintain a health. Examples: zinc, copper, iron.

**Obese**—More than 20% over the individual's ideal weight for their height and age or having a body mass index (BMI) of 30 or greater.

**Vitamin**—A nutrient that the body needs in small amounts to remain healthy but that the body cannot manufacture for itself and must acquire through diet.

The diet contains a lot of lean protein, such as fish and chicken. Some dieters may find that their meal plan contains fish or chicken nearly every day. The plan also contains some fruits and vegetables, although they do not seem to be included in every day.

Simple carbohydrates seem to be especially limited on the Fat Loss 4 Idiots diet. Some days have carbohydrates in the form of oatmeal or pasta, or the bread from a sandwich. Other days seem to contain no significant sources of carbohydrates at all. Many days seem to contain some dairy, such as cottage cheese, although others may contain no dairy at all.

The diet contains no preserved, pre-packaged, or processed foods. Most of the foods are to be eaten in a very natural state and minimally prepared. There is very little sugar allowed while on the diet, and none of the days seem to contain any type of desert.

The meals that are on the created meal plan may often seem more like foods than actual meals. Often the dieter will be allowed to eat chicken for one of his or her meals. This means that he dieter can have as much chicken as he or she would like to eat, but it must be minimally prepared (that is, not breaded, fried, etc.) and it is possible that nothing else will be listed for that

meal. Another meal for that day might be just cottage cheese, or just a fish fillet.

The meal plans lasts 11 days, during which time the dieter is supposed to be able to lose 9 pounds. After these 11 days the dieter is allowed three "cheat" days during which anything desired can be eaten, then the diet can be begun again. The diet claims that it can be repeated as often as desired until the dieter has attained his or her goal weight.

When the dieter purchases the Fat Loss 4 Idiots diet he or she will the be able to download the personalized 11 day meal plan. Dieters can also download a "Diet Handbook" that promises to give the dieter other helpful diet secrets. There are no exercise recommendations given by this diet, and no stress reduction or other healthy living suggestions. There is no significant support available for dieters on this program from the program's website or by telephone.

## Function

Fat Loss 4 Idiots reports that it allows dieters to lose 9 pounds every 11 days. This is a diet intended solely for weight loss, and is not intended to be a general guide for healthy living. It does not include exercise recommendations, recipes, or stress reduction advice. The diet says that it can be repeated as desired for weight loss. It allows three "cheat" days after the diet is completed before the diet is begun again.

## Benefits

There are many benefits to losing weight if it is done at a safe, moderate pace through healthy eating and exercise. The risk of many obesity-related diseases and conditions such as type II diabetes and heart disease is higher for people who are very overweight. Often this risk can be reduced by safe weight loss. This diet, however, is not generally considered appropriate for long term moderate weight loss.

Some dieters may find that the specific meal plans provided are a considerable benefit of this diet. Dieters do not have to make choices about which foods to eat, or count calories or grams of carbohydrates. The requirement of eating four meals per day may also be beneficial, as it may help dieters to eat less overall by allowing them to eat more frequently. This diet does not limit the amount of food that can be consumed except for saying that dieters should stop eating just before being full. This may make the diet easier to stick to for some dieters.

### QUESTIONS TO ASK THE DOCTOR

- Is this the best diet to meet my goals?
- Would a multivitamin or supplement be appropriate for me if I were to begin this diet?
- Do I have any special dietary needs that this diet might not meet?
- Is this diet safe for me?
- Is this diet safe for my entire family?
- Is it safe for me to follow this diet over a long period of time?
- Are there any sign or symptoms that might indicate a problem while on this diet?

## Precautions

Anyone thinking of beginning a new diet should consult a medical practitioner. Requirements of calories, fat, and nutrients can differ significantly from person to person, depending on gender, age, weight, and other factors such as the presence of diseases or conditions. This diet may be of special concern because it only allows a few foods to be eaten each day. Pregnant or **breastfeeding** women should be especially cautious because when the foods a mother eats can impact a baby who is receiving nutrients from her.

## Risks

There are some risks to any diet. Fat Loss 4 Idiots severely limits the foods that can be eaten each day. It does not generally include many fruits or vegetables, which are important sources of many **vitamins** and **minerals**. This means that it is likely that the dieter will not get enough of all vitamins and minerals required each day for good health. It is difficult, however, to determine how severe the risk of deficiency is because each dieter is given a personalized meal plan, and quantities of food are not specified. Any dieter thinking of beginning this diet may want to consult a healthcare provider about a multivitamin or supplement to help reduce the risk of deficiencies. Supplements have their own associated risks.

## Research and general acceptance

There have been no significant scientific studies of the Fat Loss 4 Idiots diet. It is not clear what evidence may support the idea that changing the types of foods

eaten each day will trick the metabolism into burning fat. There is no evidence cited, and no significant scientific studies have been done that support this idea.

Although the diet provides different meal plans to different dieters based on the dieter's preferences and goals, the diet does seem to have some common components for each dieter. Because the diet attempts to change the kinds of food that are consumed each day, it is difficult for a dieter to eat a balanced diet. For this reason, and because many meals are made up of just one food, the diet may not meet the recommendations by the United States Department of Agriculture in their MyPyramid food guidelines for a healthy diet.

Fat Loss 4 Idiots only includes one type of food in most meals. This makes getting enough vegetables difficult because vegetables are often seen as a side dish. MyPyramid recommends that healthy adults eat the equivalent of 2 to 3 cups of vegetables each day. The Fat Loss 4 Idiots diet is unlikely to meet this recommendation on most days.

MyPyramid also recommends that healthy adults eat the equivalent of 1 and a half to 2 cups of fruit per day. It is unlikely that a person following the Fat Loss 4 Idiots diet would eat this much fruit. Some daily meal plans for this diet do not include fruit at all.

Dairy products are generally considered to be part of a healthy diet. MyPyramid recommends the equivalent of 3 cups of low-fat or non-fat dairy per day for healthy adults. Some days of the diet may not include any dairy products. If a dairy product, such as cottage cheese, is included in one meal it is unlikely that a dieter would want to eat enough of it in one sitting to get three full servings.

Starches and grains are also considered a necessary and important part of any healthy diet. MyPyramid recommends the equivalent of 3 to 4 ounces of grains each day for healthy adults, of which at least half should be whole grains. The Fat Loss 4 Idiots diet would probably very rarely meet this requirement. Many days of this diet do not include any kind of starch or grain at all.

MyPyramid recommends that healthy adults eat between 5 and 6 and one half ounces of meat or beans each day. The Fat Loss 4 Idiots would probably meet, and in most cases probably exceed, this recommendation on most days. Many different lean meats seem to be included in this diet on a daily basis.

Fat Loss 4 Idiots does not include any specific recommendations for exercise. Exercise is generally accepted to be an important part of any weight loss program, and is required for general good health. Many studies have found that dieting and exercise are more effective for weight loss when done together than either is when done alone. In 2007, the Centers for Disease Control recommended that healthy adults get 30 minutes or more of light to moderate exercise each day. Following the Fat Loss 4 Idiots diet without adding exercise to the plan would not meet this requirement.

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#### ORGANIZATIONS

American Dietetic Association. 120 South Riverside Plaza, Suite 2000, Chicago, Illinois 60606-6995. Telephone: (800) 877-1600. Website: <http://www.eatright.org>

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Helen M. Davidson

# Weight Watchers

## Definition

Weight Watchers is the largest commercial weight-loss program in the world. The diet is based on calorie and portion control while eating regular food, exercise, and behavior modification.

## Origins

By the mid 2000s, more than 25 million people worldwide had participated in the Weight Watchers program that was started in the living room of an overweight housewife in Queens, New York. When Jean Nidetch needed to lose weight, she attended a diet clinic sponsored by the New York City Board of Health. However, after she had lost about 20 lb (10 kg), she found it hard to remain motivated to stay on the diet. Her solution was to ask a group of overweight friend to come to her house and talk about their eating and dieting challenges. This group evolved into a regular support group. While attending this group, Nidetch had the insight that dieting was not just about food, but about changing behaviors.

## KEY TERMS

**Cholesterol**—a waxy substance made by the liver and also acquired through diet. High levels in the blood may increase the risk of cardiovascular disease.

**Dietary supplement**—a product, such as a vitamin, mineral, herb, amino acid, or enzyme, that is intended to be consumed in addition to an individual's diet with the expectation that it will improve health

**Type 2 diabetes**—sometime called adult-onset diabetes, this disease prevents the body from properly using glucose (sugar), but can often be controlled with diet and exercise.

Two years later in 1963, Nidetch established Weight Watchers as a company and held her first public meeting. Demand for her program far exceeded expectations. Over the years the program evolved to incorporate new research in nutrition. Behavior management modules and an exercise program were added. In 1978 the company was bought by H. J. Heinz Company, which added a line Weight Watchers supermarket foods. Today Weight-Watcher endorsed cookbooks, exercise tapes, and a magazine all are available to support dieters who are either Weight Watcher members or who want to try the diet plan on their own.

### Description

The fundamental message of the Weight Watcher program is "move more, eat less." There is nothing unique about this approach to dieting. What distinguishes the Weight Watchers program are the tools it provides members to stay motivated to meet these goals.

There are two ways to join Weight Watchers. The traditional method is to attend weekly Weight Watchers meetings. More than 29,000 meetings are held in Weight Watchers centers, churches, hospitals, and workplaces each week in 27 different countries. Meetings last about 50 minutes and are led by a trained Weight Watcher member who has lost weight using the program and has successfully kept the weight off.

Upon registering, members set their first goal as losing 10% of their body weight. Once this goal is reached, a final weight goal is selected based on the individual's height, age, and gender. In 2007, registration in the United States cost about $30 and weekly meetings between $10 and $12, Discounts are available in the form of monthly passes, and each year Weight Watchers offers at least one period when the registration fee is waived. A bring-a-friend program allows people to attend a meeting before signing up for the program. Members can attend any meeting anywhere in the world and have the option of attending more than one meeting each week at no additional charge, but they can only be weighed once a week.

Weight Watchers Online is a program designed to let people follow the Weight Watchers diet at home without attending weekly meetings. The step-by-step plan provides the same information as the in-person plan, but lacks the support of and accountability to the group. Weight Watches Online costs about half as much as the in-person meetings.

Weight Watchers meetings are a combination of nutrition education, behavior modification, and motivational psychology. Weight Watchers diet plans have evolved over the years. The current system gives members a choice of two plans, he Flex Plan or the Core Plan. The Flex Plan assigns a point value per serving to every food. Points are based on the amount of calories, dietary **fiber**, and fat in the food. One point is roughly equal to 50 calories. Written material and an online database give the point value of most common foods. A small cardboard Points Calculator that works something like an old-fashioned slide rule lets members calculate the point value of any food based on nutrition information on the product's label. Dieters are assigned a number of Daily Points. They may eat anything they wish so long as they stay within their allotted points. In reality, to follow the plan dieters must select low calorie options—lean meats, lots of fruits and vegetables, and reasonable helpings of **carbohydrates**. Points are adequate for an occasional treat.

The Core Plan gives dieters a list of "core foods." They may eat unlimited quantities (within reason) of any of the core foods without weighing or measuring. This simplifies shopping and food preparation, but also reduces variety in the diet. A weekly points allowance can be spent on foods that are not core foods. Dieters are told to choose either the Flex Plan or the Core Plan, but they may switch from one to the other on a weekly basis.

Every Weight Watchers meeting has a behavioral module. These modules help dieters uncover harmful behaviors and suggest ways to correct them. For instance, one module may deal with eating in response to stress. Another might be on how to handle people who want to sabotage your diet, challenges of eating out, handling holiday meals, fitting exericse into daily

life, or overcoming feelings of low self-worth. These topics are presented by the leader and often supported with short worksheets or take-away information. Members are encouraged to share their experiences and make suggestions for solutions that are then summarized and reinforced by the leader. Weight Watchers eTools (different from Weight Watchers Online) offers online support for behavior change along with recipes and dieting tips.

Motivation is a big part of the Weight Watchers program. At every in-person meeting, the member is privately weighed and their weight recorded. Even small successes are celebrated. Members receive recognition for every 5 lb (2 kg) of weight loss, along with larger recognition for attending 16 weekly meetings (the number Weight Watchers says is needed to change behavior), losing 10% of their body weight, and reaching their goal weight. Lifetime membership is conferred on individuals who reach their goal weight and stay at or below that weight for at least six weeks. Lifetime members may attend meetings free so long as they weigh in at no more than 2 lb (1 kg) above their goal weight. If their weight is out of that range, they pay the weekly meeting fee, but never have to pay a registration fee once they have achieved Lifetime status.

Daily exercise is strongly encouraged at Weight Watchers, but it is not a required part of the program. Individuals who exercise can earn extra points to spend on food if they wish. Walking is strongly encouraged, and Weight Watchers sells branded pedometers to encourage walkers to gradually increase their walking activity to 10,000 steps a day (about 5 miles). Some motivational exercises involve group tracking of physical activity. For example, one group may set themselves the challenge to, as a group, walk the number of steps it would take to travel from the distance from Boston to Washington DC within a certain number of weeks.

## Function

Weight Watchers is a calorie controlled, portion-controlled diet plan that is intended to change the individual' eating and exercise habits for a lifetime.

## Benefits

Some benefits of the Weight Watchers program include:

- The diet uses regular food, keeping costs low. Weight Watchers-branded foods are available in most supermarkets, but members are not required to buy them to use the diet plan.
- The Weight Watchers plan does not require or encourage individuals to use dietary supplements.
- The diet plan is designed for slow, steady weight loss of between 1.5 and 2 lb per week (0.6–1 kg)
- Dieters are given tools to explore the emotional roots of their eating problems so that they can be understood and changed.
- Membership is on a pay-as-you-go system. There are no long-term contracts or large upfront fees.
- The program has an extensive selection of approved recipes and support tools available at no additional charge.
- The POINTS system makes it possible to fit unusual or ethnic foods into the diet.
- It is not necessary to cook separate meals for other family members. Home cooked meals that fit the Weight Watchers diet plan are suitable (and healthy) for the entire family.
- The Weight Watchers program is recognized as safe and healthy by many accredited medical organizations. In some cases, the member's health insurance will pay a portion of the meeting fees.
- Weight Watchers has a special set of weight-loss tool designed just for men.

Despite these benefits, the Weight Watchers program is not for everyone. Some people find the group meeting a bit too cheerleaderish to feel comfortable. However many dieters attend the same meeting week after week and develop relationships with other members and a sense of accountability to the group that motivates them to stay on the diet.

## Precautions

Weight Watchers does not accept children under age 10 or pregnant women. Children under age 17 must present written medical permission to join the program. Teens and **breastfeeding** women must agree to follow a special plan to meet their dietary needs. Weight Watchers will not accept anyone whose weight is within 5 lb (2.3 kg) of the lowest weight in their goal range, nor does it accept people with a diagnosis of **bulimia nervosa** (binge and purge disorder). The Weight Watchers program is not intended to treat or cure any particular disease or disorder.

## Risks

Individuals who are under treatment for an illness, taking prescription drugs, or on a therapeutic diet (e.g. low **sodium**, gluten-free) should consult their doctor about the Weight Watchers plan and follow any changes or modifications the physician makes to the Weight

## QUESTIONS TO ASK THE DOCTOR

- Do I have any special dietary needs that this diet might not meet?
- Do I have any health conditions that might affect my participation in this diet?
- Are there any sign or symptoms that might indicate a problem while on this diet?
- At what level of intensity is it appropriate for me to begin exercising?
- Do you have any experience with the long-term success of this diet?
- If one of your family members wanted to go on a diet, would you recommend this one?

Watchers plan. Failure to do this can increase the risk of developing health complications.

### Research and general acceptance

Of all the commercial diet plans, Weight Watchers is the plan that is most enthusiastically accepted by the medical community. The program has been in existence for more than 40 years. Many independent studies have confirmed that it is a safe and effective way to lose weight. In comparison studies, members that attend Weight Watchers meetings lose more weight than those who join the program but do not go to meetings. The Weight Watchers plan also compares favorably to other diet plans in terms of total weight loss and maintenance of weight loss. Unlike some diets, the Weight Watchers plan does not address specific health issues such as lowering blood pressure or cholesterol levels, or controlling type 2 diabetes without drugs, although these effects may occur as a result of adherence to the diet and weight loss.

### Resources

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#### ORGANIZATIONS

American Dietetic Association. 120 South Riverside Plaza, Suite 2000, Chicago, Illinois 60606-6995. Telephone: (800) 877-1600. Website: <http://www.eatright.org>

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Welsh diet *see* **Northern European diet**

West African diet *see* **African diet**

# Women's nutrition

### Definition

Women have special nutritional needs due to hormonal changes that occur with menstruation, pregnancy, lactation, and menopause, all of which alter the recommended daily intake of nutrients. Of the many diseases that affect women, five have a scientific-based connection to nutrition: iron-deficiency anemia, osteoporosis, heart disease, type 2 diabetes, and some types of cancer. In addition, many women look to nutrition for the management of premenstrual and menopausal symptoms.

### Description

#### *Anemia*

Iron-deficiency anemia is a very common nutritional disorder among females following the beginning

of the menstrual cycle. **Iron** deficiency is also common among females with poor diets or very low body weight. The recommended intake of iron for females is 15 to 18 milligrams (mg) per day. Good sources of iron include red meat, dark green leafy vegetables, legumes, and fortified breads and cereals.

### *Nutrition for Pregnancy and Breastfeeding*

Good nutrition is important during pregnancy and **breastfeeding**, as there is an increased need for calories and for most nutrients. A particularly important nutrient during pregnancy is folic acid, one of the B vitamins. Folic acid reduces the chance of having a baby with birth defects of the brain and spinal cord. Experts recommend that women of childbearing age consume 400 micrograms (µg) of folic acid every day. Pregnant women should consume 600 µg per day. Good sources of folic acid include dark green leafy vegetables, oranges and orange juice, dried beans and peas, and fortified breads and cereals.

Adequate **calcium** intake during both pregnancy and breastfeeding is also important, since calcium is drawn from the mother. The recommended intake of calcium during pregnancy and lactation is 1,000 mg a day. A pregnant or lactating teenager needs 1,300 mg of calcium a day. Before becoming pregnant, a woman should discuss folic acid or calcium supplementation with a physician, as well as multivitamin supplementation.

Hormonal changes during pregnancy may trigger a condition called gestational diabetes. Gestational diabetes is characterized by high levels of sugar in the blood. The condition can be diagnosed by a screening test between the twenty-fourth and twenty-eighth week of pregnancy. Changes in diet and exercise are often sufficient to keep blood sugar levels in the normal range. For most women, the condition goes away after the birth of the baby. Women who have gestational diabetes are more likely to develop type 2 diabetes later in life.

### *PMS and Menopause*

Many women seek medical help for premenstrual syndrome (PMS). While nutrition advice often varies, there is insufficient scientific evidence that any diet modifications will prevent or relieve PMS symptoms. A combination of good nutrition, exercise, and stress management may be the best way to relieve the symptoms of PMS.

**Soy** has garnered much attention in recent years as a dietary treatment for menopausal symptoms. Soy is a rich source of isoflavones, an estrogen-like substance found in plants. Some studies suggest that regularly eating moderate amounts of soy-based food products can help decrease menopausal symptoms; however, other studies do not support the idea. More research is needed to gain a better understanding of the effects of soy on menopausal symptoms.

During menopause, a woman's metabolism slows down and weight gain can occur. The accumulation of body fat around the abdomen also increases. Exercise and careful food choices can minimize both of these occurrences.

## KEY TERMS

**Antioxidant**—Substance that prevents oxidation, a damaging reaction with oxygen.

**Fortified**—Altered by addition of vitamins or minerals.

**Isoflavones**—Estrogen-like compounds in plants.

**Menopause**—Phase in a woman's life during which ovulation and menstruation end.

**Saturated fat**—A fat with the maximum possible number of hydrogens; more difficult to break down than unsaturated fats.

## Complications

### *Chronic Diseases*

As women age, the risk of developing chronic disease increases. Women over age forty-five who are overweight, physically inactive, and have a family history of diabetes are more likely to develop type 2 diabetes. Maintaining a healthy weight, eating a varied and balanced diet, and engaging in an active lifestyle can reduce the risk of developing type 2 diabetes. Diabetes carries many risks with it, including eye disease, nerve disease, kidney disease, and heart disease.

Women are at a higher risk of developing **osteoporosis** as they age than men are. Osteoporosis is an irreversible disease in which the bones become porous and break easily. There are many factors that contribute to this disease, including genetics, diet, hormones, age, and lifestyle factors. The disease usually has no symptoms until a fracture occurs.

Diets low in calcium, vitamin D, or magnesium—or high intakes of **caffeine**, alcohol, sodium, phosphorous, or protein—may increase the chance of developing osteoporosis. Good nutrition and weight-bearing exercise, such as walking, hiking, or climbing stairs, helps to build strong bones.

Good sources of calcium include low-fat dairy products such as cheese, yogurt, and milk; canned fish with bones, such as salmon and sardines; dark green leafy vegetables; and calcium-fortified foods such as orange juice, bread, and cereal. The recommended intake of calcium for women ages nineteen to fifty is 1,000 mg per day. Women over the age of fifty should consume 1,200 mg of calcium per day.

Breast **cancer** is the most common type of cancer among U.S. women other than skin cancer. Obese, sedentary women are more likely to develop breast cancer, and dietary factors may possibly play a role in its development. Some studies suggest that excessive fat intake may increase breast-cancer risk, either by raising estrogen levels in a woman or by altering immune function. Diets that include adequate amounts of fruits, vegetables, and other fiber-rich foods may protect against breast cancer. However, controversy exists as to whether diet is actually a contributing factor. Excessive **alcohol consumption** does appear to raise the risk of breast cancer in women.

