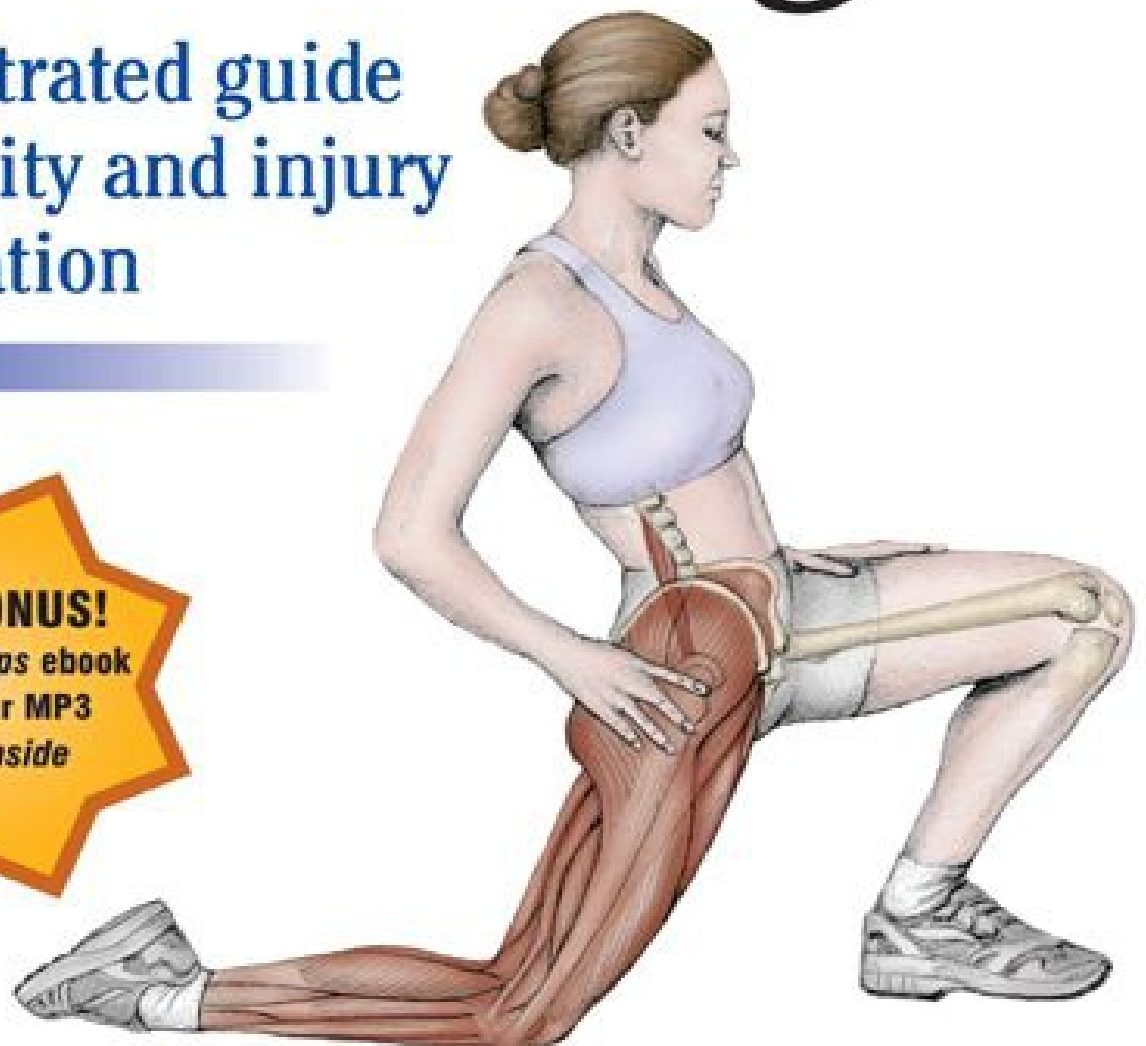




# *The Anatomy of* **Stretching**

your illustrated guide  
to flexibility and injury  
rehabilitation

**FREE BONUS!**  
*Stretching Tips* ebook  
Plus 1-hour MP3  
*Details Inside*



**Brad Walker**

*Author of The Anatomy of Sports Injuries*

**Second  
Edition**

# **The Anatomy of Stretching**

Your Illustrated Guide  
to Flexibility and Injury  
Rehabilitation

**Second Edition**

**Brad Walker**



**Lotus Publishing**  
Chichester, England



**North Atlantic Books**  
Berkeley, California

Copyright © 2007, 2011 by Brad Walker. All rights reserved. No portion of this book, except for brief review, may be reproduced, stored in a retrieval system, or transmitted in any form or by any means – electronic, mechanical, photocopying, recording, or otherwise – without the written permission of the publisher. For information, contact Lotus Publishing or North Atlantic Books.

First published in 2007. This revised second edition published in 2011 by

**Lotus Publishing**

Apple Tree Cottage, Inlands Road, Nutbourne, PO18 8RJ and

**North Atlantic Books**

P.O. Box 12327

Berkeley, California 94712

**Drawings** Pascale Pollier and Amanda Williams

**Cover Design** Jim Wilkie

*The Anatomy of Stretching* is sponsored by the Society for the Study of Native Arts and Sciences, a nonprofit educational corporation whose goals are to develop an educational and cross-cultural perspective linking various scientific, social, and artistic fields; to nurture a holistic view of arts, sciences, humanities, and healing; and to publish and distribute literature on the relationship of mind, body, and nature.

**MEDICAL DISCLAIMER:** The following information is intended for general information purposes only. Individuals should always consult their health care provider before administering any suggestions made in this book. Any application of the material set forth in the following pages is at the reader's discretion and is his or her sole responsibility.

**The British Library Cataloguing has cataloged the printed edition as follows:**

A CIP record for this book is available from the British Library

eBook ISBN: 978-1-58394-730-2

ISBN 978 1 905367 29 0 (Lotus Publishing)

Trade Paperback ISBN 978 1 55643 596 6 (North Atlantic Books)

**The Library of Congress has cataloged the first edition as follows:**

Walker, Brad, 1971–

The anatomy of stretching / Brad Walker.

p. cm.

ISBN-13: 978-1-55643-596-6 (pbk.)

ISBN-10: 1-55643-596-7 (pbk.)

1. Stretching exercises. I. Title.

RA781.63.W35 2006

613.7'182–dc22

2006022377

**Here's Where You Get \$97 Worth of Bonus Information, Just for Purchasing This Book: [www.StretchingBonus.com](http://www.StretchingBonus.com)**

Find all the answers to your questions about stretching for maximum performance and injury reduction with the free Stretching Tips ebook. The 1-hour MP3 audio presentation takes you beyond the basics and discusses little-known stretching secrets that will revolutionize the way you think about stretching and flexibility.





# Contents

*Cover*

*Title Page*

*Copyright*

## **How to Use This Book**

## **Introduction**

## **Chapter 1 Flexibility, Anatomy, and Physiology**

Fitness and Flexibility

Muscle Anatomy

The Physiology of Muscle Contraction

Muscle Reflexes

Musculo-skeletal Mechanics

Lever

Generation of Force

What Happens When a Muscle Is Stretched?

Terms of Anatomical Direction

## **Chapter 2 The Principles of Stretching**

The Benefits of Stretching

Types of Stretching

Static Stretches

Dynamic Stretches

The Rules for Safe Stretching

How to Stretch Properly

How to Use Stretching as Part of the Warm-up

## **Chapter 3 Neck and Shoulders**

A01: Lateral Neck Stretch

A02: Rotating Neck Stretch

A03: Forward Flexion Neck Stretch

A04: Diagonal Flexion Neck Stretch

A05: Neck Extension Stretch

A06: Neck Protraction Stretch

A07: Sitting Neck Flexion Stretch

A08: Parallel Arm Shoulder Stretch

- A09: Bent Arm Shoulder Stretch
- A10: Wrap Around Shoulder Stretch
- A11: Cross Over Shoulder Stretch
- A12: Reaching-up Shoulder Stretch
- A13: Elbow-out Rotator Stretch
- A14: Arm-up Rotator Stretch
- A15: Arm-down Rotator Stretch
- A16: Reverse Shoulder Stretch
- A17: Assisted Reverse Shoulder Stretch

## **Chapter 4 Arms and Chest**

- B01: Above Head Chest Stretch
- B02: Partner Assisted Chest Stretch
- B03: Seated Partner Assisted Chest Stretch
- B04: Parallel Arm Chest Stretch
- B05: Bent Arm Chest Stretch
- B06: Assisted Reverse Chest Stretch
- B07: Bent-over Chest Stretch
- B08: Kneeling Chest Stretch
- B09: Reaching-down Triceps Stretch
- B10: Triceps Stretch
- B11: Kneeling Forearm Stretch
- B12: Palms-out Forearm Stretch
- B13: Fingers-down Forearm Stretch
- B14: Finger Stretch
- B15: Thumb Stretch
- B16: Fingers-down Wrist Stretch
- B17: Rotating Wrist Stretch

## **Chapter 5 Stomach**

- C01: On Elbows Stomach Stretch
- C02: Rising Stomach Stretch
- C03: Rotating Stomach Stretch
- C04: Standing Lean-back Stomach Stretch
- C05: Standing Lean-back Side Stomach Stretch
- C06: Back Arching Stomach Stretch

## **Chapter 6 Back and Sides**

- D01: Reaching Forward Upper Back Stretch
- D02: Reaching Upper Back Stretch
- D03: Reach-up Back Stretch
- D04: Lying Whole Body Stretch

D05: Sitting Bent-over Back Stretch  
D06: Sitting Side Reach Stretch  
D07: Standing Knee-to-chest Stretch  
D08: Lying Knee-to-chest Stretch  
D09: Lying Double Knee-to-chest Stretch  
D10: Kneeling Reach Forward Stretch  
D11: Kneeling Back-arch Stretch  
D12: Kneeling Back-slump Stretch  
D13: Kneeling Back Rotation Stretch  
D14: Standing Back Rotation Stretch  
D15: Standing Reach-up Back Rotation Stretch  
D16: Lying Leg Cross-over Stretch  
D17: Lying Knee Roll-over Stretch  
D18: Sitting Knee-up Rotation Stretch  
D19: Sitting Knee-up Extended Rotation Stretch  
D20: Kneeling Reach-around Stretch  
D21: Standing Lateral Side Stretch  
D22: Reaching Lateral Side Stretch  
D23: Sitting Lateral Side Stretch

## **Chapter 7 Hips and Buttocks**

E01: Lying Cross-over Knee Pull-down Stretch  
E02: Lying Leg Tuck Hip Stretch  
E03: Standing Leg Tuck Hip Stretch  
E04: Standing Leg Resting Buttocks Stretch  
E05: Sitting Rotational Hip Stretch  
E06: Standing Rotational Hip Stretch  
E07: Sitting Cross-legged Reach Forward Stretch  
E08: Sitting Feet-together Reach Forward Stretch  
E09: Sitting Knee-to-chest Buttocks Stretch  
E10: Sitting Foot-to-chest Buttocks Stretch  
E11: Lying Cross-over Knee Pull-up Stretch  
E12: Sitting Leg Resting Buttocks Stretch  
E13: Lying Leg Resting Buttocks Stretch

## **Chapter 8 Quadriceps**

F01: Kneeling Quad Stretch  
F02: Standing Quad Stretch  
F03: Standing Reach-up Quad Stretch  
F04: Lying Quad Stretch  
F05: On-your-side Quad Stretch  
F06: Single Lean-back Quad Stretch  
F07: Double Lean-back Quad Stretch

## **Chapter 9 Hamstrings**

- G01: Sitting Reach Forward Hamstring Stretch
- G02: Standing Toe-pointed Hamstring Stretch
- G03: Standing Toe-raised Hamstring Stretch
- G04: Standing Leg-up Hamstring Stretch
- G05: Standing Leg-up Toe-in Hamstring Stretch
- G06: Sitting Single Leg Hamstring Stretch
- G07: Lying Partner Assisted Hamstring Stretch
- G08: Lying Bent Knee Hamstring Stretch
- G09: Lying Straight Knee Hamstring Stretch
- G10: Kneeling Toe-raised Hamstring Stretch
- G11: Sitting Leg Resting Hamstring Stretch
- G12: Standing Leg-up Bent Knee Hamstring Stretch
- G13: Standing High-leg Bent Knee Hamstring Stretch
- G14: Sitting Bent Knee Toe-pull Hamstring Stretch
- G15: Standing Reach Down Hamstring Stretch

## **Chapter 10 Adductors**

- H01: Sitting Feet Together Adductor Stretch
- H02: Standing Wide Knees Adductor Stretch
- H03: Standing Leg-up Adductor Stretch
- H04: Kneeling Leg-out Adductor Stretch
- H05: Squatting Leg-out Adductor Stretch
- H06: Kneeling Face-down Adductor Stretch
- H07: Sitting Wide Leg Adductor Stretch
- H08: Standing Wide Leg Adductor Stretch

## **Chapter 11 Abductors**

- I01: Standing Hip-out Abductor Stretch
- I02: Standing Leg Cross Abductor Stretch
- I03: Leaning Abductor Stretch
- I04: Standing Leg-under Abductor Stretch
- I05: Lying Abductor Stretch
- I06: Lying Swiss Ball Abductor Stretch
- I07: Lying Leg Hang Abductor Stretch

## **Chapter 12 Upper Calves**

- J01: Standing Toe-up Calf Stretch
- J02: Standing Toe Raised Calf Stretch
- J03: Single Heel Drop Calf Stretch
- J04: Double Heel Drop Calf Stretch
- J05: Standing Heel Back Calf Stretch

J06: Leaning Heel Back Calf Stretch

J07: Crouching Heel Back Calf Stretch

J08: Sitting Toe Pull Calf Stretch

## **Chapter 13 Lower Calves and Achilles Tendon**

K01: Standing Toe-up Achilles Stretch

K02: Single Heel Drop Achilles Stretch

K03: Standing Heel Back Achilles Stretch

K04: Leaning Heel Back Achilles Stretch

K05: Sitting Bent Knee Toe Pull Achilles Stretch

K06: Crouching Heel Back Achilles Stretch

K07: Kneeling Heel-down Achilles Stretch

K08: Squatting Achilles Stretch

## **Chapter 14 Shins, Ankles, Feet, and Toes**

L01: Foot-behind Shin Stretch

L02: Front Cross-over Shin Stretch

L03: Raised Foot Shin Stretch

L04: Double Kneeling Shin Stretch

L05: Squatting Toe Stretch

L06: Ankle Rotation Stretch

## **Resources**

**Top Five Stretches for Each Sports Injury**

**Top Five Stretches for Each Sport**

**Glossary**

# How to Use This Book

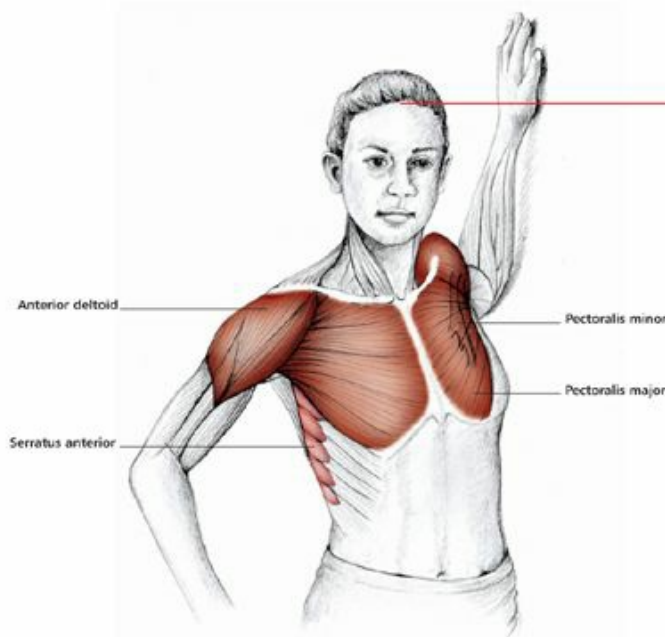
*The Anatomy of Stretching* is designed to provide a balance of theoretical information about the fundamentals of stretching and flexibility anatomy and physiology, and the practical application of how to perform 135 unique stretching exercises. All the stretching exercises are indexed according to what part of the body is being stretched and further information is provided on exactly which muscles are being targeted.

As well as a detailed anatomical drawing, each stretch section includes a description of how the stretch is performed, a list of sports and sports injuries that the stretch is most beneficial for, and additional information about any common problems associated with this stretch.

The information about each stretch is presented in a uniform style throughout. An example is given below, with the meaning of headings explained in bold.

Each stretch has a unique number and descriptive name for easy reference

## B05: BENT ARM CHEST STRETCH



A visual anatomical diagram shows the targeted muscles being stretched during the stretching exercise

Used in association with the anatomical diagram, the written description provides a detailed overview of exactly how to perform the stretch

### Technique

Stand with your arm extended and your forearm at right angles to the ground. Rest your forearm against an immovable object and then turn your shoulders and body away from your extended arm.

### Muscles being stretched

Primary muscles: Pectoralis major and minor.  
Anterior deltoid.  
Secondary muscle: Serratus anterior.

### Sports that benefit from this stretch

Basketball, Netball, Hiking, Backpacking, Mountaineering, Orienteering, Tennis, Badminton, Squash, Rowing, Canoeing, Kayaking, Swimming, Cricket, Baseball, Athletics throwing field events.

### Sports injury where stretch may be useful

Dislocation, Subluxation, Acromioclavicular separation, Sternoclavicular separation, Impingement syndrome, Rotator cuff tendonitis, Shoulder bursitis, Frozen shoulder (adhesive capsulitis), Chest strain, Pectoral muscle insertion inflammation.

### Additional information for performing this stretch correctly

Keep your upper arm parallel to the ground.

### Complementary stretch

B04.

A complete list of sports injuries where the stretch would be useful for sports injury prevention or sports injury treatment

Precautions, special needs, and additional information to ensure the stretch is performed in a safe and beneficial manner

A complementary stretch is suggested here to further enhance the benefit of this stretch

Primary muscles: The targeted muscles that are being stretched during the stretching exercise.  
Secondary muscles: Any additional muscles that are stretched during the stretching exercise

A complete list of sports that use the targeted muscles during the main activity of the sport

# Introduction

The subject of stretching and flexibility has evolved considerably over the last fifteen to twenty years. Long gone are the days when the topic of stretching was relegated to a few pages at the back of books on health and fitness, or when a dozen stick figures performing the most basic of stretching exercises was considered a detailed reference.

Fifteen years ago it was hard to find a text specifically on stretching, but today there are dozens of references. Everything from “New Age” stretching techniques to martial arts stretching and the very detailed clinical application of stretching for academics has been written.

When *The Anatomy of Stretching* was originally published in 2007 it was the first book to cover the topic of anatomy and physiology for stretching and flexibility. Since then others have been written, but no other book on the subject contains more examples of stretching exercises, or is able to take detailed anatomical information and present it in a way that is easy for everyone to understand.

This is where *The Anatomy of Stretching* is different: it is able to take you inside the body and show you both the primary and secondary muscles in action during the stretching process.

*The Anatomy of Stretching* looks at stretching from every angle, including physiology and flexibility; the benefits of stretching; the different types of stretching; rules for safe stretching; and how to stretch properly. Aimed at fitness enthusiasts of any level, as well as fitness pros, *The Anatomy of Stretching* also focuses on which stretches are useful for the alleviation or rehabilitation of specific sports injuries.

Plus in this second edition, over 20 new stretches have been added; the chapter on physiology has been expanded; more detailed anatomy has been included with each stretching chapter; and a new numbering system has been included to help reference each stretch.

Written as a visual aid for athletes and fitness professionals, *The Anatomy of Stretching* gives readers a balance of theoretical information about the fundamentals of stretching and flexibility anatomy and physiology, and the practical application of how to perform 135 unique stretching exercises.

Divided into stand-alone sections, *The Anatomy of Stretching* does not have to be read from cover-to-cover to take advantage of the information it contains. If you would like to see how a muscle works, refer to [Chapter 1](#); if you would like to know how stretching can help you, have a read through some of the benefits in [Chapter 2](#); and if you would like information on stretches for the hamstrings, look under [Chapter 9](#).

Whether you are a professional athlete or a fitness enthusiast, a sports coach or personal trainer, a physical therapist or sports doctor, *The Anatomy of Stretching* will benefit you.

Brad Walker





## **Flexibility, Anatomy, and Physiology**

### **Fitness and Flexibility**

An individual's physical fitness depends on a vast number of components; flexibility is only one of these. Although flexibility is a vital part of physical fitness, it is important to see it as only one spoke in the fitness wheel. Other components include strength, power, speed, endurance, balance, coordination, agility, and skill.

Although particular sports require different levels of each fitness component, it is essential to plan a regular exercise or training program that covers all the components of physical fitness. Rugby and American football (gridiron), for example, rely heavily on strength and power; however, the exclusion of skill drills and flexibility training could lead to serious injury and poor performance. Strength and flexibility are of prime concern to a gymnast, but a sound training program would also improve power, speed, and endurance.

The same is true for each individual: while some people seem to be naturally strong or flexible, it would be foolish for such persons to completely ignore the other components of physical fitness. And just because an individual exhibits good flexibility at one joint or muscle group, it does not mean that the entire individual will be flexible. Therefore, flexibility must be viewed as specific to a particular joint or muscle group.

### **The Dangers and Limitations of Poor Flexibility**

Tight, stiff muscles limit our normal range of movement. In some cases, lack of flexibility can be a major contributing factor to muscle and joint pain. In the extreme, lack of flexibility can mean it is difficult, for example, to even bend down or look over our shoulder.

Tight, stiff muscles interfere with proper muscle action. If the muscles cannot contract and relax efficiently, this will result in decreased performance and a lack of muscle movement control. Short, tight muscles also cause a dramatic loss of strength and power during physical activity.

In a very small percentage of cases, muscles that are tight and stiff can even restrict blood circulation. Good blood circulation is vitally important in helping the muscles receive adequate amounts of oxygen and nutrients. Poor circulation can result in increased muscle fatigue and, ultimately, impede the muscles' repair process and the ability to recover from strenuous exercise.

Any one of these factors can greatly increase the chances of becoming injured. Together they present a package that includes muscular discomfort, loss of performance, an increased risk of injury, and a greater likelihood of repeated injury.

### **How Is Flexibility Restricted?**

The muscular system needs to be flexible to achieve peak performance, and stretching is the most effective way of developing and retaining flexible muscles and tendons. However, a number of other factors also contribute to a decrease in flexibility.

Flexibility, or range of movement, can be restricted by both internal and external factors. Internal factors such as bones, ligaments, muscle bulk, muscle length, tendons, and skin all restrict the amount of movement at any particular joint. As an example, the human leg cannot bend forward beyond a straight position, because of the structure of the bones and ligaments that make up the knee joint.

External factors such as age, gender, temperature, restrictive clothing, and of course any injury or disability will also have an effect on one's flexibility.

### **Flexibility and the Ageing Process**

It is no secret that with each passing year muscles and joints seem to become stiffer and tighter. This is part of the ageing process and is caused by a combination of physical degeneration and inactivity. Although we cannot help getting older, this should not mean that we give up trying to improve our flexibility.

Age should not be a barrier to a fit and active lifestyle but certain precautions should be taken as we get older. Participants just need to work at it for longer, be a little more patient, and take a lot more care.

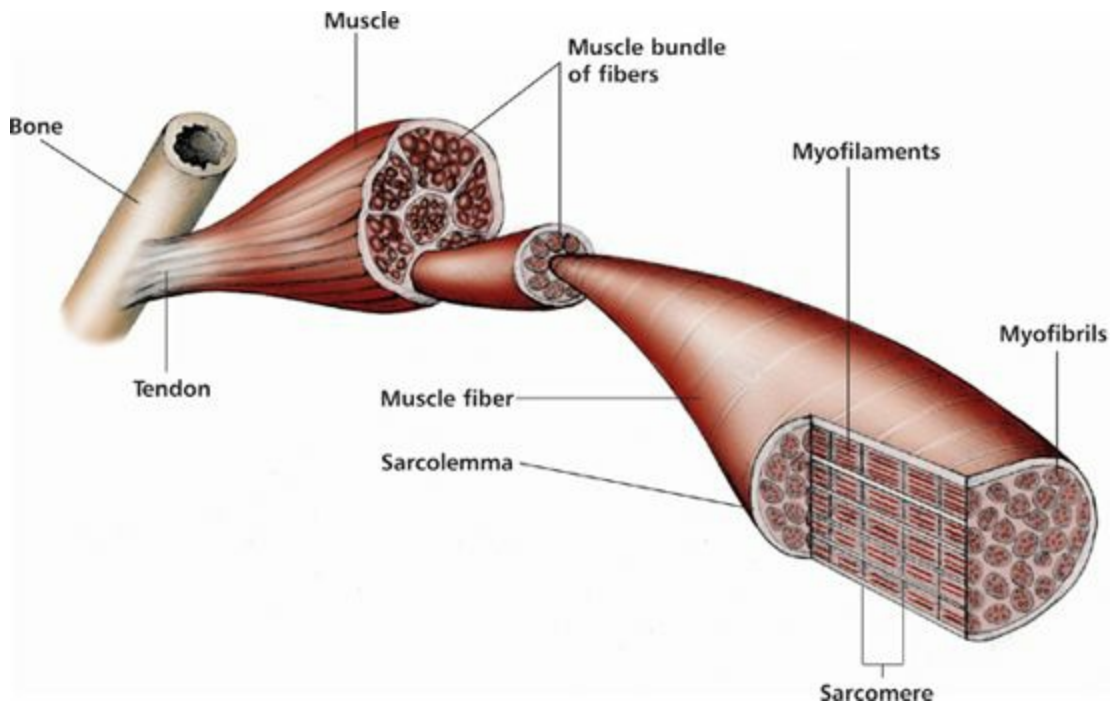


Figure 1.1: A cross-section of muscle fibers, including myofibrils, sarcomeres, and myofilaments.

# Muscle Anatomy

When aiming to improve flexibility, the muscles and their fascia (sheath) should be the major focus of our flexibility training. While bones, joints, ligaments, tendons, and skin do contribute to our overall flexibility, we have very little control over these factors.

## Bones and Joints

Bones and joints are structured in such a way as to allow a specific range of movement. For example, the knee joint will not allow our leg to bend any further forward past a straight leg position, no matter how hard we try.

## Ligaments

Ligaments connect bone to bone and act as stabilisers for joints. Stretching the ligaments should be avoided and can result in a permanent reduction of stability at the joint, which can lead to joint weakness and injury.

## Tendons

Muscles are connected to the bones by tendons, which consist of dense connective tissue. They are extremely strong yet very pliable. Tendons also play a role in joint stability and contribute less than 10% to a joint's overall flexibility; therefore tendons should not be a primary focus of stretching.

## Muscles

The human body contains over 215 pairs of skeletal muscles, which make up approximately 40% of its weight. Skeletal muscles are so named because most attach to and move the skeleton, and so are responsible for movement of the body.

Skeletal muscles have an abundant supply of blood vessels and nerves, which is directly related to contraction, the primary function of skeletal muscle. Each skeletal muscle generally has one main artery to bring nutrients via the blood supply, and several veins to take away metabolic waste. The blood and nerve supply generally enters the muscle through the centre of the muscle, but occasionally toward one end, which eventually penetrates the endomysium around each muscle fiber.

The three types of skeletal muscle fiber are: red slow-twitch, intermediate fast-twitch, and white fast-twitch. The colour of each is reflected in the amount of myoglobin present, a store for oxygen. The myoglobin is able to increase the rate of oxygen diffusion, so red slow-twitch fibers are able to contract for longer periods, which is particularly useful for endurance events. The white fast-twitch fibers have a lower content of myoglobin. Because they rely on glycogen (energy) reserves, they can contract quickly, but they also fatigue quickly, so are more prevalent in sprinters, or sports where short, rapid movements are required, such as weightlifting. World-class marathon runners have been reported to possess 93–99% slow-twitch fibers in their gastrocnemius (calf) muscle, whilst world-class sprinters only possess about 25% in the same muscle (Wilmore & Costill, 1994).

Each skeletal muscle fiber is a single cylindrical muscle cell, which is surrounded by a plasma membrane called the sarcolemma. The sarcolemma features specific openings, which lead to tubes known as transverse (or T) tubules. (The sarcolemma maintains a membrane potential, which allows impulses, specifically to the sarcoplasmic reticulum (SR), to either generate or inhibit contractions.)

An individual skeletal muscle may be made up of hundreds, or even thousands, of muscle fibers bundled together and wrapped in a connective tissue sheath called the epimysium, which gives the muscle its shape, as well as providing a surface against which the surrounding muscles can move. Fascia, connective tissue outside the epimysium, surrounds and separates the muscles.

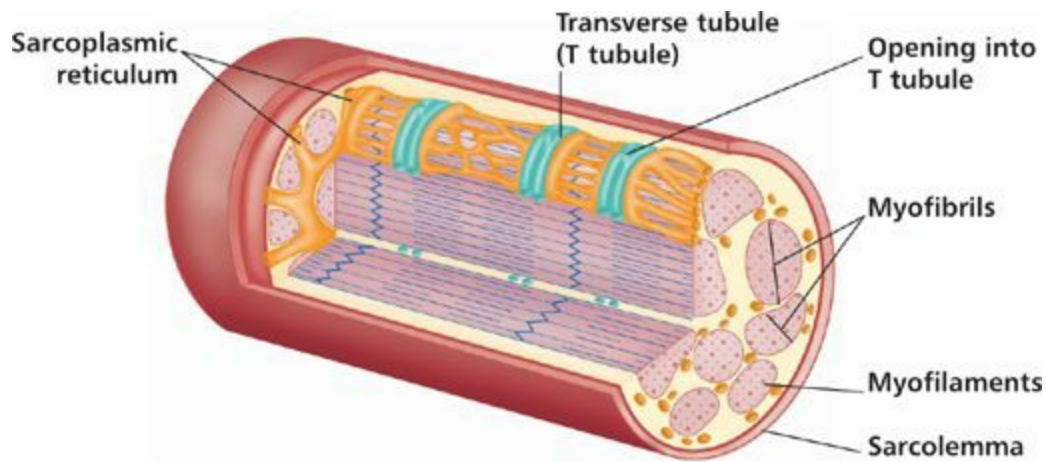


Figure 1.2: Each skeletal muscle fiber is a single cylindrical muscle cell.

Portions of the epimysium project inward to divide the muscle into compartments. Each compartment contains a bundle of muscle fibers; each of these bundles is called a fasciculus (Latin = small bundle of twigs) and is surrounded by a layer of connective tissue called the perimysium. Each fasciculus consists of a number of muscle cells, and within the fasciculus, each individual muscle cell is surrounded by the endomysium, a fine sheath of delicate connective tissue.

Skeletal muscles come in a variety of shapes, due to the arrangement of their fasciculus (English = fascicles), depending on the function of the muscle in relation to its position and action. Parallel muscles have their fasciculus running parallel to the long axis of the muscle, e.g., sartorius. Pennate muscles have short fasciculus, which are attached obliquely to the tendon, and appear feather-shaped, e.g., rectus femoris. Convergent (triangular) muscles have a broad origin with the fasciculus converging toward a single tendon, e.g., pectoralis major. Circular (sphincter) muscles have their fasciculus arranged in concentric rings around an opening, e.g., orbicularis oculi.

Figure 1.3: Muscle shapes



(a) parallel



(b) pennate



(c) convergent



(d) circular.

Each muscle fiber is composed of small structures called muscle fibrils or myofibrils (“myo-” meaning “muscle” in Latin). These myofibrils lie in parallel and give the muscle cell its striated appearance, because they are composed of regularly aligned myofilaments. Myofilaments are chains of protein molecules, which under microscope appear as alternate light and dark bands. The light isotropic (I) bands are composed of the protein actin. The dark anisotropic (A) bands are composed of the protein myosin. (A third protein called titin has been identified, which accounts for about 11% of the combined muscle protein content.) When a muscle contracts, the actin filaments move between the myosin filaments, forming cross-bridges, which results in the myofibrils shortening and thickening. (See “The Physiology of Muscle Contraction.”)