The risk of developing heart disease begins to rise once a woman reaches menopause, and it increases rapidly after age sixty-five. Dietary risk factors involved in the cause or prevention of heart disease include dietary antioxidants, dietary **fiber**, and the type and amount of fat in the diet. **Antioxidants** are non-nutrient compounds in foods that protect the body's cells from damage. They are found in fruits and vegetables. Soluble fiber, such as the fiber in oatmeal, helps to lower blood cholesterol levels, while levels of cholesterol in the blood increase in response to diets high in total fat and/or saturated fat. A high level of cholesterol in the blood is a risk factor for heart disease.

**Hypertension**, or high blood pressure, is related to heart disease. After menopause, women with hypertension outnumber men with the condition. Weight control, an active lifestyle, a diet low in salt and fat, and with plenty of fruits and vegetables may help to prevent hypertension.

Good nutrition is the cornerstone of good health for a woman, but the many phases of a woman's life require nutritional adjustments. Learning and following dietary recommendations, and making the appropriate nutritional adjustments, can improve a woman's quality of life and reduce the risk of chronic disease.

## Resources

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Beth Fontenot

# XYZ

Xenical *see* **Orlistat**

## Yersinia

### Definition

Yersinia is a bacterium that can contaminate food and is responsible for a foodborne disease called yersiniosis.

### Purpose

Yersinia is a serious issue because it contributes to waterborne and foodborne diseases that each year affect an estimated seventy-six million people in the United States. Awareness of potential sources of food contamination and knowledge of preventive measures is an important factor for maintaining health.

### Description

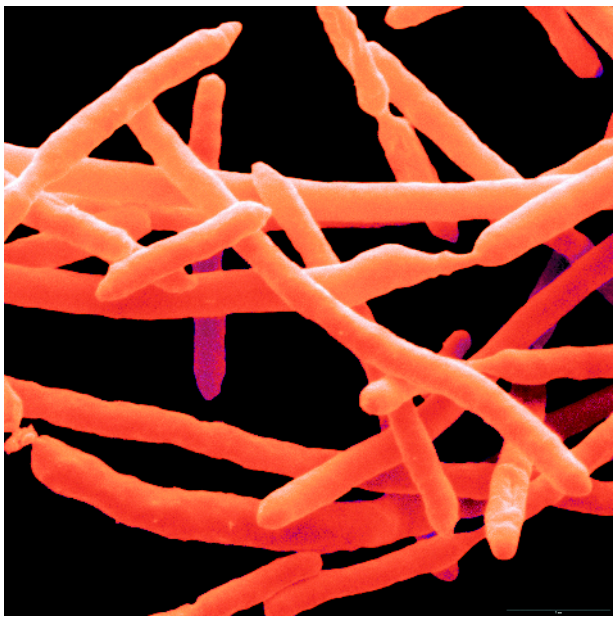
The genus Yersinia consists of 11 species of gram-negative bacilli. *Yersinia enterocolitica*, *Yersinia pseudotuberculosis*, and *Yersinia pestis* are the three disease-causing (pathogen) species.

*Yersinia pestis* causes plague and people usually get it from being bitten by a rodent flea that is a carrier or by handling an infected animal. Millions of people in Europe died from plague in the Middle Ages, carried by flea-infested rats. Nowadays, antibiotics are used effectively against plague, but if an infected person is not treated promptly, the disease is likely to cause illness or death. In the United States, the last plague epidemic occurred in Los Angeles in 1924–25. Since then, plague has occurred as a few scattered cases in rural areas, at an average rate of 10 to 15 persons each year.

Fifteen pathogenic O groups of *Y. enterocolitica* have been identified with serotype O:3 now predominating as the most common type in the United States. *Y. enterocolitica* infections are uncommon in the United States. According to the Foodborne Disease Active Surveillance Network (FoodNet), the annual incidence per 100,000 people is 9.6 for infants, 1.4 for young children, and 0.2 for other age groups. *Y. pseudotuberculosis* infections are even more rare. *Y. enterocolitica* is mostly found in swine and *Y. pseudotuber-culosis* has been reported in deer, elk, goats, sheep, cattle, rats, squirrels, beaver, rabbits, and many bird species. To date however, no foodborne outbreaks caused by *Y. pseudotuberculosis* have been reported in the United States.

*Y. enterocolitica* infections cause yersiniosis, a disease with a variety of symptoms depending on the age of the person infected. In children, common symptoms are fever, abdominal pain, and diarrhea, which is often bloody. Yersinia infections are transmitted by eating contaminated food, such as raw or incompletely cooked pork products and unpasteurized milk, by contaminated **water**, by contact with infected animals, by transfusion with contaminated blood, and rarely from person-to-person. The incubation period usually varies between 4 to 6 days. The exact cause of the food contamination is unknown, but prevalence of the organism in the soil and water and in animals such as beavers, pigs, and squirrels, allows it to enter the food supply chain. *Y. enterocolitica* outbreaks documented at the Center for Disease Control (CDC) include:

- 1976: Chocolate milk outbreak in Oneida County, NY. involving school children.
- December 1981–February 1982: Outbreak in King County, WA, caused by ingestion of tofu. Investigators from the Food and Drug Administration (FDA) identified the source of the infection to be an non–chlorinated water supply.
- 1982. Outbreaks in Arkansas, Tennessee, and Mississippi due to the consumption of pasteurized milk. FDA investigators identified the infection source to be contaminated milk containers.



**Yersinia enterocolitica bacteria causes most cases of the food-borne disease yersiniosis in the United States.** *(Scimat/Photo Researchers, Inc. Reproduced by permission.)*

- 1995. Outbreak in the Upper Valley of Vermont and New Hampshire. This outbreak likely resulted from post-pasteurization contamination of milk. Dairy pigs were the most likely source of contamination. Milk bottles were also likely contaminated by rinsing with untreated well water prior to filling.

## Precautions

Poor sanitation and improper sterilization techniques by food handlers, including improper storage, are important factors contributing to contamination. To prevent yersinia outbreaks, the Center for Disease Control (CDC) offers the following preventive advice:

- Avoid eating raw or undercooked pork.
- Consume only pasteurized milk or milk products.
- Wash hands with soap and water before eating and preparing food, after contact with animals, and after handling raw meat.
- After handling raw chitterlings, clean hands and fingernails scrupulously with soap and water before touching infants or their toys, bottles, or pacifiers. A person other than the foodhandler should care for children while chitterlings are being prepared.
- Prevent cross-contamination in the kitchen by using separate cutting boards for meat and other foods, and carefully cleaning all cutting boards, countertops, and utensils with soap and hot water after preparing raw meat.
- Dispose of animal feces in a sanitary manner.

## Interactions

As long as the bacteria continues to be excreted, yersiniosis can be transmitted to others and accordingly requires strict attention to personal hygiene. People with yersiniosis should stay off work or school while they have symptoms. Those in high risk groups or occupations (infants, children, school pupils, students, food workers, child-care workers, teachers, and health care practitioners) can only return to work after being completely free of symptoms for two days.

## Aftercare

Uncomplicated cases of *Y. enterocolitica* diarrhea usually resolve on their own without antibiotic treatment. However, in more severe or complicated infections, antibiotics may be required. Diarrhea is a symptom that is not only uncomfortable, but also dangerous to health, because it can result in the body loosing too much fluid (**dehydration**) and the salts and **minerals** (**electrolytes**) required to maintain health. Medicines that stop diarrhea are not recommended because diarrhea helps to purge the pathogen. To prevent dehydration and replenish lost electrolytes, a bland diet should be followed. Typically, it involves:

- Day 1: Drinking clear liquids at room temperature such as sports drinks (Powerade/Gatorade), weak tea (decaffeinated), non-caffeinated sodas;
- Day 2: Slowly adding bland foods in small amounts as can be tolerated during the day. Examples are: oatmeal or cream of wheat made with water, dry cereal (without milk), plain rice or pasta (no butter, oil, or sauces), crackers or pretzels, gingersnaps, plain toast (no butter or jelly), mashed potatoes (no skins), ripe bananas, applesauce, chicken noodle soup.
- Day 3: Gradually adding more variety of foods in small, more frequent meals evenly spaced throughout the day. Examples are: soft boiled eggs or scrambled eggs, plain baked potato, fish or chicken (no skin) well-cooked, baked or grilled (not fried), plain yogurt, cottage cheese, cooked carrots or green beans, milk (skim or low-fat after diarrhea has stopped).

## Complications

The major complication of yersiniosis is the performance of unnecessary appendix removals (appendectomies) since one of the main symptoms of yersinia infections is abdominal pain of the lower right abdomen.

## KEY TERMS

**Antibiotics**—Medicines created using microbes or fungi that are weakened and taken into the body to destroy harmful bacteria.

**Appendicitis**—Inflammation of the appendix, the small pouch at the start of the large intestine. Patients with appendicitis often present with pain in the right lower abdomen.

**Bacillus**—A genus of bacteria, including spore-forming bacteria; any rod-shaped bacteria (pl. bacilli).

**Bacteria**—Microorganisms found in the environment. Bacteria can multiply quickly in food, and can cause foodborne illnesses. Not all bacteria are harmful: some are used to make yogurt and cheese.

**Bubonic plague**—Deadly infectious disease caused by the *Yersinia pestis*. Symptoms are chills, fever, diarrhea, headaches, and the swelling of the infected lymph nodes, where the bacteria grow and replicate. If untreated, the rate of mortality can reach 90%.

**Carrier**—One who harbors disease organisms in their body without manifest symptoms, thus acting as a distributor of infection.

**Chitterlings**—Name given to the edible intestines of an animal, usually a pig. They are normally fried.

**Contamination**—The undesired occurrence of harmful microorganisms or substances in food.

**Cross–contamination**—The transfer of harmful bacteria from one food to another, or also from hands to food.

**Epidemic**—Disease attacking or affecting many individuals in a community or a population simultaneously.

**Feces**—Waste product of digestion formed in the large intestine. About 75% of its mass is water, the remainder is protein, fat, undigested roughage, dried digestive juices, dead cells, and bacteria.

**Foodborne illness**—Illness caused by pathogenic bacteria transmitted to humans by food.

**Genus**—A category ranking below that of family and above that of species and generally consisting of a group of species.

**Gram–negative**—Bacterium that does not retain the violet stain used in Gram's method.

**Incubation period**—The time interval between the initial exposure to infection and appearance of the first symptom or sign of disease.

**Infectious disease**—Disease that can be transmitted from person to person and that results from the presence and activity of one or more pathogenic microbial agents, including viruses, bacteria, fungi.

**Microorganism**—A general term for bacteria, molds, fungus, or viruses, that can be seen only with a microscope.

**Pathogen**—A disease-causing microorganism.

**Serotype**—A subdivision of a species of microorganism, for example, a bacteria, based upon its particular antigens.

**Species**—A category of classification, ranking below that of genus or subgenus and consisting of related organisms capable of interbreeding.

**Unpasteurized milk**—Milk that has not undergone pasteurization, a heating process that destroys the most heat–resistant pathogenic or disease-causing microorganisms.

As a result, it is often misdiagnosed as appendicitis. In some cases, *Y. enterocolitica* and *Y. pseudotuberculosis* infections have also been followed by arthritis. Another possible rare complication is bacteremia, the entrance of the bacteria into the blood stream.

### Parental concerns

Besides ensuring that food is properly handled in the home so as to avoid yersinia contamination, parents should know that Federal Agencies provide detailed yersinia information to the general public. The Centers for Disease Control and Prevention (CDC) monitors the frequency of *Y. enterocolitica* infections through its Foodborne Disease Active Surveillance Network (FoodNet). CDC also investigates outbreaks to control them and to learn more about how to prevent these infections. It also promotes educational campaigns to increase public awareness about prevention measures. The United States Food and Drug Administration (FDA) inspects imported foods and milk pasteurization facilities while promoting safe food preparation techniques in restaurants and food processing plants. The United States Department of Agriculture (USDA) monitors the health of food animals and the quality of slaughtered and processed meat. The United States Environmental Protection Agency (EPA) regulates and monitors the safety of drinking water supplies.

Parents are advised to call their pediatrician as soon as yersiniosis symptoms appear in a child to prevent the infection from leading to other health problems. The Nemours Foundation offers the following guidelines to parents:

- Never allow a child to eat raw or undercoooked meat.
- Give a child only pasteurized milk or milk products.
- Wash hands with soap and water before eating and preparing food, before touching infants and after contact with animals or handling raw meat.
- Use separate cutting boards for meat and other foods.
- Clean all cutting boards, countertops, and utensils with soap and hot water after using them for raw meat. Keep them away from baby bottles and dishwares.
- Always cook meat thoroughly, especially pork products.
- Dispose of animal feces and sanitize anything it has come into contact with.
- Avoid drinking directly from natural water sources such as ponds and mountain streams, especially if there nearby farms where cattle, pigs, or goats are raised.
- When caring for a family member who has diarrhea, wash hands thoroughly before touching other people and before handling food.
- If a pet dog or cat has diarrhea, wash hands frequently and have them checked by a veterinarian for treatment.

### Resources

#### BOOKS

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McDevitt, B. L.*Diarrhea*. Frederick, MD: PublishAmerica Inc., 2005.

Wilson, C. L., Droby, S. *Microbial Food Contamination*. Boca Raton, FL: CRC Press, 2000.

#### ORGANIZATIONS

Centers for Disease Control and Prevention (CDC). 1600 Clifton Road, NE, Atlanta, GA 30333. 1-800-CDC-INFO (1-800-232-4636) or 404-639-3534.<www.cdc.gov>.

Food and Drug Administration (FDA), Center for Food Safety and Applied Nutrition. 5100 Paint Branch Parkway, College Park, MD 20740-3835. 1-888-SAFEFOOD (1-888-723-3663). <vm.cfsan.fda.gov>.

United States Department of Agriculture (USDA), Food Safety and Inspection Service. Meat and Poultry Hotline: 1-888-MPHotline (1-888-674-6854). <www.fsis.usda.gov>.

U.S. Environmental Protection Agency (EPA). 1200 Pennsylvania Avenue, NW, Washington, DC 20460. 202-272-0167. <www.epa.gov>.

Monique Laberge, Ph.D.

# Zinc

## Definition

Zinc is a trace element considered a micronutrient, meaning a nutrient needed in very small amounts. It is found in almost every living cell. The significance of zinc in human nutrition and public health was recognized relatively recently (1961) and it is now considered to have a wide range of essential biological roles in maintaining life and health.

## Purpose

Zinc is considered essential to maintain health. It is required for the activity of numerous metalloenzymes involved in **metabolism**, it maintains the immune system that protects the body against disease, and also supports normal growth and development during pregnancy, childhood, and adolescence. It plays three crucial roles:

- Catalytic role: Enzymes are proteins that are vitally important for speeding up the biochemical reactions (catalysis) of cells and organisms and nearly 200 different ones depend on zinc. Zinc-dependent enzymes can be found in all known classes of enzymes.
- Structural role: Zinc also maintains the structure of proteins and cell membranes. A finger-like structure, called a zinc finger motif, strengthens the structure of several important proteins and enzymes. For instance, that of the antioxidant copper-zinc superoxide dismutase enzyme. Copper is required for the catalytic activity of the enzyme, but zinc plays a critical structural role. Zinc also affects the structure and function of cell membranes, which become more likely to be damaged by harmful oxidative species (oxidative stress) with zinc loss.
- Regulatory role: Zinc finger proteins are also involved in the regulation of gene expression by binding to DNA and influencing the copying of specific genes. Zinc also plays a role in the regulation of cell signaling

**Zinc**

| Age | Recommended Dietary Allowance (mg) |
|---|---|
| Children 0–6 mos. | 3 |
| Children 7–12 mos. | 3 |
| Children 1–3 yrs. | 3 |
| Children 4–8 yrs. | 5 |
| Children 9–13 yrs. | 8 |
| Boys 14–18 yrs. | 11 |
| Girls 14–18 yrs | 9 |
| Men 19≥ yrs. | 11 |
| Women 19≥ yrs. | 8 |
| Pregnant women | 13 |
| Breastfeeding women | 14 |

| Food | Zinc (mg) |
|---|---|
| Oysters, 6 med. | 16 |
| Beef shank, lean, 1 oz. | 3 |
| Beef chuck, lean, 1 oz. | 2.7 |
| Chickpeas, canned, 1 cup | 2.6 |
| Yogurt, plain, low fat, 1 cup | 2.2 |
| Milk, 1 cup | 1.8 |
| Beans, kidney, California red, 1 cup | 1.6 |
| Beef tenderloin, lean, 1 oz. | 1.6 |
| Cashews, dry roasted, no salt, 1 oz. | 1.6 |
| Peas, green, frozen, 1 cup | 1.6 |
| Pecans, dry roasted, no salt, 1.oz | 1.4 |
| Pork shoulder, lean, 1 oz. | 1.4 |
| Beef, eye of round, lean, 1 oz. | 1.3 |
| Cheese, Swiss, 1 oz. | 1.1 |
| Nuts, mixed, dry roasted, no salt, 1 oz. | 1.1 |
| Almonds, dry roasted, no salt, 1 oz. | 1.0 |
| Walnuts, black, dried, 1 oz. | 1.0 |
| Cheese, cheddar, 1 oz. | 0.9 |
| Cheese, mozzarella, part skim, 1 oz. | 0.9 |
| Chicken breast, meat only, 1 oz. | 0.9 |
| Chicken leg, meat only, 1 oz. | 0.9 |
| Oatmeal, instant, low salt, 1 packet | 0.8 |
| Pork tenderloin, lean, 1 oz. | 0.8 |
| Beans, baked, canned with pork, 1 oz. | 0.6 |
| Flounder, sole, 1 oz. | 0.2 |

mg = milligram

*(Illustration by GGS Information Services/Thomson Gale.)*

and influences the release of hormones and the transmission of nerve impulses.

Additionally, zinc has the following functions:

- It is required for vision, taste, and smell.
- It maintains healthy a healthy connective tissue in skin.
- It helps tissue repair after burns and wound healing.
- It is needed for bone growth.
- It promotes the production of healthy white blood cells and antibodies, important components of the body's immune system.
- It is involved in the metabolism of carbohydrates, proteins and phosphorus.
- It is involved in the production of insulin in the pancreas.

Recent research reports indicate that zinc has been found to play a role in cell death (apoptosis) with implications for growth and development, as well as a number of chronic diseases. Zinc is also actively taken up by synaptic vesicles that store the neurotransmitters released by nerve cells, suggesting a new role in neuronal activity and memory.

## Description

Zinc is found in the body in a form bound to proteins within cells, especially in the nucleus, and cell membranes. The adult body contains about 1.5–2.5 g of zinc bound to various proteins. They occur in specialized areas of the brain that produce the chemical substances that can send messages from one nerve cell to another (neurotransmitters). Zinc is also found in the pancreas, adrenal gland, bones, liver, **prostate** and in the reproductive organs. Most of the zinc (75–88%) in blood is found in a red blood cell metalloenzyme called carbonic anhydrase. In the plasma, zinc is bound to proteins such as alpha-2-macroglobulin, albumin, transferrin and ceruloplasmin.

Zinc is found in a wide variety of foods. Oysters are the richest zinc source per serving, but since they are not consumed regularly in the American diet, red meat and poultry provide the majority of dietary zinc. Other good zinc sources include beans, nuts, certain seafood, whole grains, fortified breakfast cereals, and dairy products. Zinc absorption is more efficient from a diet high in animal **protein** than a diet rich in plant proteins. Phytates, which are found in whole grain breads, cereals, legumes and other products, are believed to decrease zinc absorption. Some good food sources of zinc include (per 1oz–serving or as indicated):

- oysters, 6 medium (16 mg)
- beef shank, lean (3 mg)
- beef chuck, lean (2.7 mg)
- beef tenderloin, lean (1.6 mg)
- pork shoulder, lean (1.4 mg)
- beef, eye of round, lean (1.3 mg)
- pork tenderloin, lean (0.8 mg)
- chicken leg, meat only (0.9 mg)
- chicken breast, meat only (0.9 mg)
- yogurt, plain, low fat (2.2 mg per cup)
- baked beans, canned with pork (0.6 mg)
- cashews, dry roasted, no salt (1.6 mg)
- pecans, dry roasted, no salt (1.4 mg)
- chickpeas, canned (2.6 mg per cup)
- mixed nuts, dry roasted, no salt (1.1 mg)

## KEY TERMS

**Acrodermatitis enteropathica**—A genetic disorder resulting from the impaired uptake and transport of zinc in the body.

**Albumin**—Water-soluble proteins that can be coagulated by heat and are found in egg white, blood serum, milk.

**Amino acid**—Organic (carbon-containing) molecules that serve as the building blocks of proteins.

**Antibody**—A protein produced by the body's immune system that recognizes and helps fight infections and other foreign substances in the body.

**Antioxidant enzyme**—An enzyme that can counteract the damaging effects of oxygen in tissues.

**Ceruloplasmin**—A blue copper containing dehydrogenase protein found in serum that is apparently involved in copper detoxification and storage.

**Chelating agent**—An organic compound in which atoms form more than one bond with metals in solution.

**Cofactor**—A compound that is essential for the activity of an enzyme.

**DNA**—The material inside the nucleus of cells that carries genetic information. The scientific name for DNA is deoxyribonucleic acid.

**Enzyme**—Enzymes are proteins and vitally important to the regulation of the chemistry of cells and organisms.

**Gene expression**—The process by which the coded information of a gene is translated into the proteins or RNA present and operating in the cell.

**High-density lipoprotein (HDL)**—HDL is called the "good cholesterol" because it helps remove fat from the body by binding with it in the bloodstream and carrying it back to the liver for excretion in the bile and disposal.

**L-cysteine**—A sulfur–containing amino acid produced by enzymatic or acid hydrolysis of proteins. Supplements are used as antioxidant.

**L-histidine**—An essential amino acid, C6H9N3O2, important for the growth and repair of tissues.

**Lipoproteins**—Proteins present in blood plasma. The five major families are: chylomicrons, very low-density lipoproteins (VLDL), intermediate-density lipoproteins (IDL), low-density lipoproteins (LDL), and high-density lipoproteins (HDL).

**Metalloenzyme**—An enzyme that contains a tightly bound metal ion, such as cobalt, copper, iron or zinc.

**Oxidative stress**—Accumulation in the body of destructive molecules such as free radicals that can lead to cell death.

**Plasma**—The liquid part of the blood and lymphatic fluid. Plasma is 92% water, 7% protein and 1% minerals.

**RNA**—A chemical similar to DNA from which proteins are made. Unlike DNA, RNA can leave the nucleus of the cell.

**Short bowel syndrome**—Problems related to absorbing nutrients after removal of part of the small intestine.

**Sickle cell anemia**—Genetic disorder in which red blood cells take on an unusual shape, leading to other problems with the blood.

**Synaptic vesicles**—Also called neurotransmitter vesicles, these pouches store the various neurotransmitters that are released by nerve cells into the synaptic cleft of a synapse.

**Trace minerals**—Minerals needed by the body in small amounts. They include: selenium, iron, zinc, copper, manganese, molybdenum, chromium, arsenic, germanium, lithium, rubidium, tin.

**Transferrin**—A protein synthesized in the liver that transports iron in the blood to red blood cells.

**Ulcerative colitis**—Inflammation of the inner lining of the colon, characterized by open sores that appear in its mucous membrane.

- walnuts, black, dried (1.0 mg)
- almonds, dry roasted, no salt (1.0 mg)
- milk (1.8 mg per cup)
- cheese, Swiss (1.1 mg)
- cheese, Cheddar (0.9 mg)
- cheese, Mozzarella, part skim (0.9 mg)
- beans, kidney, California red (1.6 mg per cup)
- peas, green, frozen (1.6 mg per cup)
- oatmeal, instant, low salt (0.8 mg per packet)
- flounder, sole (0.2 mg)

The Recommended Dietary Allowance (RDA) for zinc is:

- infants: (0–6 months): 3 mg
- infants: (7–12 months): 3 mg
- children (1–3 y): 3 mg
- children (4–8 y): 5 mg
- children (9–13 y): 8 mg
- adolescents (14–18): males, 11 mg, females, 9 mg
- adults: males, 11 mg, females, 8 mg
- pregnancy: 13 mg
- lactation: 14 mg

Zinc in nutritional supplements is available as zinc gluconate, zinc oxide, zinc aspartate, zinc picolinate, zinc citrate, zinc monomethionine and zinc histidine. They are distributed as stand-alone or combination products as tablets, capsules or liquids.

## Precautions

Zinc deficiency most often occurs when zinc intake is inadequate or poorly absorbed and it can have serious health consequences. Moderate to severe zinc deficiency is rare in the United States. However, it is highly prevalent in developing countries. The symptoms of severe deficiency include the slowing or cessation of growth and development, delayed sexual maturation, skin rashes, chronic and severe diarrhea, immune system deficiencies, poor wound healing, decreased appetite, impaired taste sensation, night blindness, swelling and clouding of the corneas, and behavioral disorders. These symptoms were first accurately described when a genetic disorder called acrodermatitis enteropathica was linked to zinc deficiency. Although mild dietary zinc deficiency is unlikely to cause such severe symptoms, it is known to contribute to several health problems, especially in young children. Zinc deficiency leads to impaired physical and neuropsychological development, and to an increased risk of life–threatening infections in young children. Individuals at risk of zinc deficiency include:

- infants and children
- pregnant and breastfeeding women, especially teenagers
- patients receiving intravenous feeding
- malnourished individuals, including those with anorexia nervosa
- people with severe or persistent diarrhea
- people with malabsorption syndromes, including celiac disease and short bowel syndrome
- people with inflammatory bowel disease, including Crohn's disease and ulcerative colitis
- people with alcoholic liver disease
- people with sickle cell anemia
- elderly people
- strict vegetarians whose major food staples are grains and legumes because the high levels of phytic acid in these foods lower the absorption of zinc

Fortified foods include many types of breakfast cereals that make it easier to consume the RDA for zinc. However, they also make it easier to consume too much zinc, especially if zinc supplements are also taken. Anyone considering zinc supplementation should accordingly first consider whether their needs could be met by dietary zinc sources and from fortified foods. Intakes between 150 and 450 mg of zinc per day lead to copper deficiency, impaired **iron** function, reduced immune function, and reduced levels of high-density lipoproteins, the "good cholesterol". A few isolated cases of acute zinc toxicity have been reported for food or beverages contaminated with zinc present in galvanized containers. Single doses of 225–450 mg of zinc are known to induce vomiting. Milder gastrointestinal distress has been reported at doses of 50–150 mg/day of supplemental zinc.

## Interactions

The simultaneous administration of zinc supplements and certain antibiotics, such as tetracyclines and quinolones, may decrease absorption of the antibiotic with potential reduction of their action. To prevent this interaction, it is recommended to take the zinc supplements and antibiotics at least two hours apart. Metal chelating agents like penicillamine, used to treat copper overload in Wilson's disease, and diethylenetriamine pentaacetate (DTPA), used to treat iron overload, can lead to severe zinc deficiency. Anticonvulsant drugs, such as **sodium** valproate, may also cause zinc deficiency. The prolonged use of **diuretics** may increase urinary zinc excretion, resulting in increased zinc losses. A medication used to treat tuberculosis, ethambutol, has been shown to increase zinc loss in rats.

Interactions of zinc taken with other supplements are as follows:

- Calcium: May lower zinc absorption in postmenopausal women.
- Iron: May reduce the absorption of both iron and zinc.
- Phosphate salts: May lower the absorption of zinc.
- L-cysteine: May increase the absorption of zinc.
- L-histidine: May also enhance the absorption of zinc.

## Aftercare

In the case of zinc deficiency, oral zinc therapy usually results in the complete disappearance of symptoms, but it must be maintained indefinitely in individuals with the acrodermatitis enteropathica.

Excessive intake can be corrected by bringing levels back to the RDA values.

## Complications

It has been estimated that 82% of pregnant women worldwide are likely to have inadequate zinc intakes. Zinc deficiency has been associated with a number of pregnancy complications, including low birth weight, premature delivery, and labor and delivery complications.

The adverse effects of zinc deficiency on immune system function are also likely to increase complications in children that have infectious diarrhea. Persistent diarrhea contributes to zinc deficiency and malnutrition. Recent research has shown that zinc deficiency may also increase the harmful effects of toxins produced by diarrhea-causing bacteria like *E. coli*. Zinc supplementation in combination with drinking plenty of liquids has also been shown to significantly reduce the duration and severity of childhood diarrhea.

## Parental concerns

Significant delays in growth and weight gain, known as growth retardation or failure to thrive, are common symptoms of mild zinc deficiency in children. But since many of the symptoms associated with zinc deficiency are general and also observed with other medical conditions, parents should not assume that they are due to a zinc deficiency. It is important to consult with a health care professional concerning medical symptoms so that appropriate care can be given.

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American Society for Nutrition (ASN). 9650 Rockville Pike, Bethesda, MD 20814. (301) 634-7050. <http://www.nutrition.org>.

Office of Dietary Supplements, National Institutes of Health. National Institutes of Health, Bethesda, Maryland 20892 USA. <http://ods.od.nih.gov>.

U.S. Department of Agriculture, Food and Nutrition Information Center. National Agricultural Library,10301 Baltimore Avenue, Room 105, Beltsville, MD 20705. (301) 504-5414. <http://www.nal.usda.gov>.

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# Zone diet

## Definition

The Zone diet is a high **protein**, low carbohydrate diet. It is based on the concept that if people eat an ideal balance of **carbohydrates**, proteins, and **fats** at every meal and snack, they will achieve hormonal balance. This will control insulin levels and result in weight loss and health benefits.

## Origins

The Zone diet was developed by Barry Sears. Sears has a Ph. D. in biochemistry, but no special training in nutrition. He began working on this diet in the 1970s. After his father died prematurely of a heart attack at age 53, Sears began studying the role of fats in the development of cardiovascular disease. In 1995, his book *Enter the Zone*, became a bestseller. Since then he has written a dozen books and cookbooks about the Zone diet, established a Web site, and developed a program of home-delivered Zone meals, turning the Zone diet concept into a multi-million dollar business.

## KEY TERMS

**B-complex vitamins**—A group of water-soluble vitamins that often work together in the body. These include thiamine ($B_1$), riboflavin ($B_2$), niacin ($B_3$), pantothenic acid ($B_5$), pyridoxine ($B_6$), biotin ($B_7$ or vitamin H), folate/folic acid ($B_9$), and cobalamin ($B_{12}$).

**Dietary fiber**—Also known as roughage or bulk. Insoluble fiber moves through the digestive system almost undigested and gives bulk to stools. Soluble fiber dissolves in water and helps keep stools soft.

**Dietary supplement**—A product, such as a vitamin, mineral, herb, amino acid, or enzyme, that is intended to be consumed in addition to an individual.

**Eicosanoids**—Hormone-like compounds made from fatty acids. Eicosanoids are thought to affect blood pressure, blood clotting, and inflammation.

**Enzyme**—A protein that change the rate of a chemical reaction within the body without themselves being used up in the reaction.

**Fatty acids**—Complex molecules found in fats and oils. Essential fatty acids are fatty acids that the body needs but cannot synthesize. Essential fatty acids are made by plants and must be present in the diet to maintain health.

**Glucagon**—A hormone made by the alpha cells of the pancreas that helps regulate blood sugar (glucose) levels by signaling liver and muscle cells to release sugar stored as glycogen.

**Glycemic index**—A ranking from 1–100 of how much carbohydrate-containing foods raise blood sugar levels within two hours after being eaten. Foods with a glycemic index of 50 or lower are considered "good."

**Insulin**—A hormone made by the beta cells of the pancreas that controls blood glucose (sugar) levels by moving excess glucose into muscle and liver to store as glycogen.

**Pancreas**—A gland near the liver and stomach that secretes digestive fluid into the intestine and the hormones insulin and glucagon into the bloodstream.

## Description

The Zone diet is designed to promote fat loss and weight loss, but its developer also claims that the diet brings about substantial health benefits. This diet is highly structured. Participants in the Zone diet are instructed that every meal and every snack should consist of 40% carbohydrates, 30% protein, and 30% fats. This produces what Sears considers the ideal ratio of protein to carbohydrate. The protein to carbohydrate ratio of .75, Sears says, allows the body to function at optimal level. He refers to this optimal functioning as being "in the Zone." Being in the Zone claims TO boosts energy, delays signs of aging, helps prevent certain chronic diseases and allows the body to function at peak physical and mental levels. The Zone diet is less concerned with people reaching a specific weight than with reducing body fat. The goal is for men to have only 15% body fat and women 22% body fat.

The amount of food a Zone dieter consumes is based on that person's protein needs. Protein needs are calculated based on height, weight, hip and waist measurements, and activity level. The amount of carbohydrates and fats allowed on the diet derives from the calculation of protein needs. The result is a daily diet that usually ranges from 1,100–1,700 calories. Dietitians consider this a low calorie diet. To simplify meal planning, portions of proteins, carbohydrates, and fats are divided into Zone Food Blocks. Instead of eating a certain number of calories, the dieter eats a specific number of Zone Blocks in the required proportions.

On the Zone diet, foods are either "good" or "bad." Some "good" foods that are allowed (in the proper ratios) include:

- proteins: lean chicken, turkey, and other poultry, seafood, egg whites, and low-fat/non-fat dairy products.
- carbohydrates: fruit, non-starchy vegetables, oatmeal, barley, very small amounts of grains
- fats: small amounts of canola and olive oil.

Some "bad" foods that are restricted include:

- red meat and organ meats such as liver
- egg yolks
- fruits and vegetables: carrots, corn, raisins, bananas, papaya, mango, most fruit juices and many fruits
- bread, cereal, rice, bagels, most baked goods
- potatoes
- whole milk dairy products
- red meat or fatty meats
- caffeinated coffee

- alcohol
- diet soft drinks

Getting the protein :carbohydrate:fat proportions right requires a good bit of measuring and calculating, which can, at least at first, be time consuming and confusing. Zone participants are also instructed to do the following:

- Eat three meals and two snacks daily, all of which meet the 40:30:30 ration of carbohydrates to proteins to fats.
- Eat the first meal of the day within one hour of arising.
- Never allow more than five hours to pass without eating.
- Drink more than 8 cups (64 oz or almost 2 L) of water daily.
- Exercise moderately every day.
- Meditate daily.

## Function

The science behind the Zone diet can be quite complicated and intimidating to someone not trained in biochemistry or nutrition. The explanation Sears gives of why the Zone diet works is based on an interplay of foods, the hormones insulin and glucagon, and hormone-like substances called eicosanoids.

The simplified explanation goes like this. When people eat, the level of glucose (sugar) in their blood increases. How much it increases depends on the foods they eat. "Good" foods with a low glycemic index (below 50) raise blood sugar less quickly than "bad" foods with a high glycemic index (above 65). When blood glucose levels increase, cells in the pancreas release the hormone insulin. This signals cells to convert glucose into a compound called glycogen that is stored in the liver and muscles and facilitates the storage of fat, stored in fat cells. When blood glucose levels go down, different cells in the pancreas release the hormone glucagon. Glucagon signals cells in the liver and muscle to release glycogen, which is converted back into glucose and is burned by the body. If glucose levels continue to be low, fat is also burned for energy.

According to Sears, carbohydrates, especially those with a high glycemic index (e.g. bread, cereal, sweets), cause the pancreas to release a lot of insulin, which in turn causes the body to store a lot of glycogen. Proteins, on the other hand, stimulate the body to release glucagon and burn stored glycogen, so that the body uses more calories.

Sears also says that another group of hormone-like compounds called eicosanoids comes into the food-insulin-glucose-glycogen equation. Eicosanoids are hormone-like substances that affect the immune system, nervous system, and cardiovascular system. "Good" eicosanoids reduce inflammation (irritation) in the walls of the blood vessels and help keep blood cells from clotting. This helps blood vessels stay open and prevents stroke and heart attack. "Bad" eicosanoids do the opposite. They cause inflammation and help blood to clot. Sears believes that increasing the amount of "good" eicosanoids to improve health can be done by following his diet. His books give a more complex explanation of the biochemistry involved in the process of regulating "good" and "bad" eicosanoids. Ultimately, he says that staying "in the Zone" by eating foods in the ideal proportions promotes both burning fat and cardiovascular health.

## Benefits

Barry Sears, developer of the Zone diet says that the makes the following claims for the Zone diet:

- weight loss of 1–1.5 lb (.6–.7 kg) per week.
- permanent weight loss
- improved physical and mental performance.
- prevention of chronic cardiovascular diseases
- improved immune system functioning
- decreased signs of aging and increased longevity
- no need to count calories (count Zone Food Blocks instead)

Many of these benefits are disputed by the dietitians and nutritional research scientists (see below). In addition, staying on the Zone diet while eating in restaurants can be quite difficult. Home delivery of perfectly balanced Zone diet meals and snacks is available at a price of about $37 per day in 2007.

## Precautions

People with reduced kidney function should discuss this diet with their doctor because of the high level of protein. Severely reducing the amount of grains eaten, especially whole grains, may lead to not getting enough dietary **fiber**. Dietary fiber plays an important role in maintaining bowel function. Too little fiber can result in **constipation**.

## Risks

This diet is unlikely to meet the calorie and nutritional needs of children, pregnant women, or **breastfeeding** women, even though Sears suggests that pregnant and breastfeeding women increase their food intake by about 25%. In addition, Sears recommends that people on the Zone diet take **dietary supplements**. He specifically

mentions **calcium** and omega-3 fatty acid supplementation. Other supplements may also be necessary.

## Research and general acceptance

The core of the Zone diet is that everything a person eats should have a balance of 40% carbohydrates, 30% protein, and 30% fats. The 30% fats fits in well with what many dietitians and nutritionists recommend, and Sears emphasizes the use of olive oil and canola oil, both high in monounsaturated fats which are considered good for the body. However, 30% protein is considered high by many nutritionists and 40% carbohydrates is considered low. The federal health guidelines, Dietary Guidelines for Americans 2005, recommend consuming food in the proportions of 55% carbohydrates, 15% protein, and no more than 30% fats. These guidelines also recommend substantial consumption of whole grain products that are severely limited on the Zone diet.

In a review of the Zone diet published in *Journal of the American College of Nutrition* in 2003, the author questions the emphasis placed on the hormonal control of weight. He argues that although it is well documented that carbohydrates stimulate the production of insulin and proteins stimulate the production of glucagon, this occurs only when single nutrients are consumed. In a mixed meal consisting of protein, carbohydrates, and fats, such as those required by the Zone diet, the situation is much more complex and Sear's conclusions about hormonal response are simplistic. In the same article, the author questions the emphasis put on the role of controlling the production of eicosanoids through diet.

The claim that the Zone diet allows individuals to perform at peak physical performance is refuted by several studies by sports nutritionists who feel that limiting carbohydrates can harm athletic performance, especially among endurance athletes.

In an effort to determine which of several popular diets helped people keep weight off, researchers at Tufts-New England Medical Center in Boston assigned a group of volunteers to one of four diets: Atkins, Dean Ornish, **Weight Watchers**, and Zone diet. The found that regardless of the initial amount of weight lost, after one year, losses were only about 5% in all programs, meaning that these diets were all equally ineffective in helping most people keep weight off. These results were published in 2005 in the prestigious *Journal of the American Medical Association*.

In general, dietitians and nutritionists believe that any benefit from the Zone diet comes from the reduction of calories and subsequent weight loss. They tend to feel that the same result can be achieved with a less complicated diet low in fats and high in fruits, vegetables, and whole-grain carbohydrates. They also question whether individuals on the Zone Diet get enough B-complex **vitamins** (found in large quantities in whole grains) without supplementation.

### QUESTIONS TO ASK THE DOCTOR

- Do I have any special dietary needs that this diet might not meet?
- Should I take dietary supplements while on this diet? If so, which ones?
- Is it safe to stay on this diet for a long time?
- Can everyone in my family go on this diet?
- Is there a less complex or less expensive diet that would meet my needs?
- Are the percent of body fat targets this diet sets realistic for me?

## Resources


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American Dietetic Association. 120 South Riverside Plaza, Suite 2000, Chicago, Illinois 60606-6995. Telephone: (800) 877-1600. Website: <http://www.eatright.org>

DrSears.Com Official Zone Web Page. Website: <http://www.drsears.com/>

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# GLOSSARY

## A

**ABDOMEN.** Part of the body that extends from the chest to the groin.

**ABDOMINAL CAVITY.** The hollow part of the body that extends from the chest to the groin. It is located between the diaphragm, which is the thin muscle below the lungs and heart, and the pelvis, the basin-shaped cavity that contains the reproductive organs, bladder, and rectum. The abdominal cavity contains the abdominal organs.

**ABSCESS.** A pocket of pus formed by an infection.

**ABSORPTION.** Uptake by the digestive tract.

**ACCEPTABLE DAILY INTAKE (ADI).** The level of a substance that a person can consume every day over a lifetime without risk. The ADIs for artificial sweeteners are very conservative measurements.

**ACCEPTABLE MACRONUTRIENT DISTRIBUTION RANGE (AMDR).** A range of intakes for a particular energy source that is associated with reduced risk of chronic disease while providing adequate intakes of essential nutrients. An AMDR is expressed as a percentage of total energy intake.

**ACESULFAME POTASSIUM.** A calorie-free artificial sweetener, also known as Acesulfame K or Ace K, and marketed under the trade names Sunett and Sweet One. Acesulfame potassium is 180-200 times sweeter than sucrose (table sugar), as sweet as aspartame, about half as sweet as saccharin, and one-quarter the sweetness of sucralose. Like saccharin, it has a slightly bitter aftertaste, especially at high concentrations. Kraft Foods has patented the use of sodium ferulate to mask acesulfame's aftertaste. Alternatively, acesulfame K is often blended with other sweeteners (usually sucralose or aspartame)

**ACIDOPHILUS.** Bacteria found in yogurt that, when ingested, helps restore the normal bacterial populations in the human digestive system.

**ACIDOSIS.** Excessive acidity of body fluids due to accumulation of acids.

**ACNE VULGARIS.** An inflammatory disease of the skin characterized by pimples and cysts that may cause scarring in severe cases.

**ACQUIRED IMMUNE DEFICIENCY SYNDROME (AIDS).** HIV infection that has led to certain opportunistic infections, cancers, or a CD4+ T-lymphocyte (helper cell) blood cell count lower than 200/mL.

**ACRODERMATITIS ENTEROPATHICA.** A genetic disorder resulting from the impaired uptake and transport of zinc in the body.

**ACUTE RETROVIRAL SYNDROME (ARS).** A syndrome that develops in about 30% of HIV patients within a few weeks of infection. ARS is characterized by nausea, vomiting, fever, headache, general tiredness, and muscle cramps.

**ACUTE.** Acute means sudden or severe. Acute symptoms appear, change, or worsen rapidly. It is the opposite of chronic.

**ADHD.** The combination of inattentive, hyperactive and impulsive behavior that are severe, developmentally inappropriate and impair function at home and in school. Common features include mood swings, anxiety, impulsivity, hostility, poor concentration and sleep problems as well as physical complaints such as stomach aches, headaches and migraines.

**ADIPOSE TISSUE.** A type of connective tissue that contains stored cellular fat.

**ADRENALINE.** Hormone produced by the adrenal glands that increases heart and respiration rates.

**AEROBIC EXERCISE.** Moderate intensity exercise, done over a long duration, that uses oxygen. Aerobic

exercise strengthens the cardiovascular system and lungs.