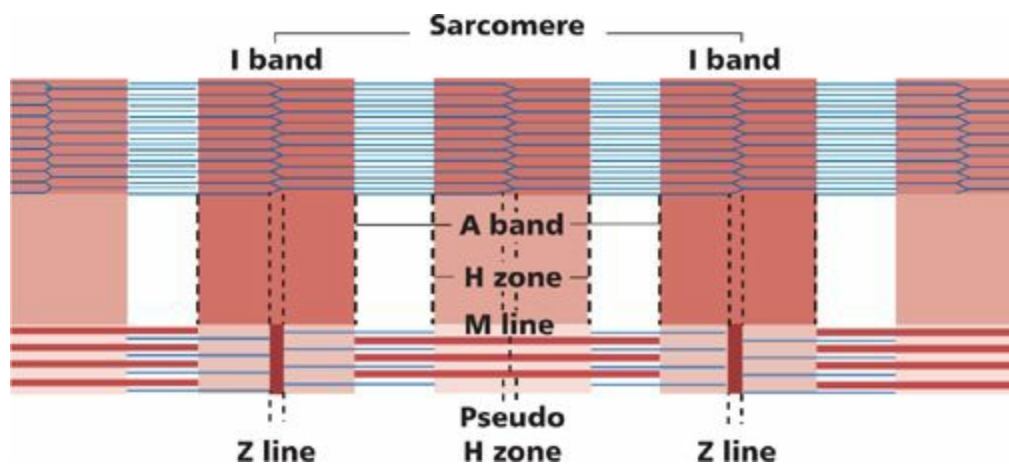


Figure 1.4: The myofilaments within a sarcomere. A sarcomere is bounded at both ends by the Z line; M line is the centre of the sarcomere; I band is composed of actin; A band is composed of myosin.

Commonly, the epimysium, perimysium, and endomysium extend beyond the fleshy part of the muscle, the belly, to form a thick ropelike tendon or broad, flat, sheet-like tendinous tissue, known as an aponeurosis. The tendon and aponeurosis form indirect attachments from muscles to the periosteum of bones or to the connective tissue of other muscles. However, more complex muscles may have multiple attachments, such as the quadriceps (four attachments). So typically a muscle spans a joint and is attached to bones by tendons at both ends. One of the bones remains relatively fixed or stable while the other end moves as a result of muscle contraction.

Each muscle fiber is innervated by a single motor nerve fiber, ending near the middle of the muscle fiber. A single motor nerve fiber and all the muscle fibers it supplies is known as a motor unit. The number of muscle fibers supplied by a single nerve fiber is dependent upon the movement required. When an exact, controlled degree of movement is required, such as in eye or finger movement, only a few muscle fibers are supplied; when a grosser movement is required, as in large muscles like gluteus maximus, several hundred fibers may be supplied.



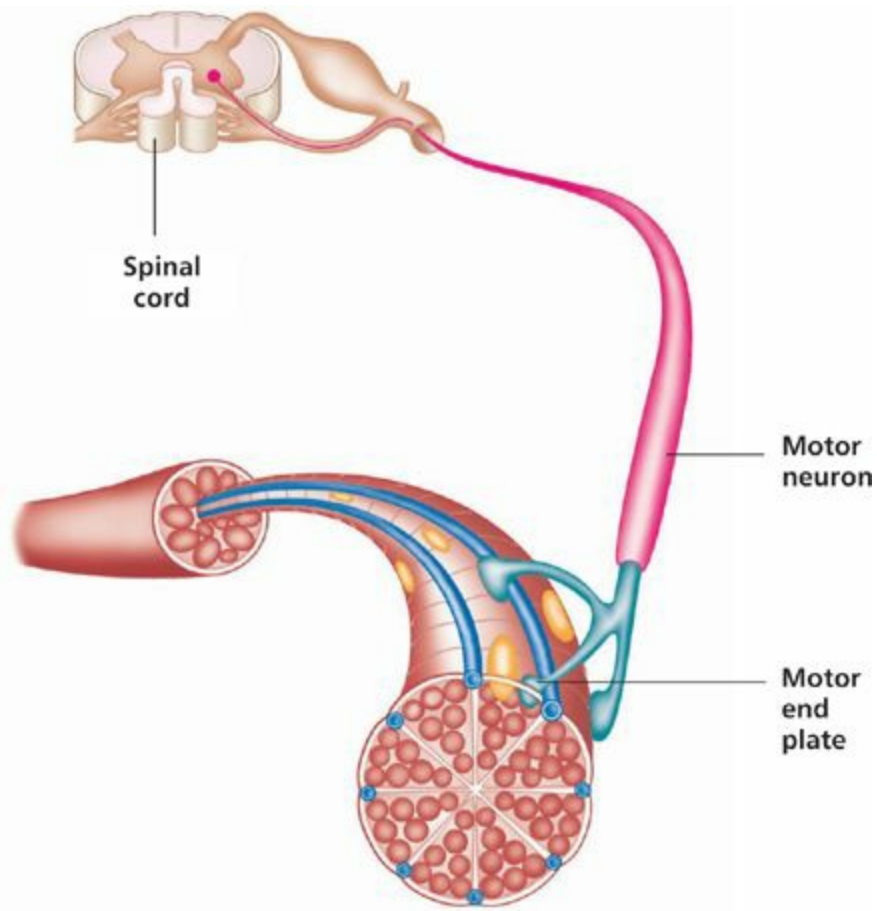


Figure 1.5: A motor unit of a skeletal muscle.

Individual skeletal muscle fibers work on an “all or nothing” principle, where stimulation of the fiber results in complete contraction of that fiber, or no contraction at all – a fiber cannot be “slightly contracted”. The overall contraction of any named muscle involves the contraction of a proportion of its fibers at any one time, with others remaining relaxed.

# The Physiology of Muscle Contraction

Nerve impulses cause the skeletal muscle fibers at which they terminate, to contract. The junction between a muscle fiber and the motor nerve is known as the neuromuscular junction, and this is where communication between the nerve and muscle takes place. A nerve impulse arrives at the nerve's endings, called synaptic terminals, close to the sarcolemma. These terminals contain thousands of vesicles filled with a neurotransmitter called acetylcholine (ACh). When a nerve impulse reaches the synaptic terminal, hundreds of these vesicles discharge their ACh. The ACh opens up channels, which allow sodium ions ( $\text{Na}^+$ ) to diffuse in. An inactive muscle fiber has a resting potential of about -95 mV. The influx of sodium ions reduces the charge, creating an end plate potential. If the end plate potential reaches the threshold voltage (approximately -50 mV), sodium ions flow in and an action potential is created within the fiber.

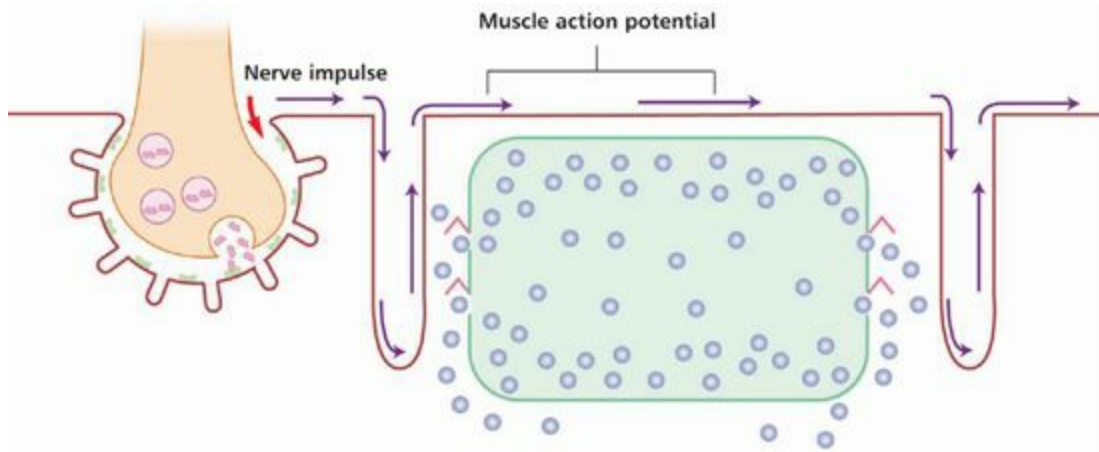


Figure 1.6: Nerve impulse triggering an action potential/muscle contraction.

No visible change occurs in the muscle fiber during (and immediately following) the action potential. This period, called the latent period, lasts from 3–10 msec. Before the latent period is over, the enzyme acetylcholinesterase breaks down the ACh in the neuromuscular junction, the sodium channels close, and the field is cleared for the arrival of another nerve impulse. The resting potential of the fiber is restored by an outflow of potassium ions. The brief period needed to restore the resting potential is called the refractory period.

So how does a muscle fiber shorten? This has been explained best by the sliding filament theory (Huxley & Hanson, 1954), which proposed that muscle fibers receive a nerve impulse (see above) that results in the release of calcium ions stored in the sarcoplasmic reticulum (SR). For muscles to work effectively, energy is required, and this is created by the breakdown of adenosine triphosphate (ATP). This energy allows the calcium ions to bind with the actin and myosin filaments to form a magnetic bond, which causes the fibers to shorten, resulting in the contraction. Muscle action continues until the calcium is depleted, at which point calcium is pumped back into the SR, where it is stored until another nerve impulse arrives.

# Muscle Reflexes

Skeletal muscles contain specialized sensory units that are sensitive to muscle lengthening (stretching). These sensory units are called muscle spindles and Golgi tendon organs and they are important in detecting, responding to, and modulating changes in the length of muscle.

Muscle spindles are made up of spiral threads called intrafusal fibers, and nerve endings, both encased within a connective tissue sheath, that monitor the speed at which a muscle is lengthening. If a muscle is lengthening at speed, signals from the intrafusal fibers will fire information via the spinal cord to the nervous system so that a nerve impulse is sent back, causing the lengthening muscle to contract. The signals give continuous information to/from the muscle about position and power (proprioception).

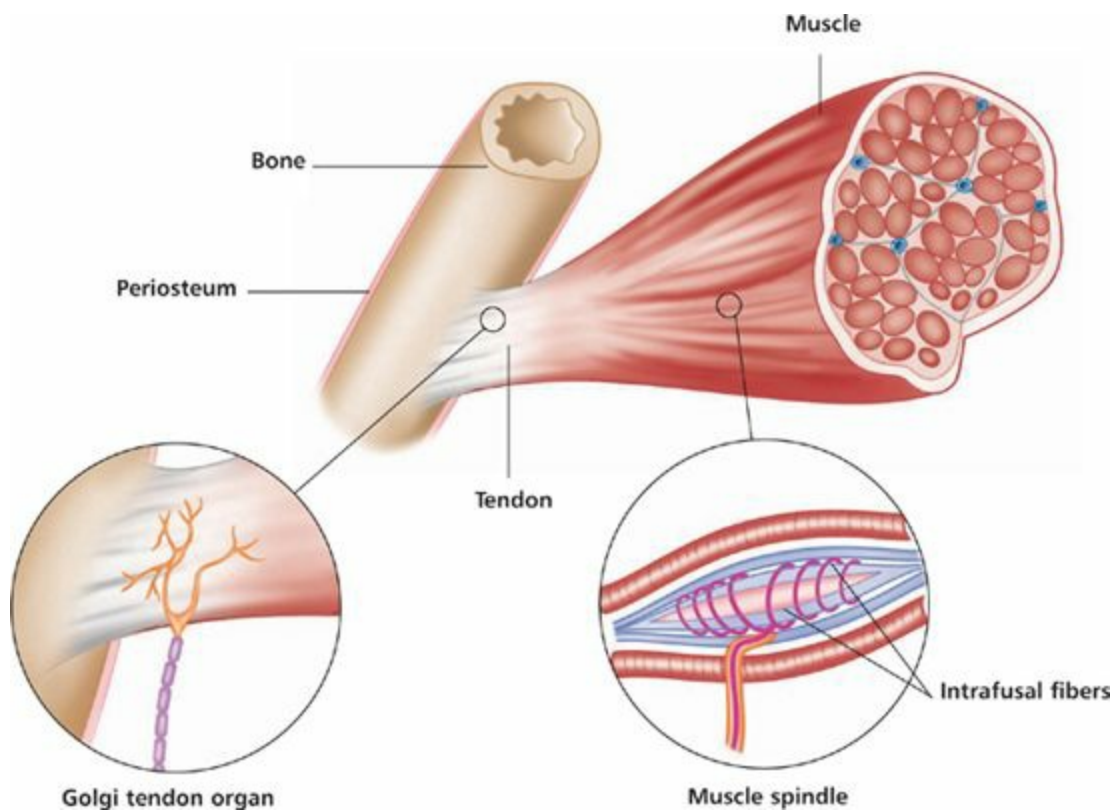


Figure 1.7: Anatomy of the muscle spindle and Golgi tendon organ.

Furthermore, when a muscle is lengthened and held, it will maintain a contractile response as long as the muscle remains stretched. This facility is known as the stretch reflex arc. Muscle spindles will remain stimulated as long as the stretch is held (see [this page](#)).

The classic clinical example of the stretch reflex is the knee jerk test, which involves activation of the stretch receptors in the tendon, which causes reflex contraction of the muscle attached, i.e., the quadriceps.

Whereas the muscle spindles monitor the length of a muscle, the Golgi tendon organs (GTOs) in the muscle tendon are so sensitive to tension in the muscle-tendon complex, that they can respond to the contraction of a single muscle fiber. The GTOs are inhibitory in nature, performing a protective function by reducing the risk of injury. When stimulated, the GTOs inhibit the contracting (agonist) muscles and excite the antagonist muscles.

# Musculo-skeletal Mechanics

Most coordinated movement involves one attachment of a skeletal muscle remaining relatively stationary, whilst the attachment at the other end moves. The proximal, more fixed attachment is known as the origin, while the attachment that lies more distally, and moves, is known as the insertion. (However, attachment is now the preferred term for origin and insertion, as it acknowledges that muscles often work so that either end can be fixed whilst the other end moves.)

Most movements require the application of muscle force, which often is accomplished by agonists (or prime movers), which are primarily responsible for movement and provide most of the force required for movement; antagonists, which have to lengthen to allow for the movement produced by the prime movers, and play a protective role; and synergists (more specifically referred to as stabilisers), which assist prime movers, and are sometimes involved in fine-tuning the direction of movement. A simple example is the flexion of the elbow, which requires shortening of the brachialis and biceps brachii (prime movers) and the relaxation of the triceps brachii (antagonist). The brachioradialis acts as the synergist by assisting the brachialis and biceps brachii.

Muscle movement can be broken down into three types of contractions: concentric, eccentric, and static (isometric). In many activities, such as running, Pilates, and yoga, all three types of contraction may occur to produce smooth, coordinated movement.

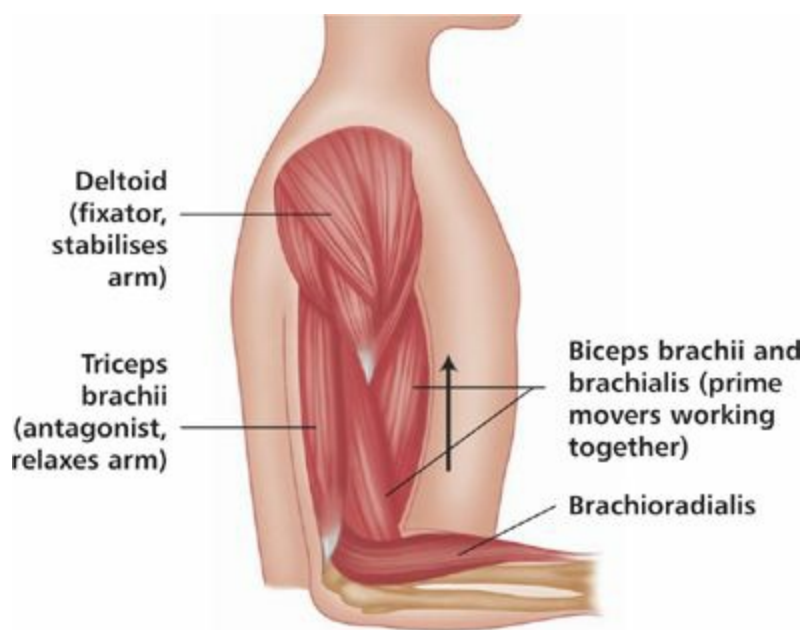


Figure 1.8: Flexion of the elbow, where brachialis and biceps brachii act as the prime movers, triceps brachii as the antagonist, and brachioradialis as the synergist.

## **Skeletal muscles can be broadly classified into two types:**

1. **Stabilisers\***, which essentially stabilize a joint. They are made up of slow-twitch fibers for endurance, and assist with postural holding. They can be further subdivided into primary stabilisers, which have very deep attachments, lying close to the axis of rotation of the joint; and secondary stabilisers, which are powerful muscles, with an ability to absorb large amounts of force. Stabilisers work against gravity, and tend to become weak and long over time (Norris, 1998). Examples include multifidus, transversus abdominis (primary), and gluteus maximus and adductor magnus (secondary).
2. **Mobilisers\*** are responsible for movement. They tend to be more superficial although less powerful than stabilisers, but produce a wider range of motion. They tend to cross two joints, and are made of fast-twitch fibers that produce power but lack endurance. Mobilisers assist with rapid or ballistic movement and produce high force. With time and use, they tend to tighten and shorten. Examples include the hamstrings, piriformis, and rhomboids.

A muscle's principle action, shortening, where the muscle attachments move closer together, is referred to as a concentric contraction. Because joint movement is produced, concentric contractions are also considered dynamic contractions. An example is that of holding an object, where the biceps brachii contracts concentrically, the elbow joint flexes, and the hand moves up toward the shoulder.

A movement is considered to be an eccentric contraction where the muscle may exert force while lengthening. As with concentric contraction, because joint movement is produced, this is also referred to as a dynamic contraction. The actin filaments are pulled further from the centre of the sarcomere, effectively stretching it.

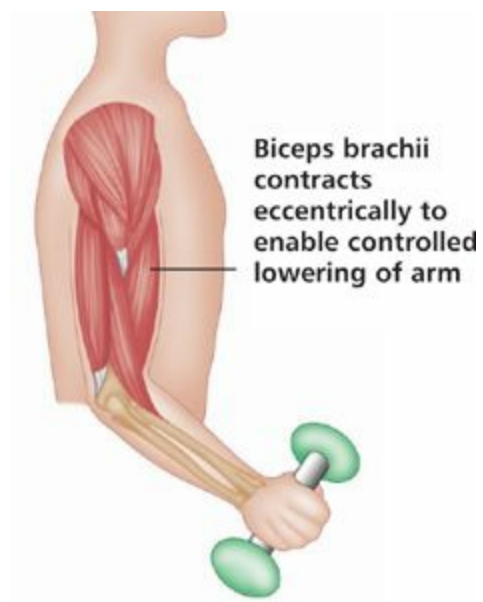


Figure 1.9: An example of eccentric contraction is the action of the biceps brachii when the elbow is extended to lower a heavy weight. Here, biceps brachii is controlling the movement by gradually lengthening in order to resist gravity.

When a muscle acts without moving, force is generated but its length remains unchanged. This is known as static (isometric) contraction.



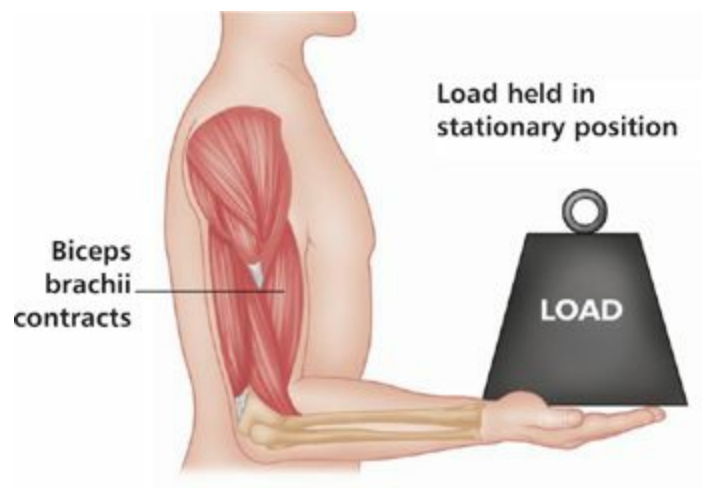


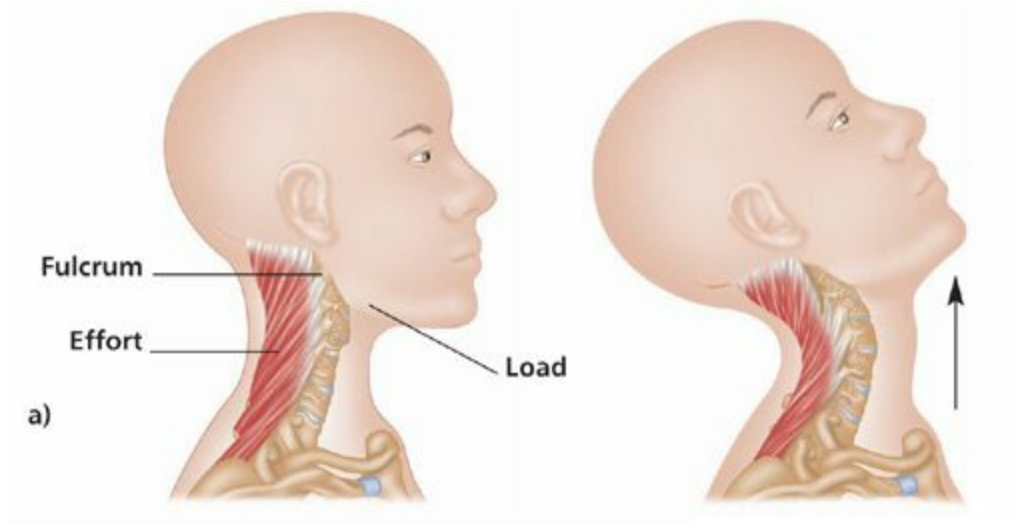
Figure 1.10: An example of static (isometric) contraction, where a heavy weight is held, with the elbow stationary and bent at 90 degrees.

# Levers

A lever is a device for transmitting (but not creating force) and consists of a rigid bar moving about a fixed point (fulcrum). More specifically, a lever consists of an effort force, resistance force, rigid bar, and a fulcrum. The bones, joints, and muscles together form a system of levers in the body, where the joints act as the fulcrum, the muscles apply the effort, and the bones carry the weight of the body part to be moved. Levers are classified according to the position of the fulcrum, resistance (load), and effort relative to each other.

In a first-class lever, the effort and resistance are located on opposite sides of the fulcrum. In a second-class lever, the effort and the resistance are located on the same side of the fulcrum, and the resistance is between the fulcrum and effort. Finally, in a third-class lever, the effort and resistance are located on the same side of the fulcrum, but the effort acts between the fulcrum and the resistance, and this is the most common type of lever in the human body.

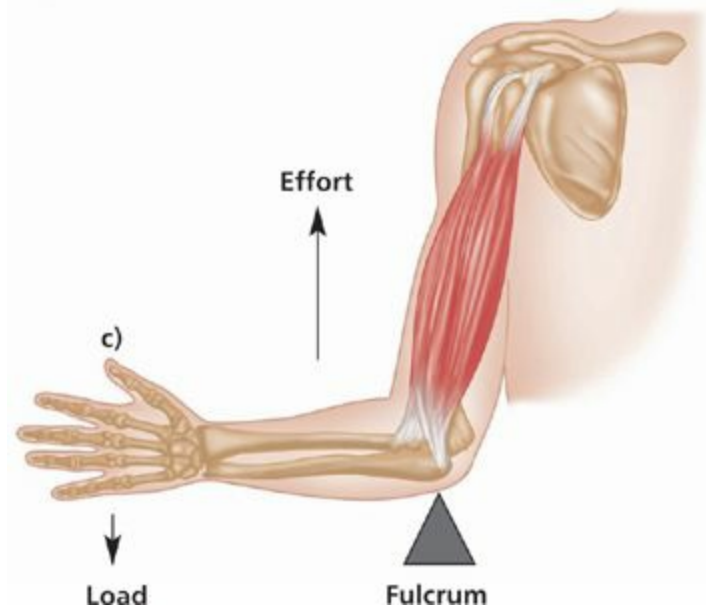
Figure 1.11: Examples of levers in the human body



(a) first-class lever



(b) second-class lever



(c) third-class lever

# Generation of Force

The strength of skeletal muscle is reflected in its ability to generate force. If a weightlifter is able to lift 75 kg, the muscles are capable of producing enough force to lift 75 kg. Even when not trying to lift a weight, the muscles must still generate enough force to move the bones to which they are attached. A number of factors are involved in this ability to generate force, including the number and type of motor units activated, the size of the muscle, and the angle of the joint.

## Reciprocal Inhibition

Most movement involves the combined effort of two or more muscles, with one muscle acting as the prime mover. Most prime movers usually have a synergistic muscle to assist them. Furthermore, most skeletal muscles have one or more antagonists that perform the opposite action. A good example might be hip abduction, in which gluteus medius acts as the prime mover, with tensor fascia latae acting synergistically and the hip adductors acting as antagonists, being reciprocally inhibited by the action of the agonists.

Reciprocal inhibition (RI) is the physiological phenomenon in which there is an automatic inhibition of a muscle when its antagonist contracts. Under special circumstances both the agonist and antagonist can contract together, known as a *co-contraction*.

Now that we have a general understanding of flexibility, muscles, and muscle mechanics, let us define stretching. Stretching, as it relates to physical health and fitness, is the process of placing particular parts of the body into a position that will lengthen the muscles and associated soft tissues.

# What Happens When a Muscle Is Stretched?

Upon undertaking a regular stretching program a number of changes begin to occur within the body and specifically within the muscles themselves. Other tissues that begin to adapt to the stretching process include the ligaments, tendons, fascia, skin, and scar tissue.

As discussed earlier in this chapter, the process of lengthening the muscles and thereby increasing range of movement begins within the muscles at the sarcomeres. When a particular body part is placed into a position that lengthens the muscle, the overlap between the thick and thin myofilaments begins to decrease. Once this has been achieved and all the sarcomeres are fully stretched, the muscle fiber is at its maximum resting length. At this point further stretching will help to elongate the connective tissues and muscle fascia. Additionally, G. Goldspink (1968) and P.E. Williams & G. Goldspink (1971) concluded that *“with regular stretching over time, the number of sarcomeres is thought to increase in series, with new sarcomeres added onto the end of existing myofibrils, which in turn increases the overall muscle length and range of motion.”*

# Terms of Anatomical Direction

<b>Abduction</b>	A movement away from the midline (or to return from adduction).
<b>Adduction</b>	A movement toward the midline (or to return from abduction).
<b>Anatomical position</b>	The body is upright with the arms and hands turned forward.
<b>Anterior</b>	Towards the front of the body (as opposed to posterior).
<b>Circumduction</b>	Movement in which the distal end of a bone moves in a circle, while the proximal end remains stable.
<b>Elevation</b>	Movement of a part of the body upwards along the frontal plane.
<b>Eversion</b>	To turn the sole of the foot outward.
<b>Extension</b>	A movement at a joint resulting in separation of two ventral surfaces (as opposed to flexion).
<b>Flexion</b>	A movement at a joint resulting in approximation of two ventral surfaces (as opposed to extension).
<b>Inferior</b>	Below or furthest away from the head.
<b>Inversion</b>	To turn the sole of the foot inward.
<b>Lateral</b>	Located away from the midline (opposite to medial).
<b>Medial</b>	Situated close to or at the midline of the body or organ (opposite to lateral).
<b>Median</b>	Centrally located, situated in the middle of the body.
<b>Opposition</b>	A movement specific to the saddle joint of the thumb, that enables you to touch your thumb to the tips of the fingers of the same hand.
<b>Palmar</b>	Anterior surface of the hand.
<b>Plantar</b>	The sole of the foot.
<b>Posterior</b>	Relating to the back or the dorsal aspect of the body (opposite to anterior).
<b>Pronation</b>	To turn the palm of the hand down to face the floor, or away from the anatomical and foetal positions.
<b>Prone</b>	Position of the body in which the ventral surface faces down (as opposed to supine).

**Rotation** Move around a fixed axis.

**Superficial** On or near the surface (as opposed to deep).

**Superior** Above or closest to the head.

**Supination** To turn the palm of the hand up to face the ceiling, or toward the anatomical and foetal positions.

*\* Importantly, all skeletal muscles are stabilisers and mobilisers – it depends on the movement and position of the body as to how the muscles are reacting at the time.*





## The Principles of Stretching

### The Benefits of Stretching

Stretching is a simple and effective activity that helps to enhance athletic performance, decrease the likelihood of injury, and minimize muscle soreness. But how, specifically, is this accomplished? The benefits of stretching are:

#### **1. Improved Range of Movement**

By placing particular parts of the body in certain positions, we are able to increase the length of our muscles. As a result of this, a reduction in general muscle tension is achieved and our normal range of movement is increased.

By increasing our range of movement we are increasing the distance our limbs can move before damage occurs to the muscles and tendons. For example, the muscles and tendons in the back of our legs are put under great strain when kicking a soccer ball. Therefore, the more flexible and pliable those muscles are, the further our leg can travel forward before a strain or injury occurs to them.

The benefits of an extended range of movement include increased comfort, a greater ability to move freely, and a lessening of our susceptibility to muscle and tendon strain injuries.

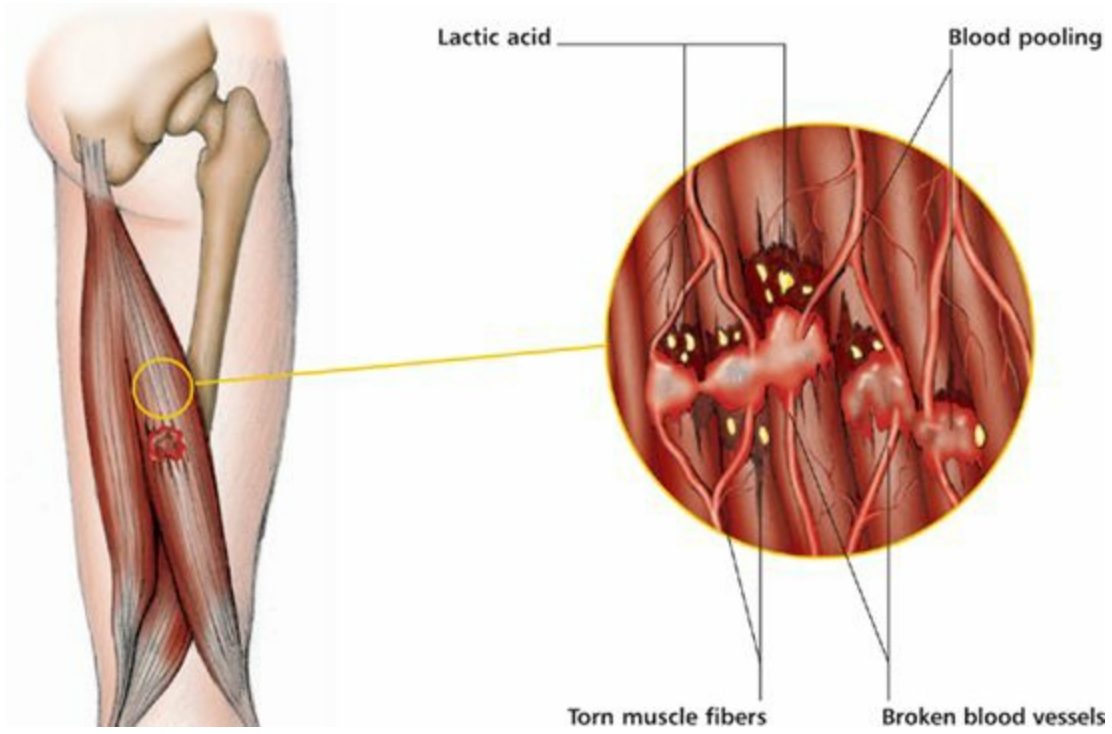
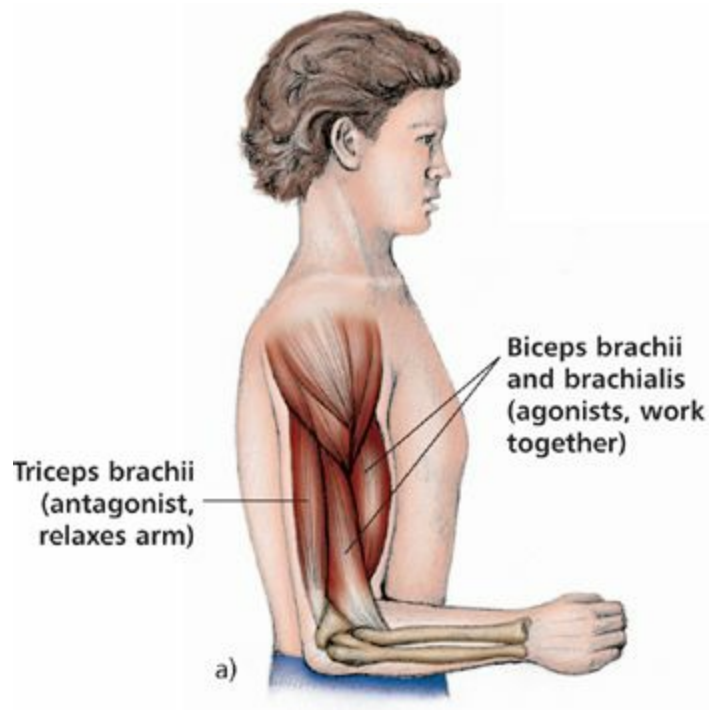
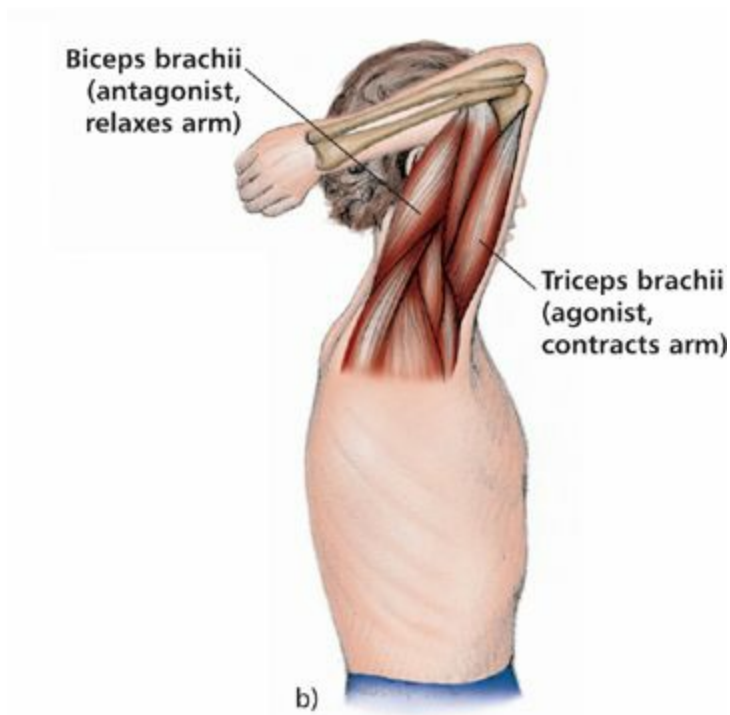


Figure 2.1: Reduced post-exercise muscle soreness: micro tears, blood pooling, and accumulated waste products.