**AETIOLOGY.** This refers to the cause of a disease.

**AFTER-BURN.** The increased rate of body metabolism that lasts for several hours after a session of vigorous exercise.

**AGGLUTINATION.** The clumping or clotting of cells.

**AHIMSA.** A Sanskrit word for non-killing and non-harming, adopted by the American Vegan Society as its official watchword. The AVS notes that the six letters in ahimsa stand for the basic principles of veganism: Abstinence from animal products; Harmlessness with reverence for life; Integrity of thought, word, and deed; Mastery over oneself; Service to humanity, nature, and creation; and Advancement of understanding and truth.

**ALBUMEN.** The white of the egg. It can be separated from the yolk for cooking or to avoid the high fat and high cholesterol content of the yolk.

**ALBUMIN.** Water-soluble proteins that can be coagulated by heat and are found in egg white, blood serum, milk.

**ALGAE (SING., ALGA).** Any of numerous groups of one-celled organisms containing chlorophyll. Spirulina is a blue-green alga.

**ALKALOID.** An organic, compound found in plants; chemically it is a base and usually contains at least one nitrogen atom.

**ALLERGEN.** Any substance that produces an allergic reaction.

**ALPHA-LINOLENIC ACID (ALA).** A polyunsaturated omega-3 fatty acid found primarily in seed oils (canola oil, flaxseed oil, and walnut oil), purslane and other broad-leaved plants, and soybeans. ALA is thought to lower the risk of cardiovascular disease.

**ALTERNATIVE MEDICINE.** A system of healing that rejects conventional, pharmaceutical-based medicine and replaces it with the use of dietary supplements and therapies such as herbs, vitamins, minerals, massage, and cleansing diets. Alternative medicine includes well-established treatment systems such as homeopathy, Traditional Chinese Medicine, and Ayurvedic medicine, as well as more-recent, fad-driven treatments.

**ALZHEIMER'S DISEASE.** A progressive, incurable condition that destroys brain cells, gradually causing loss of intellectual abilities, such as memory, and extreme changes in personality and behavior.

**AMARANTH.** An herb cultivated as a food crop in Mexico and South America. Its grains can be toasted and mixed with honey or molasses as a vegetarian treat.

**AMENORRHEA.** Absence or suppression of normal menstrual periods in women of childbearing age, usually defined as three to six missed periods.

**AMINO ACID.** These compounds are the building blocks of protein. Some amino acids can be synthesised by the body but some cannot. The latter are referred to as essential amino acids and therefore must be obtained from protein in the diet.

**AMOEBA.** A single-celled organism, many species of which live in free in water.

**AMOEBIC DYSENTERY.** Disease characterized by severe diarrhea, caused by infection of the gut by *Entamoeba histolytica*.

**AMPHETAMINES.** Stimulant drugs whose effects are very similar to cocaine.

**AMYLOIDOSIS.** Condition characterized by accumulation in body tissues of deposits of abnormal proteins (amyloids) produced by cells. Amyloidosis can lead to kidney disease.

**ANABOLIC.** Pertaining to the putting together of complex substances from simples ones, especially to the building of muscle protein from amino acids.

**ANABOLIC STEROID.** A group of synthetic hormones that promote the storage of protein and the growth of tissue, sometimes used by athletes to increase muscle size and strength.

**ANAEMIA.** Anaemia refers to a reduction in the quantity of the oxygen-carrying pigment haemoglobin in the blood. The main symptoms of anaemia are excessive tiredness and fatigability, breathlessness on exertion, pallor and poor resistance to infection.

**ANAEROBIC.** Without air, or oxygen.

**ANAEROBIC EXERCISE.** Brief, strength-based activity, such as sprinting or weight training, in which anaerobic (without oxygen) metabolism occurs in the muscles.

**ANAL FISSURE.** A crack or slit that develops in the mucous membrane of the anus, often as a result of a constipated person pushing to expel hardened stool. Anal fissures are quite painful and difficult to heal.

**ANALGESIC.** A substance capable of producing analgesia, meaning one that relieves pain.

**ANAPHYLAXIS (ANAPHYLACTIC SHOCK).** A severe and potentially fatal systemic allergic reaction characterized by itching, hives, fainting, and respiratory symptoms. Sulfites may trigger anaphylaxis in a small number of people who are unusually sensitive to them.

**ANECDOTAL EVIDENCE.** A category of medical or dietary evidence based on or consisting of individual reports, usually written by observers who are not doctors or scientists.

**ANEMIA.** Low level of red blood cells in the blood.

**ANGINA PECTORIS.** Chest pain or discomfort. Angina pectoris is the more common and stable form of angina. Stable angina has a pattern and is more predictable in nature, usually occurring when the heart is working harder than normal.

**ANORECTIC.** A drug which suppresses the appetite.

**ANOREXIA NERVOSA.** A psychiatric disorder signified by obsession with weight loss and voluntary self-starvation accompanied by serious, potentially fatal health problems.

**ANOREXIANT.** A drug that causes loss of appetite.

**ANTHROPOLOGICAL.** Pertaining to anthropology or the study or the natural and cultural history of humans.

**ANTIANEMIC.** Preventing or curing anemia, a condition characterized by a lower than normal count of red blood cells.

**ANTIBIOTIC.** A drug that kills bacteria and other germs.

**ANTIBODY.** A protein produced by the body's immune system that recognizes and helps fight infections and other foreign substances in the body.

**ANTICOAGULANTS.** Blood thinners.

**ANTIDEPRESSANTS.** Drugs used primarily to treat depression.

**ANTIEMETIC.** Agents that prevent nausea and vomiting.

**ANTIFUNGAL.** Substance that prevents the growth of fungi.

**ANTIGEN.** A substance that is foreign to the body and invokes an immune response.

**ANTIHISTAMINE.** Medication that stops the action of histamines.

**ANTIHYPERLIPIDEMIC.** Substance used in the treatment of very high serum triglyceride levels.

**ANTI-INFLAMMATORY.** Medication such as aspirin or Ibuprophen that reduces swelling.

**ANTIMICROBIAL.** Substance that prevents the growth of microorganisms including bacteria, viruses and fungi.

**ANTIMUTAGENIC.** Substance that protects against genetic mutation.

**ANTINOCICEPTIVE.** Substance that reduces sensitivity to painful stimuli.

**ANTIOXIDANT.** A molecule that prevents oxidation. In the body antioxidants attach to other molecules called free radicals and prevent the free radicals from causing damage to cell walls, DNA, and other parts of the cell.

**ANTIOXIDATIVE.** A substance that inhibits oxidation.

**ANTIPYRETIC.** An agent that reduces or prevents fever.

**ANTISEPTIC.** Medicine used to control infection.

**ANTITUSSIVE.** Preventing or relieving cough.

**ANUS.** The opening from the rectum to the outside of the body through which stools pass. The opening and closing of the anus is controlled by a strong ring of muscles under somewhat voluntary control.

**APPETITE SUPPRESSANT.** Drug that decreases feelings of hunger. Most work by increasing levels of serotonin or catecholamine, chemicals in the brain that control appetite.

**ARTERY.** A blood vessel that carries blood from the heart to the body.

**ARTHRITIS (PLURAL, ARTHRITIDES).** A general term for the inflammation of a joint or a condition characterized by joint inflammation.

**ASCITES.** Abnormal accumulation of fluid in the abdominal cavity.

**ASD.** Autistic Spectrum Disorder (ASD) refers to the features of individuals who have a degree of the condition known as autism. Autism is a serious developmental disorder characterised by profound deficits in language, communication, socialization and resistance to learning.

**ASSOCIATION.** In psychology, a connection between two ideas, actions, or psychological phenomena through learning or experience. The Shangri-la diet is based in part on the notion that humans eat more than they

need to in the modern world because of a strong association between food flavors and calories.

**ASTHMA.** A respiratory disorder marked by wheezing, shortness of breath, and mucus production.

**ASTRINGENT.** A substance that reduces secretions, dries and shrinks tissue, and helps control bleeding.

**ATHEROSCLEROSIS.** Clogging, narrowing, and hardening of the large arteries and medium-sized blood vessels. Atherosclerosis can lead to stroke, heart attack, eye problems and kidney problems.

**ATP.** Adenosine triphosphate, a high-energy phosphate molecule required to provide energy for cellular function. The energy source of muscles for short bursts of power.

**AUTISM.** A brain disorder that begins in early childhood and persists throughout adulthood. It affects three important areas of development: communication, social interaction, and creative or imaginative play.

**AUTOIMMUNE DISEASE.** An illness that occurs when the body tissues are attacked by its own immune system.

**AUTO-IMMUNITY.** A response, involving the immune system, that results in a person's own tissues being attacked.

**AUTOINTOXICATION.** A belief, now discredited, that the contents of the intestine are toxic and produce poisons that can damage other body organs.

**AUTONOMIC NERVOUS SYSTEM.** The part of the nervous system that innervates the smooth muscle of the viscera, the heart, and glandular tissue, and governs the body's involuntary functions and responses.

**AUTOSOMAL RECESSIVE.** A term used to describe a pattern of genetic inheritance in which a child receives two copies of a defective gene, one from each parent, on an autosome (a nonsex chromosome). MSUD is an autosomal recessive disorder.

**AVOCADO SOYBEAN UNSAPONIFIABLES (ASU).** A compound of the fractions of avocado oil and soybean oil that cannot be used in the production of soap. ASU shows promise in the treatment of OA. It is available only by prescription in France, where it was first studied, but can be purchased over the counter in the United States.

**AYURVEDA.** The traditional system of natural medicine that originated in India around 3500 BC. Its name is Sanskrit for "science of long life." Some people have tried Ayurvedic medicines and dietary recommendations in the treatment of arthritis.

## B

**BACTERIA.** Microscopic, single-celled organisms found in air, water, soil, and food. Only a few actually cause disease in humans.

**BACTERICIDAL.** A state that prevents growth of bacteria.

**BARBERRY.** A shrub native to southern Europe and western Asia that produces oblong red berries that have a sour taste. Barberry has been used as a natural treatment for giardiasis.

**BARIATRICS.** A medical specialty that deals with weight management and the treatment of obesity.

**BARRETT'S SYNDROME.** Also called Barrett's esophagus or Barrett's epithelia, this is a condition where the squamous epithelial cells that normally line the esophagus are replaced by thicker columnar epithelial cells.

**BASAL METABOLIC RATE.** The number of calories the body burns at rest to maintain normal body functions.

**BATERIOSTATIC.** A substance that kills bacteria.

**B-COMPLEX VITAMINS.** A group of water-soluble vitamins that often work together in the body. These include thiamine ($B_1$), riboflavin ($B_2$), niacin ($B_3$), pantothenic acid ($B_5$), pyridoxine ($B_6$), biotin ($B_7$ or vitamin H), niacin/folic acid ($B_9$), and cobalamin ($B_{12}$).

**BEAVER FEVER.** An informal name for giardiasis, so called because beavers are a common animal reservoir of the parasite that causes giardiasis.

**BEHAVIOR MODIFICATION.** Changing an individual's behavior through positive and negative responses to achieve a desired result.

**BEHAVIOR THERAPY.** A non-biological form of therapy that developed largely out of learning theory research and is normally applied to the treatment of specific maladaptive behavior patterns.

**BENIGN.** Mild, does not threaten health or life. When referring to a tumor, it generally means noncancerous.

**BENZOIC ACID.** A type of preservative used in processed foods known to cause food sensitivity in some individuals when consumed in the diet.

**B-GROUP VITAMINS.** Group of eight water-soluble vitamins that are often present as a single, vitamin complex in many natural sources, such as rice, liver and yeast.

**BILE ACIDS.** Produced by the liver, from cholesterol, for the digestion and absorption of fat.

**BILE DUCTS.** Tubes that carry bile from the liver to the gallbladder for storage and to the small intestine for use in digestion.

**BILE.** Fluid made by the liver and stored in the gallbladder. Bile helps break down fats and gets rid of wastes in the body.

**BINGE DRINKING.** Usually used to refer to heavy drinking over an evening or similar time span. Sometimes also referred to as heavy episodic drinking.

**BINGE EATING DISORDER.** A mental eating disorder that features the consumption of large amounts of food in short periods of time.

**BIOAVAILABILITY.** Availability to living organisms, based on chemical form.

**BIODIVERSITY.** The presence of many different species of plants and animals within a limited geographical region.

**BIOELECTRICAL IMPEDANCE ANALYSIS (BIA).** A technique for evaluating body composition by passing a small amount of electrical current through the body and measuring the resistance of different types of tissue.

**BIOFEEDBACK.** A technique for improving awareness of internal bodily sensations in order to gain conscious control over digestion and other processes generally considered to be automatic.

**BIOMOLECULE.** Any organic molecule that is an essential part of a living organism.

**BIPOLAR DISORDER.** A psychiatric disorder marked by alternating episodes of mania and depression.

**BLAND DIET.** A diet that is free of irritating or stimulating foods.

**BLOOD BRAIN BARRIER.** A physiological mechanism that alters the permeability of brain capillaries, so that some substances, such as certain drugs, are prevented from entering brain tissue, while other substances are allowed to enter freely.

**BLOOD CHOLESTEROL.** Cholesterol is a molecule from which hormones, steroids and nerve cells are made. It is an essential molecule for the human body and circulates in the blood stream. Between 75 and 80% of the cholesterol that circulates in a person's bloodstream is made in that person's liver. The remainder is acquired from animal dietary sources. It is not found in plants. Normal blood cholesterol level is a number obtained from blood tests. A normal cholesterol level is defined as less than 200 mg of cholesterol per deciliter of blood.

**BLOOD DOPING.** Practice of illicitly boosting the number of red blood cells in the circulation in order to enhance athletic performance.

**BLOOD PLASMA.** The pale yellowish, protein-containing fluid portion of the blood in which cells are suspended. 92% water, 7% protein and 1% minerals.

**BODY DYSMORPHIC DISORDER.** A mental disorder involving extreme preoccupation with some feature of one's appearance. Excessive time spent in physical exercise, often involving bodybuilding or weight-lifting practices, is a common symptom of the disorder in adolescents.

**BODY MASS INDEX.** Also known as BMI, the index determines whether a person is at a healthy weight, underweight, overweight, or obese. The BMI can be calculated by converting the person's height into inches. That amount is multiplied by itself and then divided by the person's weight. That number is then multiplied by 703. The metric formula for the BMI is the weight in kilograms divided by the square of height in meters.

**BODYBUILDING.** Developing muscle size and tone, usually for competitive exhibition.

**BONE MINERAL DENSITY (BMD).** Test used to measure bone density and usually expressed as the amount of mineralized tissue in the area scanned (g/cm2). It is used for the diagnosis of osteoporosis.

**BORDERLINE PERSONALITY DISORDER.** A serious mental illness characterized by ongoing instability in moods, interpersonal relationships, self-image, and behavior.

**BOTANICAL.** An herb; a dietary supplement derived from a plant.

**BOTULISM.** A potentially deadly disease characterized by respiratory and musculoskeletal paralysis caused by a bacterium called *Clostridium botulinum*. Botulism is a medical emergency. Nitrites are sometimes used to prevent the growth of *C. botulinum* spores in meat and smoked fish.

**BRAN.** The outer layer of cereal kernel that contains fiber and nutrients. It is removed during the refining process.

**BRANCHED-CHAIN ALPHA-KETO ACID DEHYDROGENASE (BCKD).** The chemical name of the enzyme that is missing or partially inactivated in patients with maple syrup urine disease (MSUD).

**BROWN ADIPOSE TISSUE.** BAT; brown fat; a heat-producing tissue found primarily in human fetuses and infants and hibernating animals.

**BULIMIA.** Also called bulimia nervosa, an eating disorder characterized by binges, or eating much food in little time, followed by purging behaviors, such as throwing up or taking laxatives.

## C

**CAFFEINE.** A plant alkaloid found in coffee, tea, hot chocolate, and some soft drinks that functions as a diuretic as well as a central nervous system stimulant.

**CALCIUM.** Calcium is a mineral present in large quantities in the body, mainly in the bones and teeth. A deficiency of calcium in the diet can increase risk of osteoporosis. Rich sources of calcium include mil, cheese, yoghurt and tofu.

**CALCIUM CARBONATE.** A salt that is used in many antacids.

**CALORIC.** Relating to heat or calories, also, full of calories, and so likely to be fattening.

**CALORIE.** A unit of food energy. In nutrition terms, the word calorie is used instead of the scientific term kilocalorie which represents the amount of energy required to raise the temperature of one liter of water by one degree centigrade at sea level. In nutrition, a calorie of food energy refers to a kilocalorie and is therefore equal to 1000 true calories of energy.

**CALORIE REDUCTION.** A decrease in the number of calories that a person consumes.

**CARBOHYDRATE.** A nutrient that the body uses as an energy source. A carbohydrate provide 4 calories of energy per gram.

**CARBOHYDRATE ADDICTION.** A compelling hunger, craving, or desire for foods high in carbohydrates, or an escalating and recurring need for starchy foods, snack foods, junk foods, and sweets.

**CARBOXYL GROUP.** The carbon atom at the end of a fatty acid hydrocarbon chain is attached by a double bond to oxygen and by a single bond to hydrogen forming the chemical structure carboxyl.

**CARCINOGEN.** A cancer-causing substance.

**CARDIAC ARRHYTHMIA.** A group of conditions in which the muscle contraction of the heart is irregular or is faster or slower than normal.

**CARDIOVASCULAR.** Pertaining to the heart and blood vessels.

**CARDIOVASCULAR DISEASE.** This describes medical conditions that relate to disease of the heart and circulatory system ( blood vessels) such as angina, heart attacks and strokes.

**CARIES.** Cavities in the teeth.

**CARMINATIVE.** A substance that stops the formation of intestinal gas and helps expel gas that has already formed.

**CARNITINE.** This is a naturally occurring substance, needed for the oxidation of fatty acids, a deficiency of which is known to have major adverse effects on the CNS.

**CARNIVORE.** An animal whose diet consists mostly or entirely of meat. Cats, wolves, snakes, birds of prey, frogs, sharks, spiders, seals, and penguins are all carnivores.

**CAROTENOID.** Fat-soluble plant pigments, some of which are important to human health.

**CARRIER.** A person who harbors an infectious agent or a defective gene without showing clinical signs of disease themselves and who can transmit the infection to others or the defective gene to their children.

**CATABOLISM.** The breakdown of complex molecules.

**CATARACT.** A condition where the lens of the eye becomes cloudy.

**CECUM.** The pouch-like start of the large intestine that links it to the small intestine.

**CELIAC DISEASE.** A digestive disease that causes damage to the small intestine. It results from the ability to digest gluten found in wheat, rye, and barley.

**CELL DIFFERENTIATION.** The process by which stem cells develop into different types of specialized cells such as skin, heart, muscle, and blood cells.

**CELLULITE.** Fat deposited in pockets just below the surface of the skin around the hips, thighs, and buttocks.

**CENTRAL NERVOUS SYSTEM (CNS).** The central nervous system (CNS) is composed of the brain and spinal cord. The brain receives sensory information

from the nerves that pass through the spinal cord, as well as other nerves such as those from sensory organs involved in sight and smell. Once received, the brain processes the sensory signals and initiates responses.

**CERULOPLASMIN.** A blue copper containing dehydrogenase protein found in serum that is apparently involved in copper detoxification and storage.

**CERUMEN.** The waxy substance secreted by glands in the external ear canal.

**CHELATING AGENT.** An organic compound in which atoms form more than one bond with metals in solution.

**CHEMOTHERAPY.** Treatment of cancer with drugs.

**CHOLELITHIASIS.** The medical term for gallstones. People on a VLCD have an increased risk of developing gallstones from an increase of cholesterol content in the bile produced by the liver.

**CHOLESTEROL.** A waxy substance made by the liver and also acquired through diet. High levels in the blood may increase the risk of cardiovascular disease.

**CHOLINE.** A compound found in egg yolks and legumes that is essential to liver function.

**CHONDROITIN SULFATE.** A compound found naturally in the body that is part of a large protein molecule (proteoglycan) helping cartilage to retain its elasticity. Chondroitin sulfate derived from animal or shark cartilage can be taken as a dietary supplement by people with OA.

**CHROMIUM.** An essential mineral that must be obtained from the diet and is important for the metabolism of fats and carbohydrates and for insulin metabolism, as well as for many enzymatic reactions in the body.

**CHRONIC.** Chronic refers to a symptom or disease that continues or persists over an extended period of time.

**CHRONIC DISEASE.** An illness or medical condition that lasts over a long period of time and sometimes causes a long-term change in the body.

**CHRONIC RENAL DISEASE.** The permanent loss of kidney function.

**CHYLOMICRONEMIA.** An excess of chylomicrons in the blood.

**CHYLOMICRONS.** Intestinal triglycerides.

**CIRRHOSIS.** A life-threatening disease that scars liver tissue and damages its cells. It severely affects liver function, preventing it from removing toxins like alcohol and drugs from the blood.

***CIS* FORMATION.** The arrangement of atoms where hydrogen atoms sit on the same side of the carbon to carbon double bond.

**CLAUDICATION.** Tiredness and pain in the leg muscles that occur when walking and disappear with rest. The cause is inadequate supply of oxygen to the muscle usually caused by clogged blood vessels.

**CLOZE TESTS.** Tests of language proficiency and what they measure.

**COCHRANE REVIEWS.** Evaluations based on the best available information about healthcare interventions. They explore the evidence for and against the effectiveness and appropriateness of treatments in specific circumstances.

**COENZYME.** Also called a cofactor, a small nonprotein molecule that binds to an enzyme and catalyzes (stimulates) enzyme-mediated reactions.

**COFACTOR.** A compound that is essential for the activity of an enzyme.

**COGNITIVE BEHAVIORAL THERAPY (CBT).** An approach to psychotherapy based on modifying the patient's day-to-day thoughts and behaviors, with the aim of changing long-standing emotional patterns. Some people consider CBT a useful or even necessary tool in maintaining long-term weight reduction.