Figure 2.2



a) a tight antagonist causing the agonist to work harder



b) a normal interaction between agonist and antagonist.

## 2. Increased Power

There is a dangerous stretching myth that says, “If you stretch too much you will lose both joint stability and muscle power.” This is untrue (as long as The Rules for Safe Stretching on [this page](#) are observed). By increasing our muscles’ length we are increasing the distance over which they are able to contract. This results in a potential increase to our muscles’ power and therefore increases our athletic ability, while also leading to an improvement in dynamic balance, or the ability to control our

muscles.

### **3. Reduced Post-Exercise Muscle Soreness**

We have all experienced what happens when we go for a run or to the gym for the first time in a few months. The following day our muscles are tight, sore, and stiff, and it is usually hard to even walk down a flight of stairs. This soreness that usually accompanies strenuous physical activity is often referred to as “post-exercise muscle soreness.” This soreness is the result of micro tears (minute tears within the muscle fibers), blood pooling, and accumulated waste products, such as lactic acid. Stretching, as part of an effective cool-down, helps to alleviate this soreness by lengthening the individual muscle fibers, increasing blood circulation, and removing waste products.

### **4. Reduced Fatigue**

Fatigue is a major problem for everyone, especially those who exercise: it results in a decrease in both physical and mental performance. Increased flexibility through stretching can help prevent the effects of fatigue by taking pressure off the working muscles (the agonists). For every muscle in the body there is an opposite or opposing muscle (the antagonist). If the opposing muscles are more flexible, the working muscles do not have to exert as much force against them. Therefore each movement of the working muscles actually takes less effort.

### **Added Benefits**

Along with the benefits listed above, a regular stretching program will also help to improve posture, develop body awareness, improve coordination, promote circulation, increase energy, and improve relaxation and stress relief.

# Types of Stretching

Stretching is slightly more technical than swinging a leg over a park bench. There are rules and techniques that will maximize its benefits and minimize the risk of injury. We will look at the different types of stretching, the particular benefits, and the risks and uses, as well as give a description of how each type is performed.

Just as there are many different ways to strength train, there are also many different ways to stretch. However, it is important to note that no one way in particular, or no one type of stretching, is better than another. Each type has its own advantages and disadvantages, and the key to getting the most out of stretching lies in being able to match the right type of stretching to the purpose or goal you are trying to achieve.

For example, proprioceptive neuromuscular facilitation (PNF) and passive stretching are great for creating permanent improvements in flexibility, but they are not very useful for warming up or preparing the body for activity. Dynamic stretching, on the other hand, is great for warming up, but can be dangerous if used in the initial stages of injury rehabilitation.

Although there are many different ways to stretch, they can all be grouped into one of two categories: static or dynamic.

# Static Stretches

The term “static stretches” refers to stretching exercises that are performed without movement. In other words, the individual gets into the stretch position and holds the stretch for a specific amount of time. Listed below are five different types of static stretching exercises.

## 1. Static Stretching

Static stretching is performed by placing the body into a position whereby the muscle (or group of muscles) to be stretched is under tension. To begin, both the antagonist, or opposing muscle, and the agonist, or muscle to be stretched, are relaxed. Then slowly and cautiously the body is moved to increase the tension of the muscle being stretched. At this point the position is held or maintained to allow the muscle to lengthen.

A minimum hold time of about 20 seconds is required for the muscle to relax and start to lengthen, while diminishing returns are experienced after 45–60 seconds.

Static stretching is a very safe and effective form of stretching, with a limited threat of injury. It is a good choice for beginners and sedentary individuals.



Figure 2.3: An example of static stretching.

## **2. Passive (or Assisted) Stretching**

This form of stretching is very similar to static stretching; however, another person or apparatus is used to help further stretch the muscle. Due to the greater force applied to the muscle, this form of stretching is slightly more hazardous. Therefore, it is very important that any apparatus used is both solid and stable. When using a partner it is imperative that no jerky or bouncing force is applied to the stretched muscle. So, choose a partner carefully – the partner is responsible for the safety of the muscles and joints while performing the stretching exercises.

Passive stretching is useful in helping to attain a greater range of movement, but carries with it a slightly higher risk of injury. It can also be used effectively as part of a rehabilitation program or as part of a cool-down.

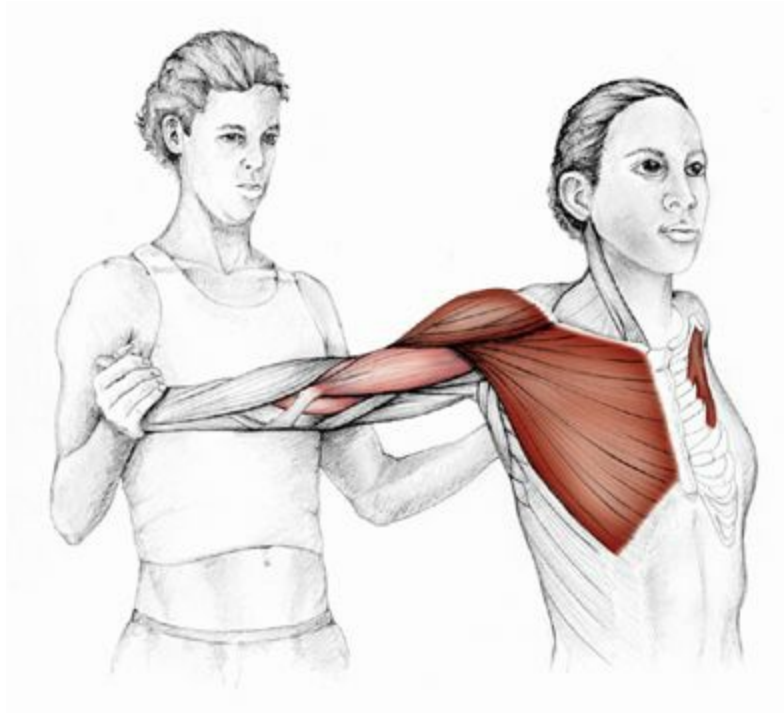


Figure 2.4: An example of passive stretching.

### 3. Active Stretching

Active stretching is performed without any aid or assistance from an external force. This form of stretching involves using only the strength of the opposing muscles (antagonists) to generate a stretch within the targeted muscle group (agonists). The contraction of the opposing muscles helps to relax the stretched muscles. A classic example of an active stretch is one where an individual raises one leg straight out in front as high as possible and then maintains that position without any assistance from a partner or object.

Active stretching is useful as a rehabilitation tool and a very effective form of conditioning before moving on to dynamic stretching exercises. This type of stretching exercise is usually quite difficult to hold and maintain for long periods of time and the stretch position is therefore usually only held for 10–15 seconds.



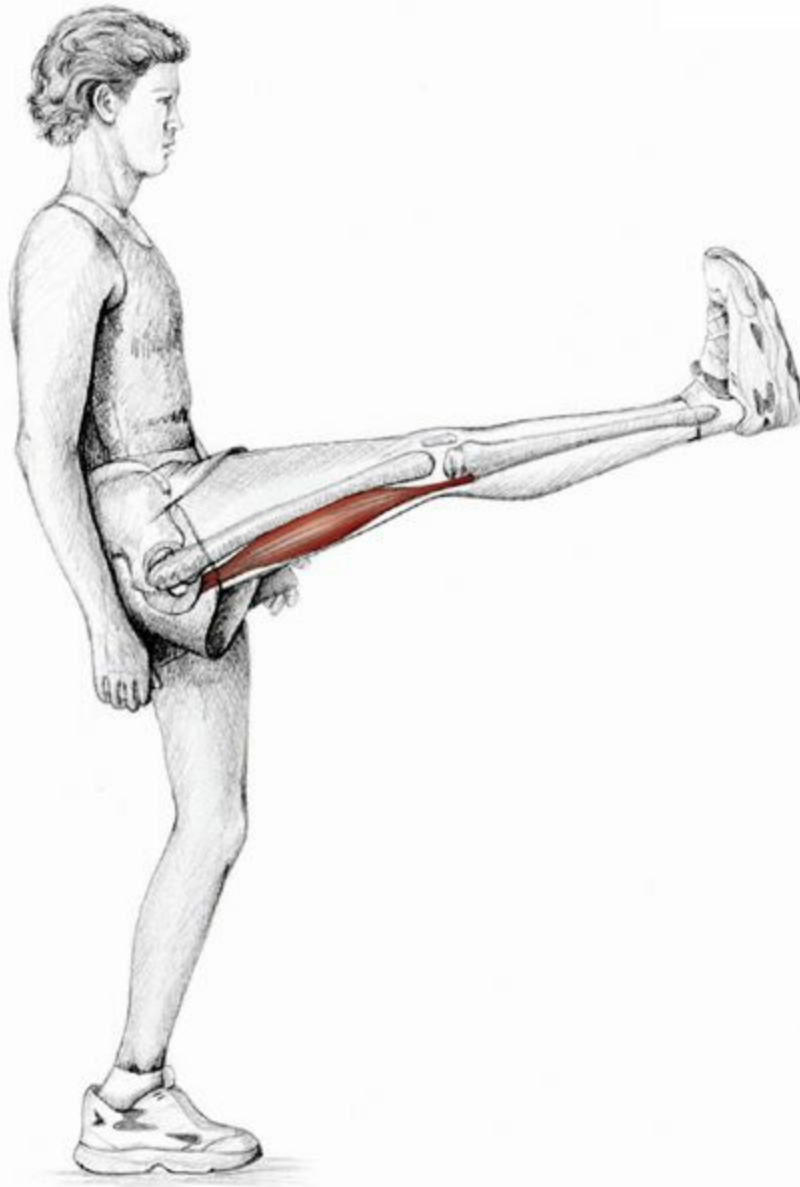


Figure 2.5: An example of active stretching.

#### **4. PNF Stretching**

PNF stretching is a more advanced form of flexibility training, which involves both the stretching and contracting of the muscle group being targeted. PNF stretching was originally developed as a form of rehabilitation and for that function it is very effective. It is also excellent for targeting specific muscle groups and, as well as increasing flexibility (and range of movement), it also improves muscular strength.

There are many different variations of the PNF stretching principle and sometimes it is referred to as “contract-relax stretching” or “hold-relax stretching.” Another variation of the PNF technique is “post isometric relaxation (PIR).”

The area to be stretched is positioned so that the muscle (or muscle group) is under tension. The individual then contracts the stretched muscle for 5–6 seconds while a partner (or immovable object) applies sufficient resistance to inhibit movement. The effort of contraction should be relevant to the level of conditioning. The contracted muscle is then relaxed and a controlled stretch is applied

for about 30 seconds. The athlete is then allowed 15 to 30 seconds to recover and the process is repeated 2–4 times.

Information differs slightly about timing recommendations for PNF stretching. Although there are conflicting responses to the questions “For how long should I contract the muscle group?” and “For how long should I rest between each stretch?”, it is my professional opinion that, through a study of research literature and personal experience, the above timing recommendations provide the maximum benefits from PNF stretching.

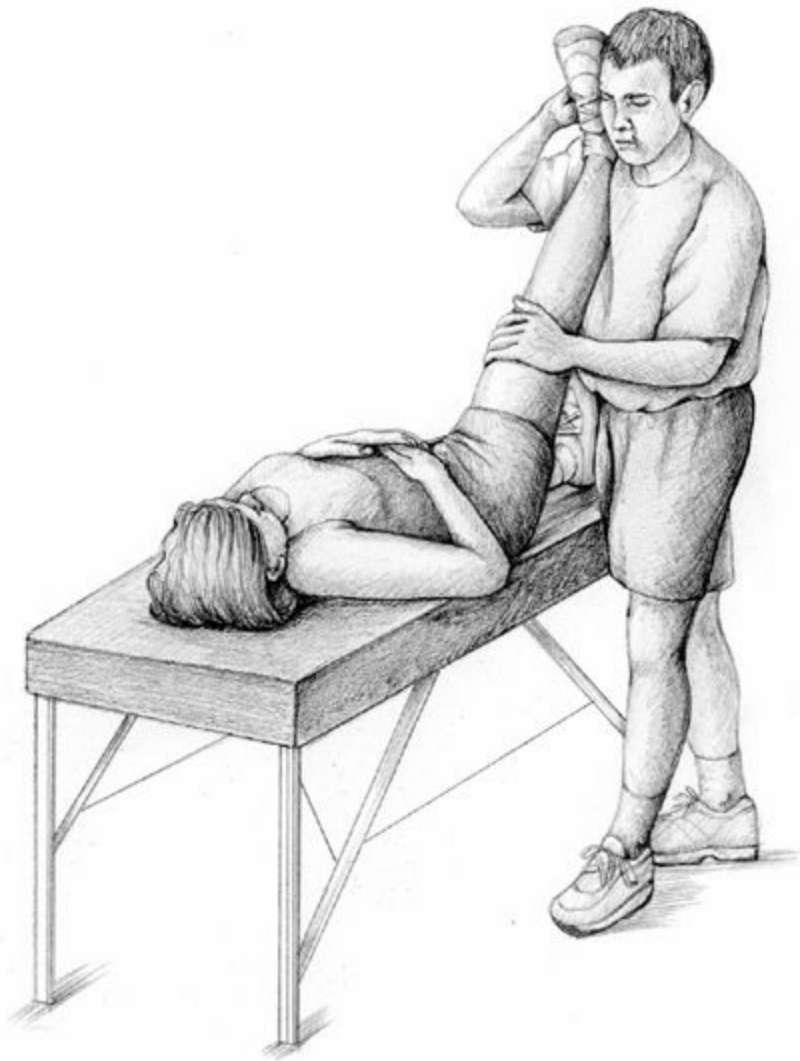


Figure 2.6: An example of PNF stretching.

## 5. Isometric Stretching

Isometric stretching is a form of passive stretching similar to PNF, but the contractions are held for a longer period of time. Isometric stretching places high demands on the stretched muscles and is not recommended for children or adolescents who are still growing. Other recommendations include allowing at least 48 hours' rest between isometric stretching sessions and performing only one isometric stretching exercise per muscle group in a session.

A classic example of how isometric stretching is used is the standing “push-the-wall” calf stretch (see [Stretch J06](#)), where the participant stands upright, leans forward against a wall, and then places one foot as far from the wall as is comfortable while making sure that the heel remains on the ground. In this position, the participant then contracts the calf muscles as if trying to push the wall down.

To perform an isometric stretch, assume the position of the passive stretch and then contract the stretched muscle for 10–15 seconds. Be sure that all movement of the limb is restricted. Then relax the muscle for at least 20 seconds. This procedure should be repeated 2–5 times.

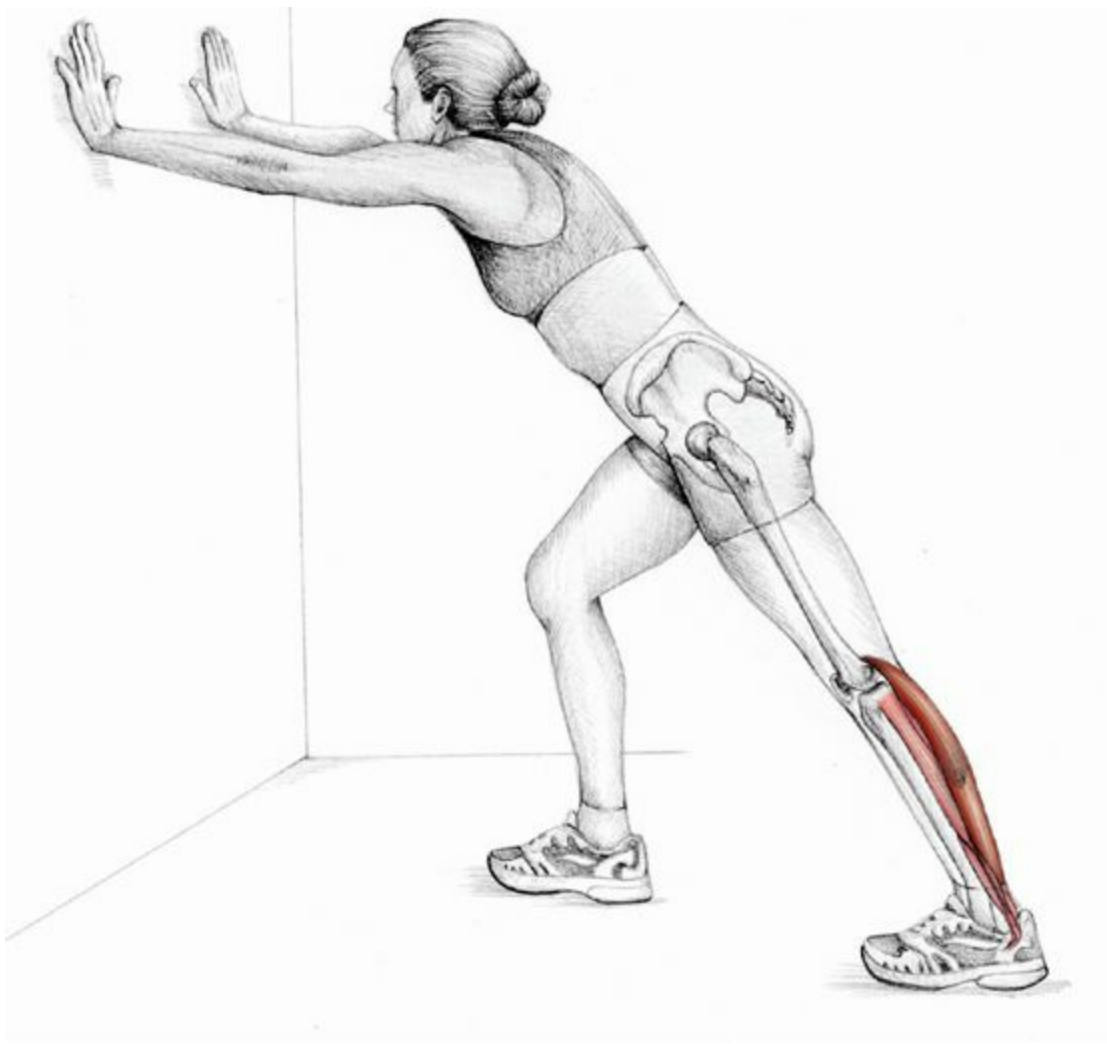


Figure 2.7: An example of isometric stretching.

# Dynamic Stretches

The term “dynamic stretches” refers to stretching exercises that are performed with movement. In other words, the individual uses a swinging or bouncing motion to extend their range of movement and flexibility. Listed below are four different types of dynamic stretching exercises.

## 1. Ballistic Stretching

Ballistic stretching is an outdated form of stretching that uses momentum generated by rapid swinging, bouncing, and rebounding movements to force a body part past its normal range of movement.

The risks associated with ballistic stretching far outweigh the gains, especially when better gains can be achieved by using other forms like dynamic and PNF stretching. Other than potential injury, the main disadvantage of ballistic stretching is that it fails to allow the stretched muscles time to adapt to the stretched position and, instead, may cause the muscles to tighten up by repeatedly triggering the [stretch](#) (or myotatic) [reflex](#).



Figure 2.8: An example of ballistic stretching.

## 2. Dynamic Stretching

Unlike ballistic stretching, dynamic stretching uses a controlled, soft bounce or swinging motion to move a particular body part to the limit of its range of movement. The force of the bounce or swing is gradually increased but should never become radical or uncontrolled.

Do not confuse dynamic stretching with ballistic stretching. Dynamic stretching is slow, gentle, and very purposeful. At no time during dynamic stretching should a body part be forced past the joint's normal range of movement. Ballistic stretching, on the other hand, is much more aggressive and its very purpose is to force the body part beyond the limit of its normal range of movement.

## 3. Active Isolated Stretching

Active isolated (AI) stretching is a new form of stretching developed by Aaron L. Mattes and is sometimes referred to as the “Mattes Method.” It works by contracting the antagonists, or opposing muscle group, which forces the stretched muscle group to relax. The procedure for performing AI stretching is as follows.

1. Choose the muscle group to be stretched and then assume the appropriate starting position.
2. Actively contract the antagonists, or opposing muscle group.
3. Move into the stretch quickly and smoothly.
4. Hold for 1–2 seconds and then release the stretch.
5. Repeat 5–10 times.

While AI stretching certainly has some benefits (mainly for the professional or well-conditioned athlete), it also has a lot of unsubstantiated claims. One such claim is that AI stretching does not engage the stretch reflex, because the stretch is only held for 2 seconds or less (Mattes 2000; Wharton 1996). This, however, defies basic muscle physiology. The stretch reflex in the calf muscle, for example, is triggered within three-hundredths of a second, so any claim that AI stretching can somehow bypass or outsmart the stretch reflex is nothing more than wishful thinking.

#### **4. Resistance Stretching and Loaded Stretching**

Resistance stretching and loaded stretching are forms of dynamic stretching that both contract and lengthen a muscle at the same time. They work by stretching a muscle group through its entire range of motion while under contraction. For this reason, both resistance stretching and loaded stretching are as much about strengthening a muscle group as they are about stretching it.

Like AI stretching above, resistance stretching and loaded stretching do have their benefits. The five-time Olympic swimmer Dara Torres credits a portion of her swimming success to the use of resistance stretching. However, these forms of stretching place high demands on the musculoskeletal system and therefore are recommended only for professional or well-conditioned athletes.

# The Rules for Safe Stretching

As with most activities there are rules and guidelines to ensure that they are safe. Stretching is no exception – it can be extremely dangerous and harmful if done incorrectly. It is vitally important that the following rules be adhered to, both for safety and for maximizing the potential benefits of stretching.

There is often confusion and concern about which stretches are good and which stretches are bad. In most cases someone has told the inquirer that they should not do this stretch or that stretch, or that this is a good stretch and that is a bad stretch.

Are there only good stretches and bad stretches? Is there no middle ground? And if there are only good and bad stretches, how do we decide which ones are good and which ones are bad?

## ***There is no such thing as a good or bad stretch!***

Just as there are no good or bad exercises, there are no good or bad stretches: only what is appropriate for the specific requirements of the individual. So a stretch that is perfectly okay for one person may not be okay for someone else.

Let me use an example. A person with a shoulder injury would not be expected to do push-ups or freestyle swimming, but that does not mean that these are bad exercises. Now, consider the same scenario from a stretching point of view. That same person should avoid shoulder stretches, but that does not mean that all shoulder stretches are bad.

The stretch itself is neither good nor bad. It is the way the stretch is performed and by whom it is being performed that makes stretching either effective and safe, or ineffective and harmful. To place a particular stretch into a category of “good” or “bad” is foolish and dangerous. To label a stretch as “good” gives people the impression that they can do that stretch whenever and however they want and it will not cause them any problems.

## ***The specific requirements of the individual are what is important!***

Remember, stretches are neither good nor bad. However, when choosing a stretch there are a number of precautions and “checks” we need to perform before giving that stretch the okay.

1. Firstly, make a general review of the individual. Are they healthy and physically active, or have they been leading a sedentary lifestyle for the past 5 years? Are they a professional athlete? Are they recovering from a serious injury? Do they have aches, pains, or muscle and joint stiffness in any area of their body?
2. Secondly, make a specific review of the area, or muscle group, to be stretched. Are the muscles healthy? Is there any damage to the joints, ligaments, tendons, etc.? Has the area been injured recently, or is it still recovering from an injury?





Figure 2.9: An example of active isolated stretching.

If the muscle group being stretched is not 100% healthy, avoid stretching this area altogether. Work on recovery and rehabilitation before moving on to specific stretching exercises. If, however, the individual is healthy and the area to be stretched is free from injury, then apply the following to all stretches.

## 1. Warm Up Prior to Stretching

This first rule is often overlooked and can lead to serious injury if not performed effectively. Trying to stretch muscles that have not been warmed is like trying to stretch old, dry rubber bands: they may snap.

Warming up prior to stretching does a number of beneficial things, but primarily its purpose is to prepare the body and mind for more strenuous activity. One of the ways it achieves this is by helping to increase the body's core temperature while also increasing the body's muscle temperature. By increasing muscle temperature we are helping to make the muscles loose, supple, and pliable. This is essential to ensure the maximum benefit is gained from our stretching.

The correct warm-up also has the effect of increasing both our heart rate and our respiratory rate. This increases blood flow, which in turn increases the delivery of oxygen and nutrients to the working muscles. All this helps to prepare the muscles for stretching.

A correct warm-up should consist of light physical activity. Both the intensity and duration of the warm-up (or how hard and how long) should be governed by the fitness level of the participating athlete, although a correct warm-up for most people should take about 10 minutes and result in a light sweat.

## 2. Stretch Before and After Exercise

The question often arises: "Should I stretch before or after exercise?" This is not an either/or

situation: both are essential. It is no good stretching after exercise and counting that as our pre-exercise stretch for next time. Stretching after exercise has a totally different purpose to stretching before exercise. The two are not the same.

The purpose of stretching before exercise is to help prevent injury. Stretching does this by lengthening the muscles and tendons, which in turn increases our range of movement. This ensures that we are able to move freely without restriction or injury occurring.

However, stretching after exercise has a very different role. Its purpose is primarily to aid in the repair and recovery of the muscles and tendons. By lengthening the muscles and tendons, stretching helps to prevent tight muscles and delayed muscle soreness that usually accompanies strenuous exercise.

After exercise, our stretching should be done as part of a cool-down. The cool-down will vary depending on the duration and intensity of exercise undertaken, but will usually consist of 5–10 minutes of very light physical activity and be followed by 5–10 minutes of static stretching exercises.

An effective cool-down involving light physical activity and stretching will help to rid waste products from the muscles, prevent blood pooling, and promote the delivery of oxygen and nutrients to the muscles. All this assists in returning the body to a pre-exercise level, thus aiding the recovery process.

### **3. Stretch Only to the Point of Tension**

Stretching is not an activity that is meant to be painful; it should be pleasurable, relaxing, and very beneficial. However, many people believe that to get the most from their stretching, they need to be in constant pain. This is one of the greatest mistakes we can make when stretching. Let me explain why.

When the muscles are stretched to the point of pain, the body employs a defense mechanism called the “stretch reflex.” This is the body’s safety measure to prevent serious damage occurring to the muscles, tendons, and joints. The stretch reflex protects the muscles and tendons by contracting them, thereby preventing them from being stretched.

So to avoid the stretch reflex, avoid pain. Never push the stretch beyond what is comfortable. Only stretch to the point where tension can be felt in the muscles. This way, injury will be avoided and the maximum benefits from stretching will be achieved.

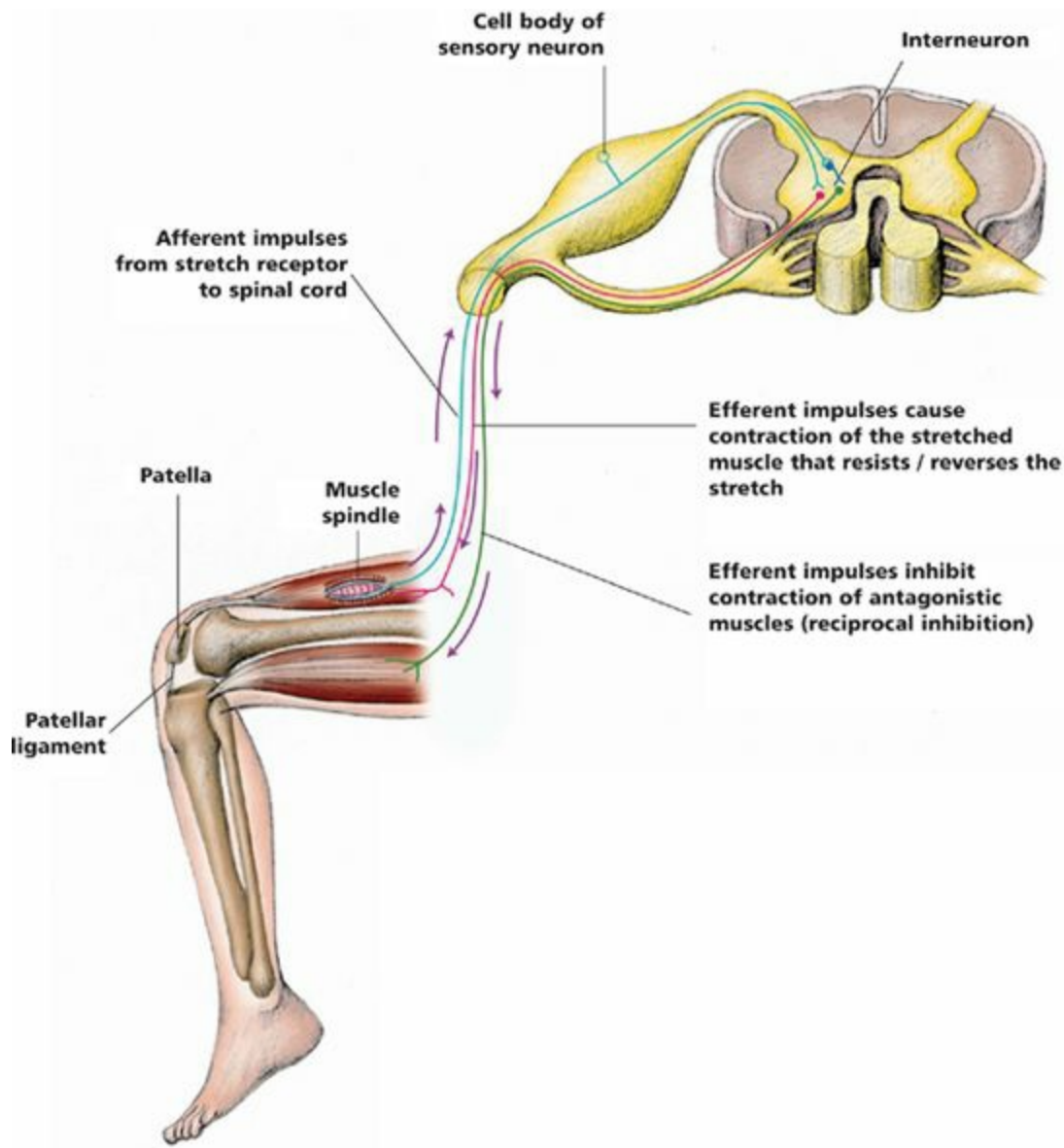


Figure 2.10: The stretch reflex arc.

#### 4. Stretch All Major Muscles and Their Opposing Muscle Groups

When stretching, it is vitally important that we pay attention to all the major muscle groups in the body. Just because a particular sport may place a lot of emphasis on the legs, for example, that does not mean that one can neglect the muscles of the upper body in a stretching routine.

All the muscles play an important part in any physical activity, not just a select few. Muscles in the upper body, for example, are extremely important in any running sport. They play a vital role in the stability and balance of the body during the running motion. Therefore it is important to keep them both flexible and supple.

Every muscle in the body has an opposing muscle that acts against it. For example, the muscles in the front of the leg (the quadriceps) are opposed by the muscles in the back of the leg (the hamstrings). These two groups of muscles provide a resistance to each other to balance the body. If one of these groups of muscles becomes stronger or more flexible than the other group, it is likely to lead to imbalances that can result in injury or postural problems. For example, hamstring tears are a common injury in most running sports. They are often caused by strong quadriceps and weak, inflexible

hamstrings. This imbalance puts a great deal of pressure on the hamstrings and can result in a muscle tear or strain.

## 5. Stretch Gently and Slowly

Stretching gently and slowly helps to relax our muscles, which in turn makes stretching more pleasurable and beneficial. This will also help to avoid muscle tears and strains that can be caused by rapid, jerky movements.

## 6. Breathe Slowly and Easily While Stretching

Many people unconsciously hold their breath while stretching. This causes tension in our muscles, which in turn makes it very difficult to stretch. To avoid this, remember to breathe slowly and deeply during all stretching exercises. This helps to relax our muscles, promote blood flow, and increase the delivery of oxygen and nutrients to our muscles.

## An Example



Figure 2.11: Controversial stretch?

By taking a look at one of the most controversial stretches ever performed, we can see how the above rules are applied. The stretch pictured below causes many a person to go into complete meltdown. It has a reputation as a dangerous, bad stretch and should be avoided at all costs.

So why is it that at every Olympic Games, Commonwealth Games, and World Championships sprinters can be seen doing this stretch before their events? Let us apply the above checks to find out.

Firstly, consider the person performing the stretch. Are they healthy, fit, and physically active? If not,

this is not a stretch they should be doing. Are they elderly, overweight, or unfit? Are they young and still growing? Do they lead a sedentary lifestyle? If so, they should avoid this stretch! This first consideration alone would prohibit 50% of the population from doing this stretch.

Secondly, review the area to be stretched. This stretch obviously puts a large strain on the muscles of the hamstrings and lower back. So if our hamstrings or lower back are not 100% healthy, we are not to perform this stretch. This second consideration would probably rule out another 25%, which means this stretch is only suitable for about 25% of the population – or, the well-trained, physically fit, injury-free athlete.

Then apply the six precautions above and the well-trained, physically fit, injury-free athlete can perform this stretch safely and effectively.

Remember, the stretch itself is neither good nor bad. It is the way the stretch is performed and by whom it is being performed that makes stretching either effective and safe, or ineffective and harmful.

# How to Stretch Properly

## 1. When to Stretch

Stretching needs to be as important as the rest of our training. If we are involved in any competitive type of sport or exercise then it is crucial that we make time for specific stretching workouts. Set time aside to work on particular areas that are tight or stiff. The more involved and committed we are to our exercise and fitness, the more time and effort we will need to commit to stretching.

As discussed earlier it is important to stretch both before and after exercise. But when else should we stretch and what type of stretching is best for a particular purpose?

Choosing the right type of stretching for the right purpose will make a big difference to the effectiveness of our flexibility program. Here are some suggestions for when to use the different types of stretches.

For warming up, dynamic stretching is the most effective, while for cooling-down, static, passive, or PNF stretching is best. For improving range of movement, try PNF and active isolated stretching; for rehabilitation, a combination of PNF, isometric, and active stretching will give the best results.

So when else should we stretch? Stretch periodically throughout the entire day. It is a great way to keep loose and to help ease the stress of everyday life. One of the most productive ways to utilize our time is to stretch while we are watching television. Start with 5 minutes of marching or jogging on the spot then take a seat on the floor in front of the television and start stretching.

Competition is a time when great demands are placed on the body; it is therefore vitally important that we are in peak physical condition. Our flexibility should be at its best just before competition. Too many injuries are caused by the sudden exertion that is needed for any sort of competitive sport. Get strict on stretching before competition.

## 2. Hold, Count, Repeat

For how long should I hold each stretch? How often should I stretch? For how long should I stretch?

These are the most commonly asked questions when discussing the topic of stretching. Although there are conflicting responses to these questions, it is my professional opinion that, through a study of research literature and personal experience, what follows is currently the most correct and beneficial information.

“For how long should I hold each stretch?” This question causes the most conflict. Some text will tell us that as little as 10 seconds is enough. This is a bare minimum: 10 seconds is only just enough time for the muscles to relax and start to lengthen. For any real benefit to our flexibility we should hold each stretch for at least 20–30 seconds.

The time we commit to our stretching will be relative to our level of involvement in our particular

sport. So, for people looking to increase their general level of health and fitness, a minimum of about 20 seconds will be enough. However, if we are involved in high-level competitive sport we need to hold each stretch for at least 30 seconds and start to extend that to 60 seconds and beyond.

“How often should I stretch?” This same principle of adjusting our level of commitment to our level of involvement in our sport applies to the number of times we should stretch each muscle group. For example, the beginner should stretch each muscle group 2–3 times. However, if we are involved at a more advanced level in our sport we should stretch each muscle group 3–5 times.

“For how long should I stretch?” Again, the same principle applies. For the beginner, about 5–10 minutes is enough, and for the professional athlete, anything up to two hours. If we feel that we are somewhere between the beginner and the professional, we should adjust the time we spend stretching accordingly.

Please do not be impatient with stretching. Nobody can get fit in a couple of weeks, so do not expect miracles from a stretching routine. Looking long term, some muscle groups may need a minimum of three months of intense stretching to see any real improvement. So stick with it – it is well worth the effort.

### **3. Sequence**

When starting a stretching program it is a good idea to start with a general range of stretches for the entire body, instead of just a select few. The idea of this is to reduce overall muscle tension and to increase the mobility of our joints and limbs.

The next step should be to increase overall flexibility by starting to extend the muscles and tendons beyond their normal range of movement. Following this, we work on specific areas that are tight or important for our particular sport. Remember, all this takes time. This sequence of stretches may take up to three months for us to see real improvement, especially if we have no background in agility-based activities or are heavily muscled.

No data exists on what order we should do our stretches in. However, it is recommended that we start with sitting stretches, because there is less chance of injury while sitting, before moving on to standing stretches. To make it easier we may want to start with the ankles and move up to the neck, or vice-versa. It really does not matter as long as we cover all the major muscle groups and their opposing muscles.

Once we have advanced beyond improving our overall flexibility and are working on improving the range of movement of specific muscles, or muscle groups, it is important to isolate those muscles during our stretching routines. To do this, concentrate on only one muscle group at a time. For example, instead of trying to stretch the hamstrings of both legs at the same time, concentrate on the hamstrings of only one leg at a time. Stretching this way will help to reduce the resistance from other supporting muscle groups.

### **4. Posture**

Posture, or alignment, while stretching is one of the most neglected aspects of flexibility training. It is important to be aware of how crucial it can be to the overall benefits of our stretching. Bad posture and incorrect technique can cause imbalances in the muscles that can lead to injury, while proper posture will ensure that the targeted muscle group receives the best possible stretch.

In many instances a major muscle group can be made up of a number of different muscles. If our posture is sloppy or incorrect, certain stretching exercises may put more emphasis on one particular muscle in that muscle group, thus causing an imbalance that could lead to injury.

For example, when stretching the hamstrings it is imperative that we keep both feet pointing straight up. If our feet fall to one side, this will put undue stress on one particular part of the hamstrings, which could result in a muscle imbalance.



# How to Use Stretching as Part of the Warm-up

Lately, I have been receiving a lot of questions regarding the latest studies and research findings on stretching, and the most popular question that is asked concerns the role that stretching plays as part of the warm-up procedure.

Currently, there seems to be a lot of confusion about how and when stretching should be used as part of the warm-up, and some people are under the impression that stretching should be avoided altogether.

This is a very important issue and needs to be clarified. The following information is provided to dispel some common myths and misconceptions about stretching and its role as part of the warm-up procedure.

## ***What has science got to say?***

Most of the studies I have reviewed attempt to determine the effects of stretching on injury prevention. This is a mistake in itself and shows a lack of understanding as to how stretching is used as part of an injury prevention program and the warm-up.

Stretching and its effect on physical performance and injury prevention is something that just cannot be measured scientifically. Certainly you can measure the effect of stretching on flexibility with simple tests like the Sit and Reach test, but then to determine how that affects athletic performance or injury susceptibility is very difficult, if not near impossible.

One of the more recent studies on stretching supports this view by stating that: Due to the paucity, heterogeneity, and poor quality of the available studies no definitive conclusions can be drawn as to the value of stretching for reducing the risk of exercise-related injury. (Weldon 2003)

To put the above quote in layman's terms, there have not been enough studies done and the ones that have been are not specific or consistent enough.

## ***The greatest misconception***

Confusion about what stretching accomplishes as part of the warm-up procedure is causing many to abandon stretching altogether. The key to understanding the role stretching plays can be found in the previous sentence – but you have to read it carefully.

## ***Stretching ... as part of the warm-up!***

Here is the key: stretching is a critical part of the warm-up, but it is not the warm-up.

Do not make the mistake of thinking that doing a few stretches constitutes a warm-up. An effective warm-up has a number of very important key elements that work together to minimize the likelihood of sports injury and prepare the individual for physical activity.

Identifying the components of an effective and safe warm-up, and executing them in the correct order, is critical. Remember, stretching is only one part of an effective warm-up, and its place in the warm-up procedure is specific and dependent on the other components.

The four key elements that should be included to ensure an effective and complete warm-up procedure are:

1. **The general warm-up:** This phase consists of 5 to 15 minutes of light physical activity. The aim here is to elevate the heart rate and respiratory rate, increase blood flow, and increase muscle temperature.
2. **Static stretching:** Next, 5 to 10 minutes of gentle static stretching should be incorporated into the general warm-up to gradually lengthen all the muscles of the major muscle groups and associated soft tissues of the body.
3. **The sports-specific warm-up:** During this phase, 10 to 15 minutes of sport-specific drills and exercises should be used to prepare the athlete for the specific demands of their chosen sport.
4. **Dynamic stretching:** This component involves a controlled, soft bounce or swinging motion to move a particular body part to the limit of its range of movement. The force of the bounce or swing is gradually increased but should never become extreme or uncontrolled.

All four parts of the warm-up are equally important and any one part should not be neglected or thought of as not necessary. The four elements work together to bring the body and mind to a physical peak, ensuring that the athlete is prepared for the activity to come.

Please note the following three points:

1. Dynamic stretching carries with it an increased risk of injury if used incorrectly.
2. The time recommendations given in the above warm-up procedure relate specifically to the requirements of a serious athlete. Adjust the times accordingly if your athletic participation is not at a professional level.
3. Recent studies have shown that static stretching may have an adverse effect on muscle contraction speed and therefore impair performance of athletes involved in sports requiring high levels of power and speed. It is for this reason that static stretching is conducted early in the warm-up and is always followed by sports-specific drills and dynamic stretching.

### ***What conclusions can we make?***

Stretching is beneficial when used correctly. Remember, stretching is just one very important component that assists in reducing the risk of injury and improving athletic performance. The best results are achieved when stretching is used in combination with other injury reduction techniques and conditioning exercises.



## Neck and Shoulders

The neck and shoulders are comprised of a multitude of muscles that control the head and upper arm. The muscles around the neck and shoulders, along with the structure of the joints, allow for a large range of movement, including: flexion; extension; hyperextension; lateral flexion; adduction; abduction; and rotation. The lateral vertebral muscles of the neck comprise the **scalenes** group, which run from the transverse processes of the cervical vertebrae downward to the ribs, plus **sternocleidomastoideus**, a long strap muscle with two heads. The **platysma** is the muscle that may be seen to stand out, for example, in a runner finishing a hard race.

**Deltoides** is composed of three parts; anterior, middle, and posterior. Only the middle part is multipennate, probably because its mechanical disadvantage of abduction of the shoulder joint requires extra strength. It acts as a shock absorber, protecting the shoulder from impact. **Trapezius** is a major mover of the shoulder; the left and right trapezius viewed as a whole create a trapezium in shape, thus giving this muscle its name. **Levator scapulae** is deep to sternocleidomastoideus and trapezius, and is named after its action of elevating the scapula. The **serratus anterior** forms the medial wall of the axilla, the region between the upper thoracic wall and the upper limb, along with the upper five ribs. It is a large muscle composed of a series of finger-like slips.

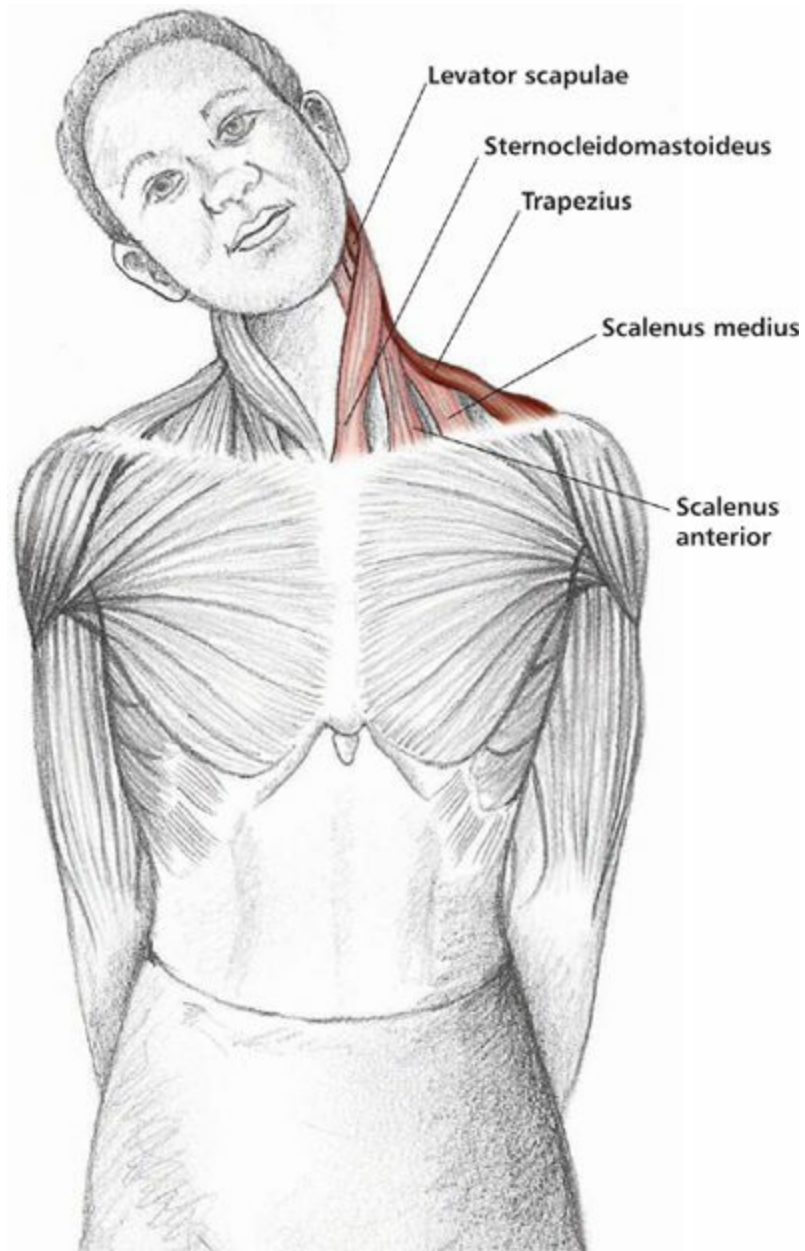
The rotator cuff is a collection of muscles that comprises of **supraspinatus**, **infraspinatus**, **teres minor**, and **subscapularis**; they act to hold the “ball” of the shoulder balanced in the right position in the “socket” of the scapula during movements of the shoulder, thus helping to prevent dislocation of the joint. The subscapularis constitutes the greater part of the posterior wall of the axilla, along with **teres major**, and the tendon of latissimus dorsi, which passes around it.

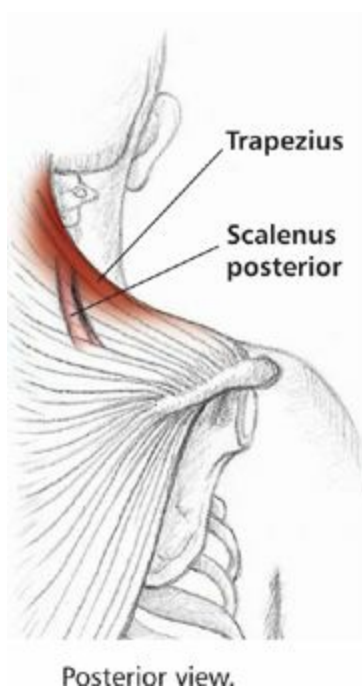
**Erector spinae**, also called sacrospinalis, comprises three sets of muscles organised in parallel columns. From lateral to medial, they are: iliocostalis, longissimus, and spinalis. Longissimus is the intermediate part of the erector spinae. It may be subdivided into thoracis, cervicis, and capitis portions. The spinalis is the most medial part of the erector spinae. It may also be subdivided into thoracis, cervicis, and capitis portions. The **transversospinalis** muscles are a composite of three small muscle groups situated deep to erector spinae. However, unlike erector spinae, each group lies successively deeper from the surface rather than side-by-side. The muscle groups are, from more

superficial to deep: semispinalis, multifidus, and rotatores. Their fibers generally extend upward and medially from transverse processes to higher spinous processes. Multifidus and rotatores are discussed in [Chapter 6](#).

Sports that benefit from these neck and shoulder stretches include: archery; batting sports like cricket, baseball, and softball; boxing; contact sports like soccer, American football (gridiron), and rugby; golf; racquet sports like tennis, badminton, and squash; swimming; throwing sports like cricket, baseball, and field events; wrestling.

## A01: LATERAL NECK STRETCH





Posterior view.

### **Technique**

Look forward while keeping your head up. Slowly move your ear towards your shoulder while keeping your hands behind your back.

### **Muscles being stretched**

Primary muscles: Levator scapulae. Trapezius.

Secondary muscles: Sternocleidomastoideus. Scalenus anterior, medius and posterior.

### **Sports that benefit from this stretch**

Boxing. American football (gridiron). Rugby. Swimming. Wrestling.

### **Sports injury where stretch may be useful**

Neck muscle strain. Whiplash (neck sprain). Cervical nerve stretch syndrome. Wryneck (acute torticollis).

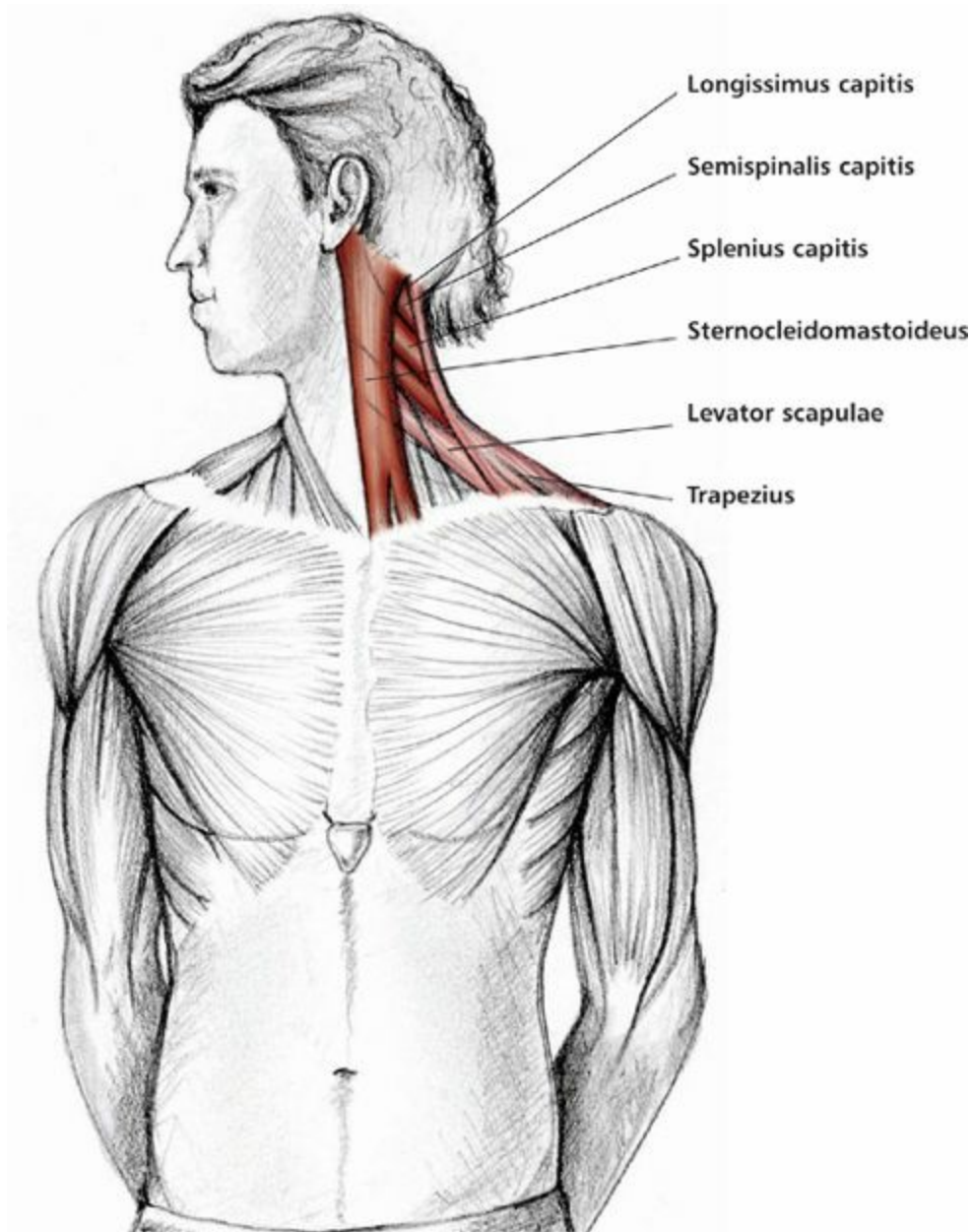
### **Additional information for performing this stretch correctly**

Keep your shoulders down and your hands behind your back. Do not lift your shoulders up when you tilt your head to the side.

### **Complementary stretch**

[A02.](#)

## A02: ROTATING NECK STRETCH



### **Technique**

Stand upright while keeping your shoulders still and your head up. Slowly rotate your chin towards your shoulder.

### **Muscles being stretched**

Primary muscles: Sternocleidomastoideus. Splenius capitis. Semispinalis capitis. Longissimus capitis.

Secondary muscles: Levator scapulae. Trapezius.

### **Sports that benefit from this stretch**

Archery. Boxing. American football (gridiron). Rugby. Swimming. Wrestling.

### **Sports injury where stretch may be useful**

Neck muscle strain. Whiplash (neck sprain). Cervical nerve stretch syndrome. Wryneck (acute torticollis).

### **Additional information for performing this stretch correctly**

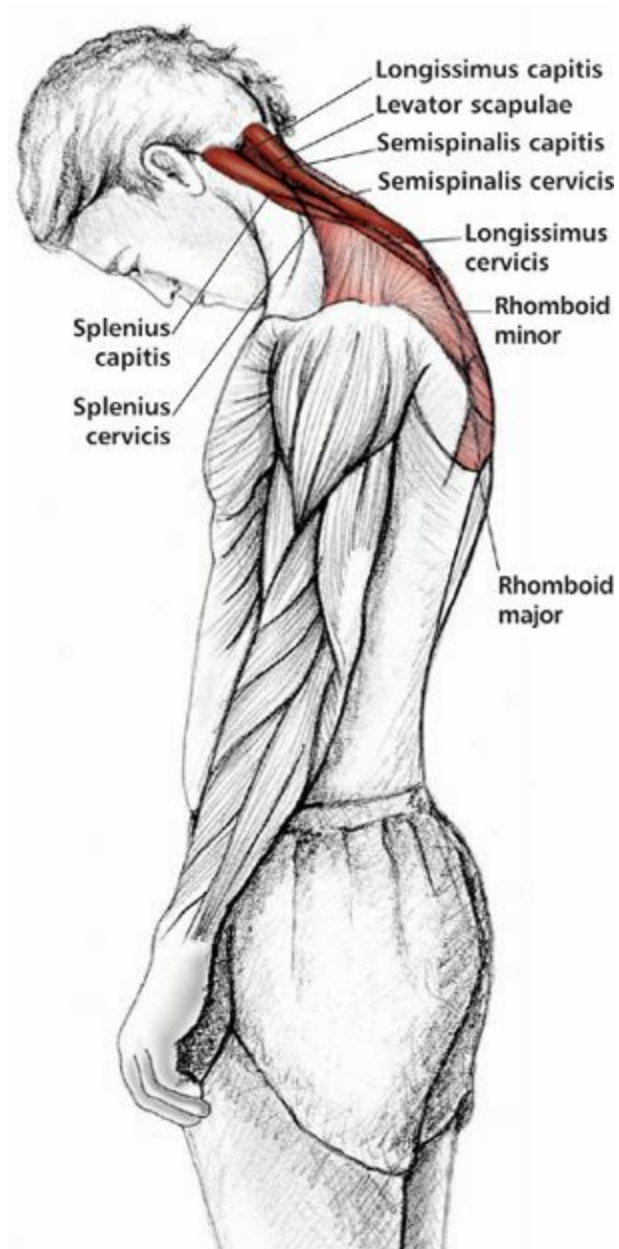
Keep your head up. Do not let your chin fall towards your shoulders.

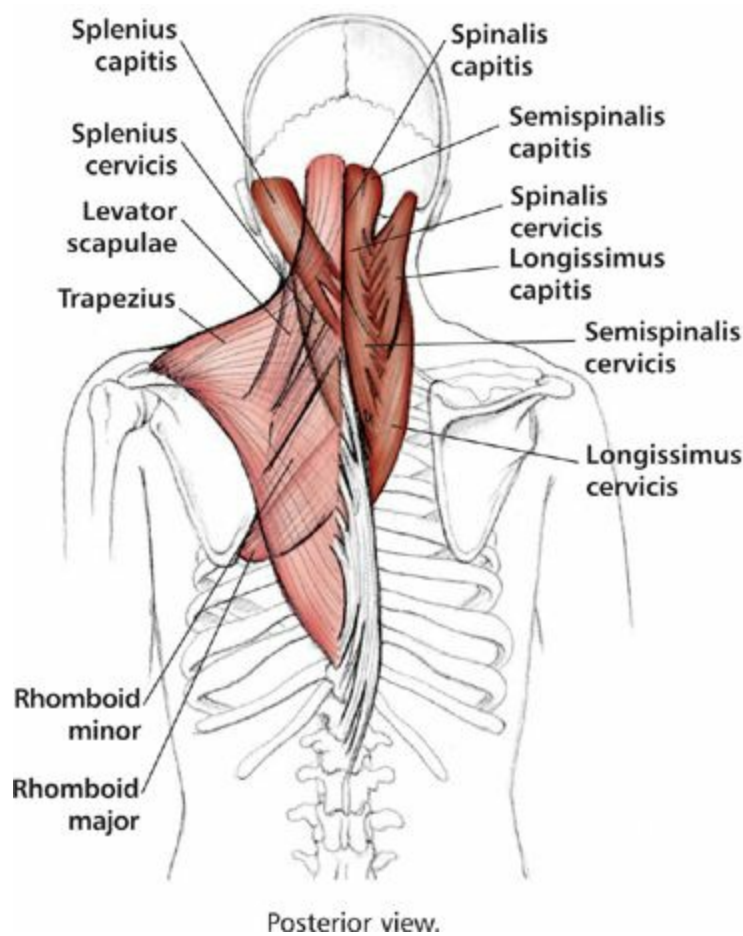
### **Complementary stretch**

[A06](#).



## A03: FORWARD FLEXION NECK STRETCH





## Technique

Stand upright and let your chin fall forward towards your chest. Relax your shoulders and keep your hands by your side.

## Muscles being stretched

Primary muscles: Semispinalis capitis and cervicis. Spinalis capitis and cervicis. Longissimus capitis and cervicis. Splenius capitis and cervicis.

Secondary muscles: Levator scapulae. Trapezius. Rhomboids.

## Sports that benefit from this stretch

Boxing. American football (gridiron). Rugby. Cycling. Swimming. Wrestling.

## Sports injury where stretch may be useful

Neck muscle strain. Whiplash (neck sprain). Cervical nerve stretch syndrome. Wryneck (acute torticollis).

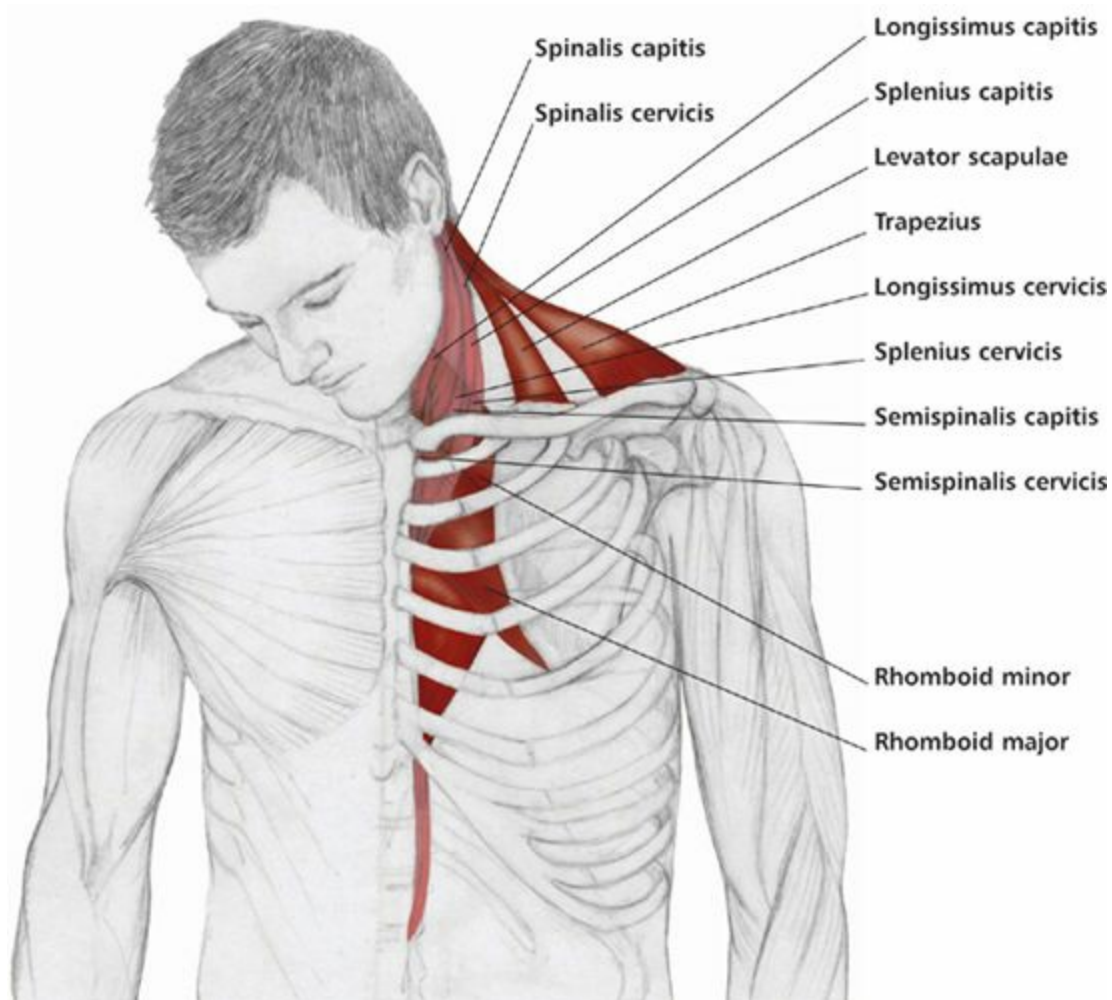
## Common problems and more information for performing this stretch correctly

Some people are more flexible in the upper back and neck than others. Do not overstretch by forcing your head down: instead, relax and let the weight of your head do the stretching for you.

## Complementary stretch

[A07](#).

## A04: DIAGONAL FLEXION NECK STRETCH



### **Technique**

Stand upright and let your chin fall forward towards your chest. Then gently lean your head to one side. Relax your shoulders and keep your hands by your side.

### **Muscles being stretched**

Primary muscles: Levator scapulae. Trapezius. Rhomboids.

Secondary muscles: Semispinalis capitis and cervicis. Spinalis capitis and cervicis. Longissimus capitis and cervicis. Splenius capitis and cervicis.

### **Sports that benefit from this stretch**

Archery. Boxing. Soccer. American football (gridiron). Rugby. Cycling. Golf. Swimming. Wrestling.

### **Sports injury where stretch may be useful**

Neck muscle strain. Whiplash (neck sprain). Cervical nerve stretch syndrome. Wryneck (acute torticollis).