**COLLAGEN.** A long fiber-like protein found in skin, bones, blood vessels, and connective tissue such as tendons and ligaments.

**COLON.** Part of the large intestine, located in the abdominal cavity. It consists of the ascending colon, the transverse colon, the descending colon, and the sigmoid colon.

**COLON POLYPS.** Extra tissue that grows in the colon.

**COLONIC.** Sometimes called colonic hydrotherapy, a colonic is a procedure similar to an enema in which the patient's colon is irrigated (washed out) with large amounts of water. Some people undergoing a detoxification diet have one or more colonics to remove fecal matter remaining in the intestines during the diet; however, this procedure is discouraged by mainstream physicians because of its potential risks to health.

**COMPLEMENTARY MEDICINE.** Includes many of the same treatments used in alternative medicine, but uses them to supplement conventional drug and therapy treatments, rather than to replace conventional medicine.

**COMPLEX CARBOHYDRATES.** Starches; polysaccharides that are made up of hundreds or thousands of monosaccharides or single sugar units; found in foods such as rice and pasta.

**CONDITIONING.** In psychology, the process of acquiring, developing, or establishing new associations and responses in a person or animal. The author of the Shangri-la diet believes that modern food products condition people to make an association between the flavors in the foods and calorie intake.

**CONJUGATED LINOLENIC ACID.** A fatty acid suggested to have health benefits.

**CONSTIPATION.** Abnormally delayed or infrequent passage of feces. It may be either functional (related to failure to move the bowels) or organic (caused by another disease or disorder).

**CONTAMINATION.** The undesired occurrence of harmful microorganisms or substances in food.

**CONTROLLED FATIGUE TRAINING (CFT).** The Warrior diet's term for a structured exercise program that trains the body to resist fatigue as well as improve strength, speed, and other performance capabilities.

**CONVENTIONAL MEDICINE.** Mainstream or Western pharmaceutical-based medicine practiced by medical doctors, doctors of osteopathy, and other licensed health care professionals.

**CORONARY ARTERY.** The arteries that supply blood to the tissues of the heart from the aorta.

**CORONARY HEART DISEASE.** A progressive reduction of blood supply to the heart muscle due to narrowing or blocking of a coronary artery.

**CORTISOL.** Hydrocortisone; a glucocorticoid that is produced by the adrenal cortex and regulates various metabolic processes and has anti-inflammatory and immunosuppressive properties. Blood levels may become elevated in response to stress.

**COUSCOUS.** A North African food consisting of steamed semolina—milled durum wheat—that is also used to make pasta.

**CRAN-WATER.** A diuretic drink consisting of one part unsweetened cranberry juice in four parts filtered water.

**C-REACTIVE PROTEIN (CRP).** a marker of inflammation circulating in the blood has been proposed as a method to identify persons at risk of these diseases.

**CREATINE.** An organic acid formed and stored in the body that supplies energy to muscle cells. Meat and fish are good dietary sources of creatine.

**CRETINISM.** Arrested mental and physical development.

**CROHN'S DISEASE.** Inflammatory disease that usually occurs in the last section of the small intestine (ileum), causing swelling in the intestines. It can also occur in the large intestine.

**CROSS-CONTAMINATION.** The transfer of harmful bacteria from one food to another, or also from hands to food.

**CYTOCHROMES.** Complex proteins within cell membranes that carry out electron transport. Grapefruit juice interferes with the functioning of an enzyme belonging to the cytochrome P-450 group.

## D

**DEAMINATION.** removal of an $NH_2$ group from a molecule

**DEEP VEIN THROMBOSIS (DVT).** Blockage of the deep veins; particularly common in the leg.

**DEGENERATIVE DISORDERS.** A condition leading to progressive loss of function.

**DEHYDRATION.** A condition of water loss caused by either inadequate intake of water or excessive loss of water as through vomiting or diarrhea.

**DEMULCENT.** A substance that soothes irritated tissue, especially mucous membranes.

**DEOXYRIBONUCLEIC ACID (DNA).** A nucleic acid molecule in a twisted double strand, called a double helix, that is the major component of chromosomes. DNA carries genetic information and is the basis of life.

**DERMATOLOGIST.** A physician that specializes in conditions of the skin.

**DESICCATION.** Drying or dehydrating food as a method of preservation.

**DETOXIFICATION.** Detox; cleansing; to remove toxins or poisons from the body.

**DETOXIFICATION DIETS.** A group of diets that are followed in order to purify the body of heavy metals, toxic chemicals, harmful microbes, the waste products of digestion, and other substances held to be harmful. Juice fasts are one type pf detoxification diet.

**DEXFENFLURAMINE.** An anorectic drug formerly marketed under the brand name Redux.

**DHA.** A long-chain omega-3 fatty acid found primarily in oily fish. It is important for the development of the brain and the retina of the eye.

**DIABETES MELLITUS.** A condition in which the body either does not make or cannot respond to the hormone insulin. As a result, the body cannot use glucose (sugar). There are two types, type 1 or juvenile onset and type 2 or adult onset.

**DIABETIC PERIPHERAL NEUROPATHY.** A condition where the sensitivity of nerves to pain, temperature, and pressure is dulled, particularly in the legs and feet.

**DIABETIC RETINOPATHY.** A condition where the tiny blood vessels to the retina, the tissues that sense light at the back of the eye, are damaged, leading to blurred vision, sudden blindness, or black spots, lines, or flashing lights in the field of vision.

**DIALYSIS.** A method of artificial kidney function used to remove waste products or other substances from the patient's body fluids. In the case of patients with MSUD, dialysis may be used to remove BCAAs from the patient's body during an acute episode requiring hospitalization.

**DIAPHORETIC.** An agent that promotes sweating.

**DIETARY APPROACHES TO STOP HYPERTENSION (DASH).** Study in 1997 that showed a diet rich in fruits, vegetables and low fat dairy foods, with reduced saturated and total fat can substantially lower blood pressure.

**DIETARY DEFICIENCY.** Lack or shortage of certain vitamins or minerals within the diet that can result in illnesses.

**DIETARY FIBER.** Also known as roughage or bulk. Insoluble fiber moves through the digestive system almost undigested and gives bulk to stools. Soluble fiber dissolves in water and helps keep stools soft.

**DIETARY GUIDELINES FOR AMERICANS.** Dietary guidelines published every five years since 1980 by the Department of Health and Human Services (HHS) and the U.S. Department of Agriculture (USDA). They provide authoritative advice for people two years and older about how good dietary habits can promote health and reduce risk for major chronic diseases. They serve as the basis for federal food and nutrition education programs.

**DIETARY SUPPLEMENT.** A product, such as a vitamin, mineral, herb, amino acid, or enzyme, that is intended to be consumed in addition to an individual's diet with the expectation that it will improve health.

**DIETITIAN.** A health care professional who specializes in individual or group nutritional planning, public education in nutrition, or research in food science. To be licensed as a registered dietitian (RD) in the United States, a person must complete a bachelor's degree in a nutrition-related field and pass a state licensing examination. Dietitians are also called nutritionists.

**DIGESTION.** The process by which food is chemically converted into nutrients that can be absorbed and used by the body.

**DIGESTIVE ENZYMES.** Molecules that catalyze the breakdown of large molecules (usually food) into smaller molecules.

**DIGESTIVE SYSTEM.** Organs and paths responsible for processing food in the body. These are the mouth, the esophagus, the stomach, the liver, the gallbladder, the pancreas, the small intestine, the large intestine, and the rectum.

**DIGESTIVE TRACT.** The tube connecting and including the organs and paths responsible for processing food in the body. These are the mouth, the esophagus, the stomach, the liver, the gallbladder, the pancreas, the small intestine, the large intestine, and the rectum.

**DIPHENHYDRAMINE HYDROCHLORIDE (BENADRYL).** An antihistamine that relieves allergy symptoms.

**DISACCHARIDE.** Any of a class of sugars, including lactose and sucrose, that are composed of two monosaccharides.

**DISEASE-MODIFYING ANTIRHEUMATIC DRUGS (DMARDS).** A class of prescription medications given to patients with rheumatoid arthritis that suppress the immune system and slow the progression of RA.

**DISTRACTIBILITY.** Inability to concentrate or attend to the task on hand; inattentiveness.

**DIURETIC.** A substance that removes water from the body by increasing urine production.

**DIVERTICULA.** Small pouches in the muscular wall of the large intestine.

**DIVERTICULAR DISORDERS.** Disorders that involve the development of diverticula.

**DIVERTICULITIS.** Inflammation of the small pouches (diverticula) that can form in the weakened muscular wall of the large intestine.

**DIVERTICULOSIS.** A condition in which pouch-like bulges or pockets (diverticula) develop along the digestive tract. Normally, these pouches don't cause any problems but may become inflamed or infected (diverticulitis).

**DOPAMINE.** A neurotransmitter and precursor of norepinephrine; found in high concentrations in the brain.

**DOPING.** The use of performance-enhancing drugs in sports competition, including anabolic steroids and other substances banned by most international sports organizations. The English word is thought to come from the Dutch *dop*, which was the name of an alcoholic beverage drunk by Zulu warriors before a battle.

**DUODENUM.** The first section of the small intestine, extending from the stomach to the jejunum, the next section of the small intestine.

**DYSBIOSIS.** The general term to describe the overgrowth of undesirable microflora in the intestines.

**DYSLEXIA.** An inherent dysfunction affecting the language centers of the brain that results in difficulties with reading and writing.

**DYSLIPIDEMIA.** A disorder of lipoprotein metabolism, including lipoprotein overproduction or deficiency. Dyslipidemias may be manifested by elevation of the total cholesterol, the "bad" low-density lipoprotein (LDL) cholesterol and the triglyceride concentrations, and a decrease in the "good" high-density lipoprotein (HDL) cholesterol concentration in the blood.

**DYSPRAXIA.** A developmental disorder that affects coordination and movement.

## E

**EDEMA.** Abnormal and excessive accumulation of fluid in body tissues or certain cavities of the body. Edema is a symptom of a number of different kidney, liver, and circulatory disorders and is commonly treated with diuretics.

**EICOSANOIDS.** Hormone-like compounds made from fatty acids. Eicosanoids are thought to affect blood pressure, blood clotting, and inflammation.

**ELECTROLYTE.** Any of several chemicals dissolved in blood and other body fluids that are capable of conducting an electric current. The most important electrolytes in humans and other animals are sodium, potassium, calcium, magnesium, chloride, phosphate, and hydrogen carbonate.

**ELECTRON.** A component of an atom or molecule. It has a negative charge when a free or unpaired electron exists making it chemically unstable and likely to initiate chemical reactions.

**ELIMINATION DIET.** A diet in which the patient excludes a specific food (or group of foods) for a period of time in order to determine whether the food is responsible for symptoms of an allergy or other disorder. Elimination diets are also known as food challenge diets.

**EMETIC.** A medicine that induces nausea and vomiting.

**EMOLLIENT.** An agent that softens and soothes the skin when applied locally.

**EMOTIONAL EATING.** Term for eating to alter mood or relieve stress, boredom, or loneliness.

**ENDOCRINOLOGIST.** A medical specialist who treats diseases of the endocrine (glands) system, including diabetes.

**ENDOGENOUS.** With no apparent external cause, originating within the organism or tissue.

**ENDOSCOPE.** A special tube-shaped instrument that allows a doctor to examine the interior of or perform surgery inside the stomach or intestines. An examination of the digestive system with this instrument is called an endoscopy.

**ENEMA.** The injection of liquid through the anus into the rectum in order to soften hardened stools.

**ENERGY BALANCE.** The number of calories burned in an hour versus the number of calories taken in.

**ENERGY DENSITY.** The calories in a given portion of food.

**ENRICHMENT.** The addition of vitamins and minerals to improve the nutritional content of a food.

**ENTEROPATHY.** A disease of the intestinal tract.

**ENZYME.** A protein that change the rate of a chemical reaction within the body without themselves being used up in the reaction.

**EPHEDRINE.** Central nervous system stimulant that that increases serum levels of norepinephrine. The herbs ma huang, ephedra sinica and sida cordifolia contain ephedrine, which structurally is similar to amphetamines.

**EPIDEMIOLOGICAL STUDIES.** These studies look at factors affecting the health and illness of populations.

**EPIDEMIOLOGIST.** A scientist or medical specialist who studies the origins and spread of diseases in populations.

**EPIGENETIC.** A modification of gene expression that is independent of the DNA sequence of the gene.

**EPILEPSY.** A disorder of the brain that results in recurrent, unprovoked seizures.

**EPINEPHRINE.** (also called adrenaline) A hormone released by the body during times of stress, it increase heart rate and blood pressure. As a medication, it may be used to constrict blood vessels, relax breathing tubes, and as a treatment for anaphylaxis.

**EPI-PEN.** A the brand name of the auto–injectable form of epinephrine. Used to stop or prevent anaphylaxis after expose to an allergen.

**EPITHELIAL CELL.** Sheet of cells lining organs throughout the body.

**ERECTILE DYSFUNCTION.** The inability to get or maintain an erection.

**ERGOGENIC.** Enhancing physical performance, particularly during athletic activity.

**ERYTHROPOETIN (EPO).** A hormone produced by the kidneys that regulates the production of red blood cells. It is sometimes used by athletes to increase the oxygen-carrying capacity of their blood.

**ESOPHAGITIS.** Inflammation of the esophagus.

**ESOPHAGUS.** Muscular tube through which food passes from the pharynx to the stomach.

**ESSENTIAL AMINO ACID.** An amino acid that is necessary for health but that cannot be made by the body and must be acquired through diet.

**ESSENTIAL FATTY ACID.** A type of fat that is necessary for the normal function of the brain and body and that the body is unable to produce itself, making them 'essential' to be taken through the diet and / or supplements.

**ESTROGEN.** A hormone produced by the ovaries and testes. It stimulates the development of secondary sexual characteristics and induces menstruation in women.

**ETHANOL.** The chemical name of beverage alcohol.

**ETIOLOGY.** The cause of a disease or medical condition.

**EVENING PRIMROSE OIL.** Oil extracted from the seeds of the evening primrose, *Oenothera biennis*; contains GLA.

**EXCIPIENT.** An inert substance, such as certain gums or starches, used to make drugs easier to take by allowing them to be formulated into tablets or liquids. Some artificial sweeteners are used as excipients.

**EXERCISE PSYCHOLOGIST.** A health professional who specializes in behaviors related to physical activity.

**EXPECTORANT.** A substance that stimulates removal of mucus from the lungs.

**EXTRACT.** A compound in which something has been taken out so that it is now in a more purified state.

**EXTRAHEPATIC.** Originating or occurring outside the liver.

## F

**FACTORY FARMING.** A term that refers to the application of techniques of mass production borrowed from industry to the raising of livestock, poultry, fish, and crops. It is also known as industrial agriculture.

**FAMINE.** Extended period of food shortage.

**FAST.** A period of at least 24 hours in which a person eats nothing and drinks only water.

**FAT.** A nutrient that the body uses as an energy source. Fats produce 9 calories per gram.

**FAT-SOLUBLE VITAMIN.** A vitamin that dissolves in and can be stored in body fat or the liver.

**FATTY ACID.** A chemical unit that occurs naturally, either singly or combined, and consists of strongly linked carbon and hydrogen atoms in a chain-like structure. The end of the chain contains a reactive acid group made up of carbon, hydrogen, and oxygen.

**FDA.** The Food and Drug Administration is the United States Department of Health and Human Services agency responsible for ensuring the safety and effectiveness of all drugs, biologics, vaccines, and medical devices.

**FECAL.** Relating to feces.

**FECES.** Waste product of digestion formed in the large intestine. About 75% of its mass is water, the

remainder is protein, fat, undigested roughage, dried digestive juices, dead cells, and bacteria.

**FEMALE ATHLETE TRIAD.** A group of three disorders often found together in female athletes, consisting of disordered eating, amenorrhea, and osteoporosis.

**FENLURAMINE.** An anorectic drug formerly marketed under the brand name Pondimin.

**FERMENTATION.** A reaction performed by yeast or bacteria to make alcohol.

**FERRITIN.** Iron is stored in the body, mainly in the liver, spleen and bone marrow, as ferritin.

**FETUS.** Unborn offspring.

**FIBER.** A complex carbohydrate not digested by the human body. Plants are the source of fiber.

**FIBROMYALGIA.** Widespread musculoskeletal pain and fatigue disorder for which the cause is still unknown.

**FISTULA.** Abnormal, usually ulcerous duct between two internal organs or between an internal organ and the skin. When open at only one end it is called an incomplete fistula or sinus. The most common sites of fistula are the rectum and the urinary organs.

**FLATULENCE.** The medical term for intestinal gas expelled through the anus.

**FLAXSEED.** Linseed; the seed of flax, *Linum usitatissimum*, used as a source of oil for treating inflammation of the respiratory, intestinal, and urinary tracts, and as a dietary supplement.

**FLUOXETINE.** An antidepressant drug, sold under the brand name Prozac.

**FOIE GRAS.** Liver of a duck or goose that has been specially fattened. It can be sold whole or prepared as pate or mousse.

**FOLATE.** One of the B vitamins, also called folic acid.

**FOLIC ACID.** Folate; a B-complex vitamin that is required for normal production of red blood cells and other physiological processes; abundant in green, leafy vegetables, liver, kidney, dried beans, and mushrooms.

**FOOD ADDITIVE.** Defined by the Federal Food, Drug, and Cosmetic Act (FD&C) of 1938 as "any substance, the intended use of which results directly or indirectly, in its becoming a component or otherwise affecting the characteristics of food."

**FOOD ALLERGY.** A hypersensitivity reaction to particular food proteins involving the immune system.

**FOOD FORTIFICATION.** The public health policy of adding essential trace elements and vitamins to foodstuffs to ensure that minimum dietary requirements are met.

**FOOD STAMP PROGRAM (FSP).** The Food Stamp Program provides a basic safety net to millions of people. The program was born in the late 1930s, with a limited program in effect from 1939 to 1943. It was revived as a pilot program in 1961 and was extended nationwide in 1974. The current program was implemented in 1977 with the goal of alleviating hunger and malnutrition by permitting low-income households to obtain a more nutritious diet through normal channels of trade.

**FOODBORNE ILLNESS.** Illness caused by pathogenic bacteria transmitted to humans by food.

**FORTIFICATION.** The addition of vitamins and minerals to improve the nutritional content of a food.

**FREDRICKSON CLASSIFICATION.** A classification system of hyperlipidemias by ultracentrifugation followed by electrophoresis that uses plasma appearance, triglyceride values, and total cholesterol values. There are five types: I, II, III, IV, and V.

**FREE RADICAL.** An unstable, highly reactive molecule that occurs naturally as a result of cellular metabolism, but can be increased by environmental toxins, ultraviolet and nuclear radiation. Free radicals damage cellular DNA and are thought to play a role in aging, cancer, and other diseases. Free radicals can be neutralized by antioxidants.

**FREEGAN.** A vegan who obtains food outside the mainstream economic system, most often by growing it, bartering for it, or scavenging for it in restaurant or supermarket trash bins.

**FREE-RANGE.** Allowed to forage and move around with relative freedom. Free-range chickens are typically raised on small farms or suburban back yards, and are often considered pets as well as egg producers.

**FRUCTOSE.** A simple sugar that occurs naturally in sucrose and fruit. It can be added in combination with sucrose in the form of high-fructose corn syrup (HFCS) to sweeten foods because it is sweeter than sucrose. Large amounts of fructose can cause diarrhea in infants and young children.

**FRUITARIAN.** A vegetarian who eats only plant-based products (fruits, seeds, and nuts) that can be obtained without killing the plant.

**FUNCTIONAL DEFICIENCY.** The depleted state of a particular nutrient that precipitates compromised function within the brain or body.

**FUNCTIONAL FOOD.** Also called nutraceuticals, these products are marketed as having health benefits or disease-preventing qualities beyond their basic supply of energy and nutrients. Often these health benefits come in the form of added herbs, minerals, vitamins, etc.

**FUNDOPLICATION.** A surgical procedure that increases pressure on the LES by stretching and wrapping the upper part of the stomach around the sphincter.

## G

**GALACTOSE.** A monosaccharide known as milk sugar.

**GALACTOSEMIA.** An inherited metabolic disorder in which galactose accumulates in the blood due to a deficiency in an enzyme that catalyzes its conversion to glucose.

**GALLSTONE.** Stones that form in the gallbladder or bile duct from excess cholesterol or salts.

**GASTROENTEROLOGIST.** A physician who specializes in the diagnosis and treatment of diseases of the stomach and intestines.

**GASTROESOPHAGEAL REFLUX.** The flow of stomach contents into the esophagus.

**GASTROESOPHAGEAL REFLUX DISEASE (GERD).** A disorder caused by the backward flow of stomach acid into the esophagus. It is usually caused by a temporary or permanent change in the sphincter that separates the lower end of the esophagus from the stomach.

**GASTROINTESTINAL TRACT (GI TRACT).** The tube connecting and including the organs and paths responsible for processing food in the body. These are the mouth, the esophagus, the stomach, the liver, the gallbladder, the pancreas, the small intestine, the large intestine, and the rectum.

**GASTROINTESTINAL.** Relating to the stomach and intestines.

**GENE.** A section of DNA that includes information about how to create certain proteins.

**GENE DOPING.** Use of gene transfer technology by athletes to improve performance.

**GENE EXPRESSION.** The process by which the coded information of a gene is translated into the proteins or RNA present and operating in the cell.

**GENERALLY RECOGNIZED AS SAFE (GRAS).** A phrase used by the federal government to refer to exceptions to the FD&C Act of 1938 as modified by the Food Additives Amendment of 1958. Artificial food preservatives that have a scientific consensus on their safety based on either their use prior to 1958 or to well-known scientific information may be given GRAS status.