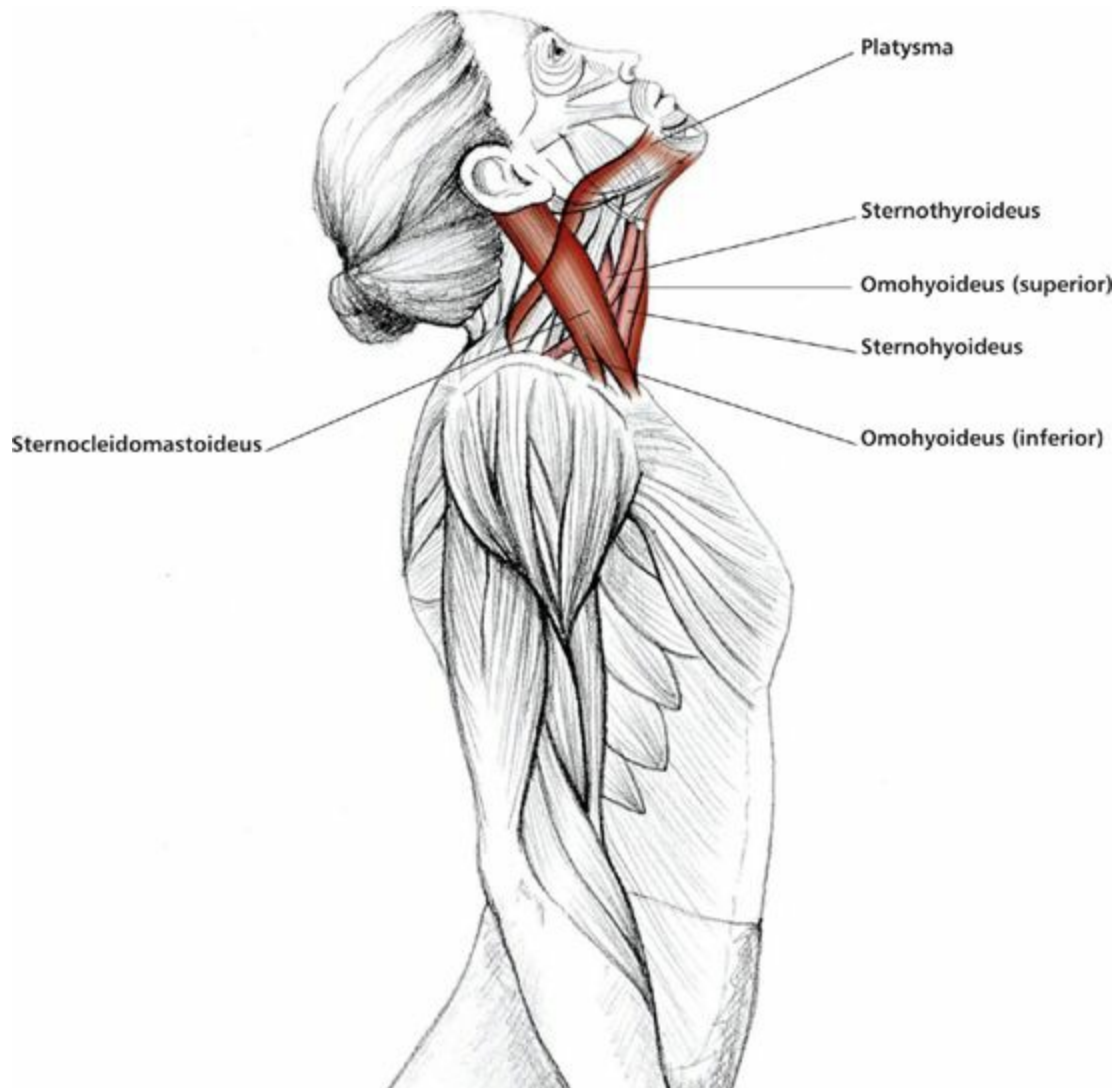
## **Common problems and more information for performing this stretch correctly**

Some people are more flexible in the upper back and neck than others. Do not overstretch by forcing your head down; instead, relax and let the weight of your head do the stretching for you.

## **Complementary stretches**

[A02](#), [A07](#).

## A05: NECK EXTENSION STRETCH



### Technique

Stand upright and lift your head, looking upwards as if trying to point up with your chin. Relax your shoulders and keep your hands by your side.

### Muscles being stretched

Primary muscles: Platysma. Sternocleidomastoideus.

Secondary muscles: Omohyoideus. Sternohyoideus. Sternothyroideus.

### Sports that benefit from this stretch

Boxing. American football (gridiron). Rugby. Cycling. Swimming. Wrestling.

### Sports injury where stretch may be useful

Neck muscle strain. Whiplash (neck sprain). Cervical nerve stretch syndrome. Wryneck (acute torticollis).

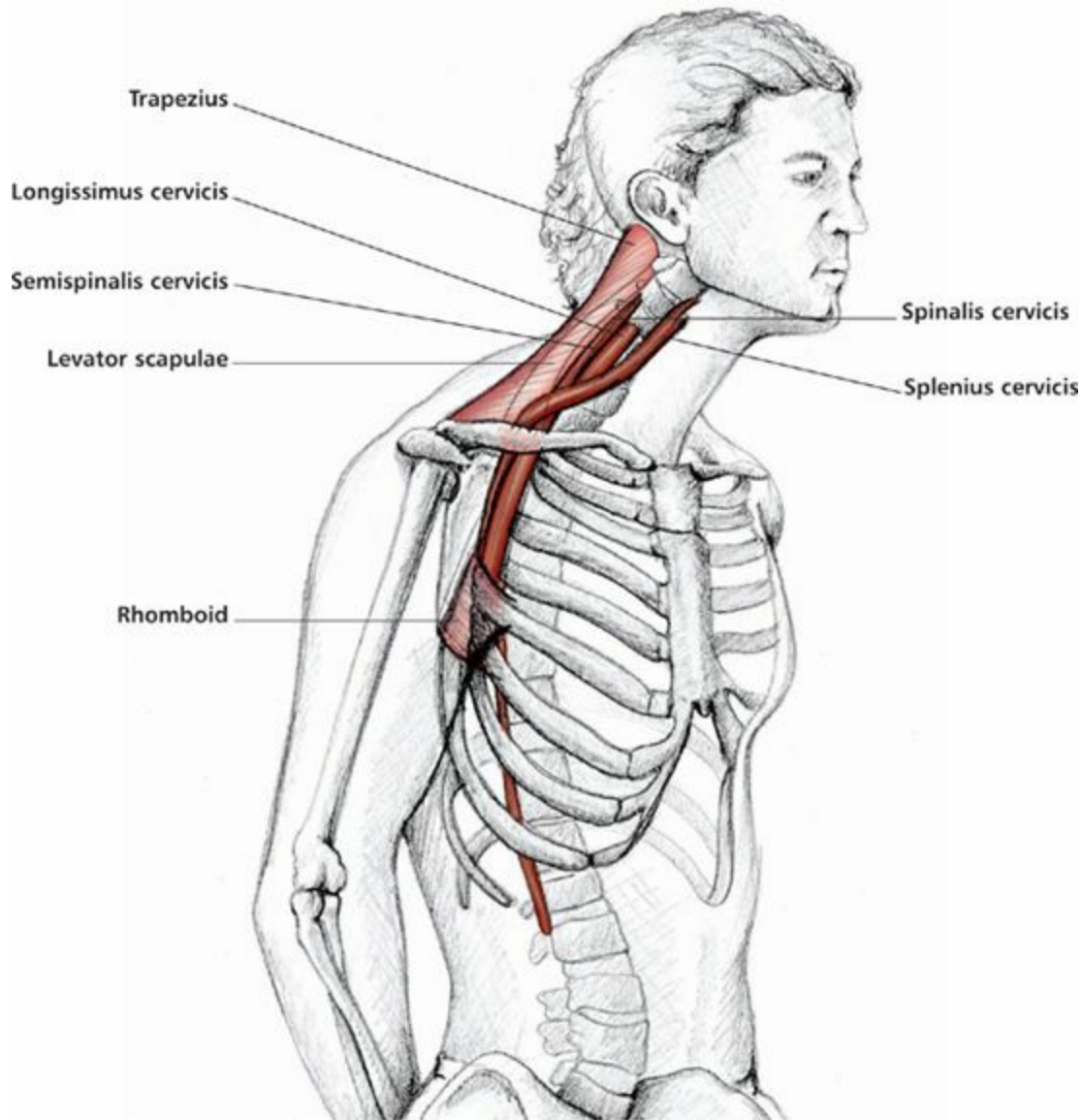
## **Additional information for performing this stretch correctly**

Keep your mouth closed and your teeth together when doing this stretch.

## **Complementary stretch**

[C02.](#)

## A06: NECK PROTRACTION STRETCH



### **Technique**

Keep your head up then push your head forward by sticking your chin out.

### **Muscles being stretched**

Primary muscles: Semispinalis cervicis. Spinalis cervicis. Longissimus cervicis. Splenius cervicis.  
Secondary muscles: Levator scapulae. Trapezius. Rhomboids.

### **Sports that benefit from this stretch**

Boxing. American football (gridiron). Rugby. Cycling. Swimming. Wrestling.

### **Sports injury where stretch may be useful**

Neck muscle strain. Whiplash (neck sprain). Cervical nerve stretch syndrome. Wryneck (acute torticollis).

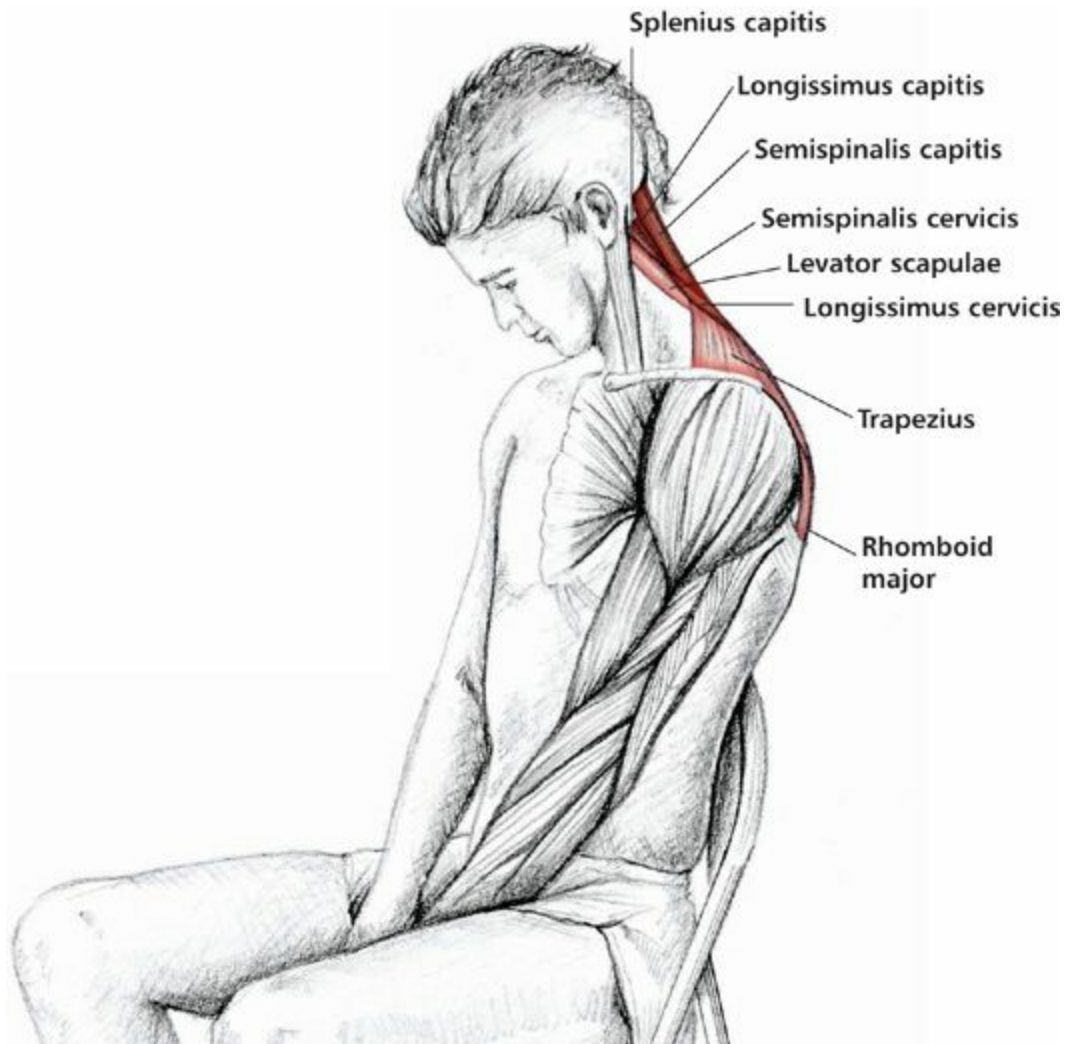
**Additional information for performing this stretch correctly**  
Keep your head up. Do not let your chin fall towards the ground.

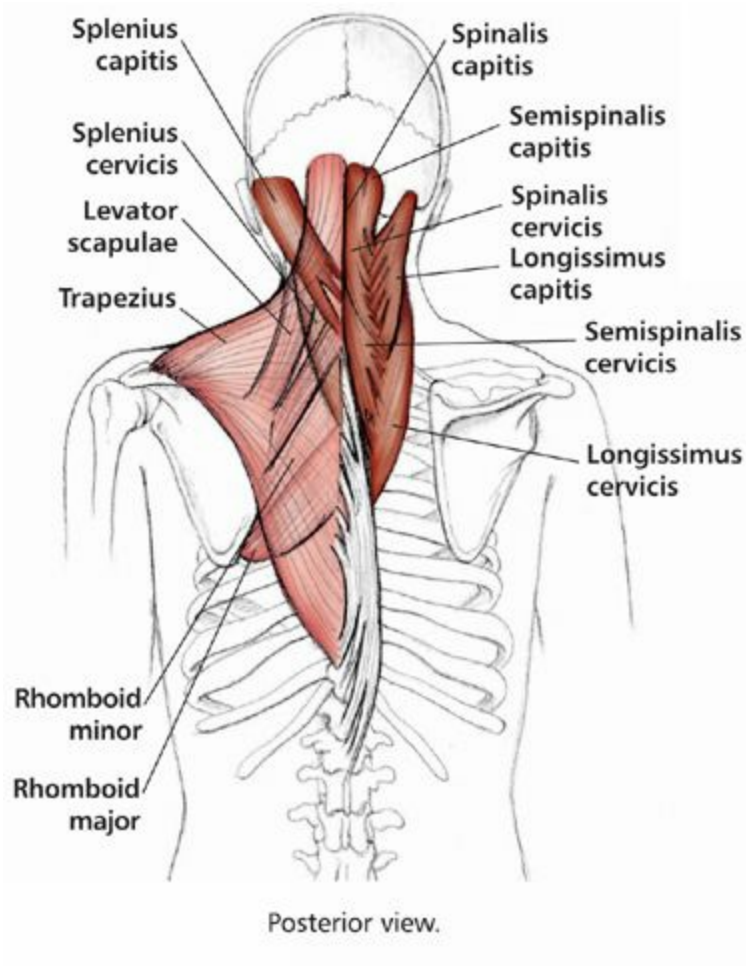
**Complementary stretch**

[A03.](#)



## A07: SITTING NECK FLEXION STRETCH





## Technique

While sitting on a chair, cross your arms over and hang on to the chair between your legs. Let your head fall forward and then lean backwards.

## Muscles being stretched

Primary muscles: Semispinalis capitis and cervicis. Spinalis capitis and cervicis. Longissimus capitis and cervicis. Splenius capitis and cervicis.

Secondary muscles: Levator scapulae. Trapezius. Rhomboids.

## Sports that benefit from this stretch

Archery. Boxing. American football (gridiron). Rugby. Cycling. Golf. Swimming. Wrestling.

## Sports injury where stretch may be useful

Neck muscle strain. Whiplash (neck sprain). Cervical nerve stretch syndrome. Wryneck (acute torticollis).

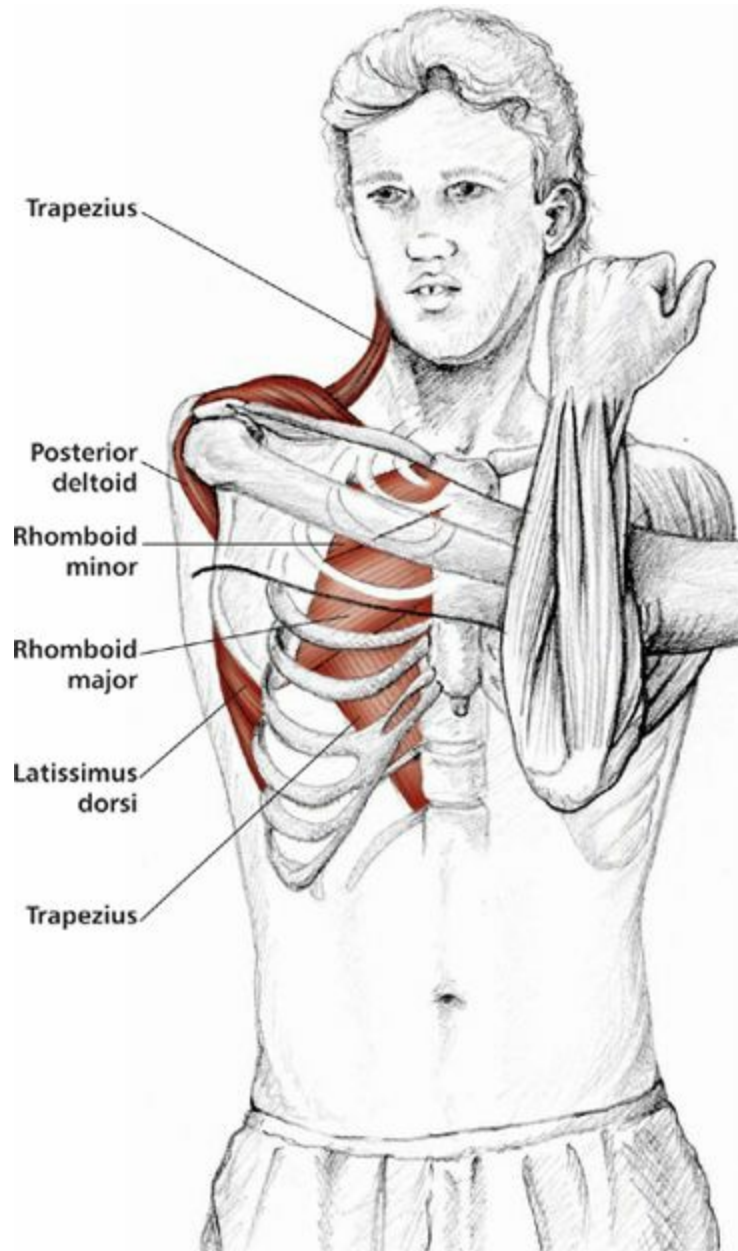
## Common problems and more information for performing this stretch correctly

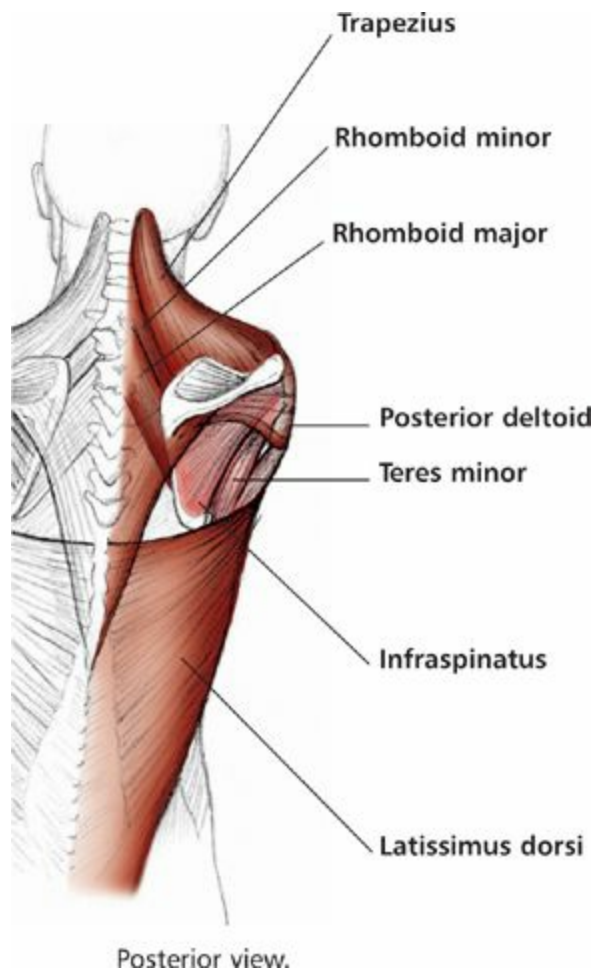
Some people are more flexible in the upper back and neck than others. Do not overstretch by forcing your head down: instead, relax and let the weight of your head do the stretching for you.

## Complementary stretches

[A03](#), [A11](#).

## A08: PARALLEL ARM SHOULDER STRETCH





### **Technique**

Stand upright and place one arm across your body. Keep your arm parallel to the ground and pull your elbow towards your opposite shoulder.

### **Muscles being stretched**

Primary muscles: Trapezius. Rhomboids. Latissimus dorsi. Posterior deltoid.

Secondary muscles: Infraspinatus. Teres minor.

### **Sports that benefit from this stretch**

Archery. Cricket. Baseball. Softball. Boxing. Golf. Tennis. Badminton. Squash. Rowing. Canoeing. Kayaking. Swimming. Athletics throwing field events.

### **Sports injury where stretch may be useful**

Dislocation. Subluxation. Acromioclavicular separation. Sternoclavicular separation.

Impingement syndrome. Rotator cuff tendonitis. Shoulder bursitis. Frozen shoulder (adhesive capsulitis).

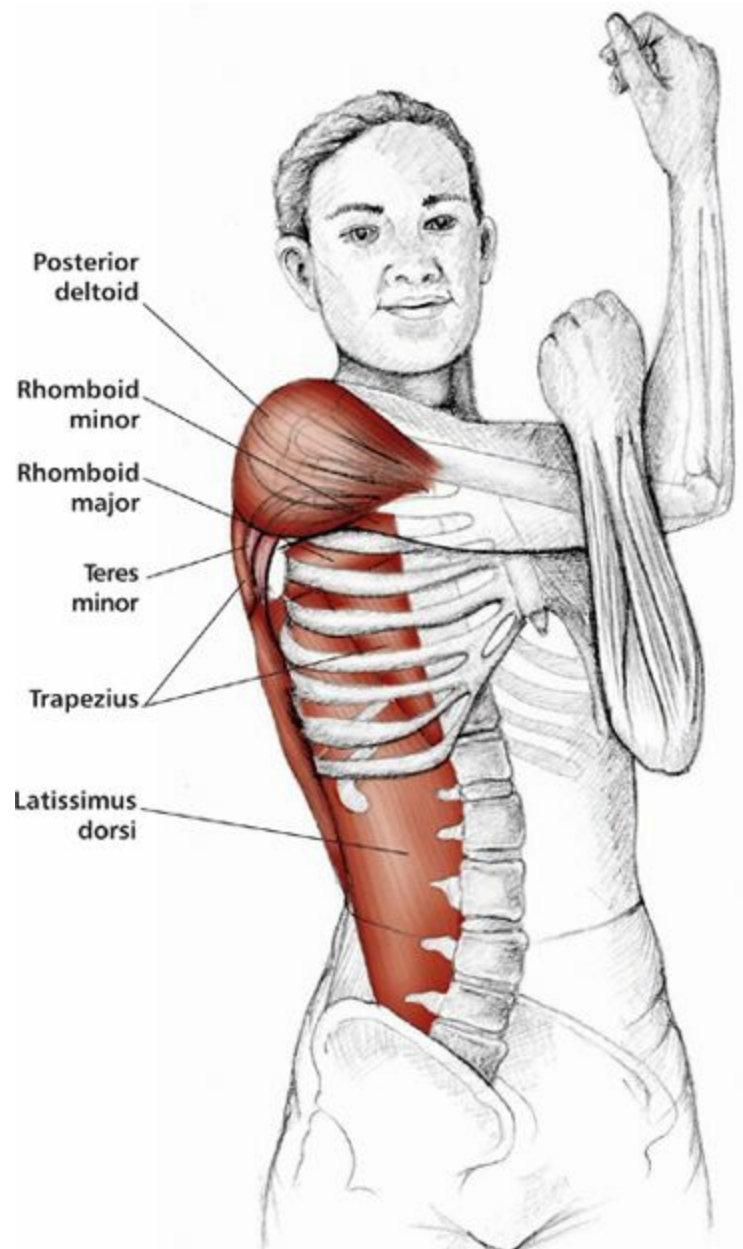
### **Additional information for performing this stretch correctly**

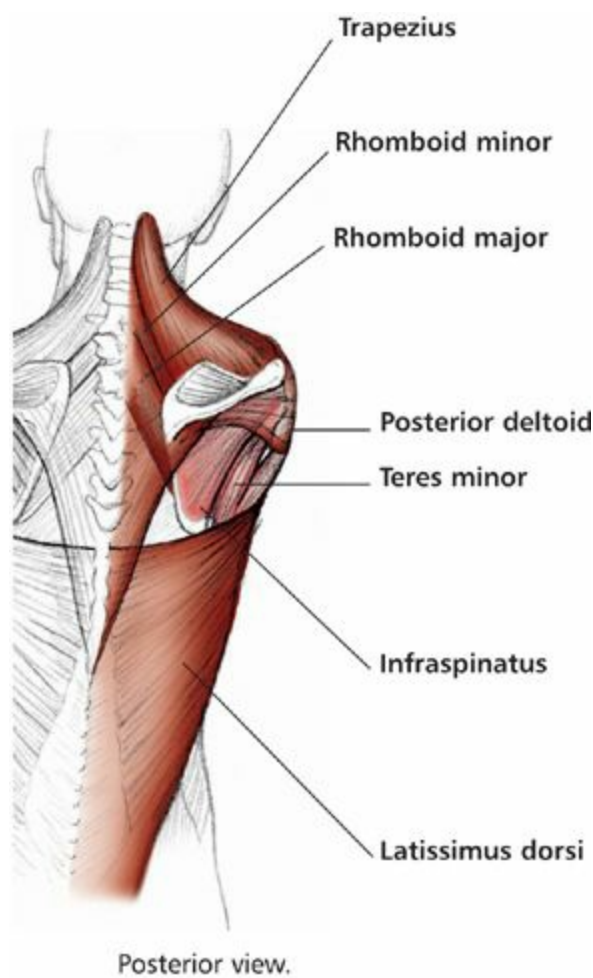
Keep your arm straight and parallel to the ground.

### **Complementary stretch**

[A09](#).

## A09: BENT ARM SHOULDER STRETCH





### **Technique**

Stand upright and place one arm across your body. Bend your arm at 90 degrees and pull your elbow towards your opposite shoulder.

### **Muscles being stretched**

Primary muscles: Trapezius. Rhomboids. Latissimus dorsi. Posterior deltoid.

Secondary muscles: Infraspinatus. Teres minor.

### **Sports that benefit from this stretch**

Archery. Cricket. Baseball. Softball. Boxing. Golf. Tennis. Badminton. Squash. Rowing. Canoeing. Kayaking. Swimming. Athletics throwing field events.

### **Sports injury where stretch may be useful**

Dislocation. Subluxation. Acromioclavicular separation. Sternoclavicular separation.

Impingement syndrome. Rotator cuff tendonitis. Shoulder bursitis. Frozen shoulder (adhesive capsulitis).

### **Additional information for performing this stretch correctly**

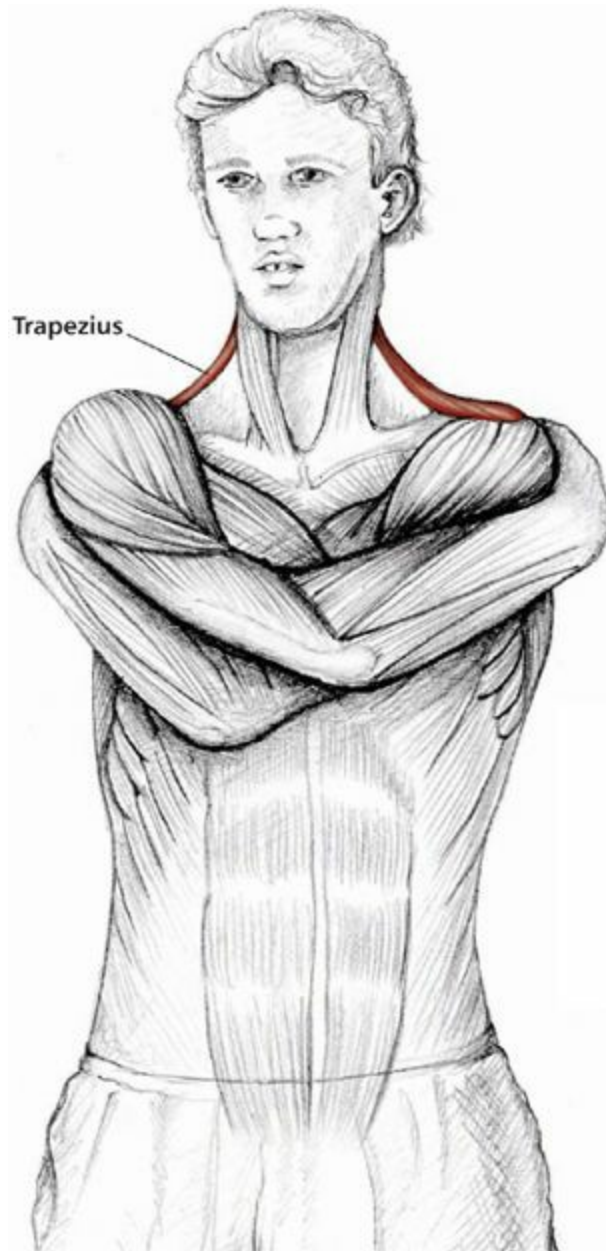
Keep your upper arm parallel to the ground.

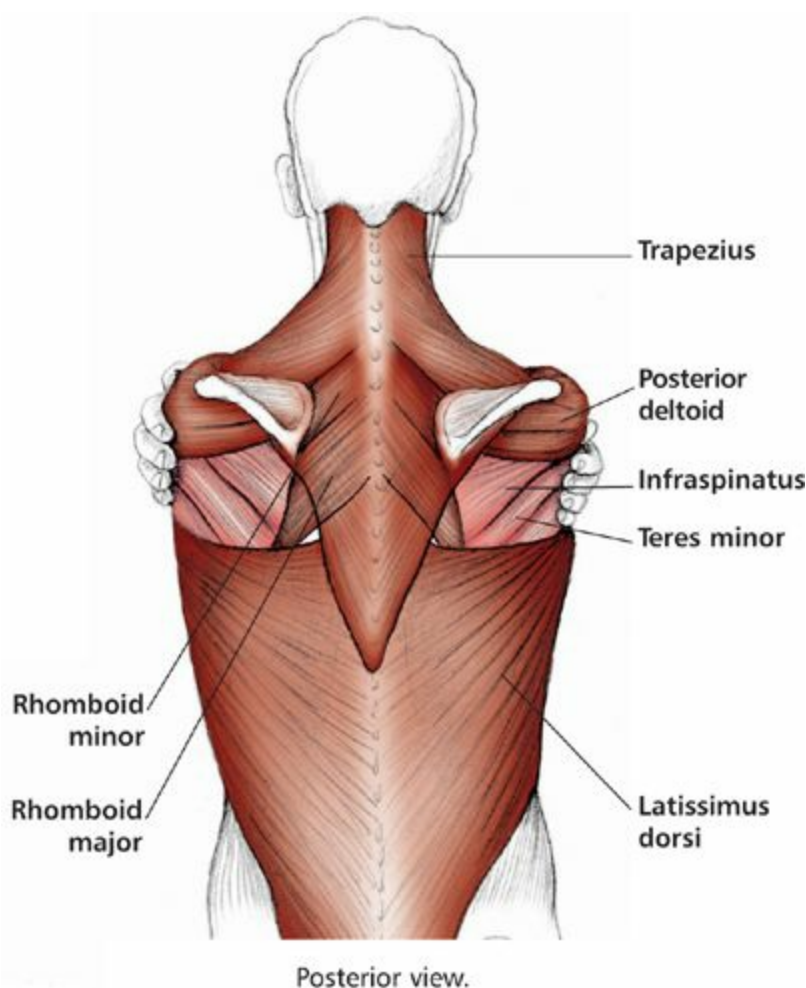
### **Complementary stretch**

[A08.](#)



## A10: WRAP AROUND SHOULDER STRETCH





## Technique

Stand upright and wrap your arms around your shoulders as if hugging yourself. Pull your shoulders back.

## Muscles being stretched

Primary muscles: Trapezius. Rhomboids. Latissimus dorsi. Posterior deltoid.

Secondary muscles: Infraspinatus. Teres minor.

## Sports that benefit from this stretch

Archery. Cricket. Baseball. Softball. Boxing. Golf. Tennis. Badminton. Squash. Rowing. Canoeing. Kayaking. Swimming. Athletics throwing field events.

## Sports injury where stretch may be useful

Dislocation. Subluxation. Acromioclavicular separation. Sternoclavicular separation.

Impingement syndrome. Rotator cuff tendonitis. Shoulder bursitis. Frozen shoulder (adhesive capsulitis).

## Common problems and more information for performing this stretch correctly

Do not pull too quickly on your shoulders. Ease into the stretch by slowly pulling your shoulders back.

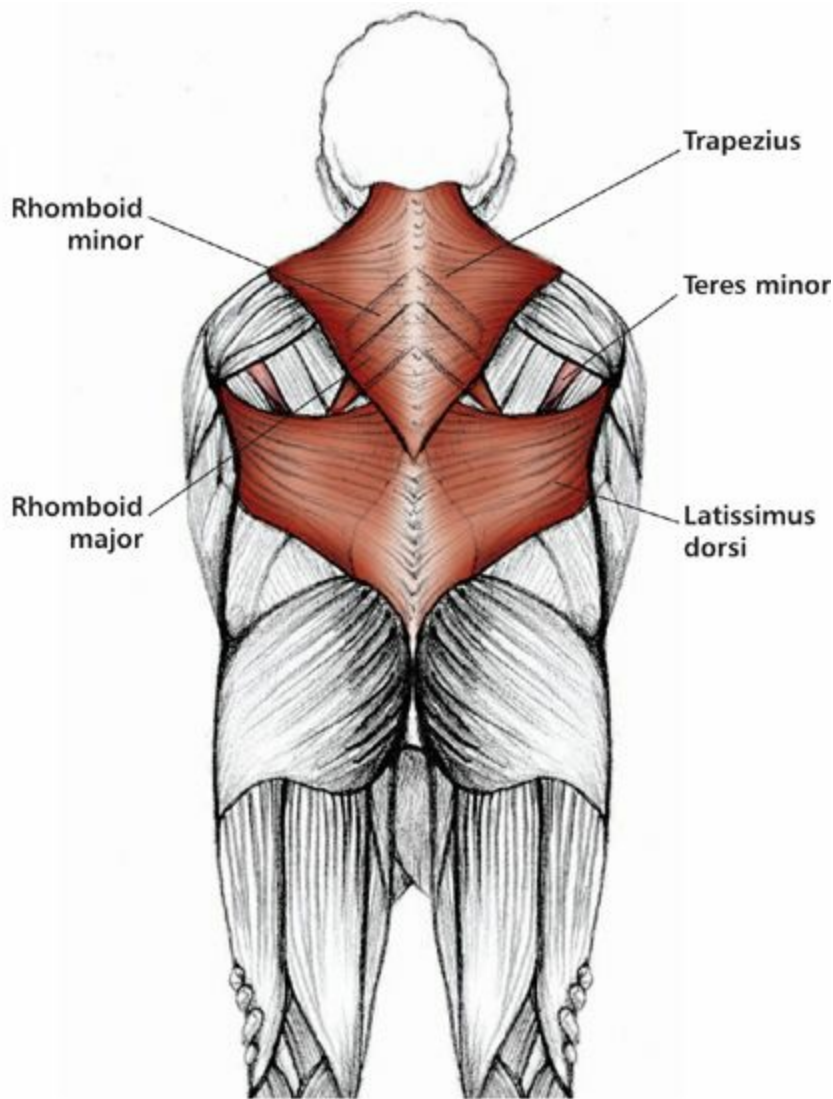
## Complementary stretch

[A11.](#)



## A11: CROSS OVER SHOULDER STRETCH





Posterior view.

### Technique

Stand with your knees bent. Cross your arms over and grab the back of your knees. Then start to rise upwards until you feel tension in your upper back and shoulders.

### Muscles being stretched

Primary muscles: Trapezius. Rhomboids. Latissimus dorsi.

Secondary muscle: Teres minor.

### Sports that benefit from this stretch

Archery. Cricket. Baseball. Softball. Boxing. Golf. Tennis. Badminton. Squash. Rowing. Canoeing. Kayaking. Swimming. Athletics throwing field events.

### Sports injury where stretch may be useful

Dislocation. Subluxation. Acromioclavicular separation. Sternoclavicular separation. Impingement syndrome. Rotator cuff tendonitis. Shoulder bursitis. Frozen shoulder (adhesive capsulitis).

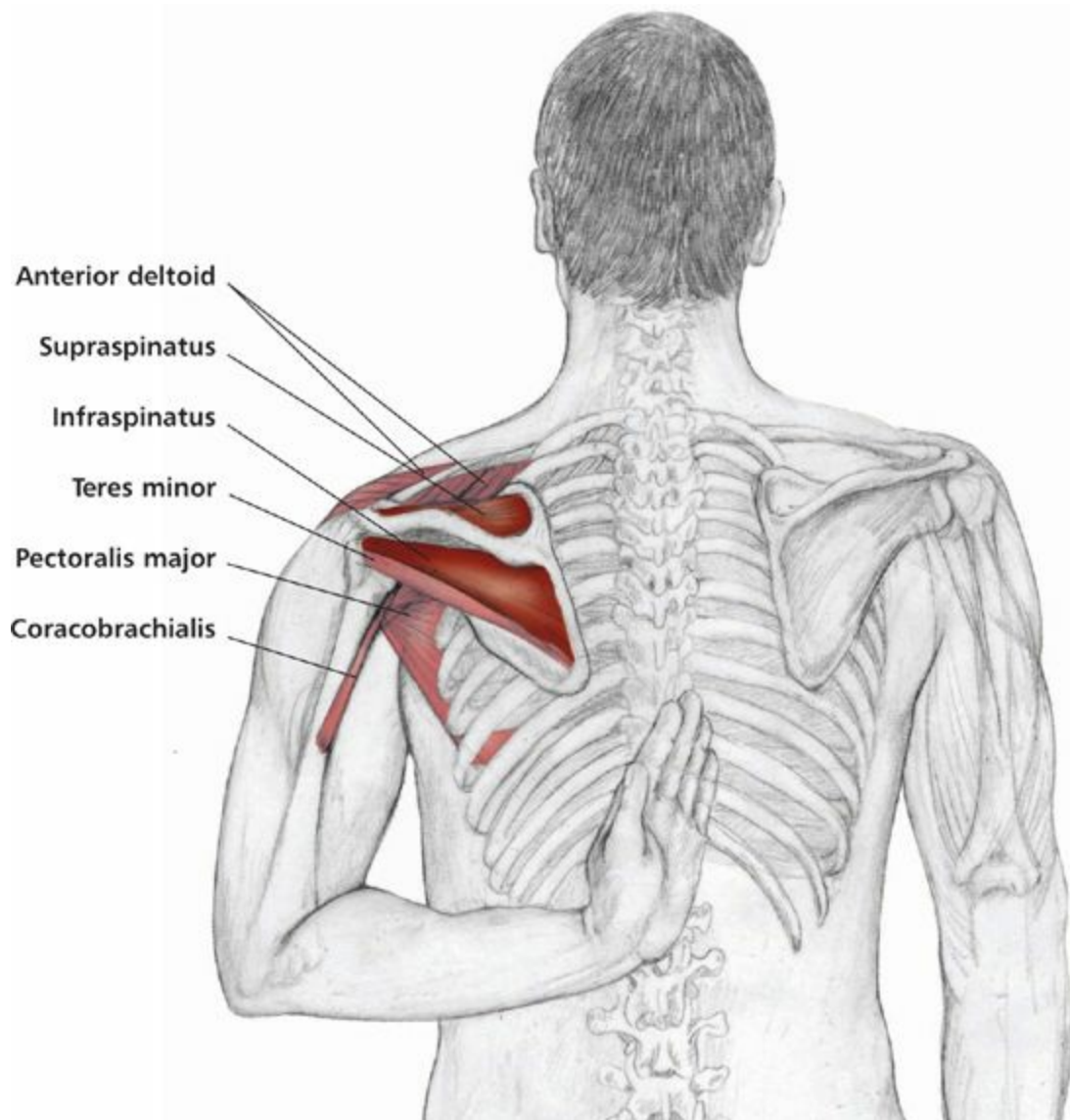
### Common problems and more information for performing this stretch correctly

Keep your shoulders level to the ground and avoid twisting or turning to one side.

## Complementary stretch

A07.

## A12: REACHING-UP SHOULDER STRETCH



### **Technique**

Place one hand behind your back and then reach up between your shoulder-blades.

### **Muscles being stretched**

Primary muscles: Supraspinatus. Infraspinatus.

Secondary muscles: Pectoralis major. Teres minor. Anterior deltoid. Coracobrachialis.

### **Sports that benefit from this stretch**

Martial arts. Tennis. Badminton. Squash. Rowing. Canoeing. Kayaking. Swimming. Cricket. Baseball. Field events. Wrestling.

### **Sports injury where stretch may be useful**

Dislocation. Subluxation. Acromioclavicular separation. Sternoclavicular separation.

Impingement syndrome. Rotator cuff tendonitis. Shoulder bursitis. Frozen shoulder (adhesive capsulitis).

### **Common problems and more information for performing this stretch correctly**

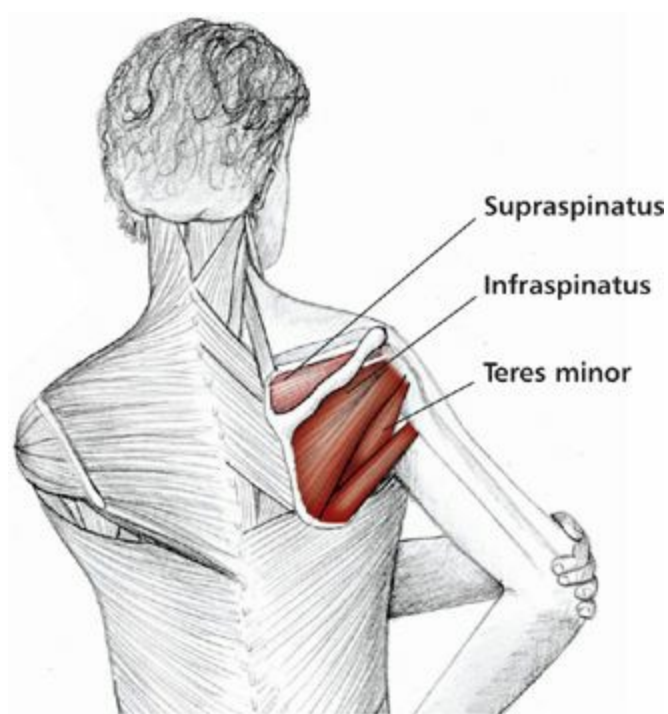
Many people are very tight in the rotator muscles of the shoulder. Perform this stretch very slowly to start with and use extreme caution at all times.

### **Complementary stretches**

[A13](#), [A15](#).

## A13: ELBOW-OUT ROTATOR STRETCH





### **Technique**

Stand with your hand behind the middle of your back and your elbow pointing out. Reach over with your other hand and gently pull your elbow forward.

### **Muscles being stretched**

Primary muscles: Infraspinatus. Teres minor.

Secondary muscle: Supraspinatus.

### **Sports that benefit from this stretch**

Martial arts. Tennis. Badminton. Squash. Rowing. Canoeing. Kayaking. Swimming. Cricket. Baseball. Athletics throwing field events. Wrestling.

### **Sports injury where stretch may be useful**

Dislocation. Subluxation. Acromioclavicular separation. Sternoclavicular separation.

Impingement syndrome. Rotator cuff tendonitis. Shoulder bursitis. Frozen shoulder (adhesive capsulitis).

### **Common problems and additional information for performing this stretch correctly**

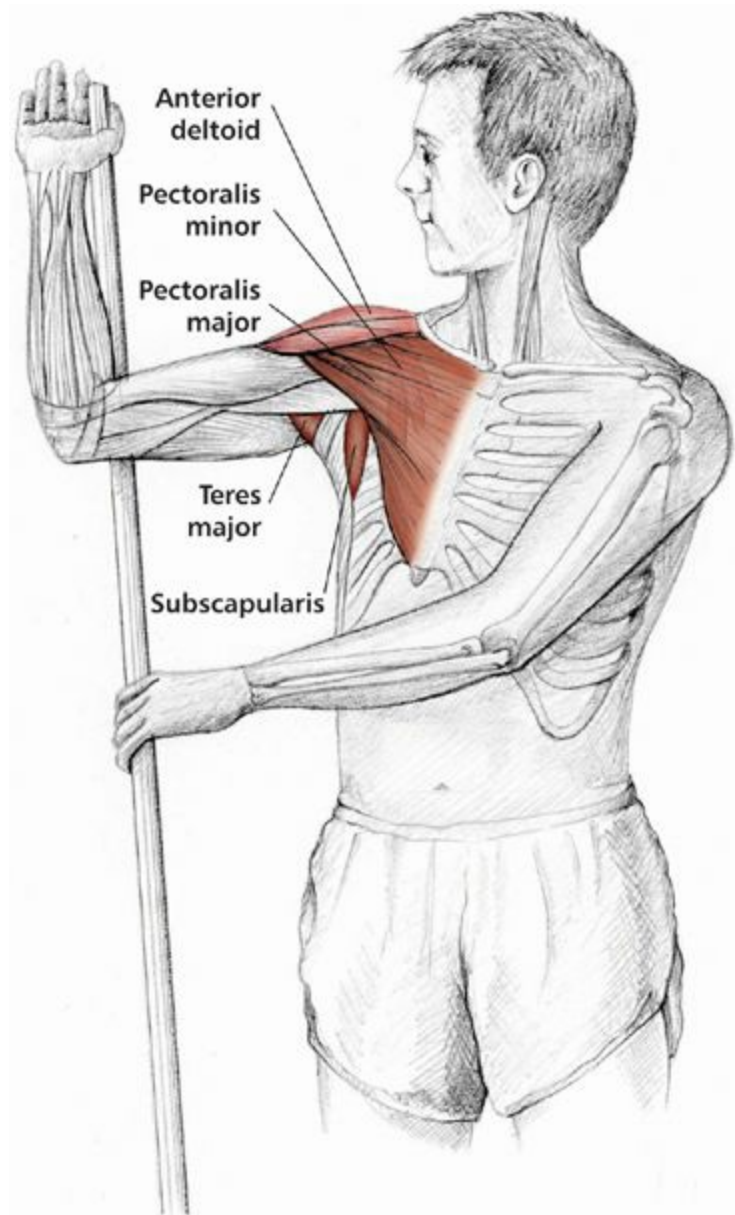
Many people are very tight in the rotator cuff muscles of the shoulder. Perform this stretch very slowly to start with and use extreme caution at all times.

### **Complementary stretch**

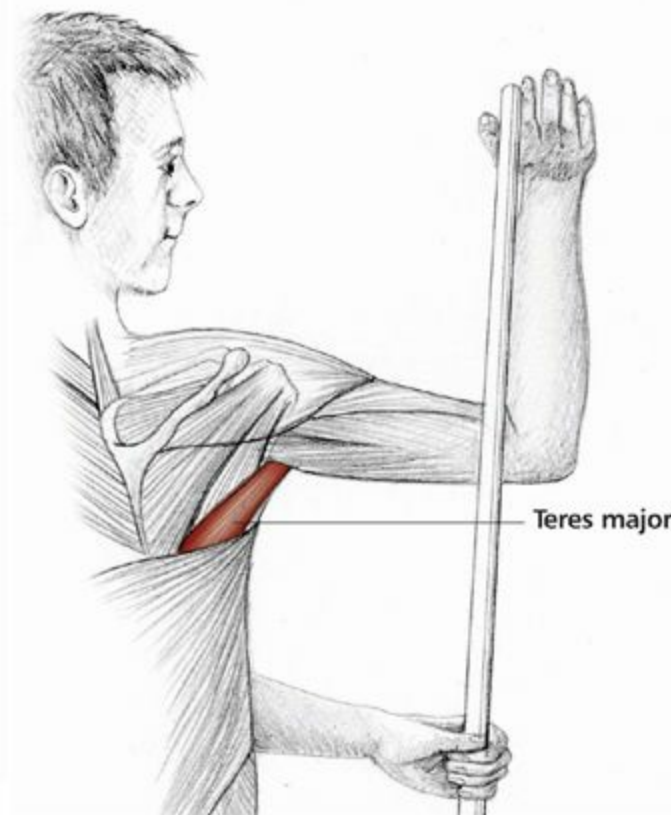
[A15.](#)



## A14: ARM-UP ROTATOR STRETCH







### **Technique**

Stand with your arm out and your forearm pointing upwards at 90 degrees. Place a broomstick in your hand and behind your elbow. With your other hand pull the bottom of the broomstick forward.

### **Muscles being stretched**

Primary muscles: Pectoralis major. Subscapularis. Teres major.

Secondary muscle: Pectoralis minor. Anterior deltoid.

### **Sports that benefit from this stretch**

Martial arts. Tennis. Badminton. Squash. Rowing. Canoeing. Kayaking. Swimming. Cricket. Baseball. Athletics throwing field events. Wrestling.

### **Sports injury where stretch may be useful**

Dislocation. Subluxation. Acromioclavicular separation. Sternoclavicular separation.

Impingement syndrome. Rotator cuff tendonitis. Shoulder bursitis. Frozen shoulder (adhesive capsulitis).

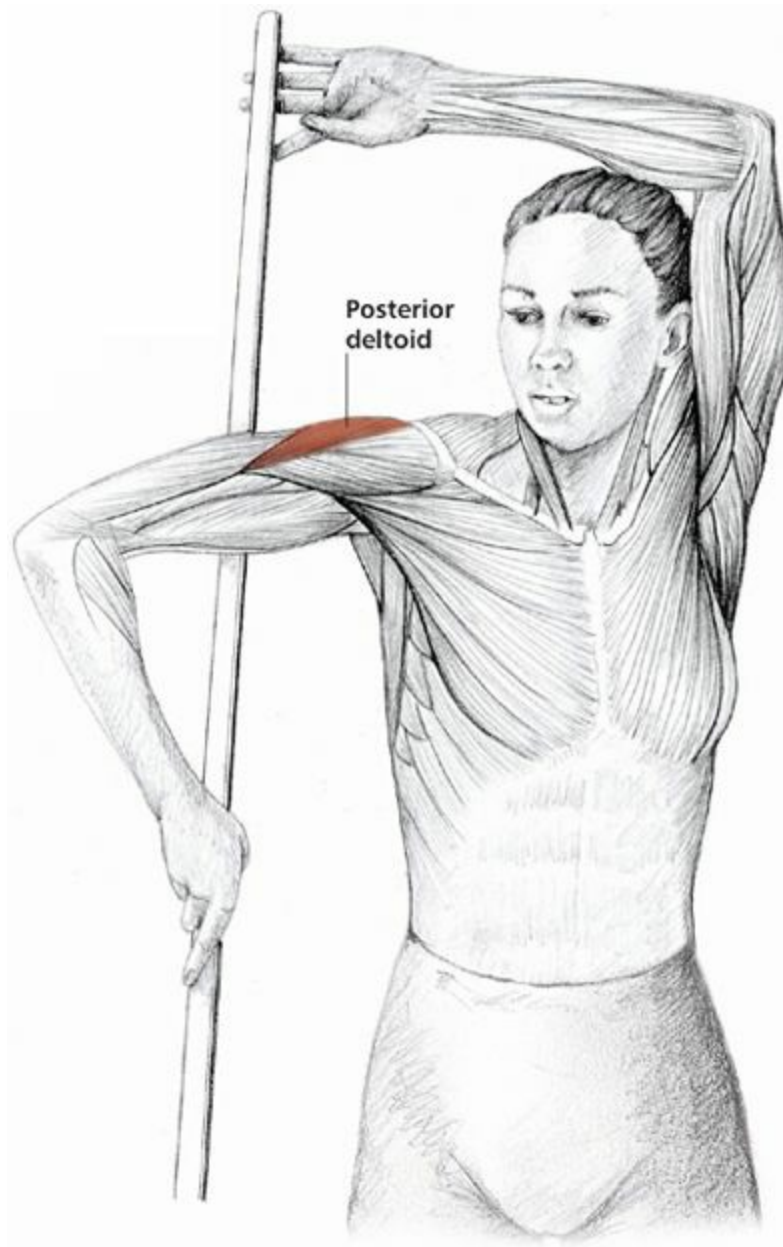
### **Common problems and additional information for performing this stretch correctly**

Many people are very tight in the rotator cuff muscles of the shoulder. Perform this stretch very slowly to start with and use extreme caution at all times.

### **Complementary stretch**

[A15.](#)

## A15: ARM-DOWN ROTATOR STRETCH



Stand with your arm out and your forearm pointing downwards at 90 degrees. Place a broomstick in your hand and behind your elbow. With your other hand pull the top of the broomstick forward.

### **Muscles being stretched**

Primary muscle: Infraspinatus. Posterior deltoid.

Secondary muscle: Teres minor.

### **Sports that benefit from this stretch**

Martial arts. Tennis. Badminton. Squash. Rowing. Canoeing. Kayaking. Swimming. Cricket. Baseball. Athletics throwing field events. Wrestling.

### **Sports injury where stretch may be useful**

Dislocation. Subluxation. Acromioclavicular separation. Sternoclavicular separation.

Impingement syndrome. Rotator cuff tendonitis. Shoulder bursitis. Frozen shoulder (adhesive capsulitis).

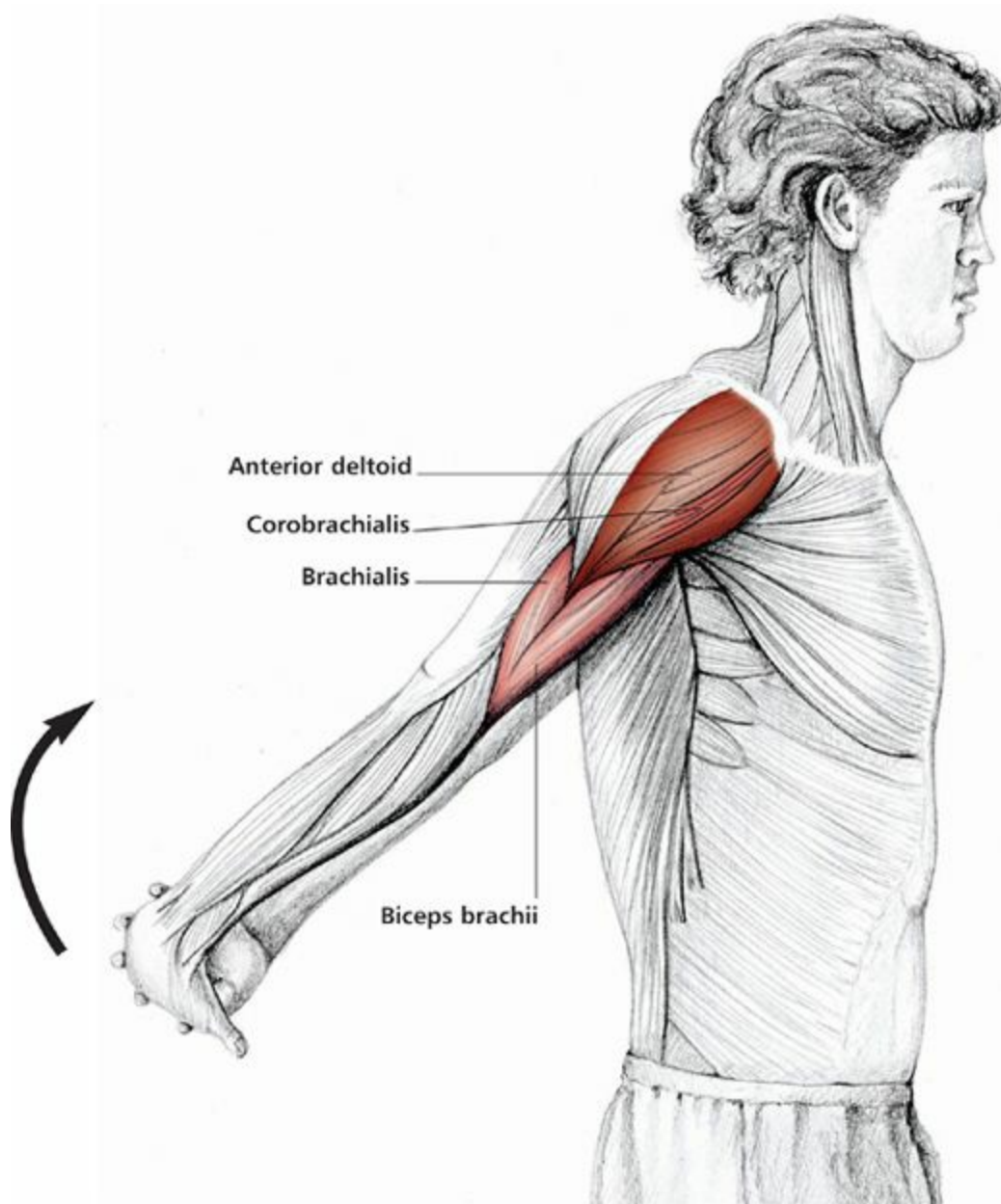
### **Common problems and additional information for performing this stretch correctly**

Many people are very tight in the rotator cuff muscles of the shoulder. Perform this stretch very slowly to start with and use extreme caution at all times.

### **Complementary stretch**

[A13](#).

## A16: REVERSE SHOULDER STRETCH



### Technique

Stand upright and clasp your hands together behind your back. Slowly lift your hands upward.

### Muscles being stretched

Primary muscle: Anterior deltoid.

Secondary muscles. Biceps brachii. Brachialis. Coracobrachialis.

### Sports that benefit from this stretch

Basketball. Netball. Hiking. Backpacking. Mountaineering. Orienteering. Tennis. Badminton. Squash. Rowing. Canoeing. Kayaking. Swimming. Cricket. Baseball. Athletics throwing field events.

### **Sports injury where stretch may be useful**

Dislocation. Subluxation. Acromioclavicular separation. Sternoclavicular separation. Impingement syndrome. Rotator cuff tendonitis. Shoulder bursitis. Frozen shoulder (adhesive capsulitis). Chest strain. Pectoral muscle insertion inflammation.

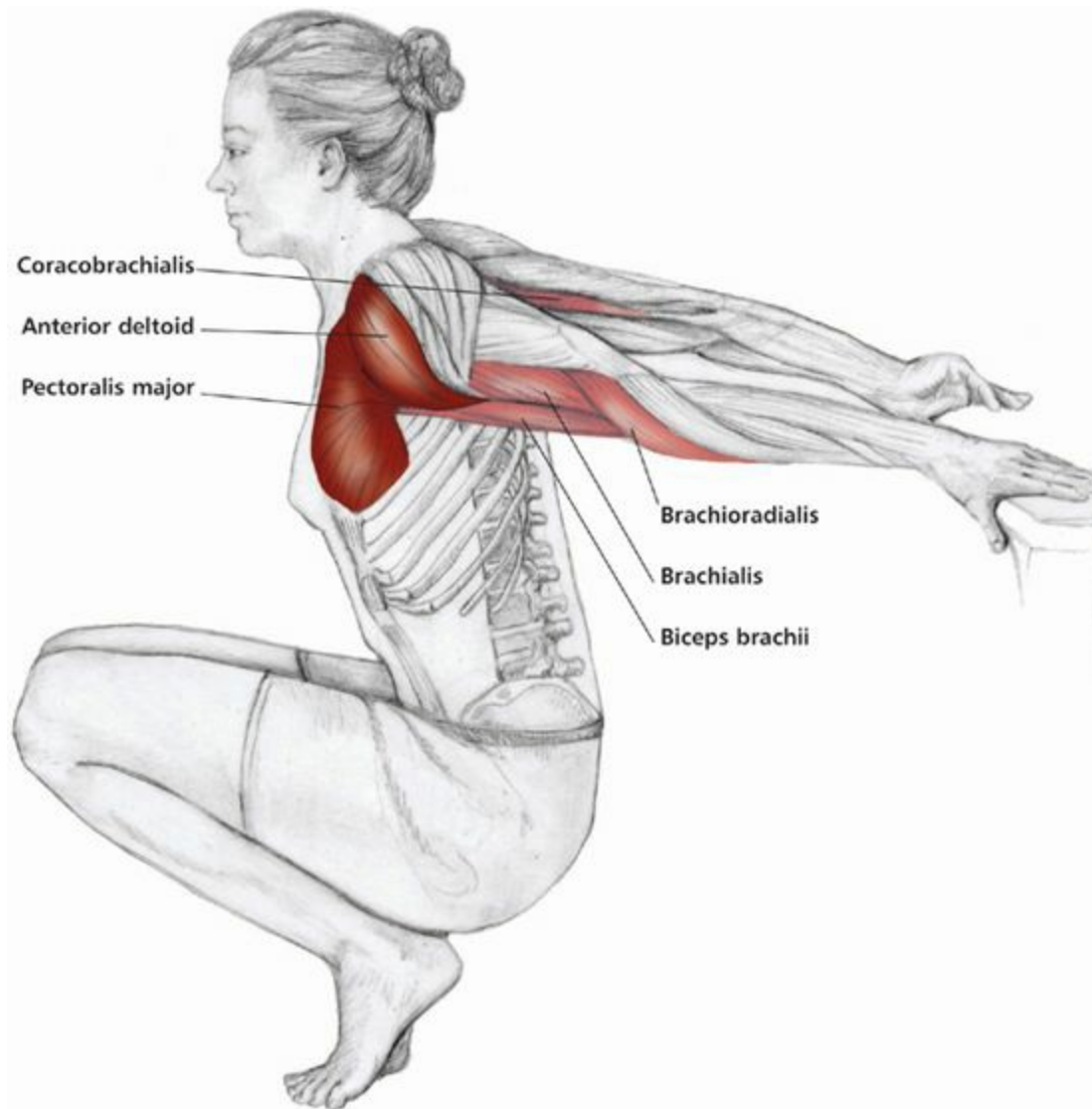
### **Additional information for performing this stretch correctly**

Do not lean forward while lifting your hands upward.

### **Complementary stretch**

[B06](#).

## A17: ASSISTED REVERSE SHOULDER STRETCH



### Technique

Stand upright with your back towards a table or bench and place your hands on the edge of the table or bench. Keep your arms straight and slowly lower your entire body.

### Muscles being stretched

Primary muscles: Anterior deltoid. Pectoralis major.

Secondary muscles: Biceps brachii. Brachialis. Brachioradialis. Coracobrachialis.

### Sports that benefit from this stretch

Basketball. Netball. Hiking. Backpacking. Mountaineering. Orienteering. Tennis. Badminton. Squash. Rowing. Canoeing. Kayaking. Swimming. Cricket. Baseball. Field events.

### Sports injury where stretch may be useful

Dislocation. Subluxation. Acromioclavicular separation. Sternoclavicular separation.

Impingement syndrome. Rotator cuff tendonitis. Shoulder bursitis. Frozen shoulder (adhesive capsulitis). Chest strain. Pectoral muscle insertion inflammation.

### **Common problems and more information for performing this stretch correctly**

Look forward and keep your body upright.

### **Complementary stretches**

[B03](#), [B05](#).

# 4

## Arms and Chest

Mobility of the upper limb is mainly dependent on three joints: the sternoclavicular, acromioclavicular, and shoulder joints. Muscles in this area can be categorised according to: 1) muscles that run between the trunk and the scapula, which act upon the shoulder girdle and not on the shoulder joint, i.e., **trapezius**, **levator scapulae**, **rhomboids**, **serratus anterior**, **pectoralis minor**, and **subclavius**; 2) muscles that run between the trunk and the humerus, which act upon the shoulder joint and the shoulder girdle: i.e., **latissimus dorsi** and **pectoralis major**; 3) muscles that run between the scapula and humerus, which act exclusively upon the shoulder joint, i.e., **deltoideus**, **supraspinatus**, **infraspinatus**, **teres minor**, **subscapularis**, **teres major**, and **coracobrachialis**.

Muscles of the arm comprise those that originate from the scapula and/or the humerus, and insert into the radius and/or ulna, so that they act upon the elbow joint. These are: **biceps brachii**; **brachialis**; **triceps brachii**; and **anconeus**. **Coracobrachialis**, although acting upon the shoulder joint, is also included because of its proximity to the other muscles of this group. **Biceps brachii** operates over three joints, and has two tendinous heads at its origin and two tendinous insertions. Occasionally it has a third head, originating at the insertion of coracobrachialis. The short head forms part of the lateral wall of the axilla, along with coracobrachialis and the humerus. **Brachialis** lies posterior to biceps brachii and is the main flexor of the elbow joint. **Triceps brachii** originates from three heads and is the only muscle on the back of the arm.