**GENOME.** A single haploid set of chromosomes and their genes.

**GENOTYPE.** All or part of the genetic constitution of an individual or group.

**GERM.** In grains, the center part of the grain kernel that contains vitamins and minerals not found in the rest of the kernel. It is removed from refined (white) flour.

**GHRELIN.** A recently discovered peptide hormone secreted by cells in the lining of the stomach. Ghrelin is important in appetite regulation and maintaining the body's energy balance.

**GINGKO BILOBA.** A deciduous tree native to northern China whose leaves are used to make an extract thought to improve memory and relieve depression.

**GLA.** Gamma-linolenic acid; an essential fatty acid found in evening primrose oil.

**GLAUCOMA.** A condition where pressure within the eye causes damage to the optic nerve, which sends visual images to the brain.

**GLUCAGON.** A hormone made by the alpha cells of the pancreas that helps regulate blood sugar (glucose) levels by signaling liver and muscle cells to release sugar stored as glycogen.

**GLUCOMANNAN.** A plant substance composed of long chains of the sugars glucose and mannose. It is not digested, and may be ised as a laxative. The material has been claimed to provide a feeling of abdominal and intestinal fullness.

**GLUCONEOGENESIS.** The process of making glucose (sugar) from its own breakdown products or from the breakdown products of lipids or proteins. Gluconeogenesis occurs mainly in cells of the liver or kidney.

**GLUCOSAMINE.** A type of amino sugar that is thought to help in the formation and repair of cartilage. It can be extracted from crab or shrimp shells and used as a dietary supplement by people with OA.

**GLUCOSE.** A simple sugar that results from the breakdown of carbohydrates. Glucose circulates in the blood and is the main source of energy for the body.

**GLUTEN.** An elastic protein found in wheat and some other grains that gives cohesiveness to bread dough. Some people are allergic to gluten and cannot digest products containing wheat.

**GLYCEMIC INDEX (GI).** A system devised at the University of Toronto in 1981 that ranks carbohydrates in individual foods on a gram-for-gram basis in regard to their effect on blood glucose levels in the first two hours after a meal. There are two commonly used GIs, one based on pure glucose as the reference standard and the other based on white bread.

**GLYCEMIC LOAD (GL).** A more practical ranking of how an amount of a particular food will affect blood glucose levels. The glycemic index (GI) is part of the equation for determining ranking.

**GLYCERIN.** A sweet syrupy alcohol obtained from animal fats. It is often used in cough syrups and other liquid medications to give them a smooth texture.

**GLYCEROL.** The central structural component of triglycerides and phospholipids. It is made naturally by animals and plants; the ratio of atoms in glycerol is three carbons, eight hydrogens, and three oxygens.

**GLYCOGEN.** The storage form of glucose found in the liver and muscles.

**GULF WAR SYNDROME (GWS).** A disorder characterized by a wide range of symptoms, including skin rashes, migraine headaches, chronic fatigue, arthritis, and muscle cramps, possibly related to military service in the Persian Gulf war of 1991. GWS was briefly attributed to the troops' high consumption of beverages containing aspartame, but this explanation has been discredited.

## H

**HDL CHOLESTEROL.** High-density lipoprotein; 'good' cholesterol that helps protect against heart disease.

**HEALTHY EATING INDEX (HEI).** A measure of diet quality that assesses conformance to federal dietary guidance.

**HEART ATTACK.** A heart attack occurs when blood flow to the heart muscle is interrupted. This deprives the heart muscle of oxygen, causing tissue damage or tissue death.

**HEART DISEASE.** Any disorder of the heart or its blood supply, including heart attack, atherosclerosis, and coronary artery disease.

**HEAT EXHAUSTION.** A mild form of heat stroke, characterized by faintness, dizziness, and heavy sweating.

***HELICOBACTER PYLORI.*** A spiral-shaped Gram-negative bacterium that lives in the lining of the stomach and is known to cause gastric ulcers.

**HEMATEMESIS.** The medical term for bloody vomitus.

**HEMODIALYSIS.** Type of dialysis to clean wastes from the blood after the kidneys have failed: the blood travels through tubes to a dialyzer, a machine that removes wastes and extra fluid. The cleaned blood then goes back into the body.

**HEMORRHAGIC.** Relating to escape of blood from the vessels. Bleeding.

**HEMORRHOID.** Swollen and inflamed veins around the anus or rectum.

**HERB.** A plant used in cooking or for medical purposes. Examples include Echinacea and ginseng.

**HERBIVORE.** An animal whose diet consists primarily or entirely of plant matter. Herbivorous animals include deer, sheep, cows, horses, elephants, giraffes, and bison.

**HIATUS HERNIA.** A protrusion of part of the stomach through the diaphragm to a position next to the esophagus.

**HIGH BLOOD PRESSURE.** Blood pressure is the force of the blood on the arteries as the heart pumps blood through the body. High blood pressure, or hypertension, is a condition where there is too much pressure, which can lead to heart and kidney problems.

**HIGH-DENSITY LIPOPROTEIN (HDL).** Often referred to as good cholesterol. This takes cholesterol away from the cells and back to the liver, where it's broken down or excreted.

**HIGH-INTENSITY SWEETENER.** Another term for nonnutritive sweetener, used because these substances add sweetness to food with very little volume.

**HIGHLY ACTIVE ANTIRETROVIRAL THERAPY (HAART).** The major form of pharmacological treatment for HIV since 1996. HAART is a combination of several different antiretroviral drugs selected for patients on an individual basis. It is not a cure for HIV infection

but acts to slow the replication of the virus and discourage new mutations. HAART has a number of side effects that complicate maintaining good nutrition in HIV patients.

**HINDUISM.** A broad group of religious and philosophical beliefs from India. It is characterized by belief in reincarnation, one God with many forms, and the pursuit of transcending the evils of earth.

**HISTAMINE.** A substance that is released by the body in the presence of allergens. It stimulates dilation of blood vessels, constriction of breathing tubes, and decreased blood pressure.

**HOMEOPATHIC.** Relating to homeopathy, a system of treating diseases by giving people very small doses of natural substances which, in healthy people, cause the same symptoms as the disease being treated.

**HOMEOSTASIS.** The complex set of regulatory mechanisms that works to keep the body at optimal physiological and chemical stability in order for cellular reactions to occur.

**HOMOCYSTEINE.** An amino-acid product of animal metabolism that at high blood levels is associated with an increased risk of cardiovascular disease (CVD).

**HORMONE.** A chemical substance produced in the body that controls and regulates the activity of certain cells or organs.

**HORMONE REPLACEMENT THERAPY (HRT).** Use of the female hormones estrogen and progestin (a synthetic form of progesterone) to replace those the body no longer produces after menopause.

**HUMAN GROWTH HORMONE (HGH).** A hormone produced in the pituitary gland that stimulates growth of bone and muscle.

**HYBRIDIZATION.** Relating to a plant produced from a cross between two genetically different plants.

**HYDROCARBON.** A substance consisting only of carbon and hydrogen atoms.

**HYDROGENATED.** Usually refers to partial hydrogenation of oil, a process where hydrogen is added to oils to reduce the degree of unsaturation. This converts fatty acids from a *cis* to *trans* fatty acids.

**HYDROGENATED FATS.** A type of fat made by the process of hydrogenation, which turns liquid oils into solid fat. Bio-hydrogenation occurs in ruminant animals (eg. cows) and so small amounts of hydrogenated fats are found in butter, dairy foods and meat but these are accepted as being harmless. The commercial hydrogenation of oils produces large quantities of hydrogenated fats and have been implicated in the development of coronary heart disease and impaired cell signalling in the brain.

**HYDROGENATION.** The addition of hydrogen atoms to carbon double bonds to make them in to single bonds.

**HYDROLYZE.** To break apart through reaction with water.

**HYDROXYLAPATITE.** The main mineral component of bone, of which Zinc is a constituent.

**HYPERCALCEMIA.** Abnormally high levels of calcium in the blood.

**HYPERCHOLESTEROLEMIA.** High levels of cholesterol in the blood.

**HYPERGLYCEMIA.** A condition where there is too much glucose or sugar in the blood.

**HYPERHYDRATION.** Excess water content of the body.

**HYPERLIPIDEMIA.** Elevation of lipid levels (fats) in the bloodstream. These lipids include cholesterol, cholesterol compounds, phospholipids and triglycerides, all carried in the blood as part of large molecules called lipoproteins.

**HYPERPLASTIC OBESITY.** Excessive weight gain in childhood, characterized by the creation of new fat cells.

**HYPERTENSION.** High blood pressure.

**HYPERTHYROIDISM.** Over production of the thyroid hormone by the thyroid gland.

**HYPERTROPHIC OBESITY.** Excessive weight gain in adulthood, characterized by expansion of already existing fat cells.

**HYPERURICEMIA.** High levels of uric acid in the blood.

**HYPOGLYCEMIA.** Abnormally low blood sugar levels.

**HYPOLIPIDEMIC.** Promoting the reduction of lipid concentrations in the serum.

**HYPONATREMIA.** Inadequate sodium levels in the body, possibly caused by loss of sodium through perspiration, diarrhea, or vomiting, and replacement of fluids with water that does not contain adequate electrolytes.

**HYPOTHYROIDISM.** A disorder in which the thyroid gland in the neck produces too little thyroid

hormone. One of the functions of thyroid hormone is to regulate metabolic rate.

## I

**IDEAL WEIGHT.** Weight corresponding to the lowest death rate for individuals of a specific height, gender, and age.

**IDIOPATHIC.** Used to describe a disease or disorder that has no known cause.

**IDIOPATHIC INTRACRANIAL HYPERTENSION.** Increased fluid pressure within the blood vessels supplying the brain. Obese women are at increased risk of developing this disorder.

**IgE.** A substance in the body that triggers the body to release histamine when an allergen enters the body. IgE is measured in allergy tests.

**ILEUM.** The last section of the small intestine located between the jejunum and the large intestine.

**IMMUNE SYSTEM.** The integrated body system of organs, tissues, cells, and cell products such as antibodies that protects the body from foreign organisms or substances.

**IMMUNOCOMPROMISED.** Having an impaired or weakened immune system. The immune system protects the body from foreign substances, cells, and tissues.

**IMMUNOSUPPRESSANT.** Suppression of the immune system.

**IMPACTION.** The medical term for a mass of fecal matter that has become lodged in the lower digestive tract. Removal of this material is called disimpaction.

**IMPULSIVITY.** Acting or speaking too quickly (upon impulse) without first thinking of the consequences.

**INDICATED.** In medical terminology, reviewed and approved by the United States Food & Drug Administration, or the comparable agency in other nations, for a specific use.

**INFLAMMATION.** A response of body tissues to injury or irritation characterized by pain and swelling and redness and heat.

**INSOLUBLE FIBER.** Fiber that cannot dissolve in water; found in whole grains, breads, and cereals as well as carrots, cucumbers, zucchini, and tomatoes.

**INSOMNIA.** The inability to sleep.

**INSULIN.** A hormone made in the pancreas that is essential for the metabolism of carbohydrates, lipids, and proteins, and that regulates blood sugar levels.

**INSULIN RESISTANCE.** A condition in which normal amounts of insulin in a person's blood are not adequate to produce an insulin response from fat, muscle, and liver cells. Insulin resistance is often a precursor of type 2 (adult-onset) diabetes.

**INSULIN RESISTANCE SYNDROME.** A medical condition in which insulin fails to function normally in regulating blood glucose (sugar) levels.

**INTEGRATIVE MEDICINE.** A medical outlook combining aspects of conventional and alternative medicines.

**INTERMITTENT CLAUDICATION.** Symptoms that occur when the leg muscles do not receive the oxygen rich blood required during exercise, thus causing cramping in the hips, thighs or calves.

**INTERNATIONAL OSTEOPOROSIS FEDERATION (IOF).** Based in Switzerland it functions as a global alliance of patient, medical and research societies, scientists, health care professionals, and international companies concerned about bone health. Its aim is to develop a world wide strategy for the management and prevention of osteoporosis.

**INTESTINAL FLORA.** The sum of all bacteria and fungi that live in the intestines. It is required to break down nutrients, fight off pathogens and helps the body build the vitamin E and K. An unbalanced intestinal flora can lead to many health problems.

**INULIN.** Naturally occurring oligosaccharides (several simple sugars linked together) produced by many types of plants. They belong to a class of carbohydrates known as fructans.

**ION.** An atom or molecule that has an electric charge. In the body ions are collectively referred to as electrolytes.

**IRON DEFICIENCY ANEMIA.** The inability to make sufficient red blood cells that results in fatigue, shortness of breath, headaches and in ability to fight infections. It is common in pregnancy.

**IRRITABLE BOWEL SYNDROME.** A chronic colon disorder that involves constipation and diarrhea, abdominal pain, and mucus in the stool.

**ISOFLAVONES.** Estrogen-like compounds in plants.

## J

**JAUNDICE.** A condition in which bilirubin, a waste product caused by the normal breakdown or red blood cells, builds up in the body faster than the liver can break it down. People with jaundice develop yellowish skin and the whites of their eyes become yellow. The condition can occur in newborns and people with liver damage.

**JEJUNUM.** The section of the small intestine located between the duodenum and the ileum.

## K

**KASHIN–BECK DISEASE.** A disorder of the bones and joints of the hands and fingers, elbows, knees, and ankles of children and adolescents who slowly develop stiff deformed joints, shortened limb length and short stature. The disorder is endemic in some areas of eastern Siberia, Korea, China and Tibet.

**KESHAN'S DISEASE.** A potentially fatal form of cardiomyopathy (disease of the heart muscle).

**KETOACIDOSIS.** A condition due to starvation or uncontrolled Type I diabetes. Ketones are acid compounds that form in the blood when the body breaks down fats and proteins. Symptoms include abdominal pain, vomiting, rapid breathing, extreme tiredness, and drowsiness.

**KETONE.** Chemicals produced by fat breakdown; molecule containing a double-bonded oxygen linked to two carbons.

**KETOSIS.** An abnormal increase in the number of ketone bodies in the body, produced when the liver breaks down fat into fatty acids and ketone bodies. Ketosis is a common side effect of low-carbohydrate diets or VLCDs. If continued for a long period of time, ketosis can cause serious damage to the kidneys and liver.

**KIDNEY DIALYSIS.** A process where blood is filtered through a dialysis machine to remove waste products that would normally be removed by the kidneys. The filtered blood is then circulated back into the patient. This process also is called renal dialysis.

**KIDNEY STONES.** A small, hard mass in the kidney that forms from chemical deposits. Kidney stones can be extremely painful and are often difficult to diagnose.

**KILOJOULE.** 1,000 joules; a unit equivalent to 0.239 calories.

**KINASE.** An enzyme that catalyzes the transfer of phosphate groups from high-energy phosphate-containing molecules, such as ATP, to another molecule.

**KREBS CYCLE.** Cellular reaction that breaks down numerous nutrients and provides building blocks for other molecules.

**KWASHIORKOR.** Severe malnutrition characterized by swollen belly, hair loss, and loss of skin pigment.

## L

**LACTO-OVO VEGETARIAN.** People who do not eat meat, but do include dairy products and eggs in their diets.

**LACTOSE.** Milk sugar; a disaccharide sugar present in milk that is made up of one glucose molecule and one galactose molecule.

**LACTOSE INTOLERANCE.** A condition in which the body does not produce enough lactase, an enzyme needed to digest lactose (milk sugar). Ovolactovegetarians with lactose intolerance often choose to use soy milk, almond milk, or other milk substitutes as sources of protein.

**LACTOVEGETARIAN.** A vegetarian who uses milk and cheese in addition to plant-based foods.

**LANGUAGE EXPERIENCE APPROACH.** An approach to reading instruction based on activities and stories developed from personal experiences of the learner.

**LANOLIN.** A greasy substance extracted from wool, often used in hand creams and other cosmetics.

**LAPAROSCOPIC.** Pertaining to a surgical procedure which uses an instrument which can be inserted into the body to view structures within the abdomen and pelvis.

**LARGE INTESTINE.** The terminal part of the digestive system, site of water recycling, nutrient absorption, and waste processing located in the abdominal cavity. It consists of the caecum, the colon, and the rectum.

**LAXATIVE.** A substance that stimulates movement of food through the bowels. Laxatives are used to treat constipation.

**L-CARNITINE.** A molecule in muscle that is responsible for transporting fatty acids across mitochondrial membranes; obtained from meat and milk.

**L-CYSTEINE.** A sulfur-containing amino acid produced by enzymatic or acid hydrolysis of proteins. Supplements are used as antioxidant.

**LDL CHOLESTEROL.** Low-density lipoprotein containing a high proportion of cholesterol that is associated with the development of arteriosclerosis.

**LEAVENING.** Yeast or other agents used for rising bread.

**LECTINS.** Protein substances found in foods that bind with carbohydrates in blood causing it to clot.

**LEPTIN.** A hormone produced by fat cells (adipose tissue) that tells the brain that the body has eaten calories and should stop eating.

**L-HISTIDINE.** An essential amino acid important for the growth and repair of tissues.

**LIGNAN.** Compounds in plants that have antioxidant and estrogenic activities.

**LIPASE.** An enzyme produced from the pancreas that breaks down fats.

**LIPID.** Group of chemicals, usually fats, that do not dissolve in water, but dissolve in ether.

**LIPID PEROXIDATION.** This refers to the chemical breakdown of fats.

**LIPODYSTROPHY.** The medical term for redistribution of body fat in response to HAART, insulin injections in diabetics, or rare hereditary disorders.

**LIPOPROTEIN.** A combination of fat and protein that transports lipids in the blood.

**LIPOTROPIC.** Factors that promote the utilization of fat by the body.

**LIQUID MEAL REPLACEMENTS (LMRS).** A general term for prepackaged liquid shakes or milk-like drinks intended to substitute for one or more meals a day as part of a weight-loss regimen or source of nutrition for people who cannot eat solid foods.

**LONG LIFE COCKTAIL.** A drink consisting of one teaspoon of powdered psyllium husks or one tablespoon of ground or milled flaxseed in 8 oz (237 ml) cran-water.

**LOW BIRTH WEIGHT.** A low birth weight infant is one who is born after the the normal gestational period (38-42 weeks) but weights less than 2.5 kgs (5.5 pounds) at birth.

**LOW DENSITY LIPOPROTEIN (LDL) CHOLESTEROL.** A type of cholesterol in the blood that is considered to be bad for the body. High levels of LDL is a risk factor for heart disease.

**LOWER ESOPHAGEAL SPHINCTER (LES).** Ring of muscle at the bottom of the esophagus that acts like a valve between the esophagus and stomach.

**LYCOPENE.** A plant pigment that appears red in natural light and is responsible for the red color of tomatoes. Grapefruit is rich in lycopene, which is a powerful antioxidant and is thought to retard skin aging and may help to protect against chronic diseases such as heart disease and cancer.

**LYMPHOMA.** Any of various usually malignant tumors that arise in the lymph nodes or in other lymphoid tissue.

## M

**MACADAMIA NUT.** A hard-shelled nut resembling a filbert, produced by an evergreen tree native to Australia and cultivated extensively in Hawaii. The nut is named for John Macadam, an Australian chemist.

**MACRO MINERALS.** Minerals that are needed by the body in relatively large amounts. They include sodium, potassium, chlorine, calcium, phosphorus, magnesium.

**MACRONUTRIENT:.** A nutrient needed in large quantities.

**MACULAR DEGENERATION.** A chronic disease of the eyes caused by the deterioration of the central portion of the retina, known as the macula, which is responsible for focusing central vision in the eye.

**MALABSORPTION.** Poor absorption of nutrients by the small intestine, difficulty in the digestion of nutrients.

**MALABSORPTION SYNDROME.** A condition characterized by indigestion, bloating, diarrhea, loss of appetite, and weakness, caused by poor absorption of nutrients from food as a result of giardiasis, other bowel disorders, or certain surgical procedures involving the digestive tract.

**MALIGNANT.** Unfavorable, tending to produce deterioration or death. For a tumor, it generally means cancerous.

**MALNOURISHED.** Lack of adequate nutrients in the diet.

**MALNUTRITION.** Poor nutrition because of an insufficient or poorly balanced diet or faulty digestion or utilization of foods.

**MALTOSE.** A disaccharide known as malt sugar.

**MEGACOLON.** A condition in which the colon becomes stretched far beyond its usual size. Children with long-term constipation may develop megacolon.

**MENINGITIS.** A serious infection of the membranes surrounding the brain.

**MENOPAUSE.** Phase in a woman's life during which ovulation and menstruation end.

**METABOLIC.** Refers to the chemical reactions in living things.

**METABOLIC RATE.** The BMR adjusted by an activity factor with the Harris-Benedict Formula to determine total daily energy expenditure in calories or kilojoules.

**METABOLIC SYNDROME.** A group of risk factors related to insulin resistance and associated with an increased risk of heart disease. Patients with any three of the following five factors are defined as having metabolic syndrome: waist circumference over 102 cm (41 in) for men and 88 cm (34.6 in) for women; high triglyceride levels in the blood; low levels of HDL cholesterol; high blood pressure or the use of blood pressure medications; and impaired levels of fasting blood glucose (higher than 110 mg/dL).

**METABOLIC SYNDROME X.** Also called the insulin resistance syndrome or pre-diabetic syndrome. The syndrome is closely associated with hypertriglyceridemia and with low HDL-"good" cholesterol.

**METABOLISM.** The process by which food is converted into energy.

**METABOLIZE.** To produce the chemical changes in the body's living cells that provide energy for vital processes and activities.

**METABOLOME.** All of the metabolites found in the cells and fluids of the body under specific dietary and physiological conditions.

**METALLOENZYME.** An enzyme that contains a tightly bound metal ion, such as cobalt, copper, iron or zinc.

**METHIONINE.** A crystalline amino acid found in many protein foods. It is sometimes taken as a supplement during a detox diet.