The anterior forearm contains three functional muscle groups: the pronators of the forearm; the wrist flexors; and the long flexors of the fingers and thumb. They are arranged in three layers: the superficial layer comprises four muscles: **pronator teres**; **flexor carpi radialis**; **palmaris longus**; and **flexor carpi ulnaris**. The middle layer contains only the **flexor digitorum superficialis**. The deepest layer consists of: **flexor digitorum profundus**; **flexor pollicis longus**; and **pronator quadratus**. On the back of the forearm there are two muscle groups. The superficial group contains, from the radial to ulnar side: **brachioradialis**; **extensor carpi radialis longus**; **extensor carpi radialis brevis**; **extensor digitorum**; **extensor digiti minimi**; and **extensor carpi ulnaris**. The muscle belly of brachioradialis is prominent when working against resistance. The deep group contains: **supinator**; **abductor pollicis longus**; **extensor pollicis brevis**; **extensor pollicis longus**;

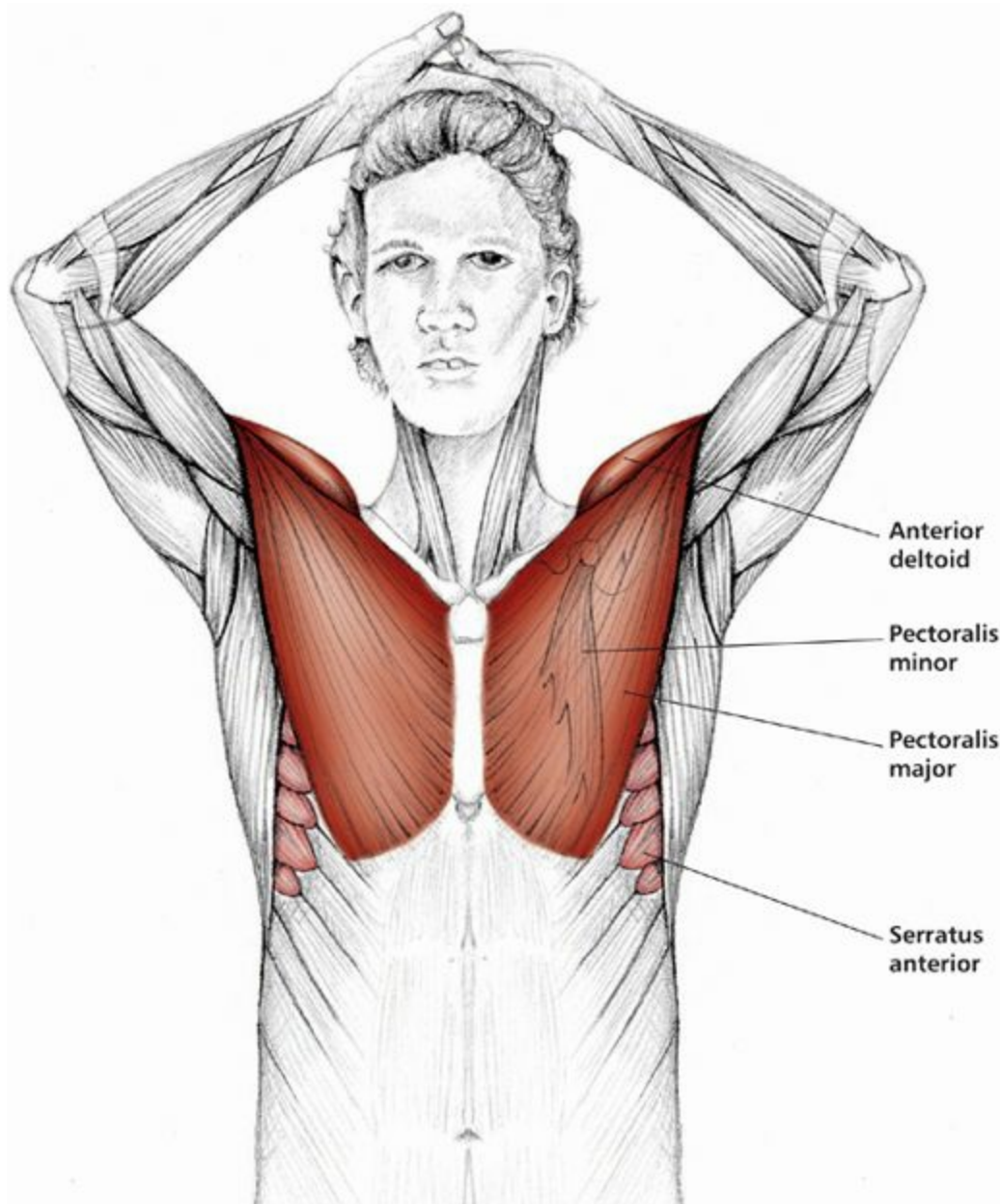


and **extensor indicis**.

The muscle groupings in the hand are: 1) the “intrinsic” muscles, consisting of the **interossei**, located within the intermetacarpal spaces to act on the four fingers and thumb, and the **lumbricals**, which arise from the tendons of flexor digitorum profundus in the palm and act on the four fingers; 2) the muscles of the hypothenar eminence; 3) the muscles of the thenar eminence; 4) **adductor pollicis**.

Sports that benefit from these arm and chest stretches include: archery; basketball and netball; batting sports like cricket, baseball, and softball; hiking, backpacking, mountaineering, and orienteering; ice hockey and field hockey; martial arts; racquet sports like tennis, badminton, and squash; rowing, canoeing, and kayaking; swimming; throwing sports like cricket, baseball, and field events; volleyball; wrestling.

## B01: ABOVE HEAD CHEST STRETCH



### **Technique**

Stand upright and interlock your fingers. Bend your arms and place them above your head while forcing your elbows and hands backwards.

### **Muscles being stretched**

Primary muscles: Pectoralis major and minor. Anterior deltoid.

Secondary muscle: Serratus anterior.

### **Sports that benefit from this stretch**

Basketball. Netball. Hiking. Backpacking. Mountaineering. Orienteering. Tennis. Badminton. Squash. Rowing. Canoeing. Kayaking. Swimming. Cricket. Baseball. Athletics throwing field events.

### **Sports injury where stretch may be useful**

Impingement syndrome. Rotator cuff tendonitis. Shoulder bursitis. Frozen shoulder (adhesive capsulitis). Chest strain. Pectoral muscle insertion inflammation.

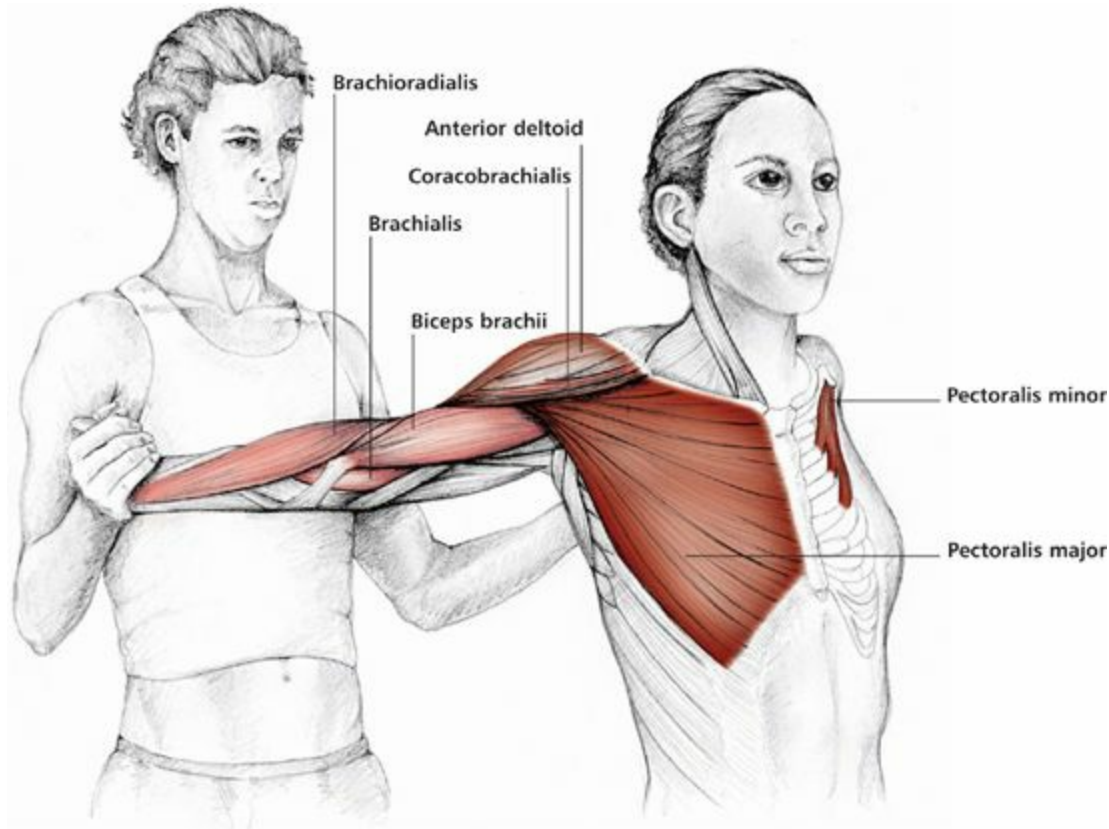
### **Additional information for performing this stretch correctly**

Vary the height of your hands. Lower your hands behind your head to place an emphasis on the *anterior deltoid* and raise your hands above your head to emphasize the *pectoral* muscles.

### **Complementary stretch**

[B07](#).

## B02: PARTNER ASSISTED CHEST STRETCH



### Technique

Extend both of your arms parallel to the ground. Have a partner hold on to your hands and slowly pull your arms backwards.

### Muscles being stretched

Primary muscles: Pectoralis major and minor. Anterior deltoid.

Secondary muscles: Biceps brachii. Brachialis. Brachioradialis. Coracobrachialis.

### Sports that benefit from this stretch

Basketball. Netball. Hiking. Backpacking. Mountaineering. Orienteering. Tennis. Badminton. Squash. Rowing. Canoeing. Kayaking. Swimming. Cricket. Baseball. Athletics throwing field events.

### Sports injury where stretch may be useful

Dislocation. Subluxation. Acromioclavicular separation. Sternoclavicular separation.

Impingement syndrome. Rotator cuff tendonitis. Shoulder bursitis. Frozen shoulder (adhesive capsulitis). Biceps tendon rupture. Bicipital tendonitis. Biceps strain. Chest strain. Pectoral muscle insertion inflammation.

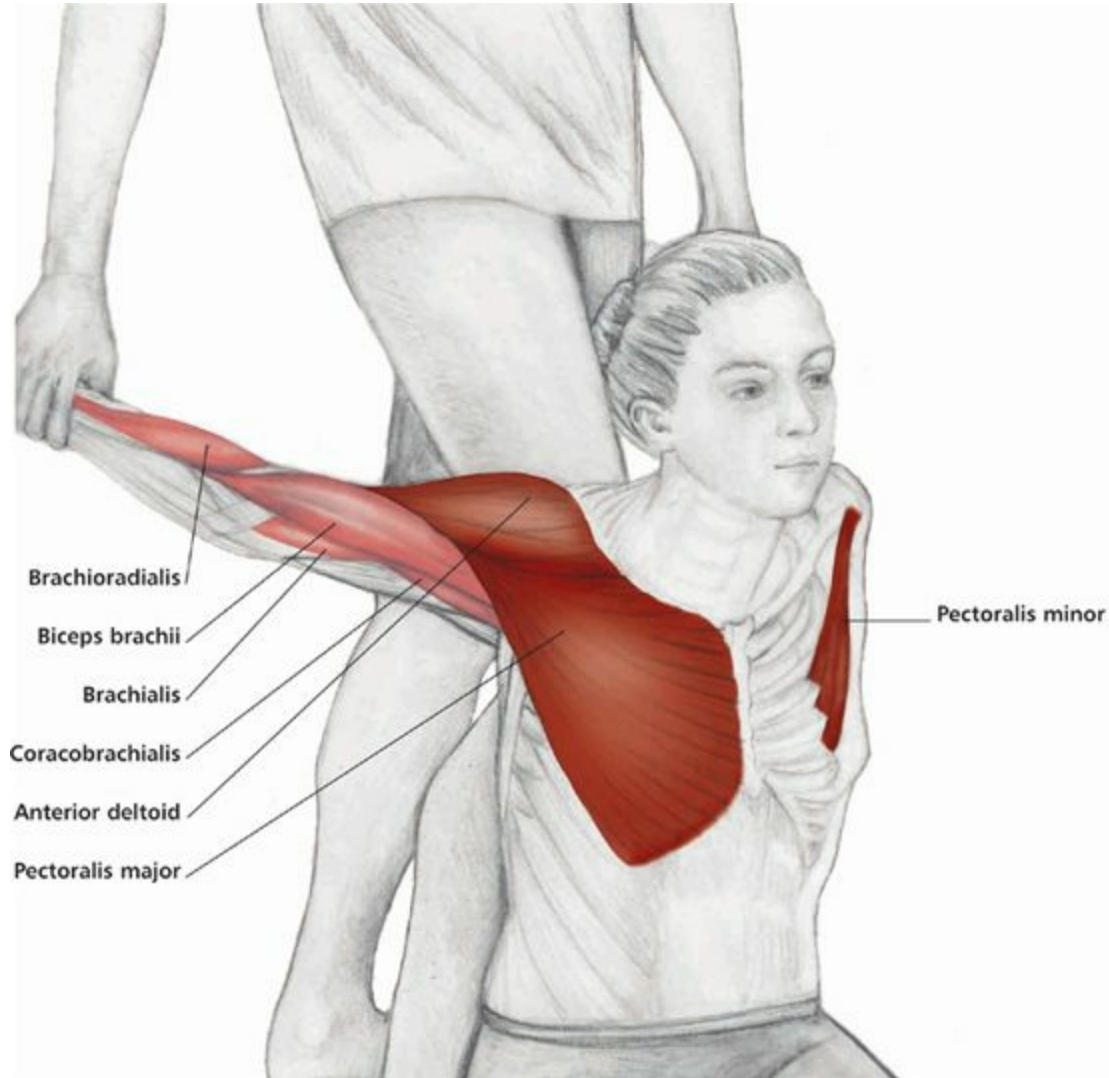
### Additional information for performing this stretch correctly

Keep your arms parallel to the ground and your palms facing outward.

# Complementary stretch

B04.

## B03: SEATED PARTNER ASSISTED CHEST STRETCH



### Technique

Sit on the ground and have a partner stand behind you. Reach behind with both arms and have the partner further extend your arms.

### Muscles being stretched

Primary muscles: Pectoralis major and minor. Anterior deltoid.

Secondary muscles: Biceps brachii. Brachialis. Brachioradialis. Coracobrachialis.

### Sports that benefit from this stretch

Basketball. Netball. Hiking. Backpacking. Mountaineering. Orienteering. Tennis. Badminton. Squash. Rowing. Canoeing. Kayaking. Swimming. Cricket. Baseball. Field events.

### Sports injury where stretch may be useful

Dislocation. Subluxation. Acromioclavicular separation. Sternoclavicular separation.

Impingement syndrome. Rotator cuff tendonitis. Shoulder bursitis. Frozen shoulder (adhesive)

capsulitis). Biceps tendon rupture. Bicipital tendonitis. Biceps strain. Chest strain. Pectoral muscle insertion inflammation.

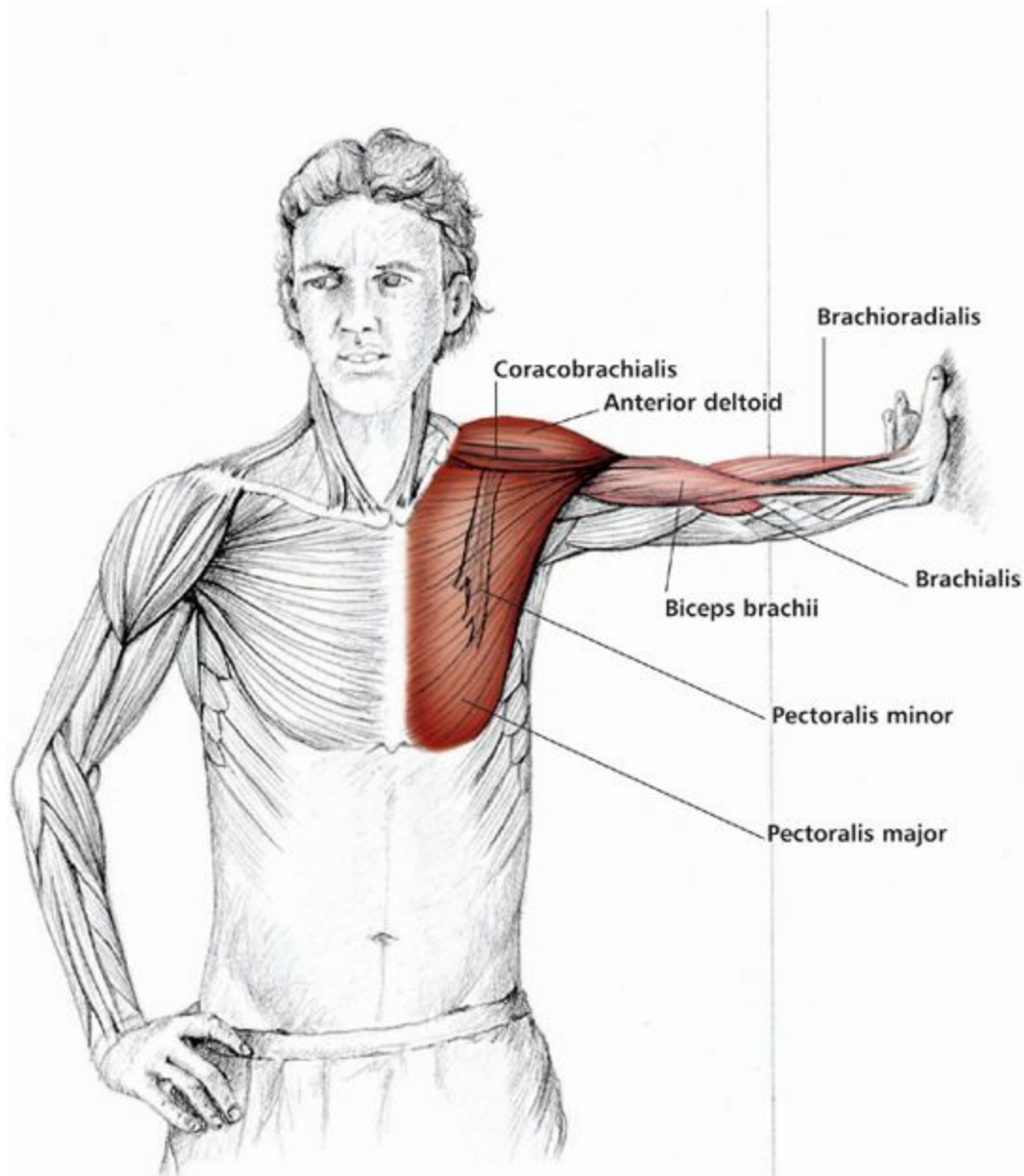
### **Common problems and more information for performing this stretch correctly**

Keep your palms facing outward and your arms slightly above parallel to the ground.

### **Complementary stretches**

[B01](#), [B05](#).

## B04: PARALLEL ARM CHEST STRETCH



### Technique

Stand with your arm extended to the rear and parallel to the ground. Hold on to an immovable object and then turn your shoulders and body away from your outstretched arm.

### Muscles being stretched

Primary muscles: Pectoralis major and minor. Anterior deltoid.

Secondary muscles: Biceps brachii. Brachialis. Brachioradialis. Coracobrachialis.

### Sports that benefit from this stretch

Basketball. Netball. Hiking. Backpacking. Mountaineering. Orienteering. Tennis. Badminton. Squash. Rowing. Canoeing. Kayaking. Swimming. Cricket. Baseball. Athletics throwing field events.



### **Sports injury where stretch may be useful**

Dislocation. Subluxation. Acromioclavicular separation. Sternoclavicular separation.

Impingement syndrome. Rotator cuff tendonitis. Shoulder bursitis. Frozen shoulder (adhesive capsulitis). Biceps tendon rupture. Bicipital tendonitis. Biceps strain. Chest strain. Pectoral muscle insertion inflammation.

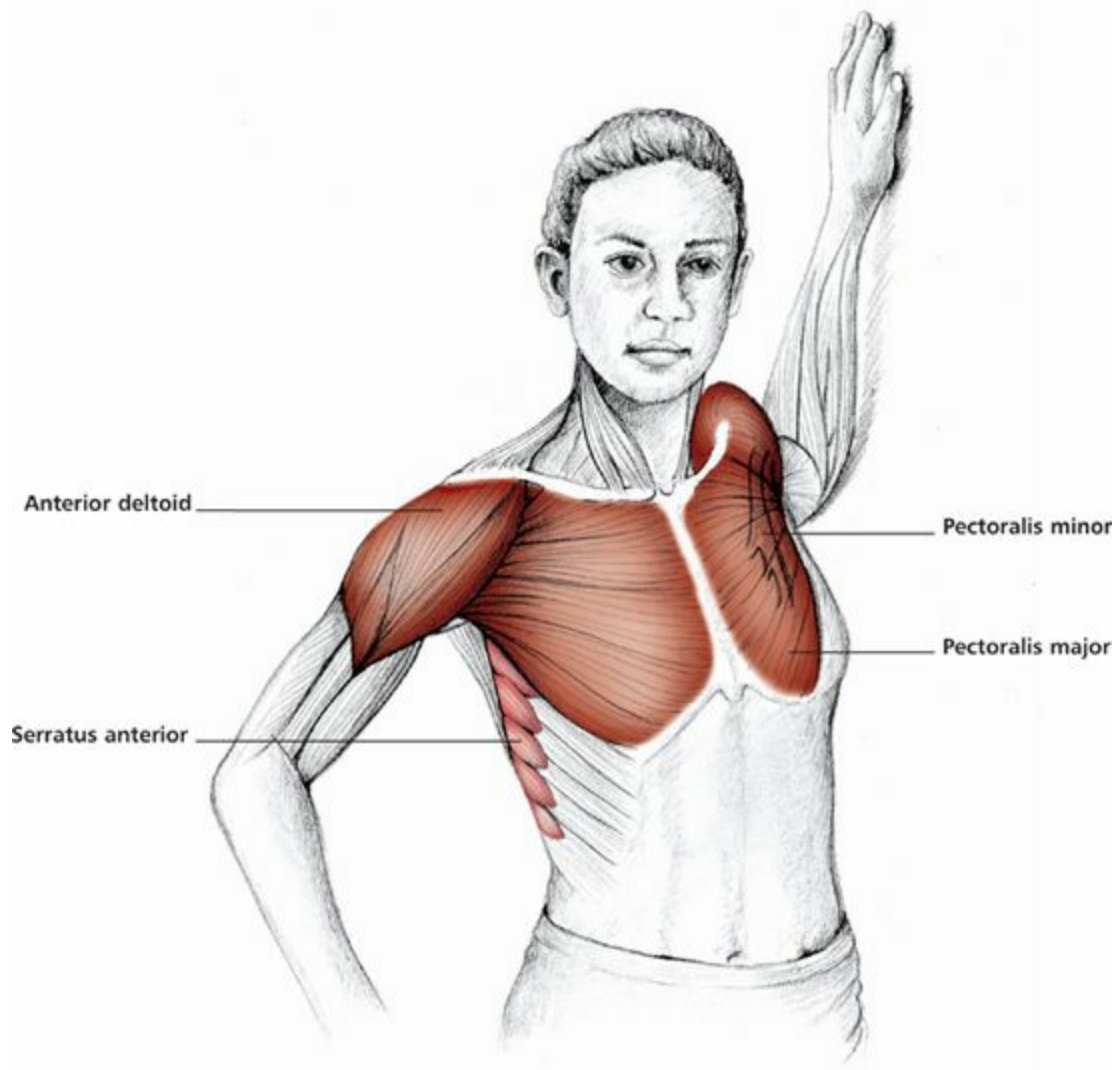
### **Additional information for performing this stretch correctly**

Keep your arm parallel to the ground and your fingers pointing backwards.

### **Complementary stretch**

[B02](#).

## B05: BENT ARM CHEST STRETCH



### Technique

Stand with your arm extended and your forearm at right angles to the ground. Rest your forearm against an immovable object and then turn your shoulders and body away from your extended arm.

### Muscles being stretched

Primary muscles: Pectoralis major and minor. Anterior deltoid.

Secondary muscle: Serratus anterior.

### Sports that benefit from this stretch

Basketball. Netball. Hiking. Backpacking. Mountaineering. Orienteering. Tennis. Badminton. Squash. Rowing. Canoeing. Kayaking. Swimming. Cricket. Baseball. Athletics throwing field events.

### Sports injury where stretch may be useful

Dislocation. Subluxation. Acromioclavicular separation. Sternoclavicular separation. Impingement syndrome. Rotator cuff tendonitis. Shoulder bursitis. Frozen shoulder (adhesive)

capsulitis). Chest strain. Pectoral muscle insertion inflammation.

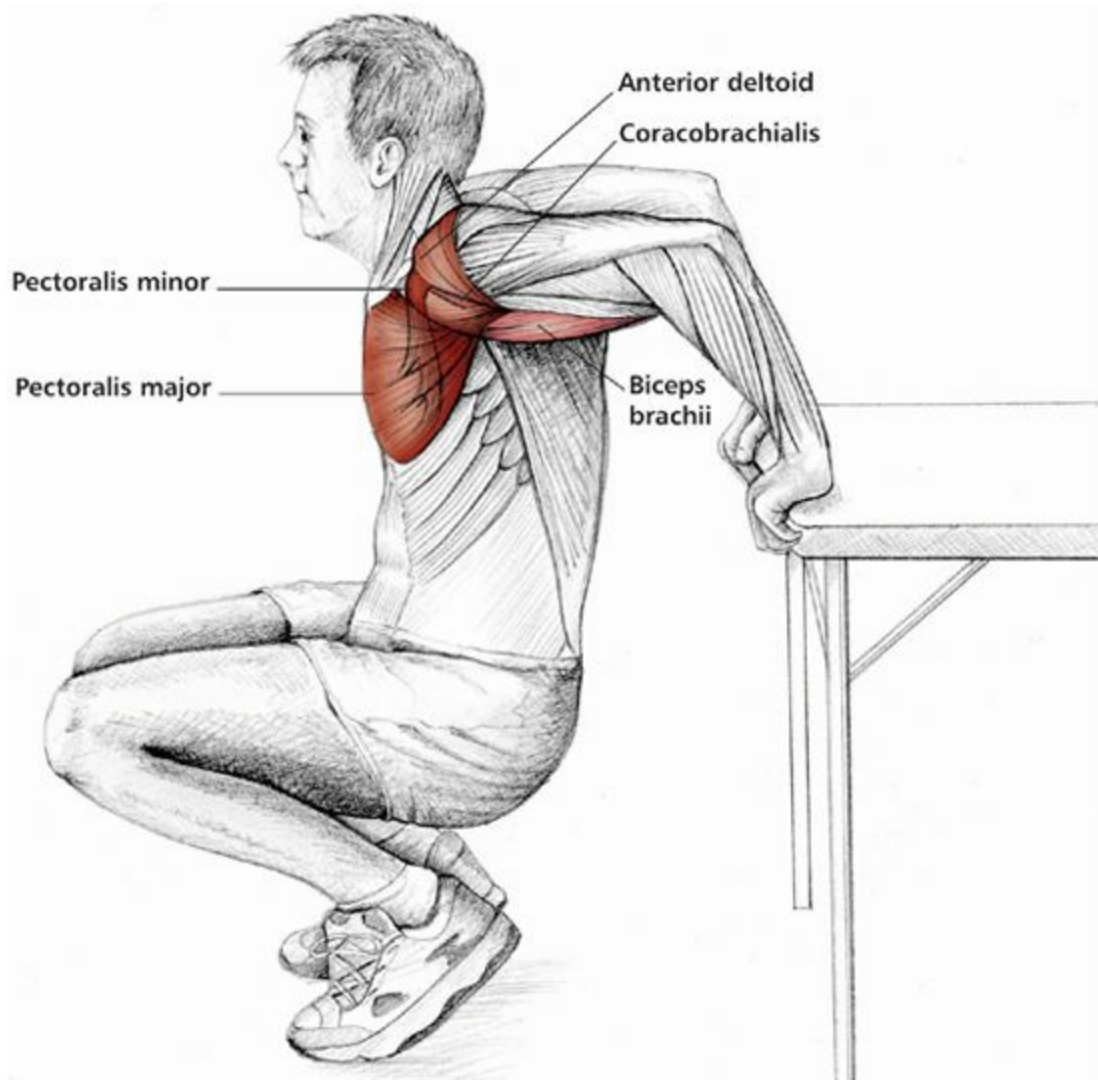
**Additional information for performing this stretch correctly**

Keep your upper arm parallel to the ground.

**Complementary stretch**

[B04.](#)

## B06: ASSISTED REVERSE CHEST STRETCH



### **Technique**

Stand upright with your back towards a table or bench and place your hands on the edge of the table or bench. Slowly lower your entire body.

### **Muscles being stretched**

Primary muscles: Anterior deltoid. Pectoralis major and minor.

Secondary muscles: Biceps brachii. Coracobrachialis.

### **Sports that benefit from this stretch**

Archery. Cricket. Baseball. Softball. Boxing. Golf. Tennis. Badminton. Squash. Rowing. Canoeing. Kayaking. Swimming. Athletics throwing field events.

### **Sports injury where stretch may be useful**

Dislocation. Subluxation. Acromioclavicular separation. Sternoclavicular separation.

Impingement syndrome. Rotator cuff tendonitis. Shoulder bursitis. Frozen shoulder (adhesive)

capsulitis). Biceps tendon rupture. Bicipital tendonitis. Biceps strain. Chest strain. Pectoral muscle insertion inflammation.

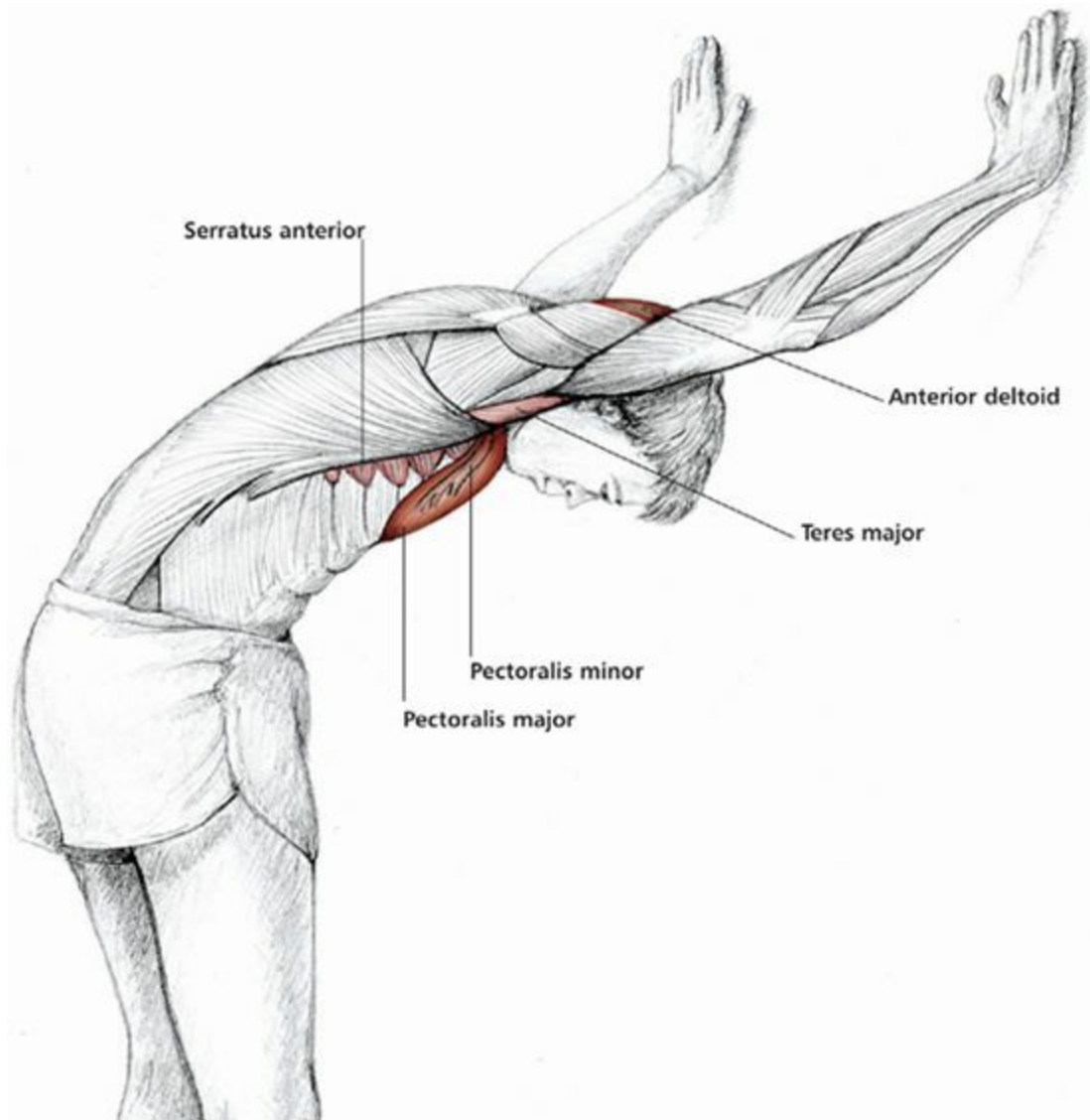
**Common problems and additional information for performing this stretch correctly**

Use your legs to control the lowering of your body. Do not lower your body too quickly.