**METRECAL.** The first product marketed as an LMR for weight reduction, introduced in 1960 by Mead Johnson.

**MICROFLORA.** This term describes the collection of small micro-organisms, such as bacteria , that colonize the gastrointestinal tract (gut).

**MICRONUTRIENT.** Nutrients needed by the body in small amounts. They include vitamins and minerals.

**MICROORGANISM.** Bacteria and protists; single-celled organisms.

**MINERAL.** An inorganic substance found in the earth that is necessary in small quantities for the body to maintain a health. Examples: zinc, copper, iron.

**MITOCHONDRIA.** Small bodies within a cell that harvest energy for use by the cell.

**MITRAL VALVE.** A heart valve, also called the *bicuspid valve* which allow blood to flow from the left auricle to the ventricle, but does not allow the blood to flow backwards.

**MOLECULAR WEIGHT.** The total of the atomic weights of the atoms in a molecule.

**MONO DIET.** A type of detoxification diet based on the use of only one food or beverage. Some versions of the grapefruit diet are essentially mono diets.

**MONO-AMINE OXIDASE INHIBITOR.** A class of antidepressant drugs that act by blocking an ezyme that destroys some of the hormones in the bRain. These drugs have a large number of food and drug interactions.

**MONOSACCHARIDE.** Any of several carbohydrates, such as glucose, fructose, galactose, that cannot be broken down to simpler sugars.

**MONOSODIUM GLUTAMATE.** MSG; sodium glutamate; a salt derived from glutamic acid that is used to enhance the flavor of foods.

**MONOUNSATURATED FAT.** A fat or fatty acid with only one double-bonded carbon atom in its molecule. The most common monounsaturated fats are palmitoleic acid and oleic acid. They are found naturally in such foods as nuts and avocados; oleic acid is the main component of olive oil.

**MORBID OBESITY.** A term used to describe individuals 100 lb (45 kg) or more than 50% overweight and/or who have a body mass index above 40.

**MTHFR.** Methylene tetrahydrofolate reductase; an enzyme that regulates folic acid and maintains blood levels of homocysteine.

**MUCILAGE.** A sticky substance used as an adhesive. A gummy substance obtained from certain plants.

**MUCOSA.** Lining of the digestive tract. In the mouth, stomach, and small intestine, the mucosa contains glands that produce juices to digest food.

**MUCUS.** Thick, viscous, gel-like material that functions to moisten and protect inner body surfaces.

**MULTIPLE SCLEROSIS.** A chronic degenerative disease of the central nervous system in which gradual destruction of myelin occurs in patches throughout the brain or spinal cord, interfering with the nerve pathways and causing muscular weakness, loss of coordination and speech and visual disturbances.

**MYOGLOBIN.** Oxygen storage protein in muscle.

**MYPYRAMID.** A guide of what to eat each day created by the U.S. Department of Agriculture based on the 2005 dietary guidelines for Americans.

## N

**NARCISSISM.** Excessive admiration of one's self.

**NARCOTIC.** An agent that causes insensibility or stupor; usually refers to opioids given to relieve pain.

**NATIONAL ACADEMY OF SCIENCES.** A private, nonprofit society of scholars with a mandate to advise the United States government on scientific and technical matters.

**NATIONAL OSTEOPOROSIS FOUNDATION (NOF).** The USA's leading voluntary health organization solely dedicated to osteoporosis and bone health.

**NATIONAL OSTEOPOROSIS SOCIETY (NOS).** The only UK national charity dedicated to eradicating osteoporosis and promoting bone health in both men and women.

**NATIONAL WEIGHT CONTROL REGISTRY (NWCR).** The largest prospective study of long-term successful weight loss. The NWCR is tracking over 5,000 individuals who have lost at least 30 pounds and kept it off for at least one year.

**NATUROPATHIC MEDICINE.** An alternative system of healing that uses primarily homeopathy, herbal medicine, and hydrotherapy and rejects most conventional drugs as toxic.

**NATUROPATHY.** A system of disease treatment that emphasizes natural means of health care, as water, natural foods, dietary adjustments, massage and manipulation, and electrotherapy, rather than conventional drugs and surgery. Naturopaths (practitioners of naturopathy) often recommend juice fasts as a way of cleansing the body.

**NAUSEA.** Unpleasant sensation in the gut that precedes vomiting

**NEPHRONS.** A tiny part of the kidneys. Each kidney is made up of about 1 million nephrons, which are the working units of the kidneys, removing wastes and extra fluids from the blood.

**NEPHROTIC SYNDROME.** A disorder marked by a deficiency of albumin (a protein) in the blood and its excretion in the urine.

**NERVINE.** An agent that calms nervousness, tension or excitement.

**NERVOUS SYSTEM.** The brain, spinal cord, and nerves that extend throughout the body.

**NEURAL TUBE DEFECTS.** Neural tube defects are serious birth defects that involve incomplete development of the brain, spinal cord and/or protective coverings for these organs.

**NEUROGENIC BLADDER.** An unstable bladder associated with a neurological condition, such as diabetes, stroke or spinal cord injury.

**NEUROPATHY.** Condition of weakness affecting the nervous system.

**NEUROTOXIC.** A substance that has a specific toxic effect on the nervous system.

**NEUROTRANSMITTER.** One of a group of chemicals secreted by a nerve cell (neuron) to carry a chemical message to another nerve cell, often as a way of transmitting a nerve impulse. Examples of neurotransmitters include acetylcholine, dopamine, serotonin, and norepinephrine.

**NONNUTRITIVE SWEETENER.** Any sweetener that offers little or no energy value when added to food.

**NONPOLAR.** Without a separation if charge within the molecule; likely to be hydrophobic.

**NONSTEROIDAL ANTI-INFLAMMATORY DRUGS (NSAIDS).** A class of drugs commonly given to treat the inflammation and pain associated with both RA and OA. NSAIDs work by blocking prostaglandins, which are hormone-like compounds that cause pain, fever, muscle cramps, and inflammation. Some NSAIDs are prescription drugs while others are available in over-the-counter (OTC) formulations.

**NOREPINEPHRINE.** Hormone released by the sympathetic nervous system onto the heart, blood vessels,

and other organs, and by the adrenal gland into the bloodstream as part of the fight-or-flight response.

**NORMOTENSIVES.** Individuals with normal blood pressure.

**NUTRICEUTICAL (ALSO SPELLED NUTRACEUTICAL).** Any substance that is a food or a part of a food and provides medical or health benefits, including the prevention and treatment of disease. Nutriceuticals include dietary supplements and meal substitutes like those recommended by the Warrior diet a well as fortified foods and functional foods.

**NUTRIENT.** A chemical compound (such as protein, fat, carbohydrate, vitamins, or minerals) that make up foods. These compounds are used by the body to function and grow.

**NUTRITION FACTS LABEL.** Labels affixed to foods sold throughout the United States. Usually on the back or the side of the bottle, package, or bag, the label specifies the amount of calories provided by the contents as well as the amount of nutrients, vitamins and supplements.

**NUTRITIONIST.** A specialist in the field of diet and nutrition.

**NUTRITIVE SWEETENER.** Any sweetener that adds some energy value to food.

## O

**OBESE.** More than 20% over the individual's ideal weight for their height and age or having a body mass index (BMI) of 30 or greater.

**OBJECTIVE.** Based on facts.

**OBLIQUES.** Types of abdominal muscle.

**OBSESSIVE-COMPULSIVE DISORDER.** A psychiatric disorder in which a person is unable to control the desire to repeat the same action over and over.

**OLIGOSACCHARIDE.** A carbohydrate that consists of a relatively small number of monosaccharides, such as maltodextrins, fructo-oligo-saccharides.

**OMEGA-3 FATTY ACIDS.** Any of several polyunsaturated fatty acids found in leafy green vegetables, vegetable oils, and fish such as salmon and mackerel, capable of reducing serum cholesterol levels and having anticoagulant properties.

**OMEGA-6 FATTY ACIDS.** Polyunsaturated fatty acid where the first double bond occurs on the sixth carbon-to-carbon double bond from the methyl end of the hydrocarbon chain.

**OMEGA-9 FATTY ACIDS.** Polyunsaturated fatty acids where the first double bond occurs on the ninth carbon-to-carbon double bond from the methyl end of the hydrocarbon chain.

**OMNIVORE.** An animal whose teeth and digestive tract are adapted to consume either plant or animal matter. The term does not mean, however, that a given species consumes equal amounts of plant and animal products. Omnivores include bears, squirrels, opossums, rats, pigs, foxes, chickens, crows, monkeys, most dogs, and humans.

**OPPORTUNISTIC INFECTION.** An infection caused by a normally harmless organism that causes disease when the host's immune system in weakened. Opportunistic infections are a major problem in the medical and nutritional care of HIV patients.

**OSTEOARTHRITIS (OA).** The most common form of arthritis, characterized by erosion of the cartilage layer that lies between the bones in weight-bearing joints. OA is also known as degenerative joint disease or DJD.

**OSTEOCALCIN.** The second most abundant protein in bone after collagen required for bone mineralization.

**OSTEOMALACIA.** Softening of bone, particularly bone weakened by demineralization (loss of mineral) and most notably by the depletion of calcium from bone. Osteomalacia may be caused by poor dietary intake or poor absorption of calcium and other minerals needed to harden bones. Osteomalacia is a characteristic feature of vitamin D deficiency in adults.

**OSTEOPENIA.** Mild thinning of the bone mass, but not as severe as osteoporosis. Osteopenia results when the formation of bone is not enough to offset normal bone loss. Osteopenia is generally considered the first step to osteoporosis.

**OSTEOPOROSIS.** Thinning of the bones with reduction in bone mass due to depletion of calcium and bone protein. Osteoporosis predisposes a person to fractures, which are often slow to heal and heal poorly. It is more common in older adults, particularly post-menopausal women; in patients on steroids; and in those who take steroidal drugs. Unchecked osteoporosis can lead to changes in posture, physical abnormality (particularly the form of hunched back known colloquially as "dowager's hump"), and decreased mobility.

**OTOTOXICITY.** Damage caused to the nerves in the ear that are involved in hearing or balance. Ototoxicity is a rare but serious adverse affect of loop diuretics.

**OVERWEIGHT.** A person is too heavy for his or her height; someone with a Body Mass Index of from 25 to 30.

**OVOLACTOVEGETARIAN.** A vegetarian who consumes eggs and dairy products as well as plant-based foods. The official diet recommended to Seventh-day Adventists is ovolactovegetarian.

**OVOVEGETARIAN.** A vegetarian who eats eggs in addition to plant-based foods but does not use milk or other dairy products.

**OXIDATION.** A chemical reaction in which electrons are lost from a molecule or atom. In the body these reactions can damage cells, tissues, and deoxyribonucleic acid (DNA) leading to cardiovascular disease or cancer.

**OXIDATIVE.** Related to chemical reaction with oxygen or oxygen-containing compounds.

**OXIDATIVE INJURY.** Damage that occurs to the cells and tissues of the brain and body by highly reactive substances known as free radicals.

**OXIDATIVE STRESS.** Accumulation in the body of destructive molecules such as free radicals that can lead to cell death.

**OXYTOCIN.** A hormone that produces a calm, relaxed feeling.

## P

**PALEOLITHIC.** Human cultures of the Pleistocene epoch, from about one million to 10,000 years ago.

**PAMABROM.** A mild diuretic found in several over-the-counter compounds for the relief of premenstrual discomfort and water retention.

**PANCHA KARMA.** An intensive one- to two-week ritual of detoxification practiced in Ayurvedic medicine that includes enemas, bloodletting, and nasal irrigation as well as fasting.

**PANCREAS.** The pancreas is a flat, glandular organ lying below the stomach. It secretes the hormones insulin and glucagon that control blood sugar levels and also secretes pancreatic enzymes in the small intestine for the breakdown of fats and proteins.

**PARASITE.** An organism that lives in or on a host; it obtains nourishment from the host without benefiting or killing the host. The parasites responsible for food-borne illnesses are mostly single-cell organisms such as amoeba, giardia, and trichomonas, while others have a worm-like appearance.

**PARASITIC.** Feeding off another organism.

**PARASYMPATHETIC NERVOUS SYSTEM (PSNS).** The part of the autonomic nervous system that stimulates the secretion of saliva, speeds up peristalsis, and increases the flow of blood to the stomach and intestines.

**PARKINSON'S DISEASE.** An incurable nervous disorder marked by symptoms of trembling hands and a slow, shuffling walk.

**PAROXETINE.** An antidepressant drug sold under the brand name Paxil.

**PASTEURIZATION.** A process for partial sterilization of milk or beverage juices by raising the liquid to a temperature that destroys disease organisms without changing its basic taste or appearance. Pasteurized fruit or vegetable juices are considered unsuitable for juice fasts on the grounds that pasteurization destroys important nutrients in the juices.

**PATHOGEN.** An organism that causes a disease.

**PAU D'ARCO.** A medicinal bark derived from a tree native to the Amazon rainforest. Pau d'arco is often brewed as a tea and taken as a diuretic or anti-inflammatory preparation.

**PEAK BONE MASS.** The highest level of bone strength generally reached in the mid 20's.

**PECTIN.** A water-soluble heterosaccharide (complex molecule composed of a sugar molecule and a non-sugar component) found in the cell walls of higher plants. It is used primarily as a gelling agent in making jams and jellies, but can also be taken by mouth as a form of plant fiber to relieve constipation.

**PEMMICAN.** Dried meat pounded into a powder and mixed with hot fats and dried fruits or berries to make a loaf or small cakes.

**PEPSIN.** A protease enzyme in the gastric juices of carnivorous and omnivorous animals that breaks down the proteins found in meat. Its existence in humans is considered evidence that humans evolved as omnivores.

**PERENNIAL HERB.** A plant that lives for several years with new growth appearing each year.

**PERENNIAL.** Reoccurring, as a plant that comes back for more than one growing season.

**PERIANAL.** The area surrounding the anus.

**PERIANAL ABSCESS.** Abscess that can occur when the tiny anal glands that open on the inside of the anus become blocked and infected by bacteria. When pus develops, an abscess forms.

**PERIPHERAL VASCULAR DISEASE.** Diseases of any blood vessels except those that supply blood to the heart.

**PERISTALSIS.** A sequence of muscle contractions that progressively squeeze one small section of the digestive tract and then the next to push food along the tract, something like pushing toothpaste out of its tube.

**PEROXIDES.** Peroxides are highly reactive free radical molecules, used as powerful bleaching agents and as disinfectant. In the body, they form as intermediate compounds, for example during the oxidation of lipids, and may damage tissues.

**PERSONAL TRAINER.** An individual specializing in diet and exercise who works with clients on an individual basis.

**PERVASIVE DEVELOPMENTAL DISORDER.** An impairment in the development of social skills.

**PESCE/POLLO VEGETARIAN.** A vegetarian who avoids the use of red meat but will include fish (*pesce* in Italian) or chicken (*pollo* in Italian) in the diet.

**PH.** A measure of the acidity or alkalinity of a solution. Solutions with a pH below 7 are considered acidic while those above 7 are alkaline. A pH of exactly 7 (pure water) is neutral.

**PHARYNX.** Part of the neck and throat that connects the mouth to the esophagus.

**PHENTERMINE.** An anorectic drug sold under a large number of brand names.

**PHENYLALANINE.** An essential amino acid that cannot be consumed by people with a metabolic disease known as phenylketonuria (PKU).

**PHENYLKETONURIA (PKU).** A rare inherited metabolic disorder resulting in accumulation of phenylalanine, an amino acid, in the body. It can lead to mental retardation and seizures. People with PKU should not use products containing the artificial sweetener aspartame because it is broken down into phenylalanine (and other products) during digestion.

**PHOSPHOLIPID.** A type of fat used to build cell membranes.

**PHYCOCYANIN.** A protein found in spirulina that gives the alga its blue color. Phycocyanin has anti-inflammatory effects.

**PHYTATE.** Phytic acid; an acid in cereal grains that interferes with the intestinal absorption of minerals such as calcium and magnesium.

**PHYTOCHEMICALS.** A nonnutritive bioactive plant substance, such as a flavonoid or carotenoid, considered to have a beneficial effect on human health.

**PHYTOESTROGENS.** Compounds that occur naturally in plants and under certain circumstances can have actions like human estrogen. When eaten they bind to estrogen receptors and may act in a similar way to oestrogen.

**PITA.** Pitta; pita bread; a round, double-layered or pocket flatbread made from wheat and yeast.

**PITUITARY GLAND.** A small gland at the base of the brain that produces many regulating hormones.

**PLACEBO EFFECT.** A term that describes the improvement in symptoms that some patients experience when they are given a placebo (sugar pill or other inert substance that does not contain any medication) as part of a clinical trial. Patients with functional dyspepsia show a high rate of placebo effect in trials of new medications for the disorder.

**PLAQUE.** Material forming deposits on the surface of the teeth, which may promote bacterial growth and decay.

**PLASMA.** The liquid part of the blood and lymphatic fluid, which makes up about half of its volume. It is 92% water, 7% protein and 1% minerals.

**POLAR.** Containing regions of positive and negative charge; likely to be soluble in water.

**POLYCYSTIC OVARY SYNDROME.** A condition in which cysts in the ovary interfere with normal ovulation and menstruation.

**POLYMORPHISM.** A gene that exists in variant or allelic forms.

**POLYOL.** An alcohol containing more than two hydroxyl (OH) groups, such as sugar alcohols, inositol.

**POLYPEPTIDE.** A molecule made up of a string of amino acids. A protein is an example of a polypeptide.

**POLYSACCHARIDE.** Any of a class of carbohydrates, such as starch, amylose, amylopectin and cellulose, consisting of several monosaccharides.

**POLYUNSATURATED FAT.** A type of fat found in some vegetable oils, such as sunflower, safflower, and corn.

**POLYUNSATURATED FATTY ACID.** A fatty acid molecule with two or more double bonds, known to be beneficial to health when consumed in moderate amounts.

**POLYURIA.** An excessive production of urine.

**POMELO.** A large pear-shaped citrus fruit with a thick rind that was crossed with the sweet orange in the West Indies to produce the modern grapefruit.

**POSTPARTUM.** This refers to the period of time after childbirth.

**POST-PRANDIAL REACTIVE HYPERINSULINEMIA.** A condition resulting from excess insulin production after eating.

**PREBIOTICS.** Substances that help manage bacteria. Two principal types commonly used are the mannanoligosaccharides (MOS) that bind potentially harmful bacteria in the gut and allow beneficial bacteria to dominate, and fructanoligosaccharides (FOS) that deliver fructans into the fore gut to 'feed' the acid producing bacteria.

**PRE-LOADING.** Administering in advance, such as drinking water prior to exercise that is likely to cause water loss.

**PREMENSTRUAL SYNDROME (PMS).** A syndrome that involves symptoms that occur in relation to the menstrual cycle and which interfere with the woman's life. The symptoms usually begin 5 to 11 days before the start of menstruation and usually stop when menstruation begins, or shortly thereafter. Symptoms may include headache, swelling of ankles, feet, and hands, backache, abdominal cramps or heaviness, abdominal pain, bloating, or fullness, muscle spasms, breast tenderness, weight gain, recurrent cold sores, acne flare-ups, nausea, constipation or diarrhea, decreased coordination, food cravings, less tolerance for noises and lights, and painful menstruation.

**PREMIER STUDY.** A research study that tested the effects of comprehensive and simultaneous lifestyle changes on blood pressure—weight loss, exercise, and a healthy diet.

**PRIMARY PULMONARY HYPERTENSION.** Abnormally high blood pressure in the arteries of the lungs, with no other heart disease causing this problem.

**PROBIOTICS.** Probiotics are dietary supplements containing potentially beneficial bacteria or yeast.

**PROCYANIDIN.** These are associated with flavanoid antioxidants derived from grape seed extract, grape skin and red wine.Like Quercetin and Resveratrol they have many health-promoting benefits.

**PROGESTERONE.** A female steroid hormone secreted by the ovary; it is produced by the placenta in large quantities during pregnancy.

**PROKINETIC DRUGS.** A class of medications given to strengthen the motility of the digestive tract.

**PROLAPSE.** The falling down or slipping out of place of an organ or part.

**PROSCRIPTION.** prohibitions, rules against.

**PROSTAGLANDINS.** A group of biologically important molecules that have hormone-like actions. They help regulate expansion of the blood vessels and the airways, control inflammation, are found in semen, and cause the uterus to contract. They are made from fatty acids.

**PROTEASES.** Enzymes that break peptide bonds between the amino acids of proteins.

**PROTEIN BIOSYNTHESIS.** Biochemical process, in which proteins are synthesized from simple amino acids.

**PROTEIN SEQUENCE.** The arrangement of amino acids in a protein.

**PROTEIN.** A nutrient that helps build many parts of the body, including muscle and bone. Protein provides 4 calories per gram. It is found in foods like meat, fish, poultry, eggs, dairy products, beans, nuts, and tofu.

**PROTEINS.** These are large molecules which are made up of thousands of amino acids. The primary function of protein is growth and repair of body tissues.

**PROTEOME.** All of the proteins expressed in a cell, tissue, or organism.

**PROTOZOAN.** Any member of a phylum of one-celled eukaryotes (organisms with nuclei) that are able to move but are not animals in the strict sense. The organism that causes giardiasis is a protozoan.

**PROVITAMIN.** A substance that the body can convert into a vitamin.

**PSORIASIS.** A chronic disease of the skin marked by red patches covered with white scales.

**PSYCHOANALYSIS.** A psychological theory that concerns the mental functions of humans both on the conscious and unconscious levels.

**PSYLLIUM.** Fleawort; plants of the genus *Plantago* whose seed husks have laxative activity.

**PUBERTY.** A stage of physiological maturity that marks the start of being capable of sexual reproduction.

**PULMONARY EMBOLISM.** Lodging of a blood clot in the lumen (open cavity) of a pulmonary artery, causing a severe dysfunction in respiratory function. Pulmonary emboli often originate in the deep leg veins and travel to the lungs through blood circulation. Symptoms include sudden shortness of breath, chest pain (worse with breathing), and rapid heart and respiratory rates.

**PULSES.** Peas, beans and lentils are collectively known as pulses. The term is reserved for crops harvested solely for the dry grain, so excludes green beans and green peas.

**PURGING.** A behavior associated with eating disorders that includes self-induced vomiting and abuse of laxatives as well as diuretics.

**PURINES.** Substances in DNA that can be metabolized into uric acid.

**PURSLANE.** A broad-leafed plant native to India, commonly considered a weed in the United States. Purslane has the highest level of omega-3 fatty acids of any leafy vegetable, however, and is eaten fresh in salads or cooked like spinach as part of the Cretan diet.

**PYCNOGENOL.** Trade name of a commercial mixture of bioflavonoids (catechins, phenolic acid, proan, thocyanidins) that exhibits antioxidative activity.

## Q

**QUERCETIN.** A natural compound which belongs to a group of plant pigments called flavonoids that are largely responsible for the colours of many fruits, flowers, and vegetables. They have many health-promoting benefits that may protect against cancer and cardiovascular disease.

**QUINOA.** A species of goosefoot that originated in the high Andes and is raised as a food crop for its edible seeds, which have an unusually high protein content (12–18 percent). Quinoa is considered a pseudo-cereal rather than a true cereal grain because it is not a grass.

## R

**RACEMIC.** A chemical term, relating to the way a compound turns a bean of light. Racemic compounds are composed of equal amounts of left turning and right turning molecules. Molecules which turn a beam of light to the right are *dextrorotatory* while those which turn a beam to the left are *levorotatory*.

**RADIOPHARMACEUTICAL.** A drug that is radioactive. It is used for diagnosing or treating diseases.

**RANCID.** Having a bad or "off" smell or taste as a result of oxidation.

**RAW FOODISM.** A term that refers to a group of dietary regimens composed entirely of foods that have not been raised above a certain temperature. Many raw foodists are vegans, although some eat raw meat or fish and use unpasteurized dairy products.

**REACTIVE NITROGEN SPECIES (RNS).** Highly reactive chemicals, containing nitrogen, that react easily with other molecules, resulting in potentially damaging modifications.

**REACTIVE OXYGEN SPECIES (ROS).** Damaging molecules, including oxygen radicals such as superoxide radical and other highly reactive forms of oxygen that can harm biomolecules and contribute to disease states.

**RECOMMENDED DIETARY ALLOWANCES (RDA).** The average daily dietary intake level that is sufficient to meet the nutrient requirements of nearly all (approximately 98 percent) healthy individuals.

**RECTUM.** Short, muscular tube that forms the lowest portion of the large intestine and connects it to the anus.

**REGURGITATIONAL VALVULAR HEART DISEASE.** A type of damage to the heart valves which allows blood to leak back through the valve.

**RENNET.** An enzyme used to coagulate milk, derived from the mucous membranes lining the stomachs of unweaned calves.

**RESERVOIR.** A term used for animals that can carry parasites that cause disease in humans without falling ill themselves. Beavers, dogs, cats, cattle, and horses are common reservoirs of *G. lamblia*.

**RESISTANCE TRAINING.** Also called strength or weight training, this type of exercise increases muscle strength by working the muscles against a weight or

force. Free weights, weight machines, resistance bands, or a person's body weight can be used in resistance training.

**RESVERATROL.** A natural compound found in grapes, mulberries, peanuts and red wine that may protect against cancer and cardiovascular disease.

**RETINA.** The layer of light-sensitive cells on the back of the eyeball that function in converting light into nerve impulses.

**RETINOL.** Also known as vitamin A. This is a fat soluble vitamin found in animal food sources.

**RETROVIRUS.** A single-stranded virus that replicates by reverse transcription to produce DNA copies that are incorporated into the genome of infected cells. AIDS is caused by a retrovirus.

**RH FACTOR.** Rh factor is a subset of blood type it may be either positive or negative.

**RHEUMATISM.** A painful condition of the joints or muscles.

**RHEUMATOID ARTHRITIS (RA).** An autoimmune disorder that can affect organ systems as well as the joints. It is much less common that OA but is potentially much more serious.

**RHEUMATOLOGIST.** A physician, usually a pediatrician or internist, who has additional specialized training in the diagnosis and treatment of diseases that affect the bones, muscles, and joints.

**RHIZOME.** An underground creeping stem.

**RIBONUCLEIC ACID (RNA).** A molecule that helps decode genetic information (DNA) and is necessary for protein synthesis.

**RICKETS.** The softening of the bones in children leading to fractures and deformity, caused by Vitamin D deficiency.

**ROME CRITERIA.** A set of guidelines for defining and diagnosing functional dyspepsia and other stomach disorders, first drawn up in the mid-1980s by a group of specialists in digestive disorders meeting in Rome, Italy. The Rome criteria continue to be revised and updated every few years.

## S

**SALT.** In chemistry, an ionic crystalline compound of positively charged ions and negatively charged ions such that the product is neutral (without a net charge).

**SATIETY.** The quality or state of feeling comfortably full. It is sometimes used as a criterion for evaluating people's satisfaction with diets or diet products.

**SATURATED FAT.** Fats found in animal products and in coconut and palm oils that are a major dietary cause of high LDL.

**SATURATED FATTY ACID.** A fatty acid molecule with no double bonds, known to be detrimental to health when consumed in large amounts.

**SCHIZOPHRENIA.** A mental illness in which the person suffers from distorted thinking, hallucinations, and a reduced ability to feel normal emotions.

**SCLERODERMA.** An autoimmune disease with many consequences, including esophageal wall thickening.

**SCURVY.** A deficiency disease caused by a lack of dietary vitamin C, characterized by spongy gums, eventual loss of teeth, and bleeding into the skin and mucous membranes.

**SEBACEOUS GLANDS.** Small glands in the skin, usually part of hair follicles, that produce a fatty substance called sebum.

**SEBUM.** The fatty substance secreted by sebaceous glands. It helps moisturize and protect skin and hair.

**SEDATIVE.** Medicines that increase drowsiness and calmness.

**SELENOCYSTEINE.** Unusual amino acid consisting of cysteine bound to selenium. The process of inserting selenocysteine into proteins is unique to cysteine, and occurs in organisms ranging from bacteria to man.

**SELENOPROTEIN.** Enzyme that requires selenium to function. At least eleven have been identified.

**SEROTONIN.** Chemical used by nerve cells to communicate with one another.

**SERTRALINE.** An antidepressant drug sold under the brand name Zoloft.

**SERUM.** The clear fluid part of the blood that remains after clotting. Serum contains no blood cells or clotting proteins, but does contain electrolytes.

**SERUM CHOLESTEROL.** Cholesterol that travels in the blood.

**SET POINT.** In medicine, a term that refers to body temperature, body weight, or other measurements that a human or other organism tries to keep at a particular value. The Shangri-la diet is said to work by lowering the dieter's set point for body weight.

**SHANGRI-LA.** A utopia; a mythical place in the Himalayas where life approaches perfection, depicted in a 1933 novel by James Hilton.

**SHORT BOWEL SYNDROME.** Problems related to absorbing nutrients after removal of part of the small intestine.

**SIALAGOGUE.** Promotes the flow of saliva.

**SICKLE CELL ANEMIA.** A genetic disorder in which red blood cells take on an unusual shape, leading to other problems with the blood.

**SIMPLE CARBOHYDRATES.** Simple sugars; monosaccharides, such as fructose found in fruit, and disaccharides made up of two sugar units, such as lactose and sucrose or table sugar.

**SMALL INTESTINE.** The part of the digestive tract located between the stomach and the large intestine. It consists of the duodenum, the jejunum, and the ileum.

**SMOOTHIE.** A blended beverage resembling a milkshake in texture but often made with nondairy ingredients. Slim-Fast and other diet product companies market prepackaged smoothies as well as shakes.

**SNP.** Single nucleotide polymorphism; a variant DNA sequence in which the base of a single nucleotide has been replaced by a different base.

**SODIUM BENZOATE.** A type of preservative used in processed foods known to cause food sensitivity in some individuals when consumed in the diet.

**SODIUM METABISULPHITE.** A type of sulphite preservative used in processed foods known to cause food sensitivity in some individuals when consumed in the diet.

**SOLUBLE.** Capable of being dissolved.

**SOLUBLE FIBER.** The part of a food plant that resists digestion and absorption in the human small intestine but is fermented partially or completely in the large intestine. This fermentation yields short-chain fatty acids, which are beneficial to health by stabilizing blood glucose levels, lowering blood cholesterol levels, and supporting the immune system.

**SORBITOL.** Sugar alcohol food additive used as a sweetener in commercially prepared low sugar foods and gum.

**SPA.** A hotel or resort for relaxation or health and fitness-related activities. Some people undergoing a juice fast do so at a spa in order to combine the fast with colonics, massage therapy, and other practices associated with juice fasts. The English word *spa* comes from the name of a famous health resort in Belgium.

**SPORTS DRINK.** Any beverage containing carbohydrates, electrolytes, and other nutrients as well as water, intended to help athletes rehydrate after training or competition. Sports drinks are isotonic, which means that they contain the same proportion of water, electrolytes, and carbohydrates as the human body.

**SQUAMOUS EPITHELIAL CELLS.** Thin, flat cells found in layers or sheets covering surfaces such as skin and the linings of blood vessels and esophagus.

**STARCH.** A naturally abundant nutrient carbohydrate found in seeds, fruits, tubers, and roots.

**STARVATION.** A long-term consequence of food deprivation.

**STEATORRHEA.** The passage of large amounts of fat or grease in the stool, caused by failure to absorb it during digestion. Steatorrhea is often associated with chronic giardiasis.

**STEROID.** A family of compounds that share a similar chemical structure. This family includes the estrogen and testosterone, vitamin D, cholesterol, and the drugs cortisone and prendisone.

**STEROL.** The building blocks of steroid hormones; a type of lipid.

**STIMULANT.** An agent, especially a chemical agent such as caffeine, that temporarily arouses or accelerates physiological or organic activity.

**STROKE.** The sudden death of some brain cells due to a lack of oxygen when the blood flow to the brain is impaired by blockage or rupture of an artery.

**SUBJECTIVE.** Based on feelings and opinions.

**SUCCULENT.** Plants with large, fleshy leaves, stems, and roots capable of storing a lot of water. These plants grow in dry environments.

**SUCROSE.** The natural sweetener commonly used as table sugar; sucrose is a compound of two simple sugars, glucose and fructose. It is used as the standard for measuring the sweetening power of high-intensity artificial sweeteners.

**SULPHITE.** A type of preservative used in processed foods known to cause food sensitivity in some individuals when consumed in the diet.

**SULPHUR DIOXIDE.** A type of preservative used in processed foods known to cause food sensitivity in some individuals when consumed in the diet.

**SUPPOSITORY.** A tablet or capsule, usually made of glycerin, inserted into the rectum to stimulate the muscles to contract and expel feces.

**SYMPATHETIC NERVOUS SYSTEM.** The part of the autonomic nervous system that speeds up heart rate, increases lung capacity, increases the flow of blood to skeletal muscles, and diverts blood flow from the digestive tract.

**SYNAPTIC VESICLES.** Also called neurotransmitter vesicles, these pouches store the various neurotransmitters that are released by nerve cells into the synaptic cleft of a synapse.

**SYNDROME X.** A group of risk factors that together, put someone at higher risk of coronary artery disease. These risk factors include: central obesity (excessive fat tissue in the abdominal region), glucose intolerance, high triglycerides and low HDL cholesterol, and high blood pressure.

**SYSTEMIC LUPUS ERYTHEMATOSUS (SLE).** A serious autoimmune disease of connective tissue that affects mainly women. It can cause joint pain, rash, and inflammation of organs such as the kidney.

## T

**TARGET HEART RATE.** A method using pulse measurements to monitor progress while exercising. A target heart rate is typically 50-85 percent of an individual's maximum heart rate.

**TEMPEH.** A food product made from whole fermented soybeans that originated in Indonesia. It can be used as a meat substitute in vegan dishes or sliced and cooked in hot vegetable oil.

**TESTOSTERONE.** A male sex hormone responsible for secondary sex characteristics.

**TEXTURED VEGETABLE PROTEIN (TVP).** A meat substitute made from defatted soybean flour formed into a dough and cooked by steam while being forced through an extruder. It resembles ground beef in texture and can replace it in most recipes. TVP is also known as textured soy protein or TSP.

**THEOBROMINE.** A breakdown product of caffeine that is responsible for the diuretic effect of coffee and tea.

**THERMOGENESIS.** The generation of heat in the body.

**THERMOGENIC.** Producing heat. Relating to diet drugs the term is used to indicate a drug which causes increased use of calories without exercise.

**THRIFTY GENE HYPOTHESIS.** A hypothesis proposed in 1962 by James Neel, a geneticist, to explain the epidemic of obesity in the modern world. The thrifty gene hypothesis holds that certain genes in humans maximize metabolic efficiency and food searching behavior, and that humans carrying these "thrifty" genes were more likely to survive during past periods of famine. The abundance of food in the modern world means that people with these genes are predisposed to obesity and other disorders related to overeating. The thrifty gene hypothesis has, however, been largely discarded in recent years.

**THYROID.** A gland located beneath the voice box that produces thyroid hormone, a hormone that regulates growth and metabolism.

**TOFU.** Bean curd; a soft food made by coagulating soy milk with an enzyme, calcium sulfate, or an organic acid, and pressing the resulting curds into blocks or chunks. Tofu is frequently used in vegetarian or vegan dishes as a meat or cheese substitute.

**TOLERANCE.** Adjustment of the body to a drug so that it takes more and more to produce the same physiological or psychological effect, or adjustment to a drug so that side effects are diminished.

**TONIC.** An agent that restores or increases body tone.

**TOPICAL.** Referring to a type of medication that is applied to the surface of the body or instilled into the eye or ear. Some topical medications contain artificial preservatives.

**TOTAL CHOLESTEROL.** The total amount of cholesterol in the blood. Cholesterol is a fat-like substance made in the body and present in many foods.

**TOURETTE'S SYNDROME.** A neurological disorder characterized by involuntary body movements called tics, and uncontrollable speech.

**TOXIN.** A general term for something that harms or poisons the body.

**TRACE MINERALS.** Minerals needed by the body in tiny, trace amounts (RDA < 200mg/day). They include: selenium, iron, zinc, copper, manganese, molybdenum, chromium, arsenic, germanium, lithium, rubidium, tin.

**TRADITIONAL CHINESE MEDICINE (TCM).** An ancient system of medicine based on maintaining a balance in vital energy or *qi* that controls emotions, spiritual, and

physical well being. Diseases and disorders result from imbalances in qi, and treatments such as massage, exercise, acupuncture, nutritional and herbal therapy is designed to restore balance and harmony to the body.

**TRANQUILIZER.** Medicine that reduces anxiety and tension.

***TRANS* FATTY ACIDS.** Monounsaturated or polyunsaturated fats where the double bonds create a linear formation. They are formed largely by the manufacture of partial hydrogenation of oils, which converts much of the oil into *trans* fat. Hydrogenated fats and *trans* fats are often used interchangably.

**TRANSFERRIN.** A protein synthesized in the liver that transports iron in the blood to red blood cells.

**TRANSIENT ISCHEMIC ATTACK (TIA).** A neurological event with the signs and symptoms of a stroke, but which go away within a short period of time. Also called a mini-stroke, a TIA is due to a temporary lack of adequate blood and oxygen (ischemia) to the brain. This is often caused by the narrowing (or, less often, ulceration) of the carotid arteries (the major arteries in the neck that supply blood to the brain). TIAs typically last 2 to 30 minutes and can produce problems with vision, dizziness, weakness or trouble speaking.

**TRANSVERSE ABDOMINIS.** A muscle layer of the wall of the abdomen.

**TRAVELER'S DIARRHEA (TD).** A nonspecific term for a form of diarrhea that frequently affects tourists abroad. TD is the most common illness affecting visitors to other countries. Some cases of TD are caused by *G. lamblia*, but others result from infection with various bacteria, rotaviruses, and other intestinal parasites.

**TRIGLYCERIDE.** A fat that comes from food or is made up of other energy sources in the body. Elevated triglyceride levels contribute to the development of atherosclerosis.

**TRITICALE.** A man-made hybrid plant that combines wheat and rye and that produces a higher protein flour.

**TROPHOZOITE.** The active feeding stage in the life cycle of *G. lamblia*. It is the trophozoites that multiply within the small intestine and cause the diarrhea and other symptoms of giardiasis.

**TROPICAL SPRUE.** A condition of unknown cause whereby abnormalities in the lining of the small intestine prevent the body from absorbing food normally. This disease is not associated with gluten enteropathy. It has been associated with travel and residence in tropical areas.

**TRYPTOPHAN.** An amino acid that plays a role in the manufacture of serotonin.

**TUBER.** Swollen plant stem below the ground.

**TUMOR NECROSIS FACTOR.** A substance that is part of an inflammatory system and used as a marker to measure inflammation.

**TURMERIC.** A perennial herb of the ginger family used as a coloring agent as well as a spice in food preparation. It is used in some traditional Ayurvedic medicines for the relief of joint pain and inflammation.

**TYPE II DIABETES.** Inability to regulate the level of sugar in the blood due to a reduction in the number of insulin receptors on the body's cells.

## U

**ULCERATION.** Formation of ulcers on a mucous membrane accompanied by pus and necrosis of surrounding tissue.

**ULCERATIVE COLITIS.** Inflammation of the inner lining of the colon, characterized by open sores that appear in its mucous membrane.

**UNDERNUTRITION.** Food intake too low to maintain adequate energy expenditure without weight loss.

**UNSATURATED FAT.** Fat that help to lower blood cholesterol; olive and canola oils are monounsaturated fats; fish, safflower, sunflower, corn, and soybean oils are polyunsaturated fats.

**URBAN LEGEND.** A story, anecdote, or piece of advice based on hearsay and circulated by person-to-person transmission.

**URIC ACID.** An acid found in urine and blood that is produced by the body's breakdown of nitrogen wastes.

**UROLOGIST.** A physician that specializes in disorders of the urinary tract and male genitals.

## V

**VANILLIN.** A synthetic version of vanilla flavoring.

**VASODILATOR.** A substance that causes blood vessels the body to become wider allowing the blood to flow more easily.

**VEGAN.** A vegetarian who excludes all animal products from the diet, including those that can be obtained without killing the animal. Vegans are also known as strict vegetarians.

**VEGETARIAN.** A diet containing no meat, but usually containing other animal products such as milk and eggs.

**VENOUS RETURN.** The blood returning to the heart via the inferior and superior venae cavae.

**VERY LOW-CALORIE DIET (VLCD).** A term used by nutritionists to classify weight-reduction diets that allow around 800 calories or fewer a day.

**VILLI.** The tiny, finger-like projections on the surface of the small intestine that help absorb nutrients.

**VILLI INTESTINALES.** Microscopic hair-like structures covered with epithelial cells measuring 1–1.5 mm that line the mucous inner membrane of the small intestine.

**VITAMIN.** A nutrient that the body needs in small amounts to remain healthy but that the body cannot manufacture for itself and must acquire through diet.

**VITAMIN $B_1$ (THIAMIN).** A vitamin which plays an important role in carbohydrate metabolism. A deficiency can lead to a disorder called Beri Beri, which results in a widespread nerve degeneration, which can damage the brain, spinal cord and heart. Good sources of this vitamin for lacto-vegetarians include cereals, beans, potatoes and nuts.

**VITAMIN $B_2$ (RIBOFLAVIN).** A vitamin or co-enzyme, which functions by helping the enzymes in the body function correctly. A good source of this vitamin for lacto-vegetarians is milk.

## W

**WASTING SYNDROME.** A combination of weight loss and change in composition of body tissues that occurs in patients with HIV infection. Typically, the patient's body loses lean muscle tissue and replaces it with fat as well as losing weight overall.

**WATER INTOXICATION.** A potentially fatal condition that occurs when an athlete loses sodium from the body through perspiration and drinks a large quantity of water in a short period of time without replacing the sodium. Long-distance runners are particularly susceptible to water intoxication.

**WATER-SOLUBLE VITAMIN.** A vitamin that dissolves in water and can be removed from the body in urine.

**WEBCAST.** The delivery of live or delayed sound or video broadcasts using web technologies. The sound or video is captured by conventional video or audio systems. It is then digitized and streamed on a web server.

**WHEY.** The watery part of milk, separated out during the process of making cheese.

**WHOLE-DIET APPROACH.** The notion that the beneficial effects of any dietary regimen are produced by the diet as a whole rather than by one specific food or other factor.

**WOMEN'S HEALTH INITIATIVE (WHI).** Major 15-year research program sponsored by the National Heart, Lung, and Blood Institute (NHLBI) of the National Institutes of Health (NIH) to address the most common causes of death, disability and poor quality of life in postmenopausal women, namely cardiovascular disease, cancer, and osteoporosis. The WHI was launched in 1991 and consisted of a set of clinical trials and an observational study, which together involved 161,808 generally healthy postmenopausal women. The study results were published in the February 16, 2007 issue of *The New England Journal of Medicine*.

## Y

**YOLK.** The yellow spherical mass in the inner portion of an egg. It contains almost all the fat and cholesterol found in eggs.

# INDEX

In the index, references to individual volumes are listed before colons; numbers following a colon refer to specific page numbers within that particular volume. **Boldface** references indicate main topical essays. Photographs and illustration references are highlighted with an *italicized* page number; and tables are also indicated with the page number followed by a lowercase, italicized *t*.

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