**Complementary stretch**

[A16.](#)

## B07: BENT-OVER CHEST STRETCH



### Technique

Face a wall and place both hands on the wall just above your head. Slowly lower your shoulders as if moving your chin towards the ground.

### Muscles being stretched

Primary muscles: Pectoralis major and minor. Anterior deltoid.

Secondary muscles: Serratus anterior. Teres major.

### Sports that benefit from this stretch

Basketball. Netball. Hiking. Backpacking. Mountaineering. Orienteering. Tennis. Badminton. Squash. Rowing. Canoeing. Kayaking. Swimming. Cricket. Baseball. Athletics throwing field events.

### Sports injury where stretch may be useful

Dislocation. Subluxation. Acromioclavicular separation. Sternoclavicular separation.

Impingement syndrome. Rotator cuff tendonitis. Shoulder bursitis. Frozen shoulder (adhesive capsulitis). Chest strain. Pectoral muscle insertion inflammation.

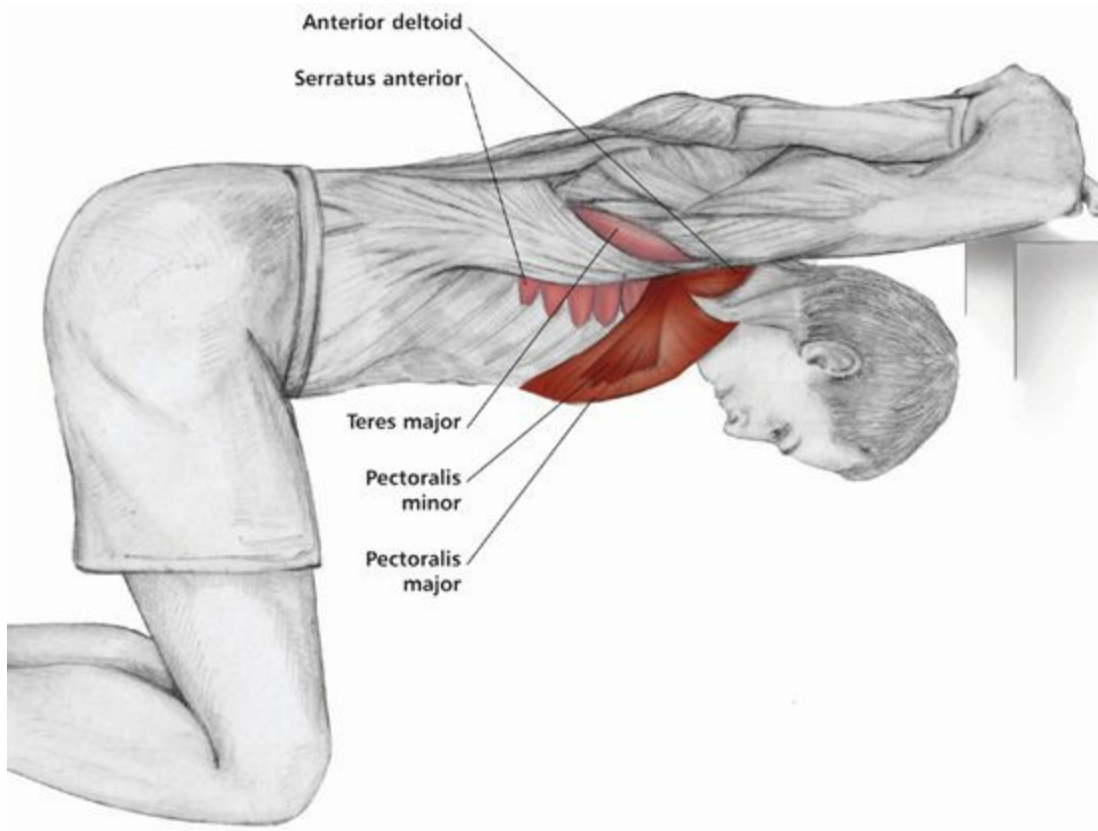
**Additional information for performing this stretch correctly**

Keep your arms straight and your fingers pointing straight upwards.

**Complementary stretch**

[B01.](#)

## B08: KNEELING CHEST STRETCH



### **Technique**

Kneel on the floor in front of a chair or table and interlock your forearms above your head. Place your arms on the object and lower your upper body toward the ground.

### **Muscles being stretched**

Primary muscles: Pectoralis major and minor. Anterior deltoid.

Secondary muscles: Serratus anterior. Teres major.

### **Sports that benefit from this stretch**

Basketball. Netball. Hiking. Backpacking. Mountaineering. Orienteering. Tennis. Badminton. Squash. Rowing. Canoeing. Kayaking. Swimming. Cricket. Baseball. Field events.

### **Sports injury where stretch may be useful**

Impingement syndrome. Rotator cuff tendonitis. Shoulder bursitis. Frozen shoulder (adhesive capsulitis). Chest strain. Pectoral muscle insertion inflammation.

### **Common problems and more information for performing this stretch correctly**

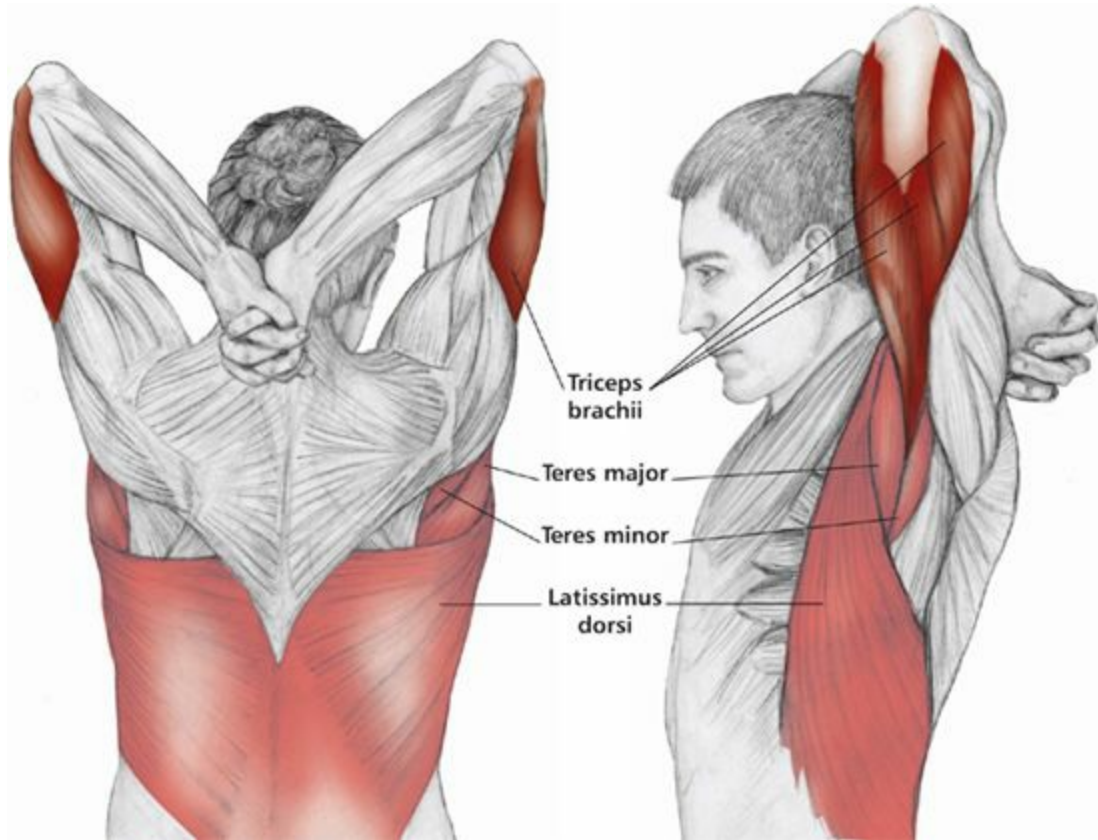
Keep your elbows bent and vary the width of your arms for a slightly different stretch.

### **Complementary stretches**



B01, B07.

## B09: REACHING-DOWN TRICEPS STRETCH



### **Technique**

Reach behind your head with both hands and your elbows pointing upwards. Then reach down your back with your hands.

### **Muscles being stretched**

Primary muscle. Triceps brachii.

Secondary muscles: Latissimus dorsi. Teres major and minor.

### **Sports that benefit from this stretch**

Basketball. Netball. Tennis. Badminton. Squash. Rowing. Canoeing. Kayaking. Swimming. Cricket. Baseball. Field events. Volleyball.

### **Sports injury where stretch may be useful**

Elbow sprain. Elbow dislocation. Elbow bursitis. Triceps tendon rupture.

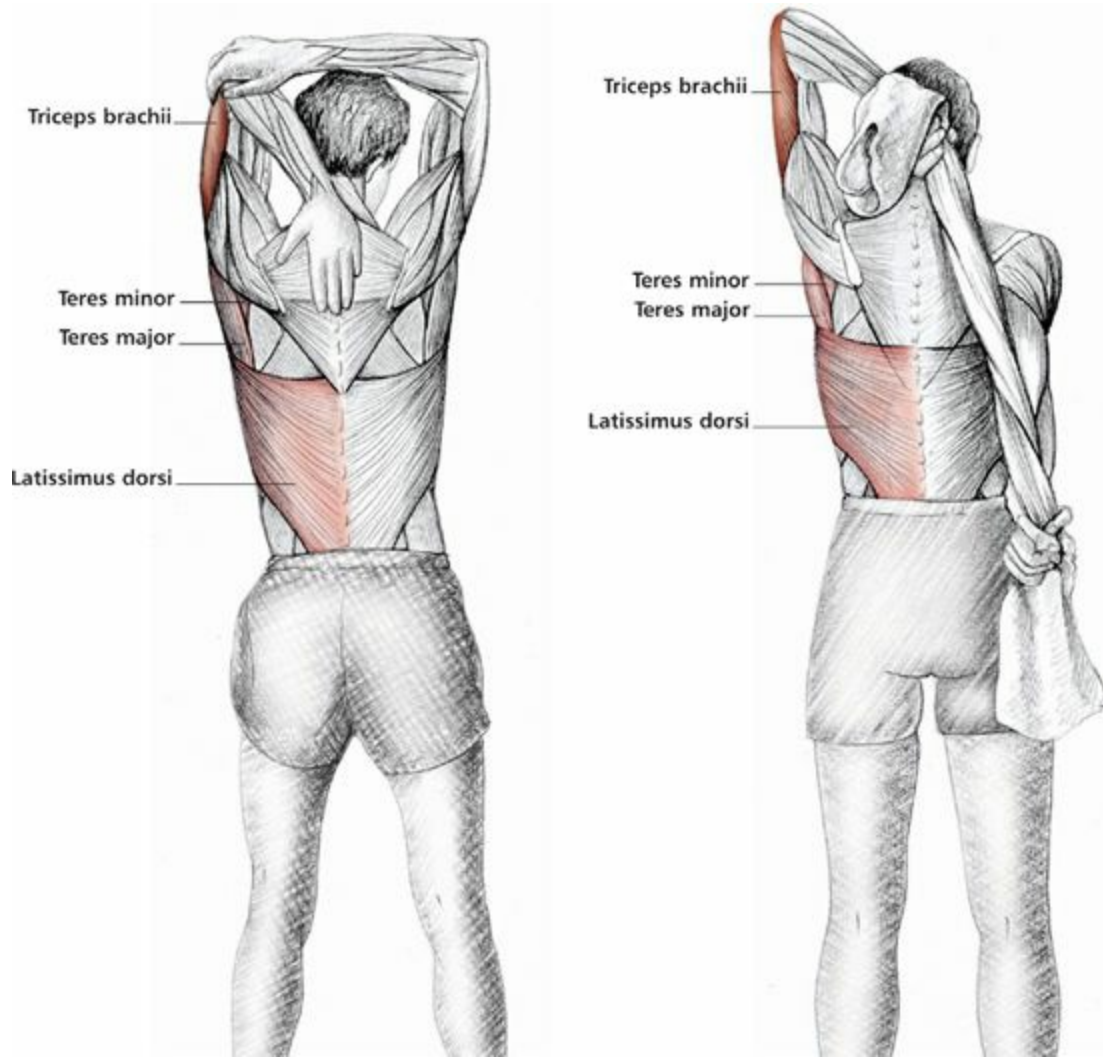
### **Common problems and more information for performing this stretch correctly**

Do not perform for an extended period of time, as circulation is restricted in the shoulder during this stretch.

### **Complementary stretches**

A14, B08.

# B10: TRICEPS STRETCH



## Technique

Stand with your hand behind your neck and your elbow pointing upwards. Then use your other hand (or a rope or towel) to pull your elbow down.

## Muscles being stretched

Primary muscle: Triceps brachii.

Secondary muscles: Latissimus dorsi. Teres major and minor.

## Sports that benefit from this stretch

Basketball. Netball. Tennis. Badminton. Squash. Rowing. Canoeing. Kayaking. Swimming. Cricket. Baseball. Athletics throwing field events. Volleyball.

## Sports injury where stretch may be useful

Elbow sprain. Elbow dislocation. Elbow bursitis. Triceps tendon rupture.

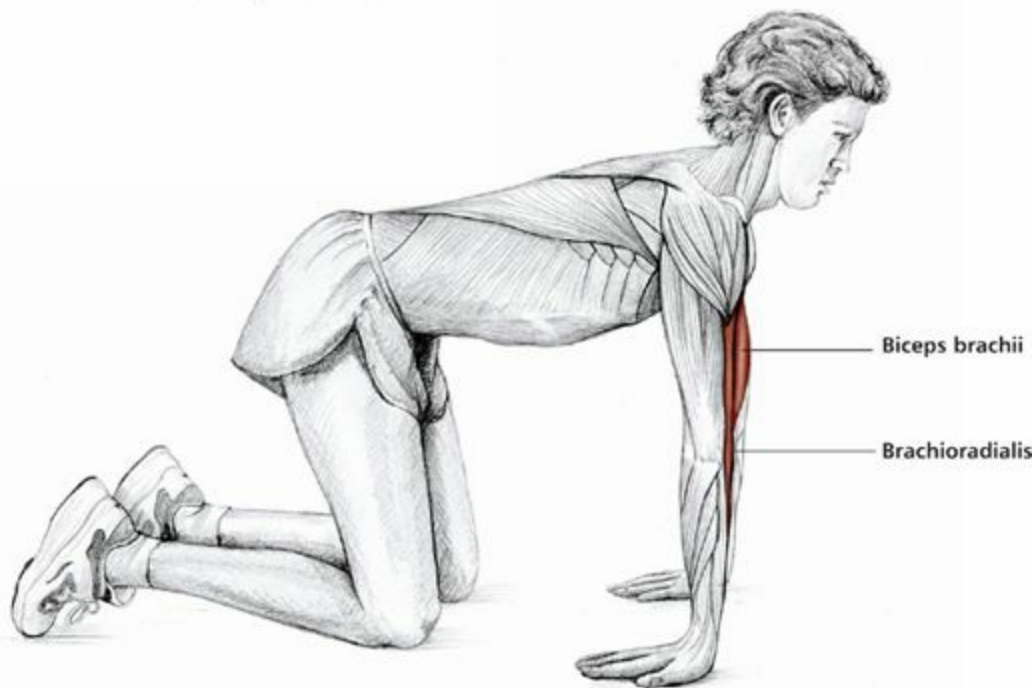
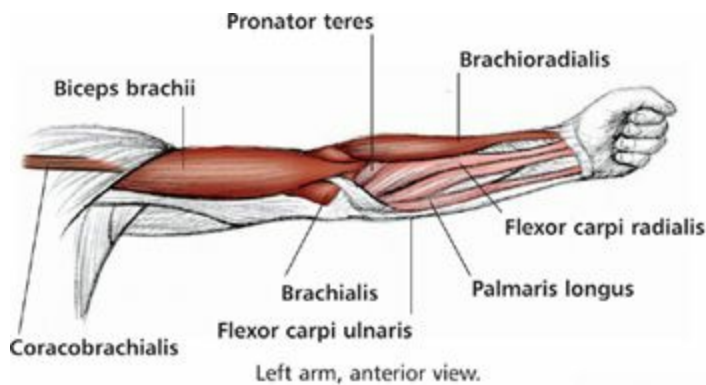
## Common problems and additional information for performing this stretch correctly

Do not perform this stretch for an extended period of time, as the blood circulation is restricted in the shoulder.

### **Complementary stretch**

[D03](#).

# B11: KNEELING FOREARM STRETCH



## Technique

While crouching on your knees with your forearms facing forward and hands pointing backwards, slowly move rearward.

## Muscles being stretched

Primary muscles: Biceps brachii. Brachialis. Brachioradialis. Coracobrachialis.

Secondary muscles: Pronator teres. Flexor carpi radialis. Flexor carpi ulnaris. Palmaris longus.

## Sports that benefit from this stretch

Basketball. Netball. Cricket. Baseball. Softball. Ice hockey. Field hockey. Martial arts. Tennis. Badminton. Squash. Rowing. Canoeing. Kayaking. Swimming. Athletics throwing field events. Volleyball. Wrestling.

## Sports injury where stretch may be useful

Biceps tendon rupture. Bicipital tendonitis. Biceps strain. Elbow strain. Elbow dislocation. Elbow

bursitis. Tennis elbow. Golfer's elbow. Thrower's elbow.

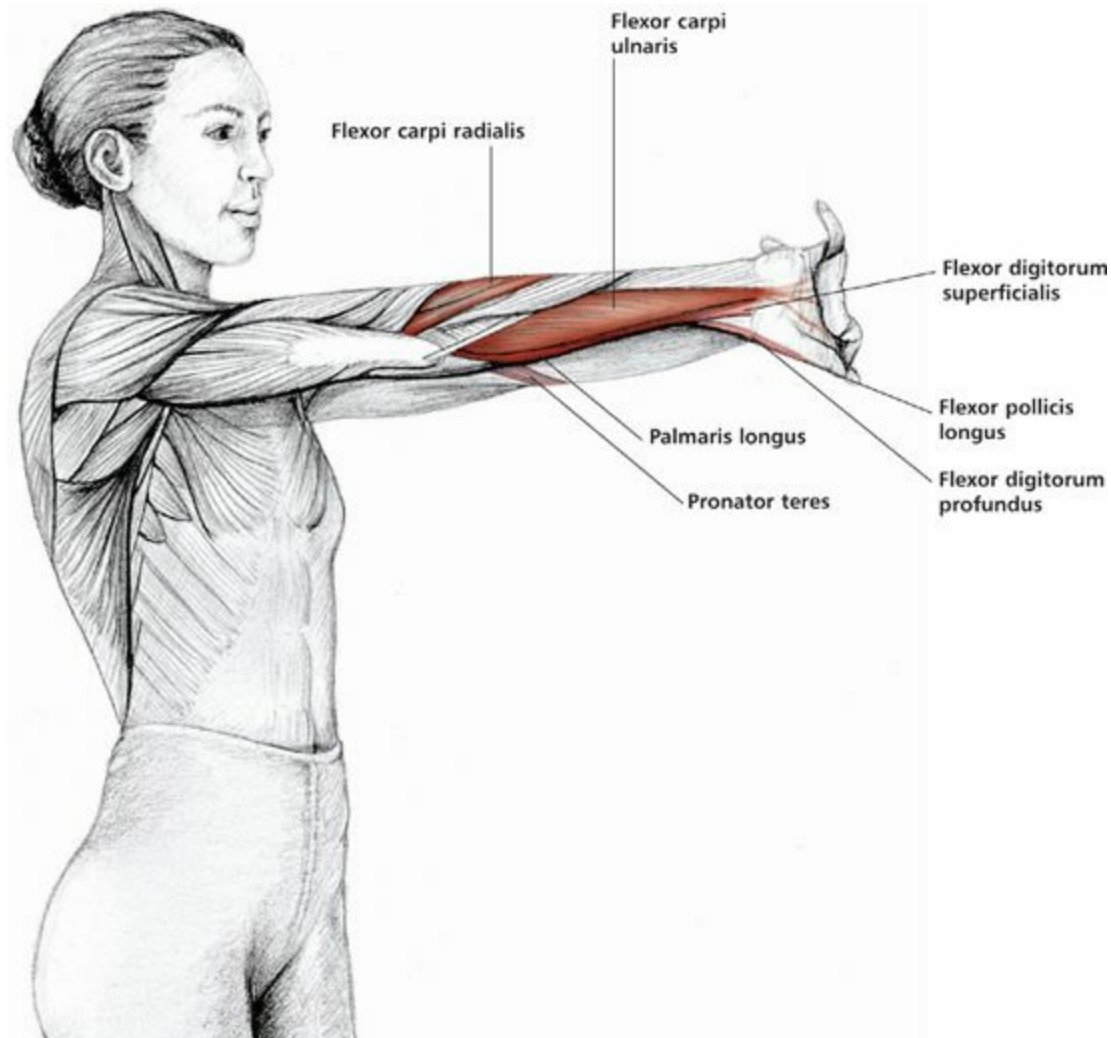
### **Common problems and more information for performing this stretch correctly**

Depending on where your muscles are most tight, you may feel this stretch more in your forearms or more in your upper arms. To make this stretch easier, move your hands towards your knees.

### **Complementary stretch**

[B12.](#)

## B12: PALMS-OUT FOREARM STRETCH



### Technique

Interlock your fingers in front of your chest and then straighten your arms and turn the palms of your hands outwards.

### Muscles being stretched

Primary muscles: Pronator teres. Flexor carpi radialis. Flexor carpi ulnaris. Palmaris longus.

Secondary muscles: Flexor digitorum superficialis. Flexor digitorum profundus. Flexor pollicis longus.

### Sports that benefit from this stretch

Basketball. Netball. Cricket. Baseball. Softball. Ice hockey. Field hockey. Martial arts. Tennis. Badminton. Squash. Rowing. Canoeing. Kayaking. Swimming. Athletics throwing field events. Volleyball. Wrestling.

### Sports injury where stretch may be useful

Tennis elbow. Golfer's elbow. Thrower's elbow. Wrist sprain. Wrist dislocation. Wrist tendonitis.



Carpal tunnel syndrome. Ulnar tunnel syndrome.

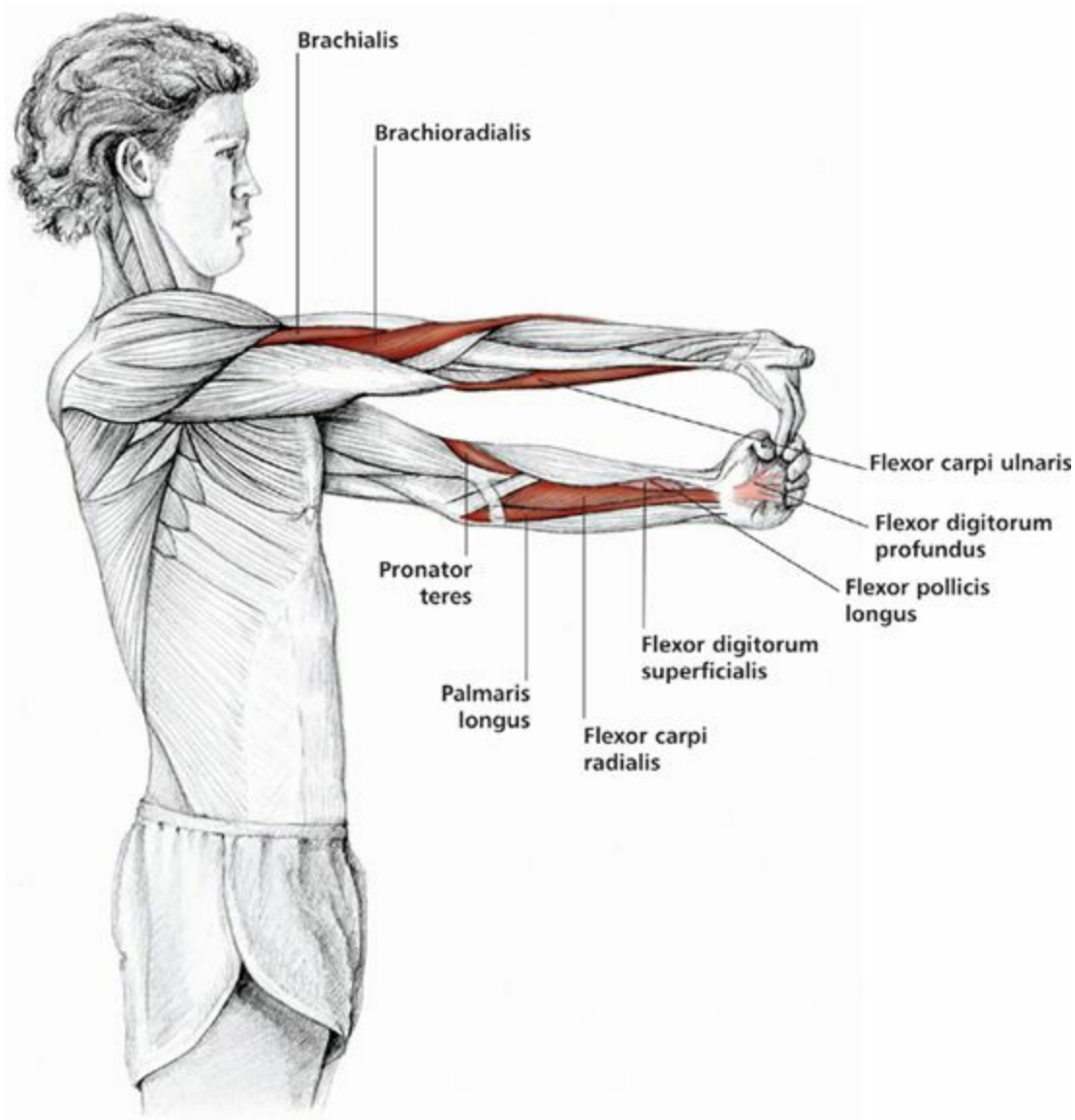
### **Common problems and more information for performing this stretch correctly**

The forearms, wrists, and fingers comprise a multitude of small muscles, tendons, and ligaments. Do not overstretch this area by applying too much force too quickly.

### **Complementary stretch**

[B13](#).

# B13: FINGERS-DOWN FOREARM STRETCH



## Technique

Hold onto your fingers and turn your palms outwards. Straighten your arm and then pull your fingers back using your other hand.

## Muscles being stretched

Primary muscles: Brachialis. Brachioradialis. Pronator teres. Flexor carpi radialis. Flexor carpi ulnaris. Palmaris longus.

Secondary muscles: Flexor digitorum superficialis. Flexor digitorum profundus. Flexor pollicis longus.

## Sports that benefit from this stretch

Basketball. Netball. Cricket. Baseball. Softball. Ice hockey. Field hockey. Martial arts. Tennis. Badminton. Squash. Rowing. Canoeing. Kayaking. Swimming. Athletics throwing field events

Volleyball. Wrestling.

**Sports injury where stretch may be useful**

Tennis elbow. Golfer's elbow. Thrower's elbow. Wrist sprain. Wrist dislocation. Wrist tendonitis. Carpal tunnel syndrome. Ulnar tunnel syndrome.

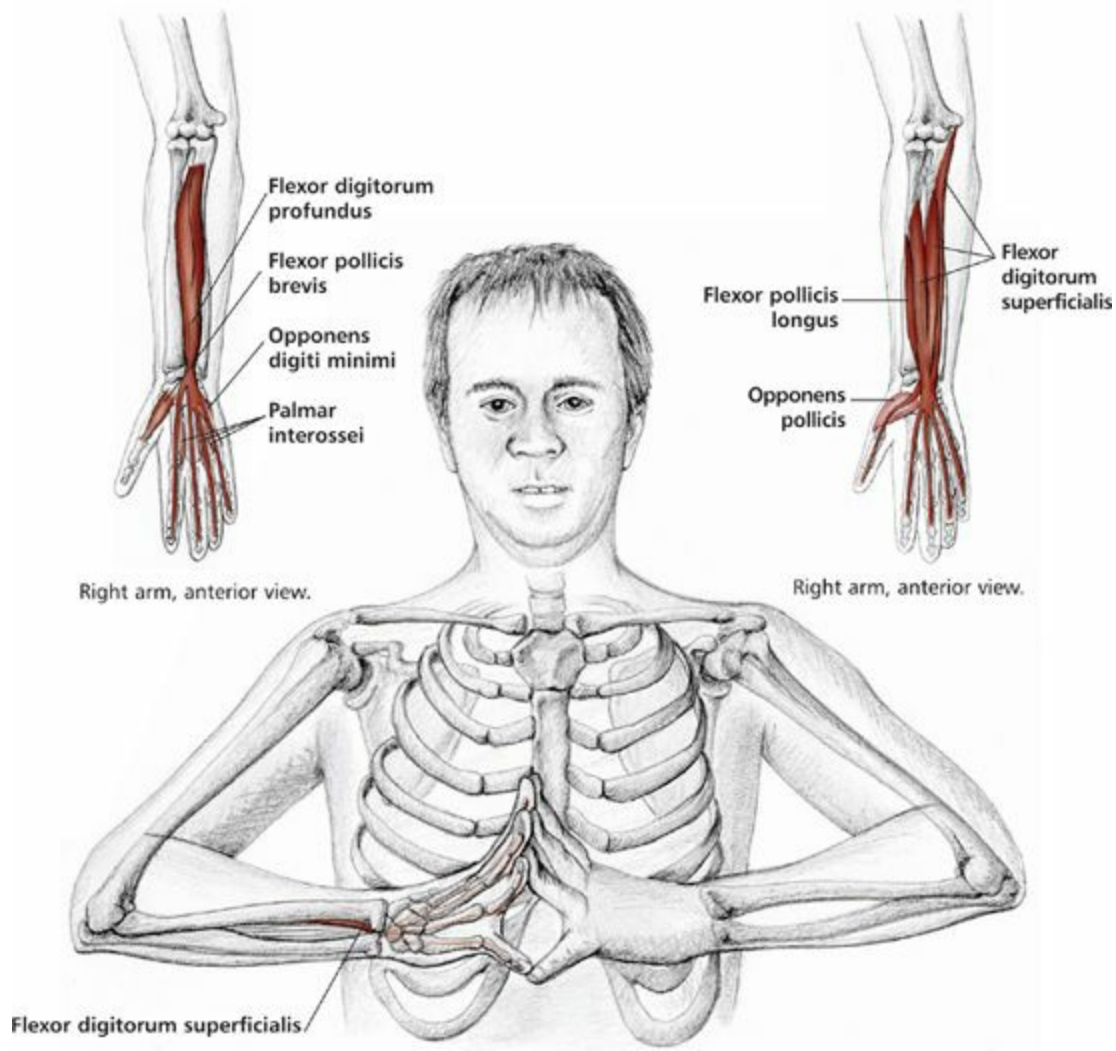
**Common problems and more information for performing this stretch correctly**

The forearms, wrists, and fingers comprise a multitude of small muscles, tendons, and ligaments. Do not overstretch this area by applying too much force too quickly.

**Complementary stretch**

[B11](#).

# B14: FINGER STRETCH



## Technique

Place the tips of your fingers together and push your palms towards each other.

## Muscles being stretched

Primary muscles: Flexor digitorum superficialis. Flexor digitorum profundus. Flexor pollicis longus. Flexor pollicis brevis.

Secondary muscles: Opponens pollicis. Opponens digiti minimi. Palmar interossei.

## Sports that benefit from this stretch

Basketball. Netball. Cricket. Baseball. Softball. Ice hockey. Field hockey. Martial arts. Tennis. Badminton. Squash. Rowing. Canoeing. Kayaking. Swimming. Athletics field events. Volleyball. Wrestling.

## Sports injury where stretch may be useful

Tennis elbow. Golfer's elbow. Thrower's elbow. Wrist sprain. Wrist dislocation. Wrist tendonitis.

Carpal tunnel syndrome. Ulnar tunnel syndrome.

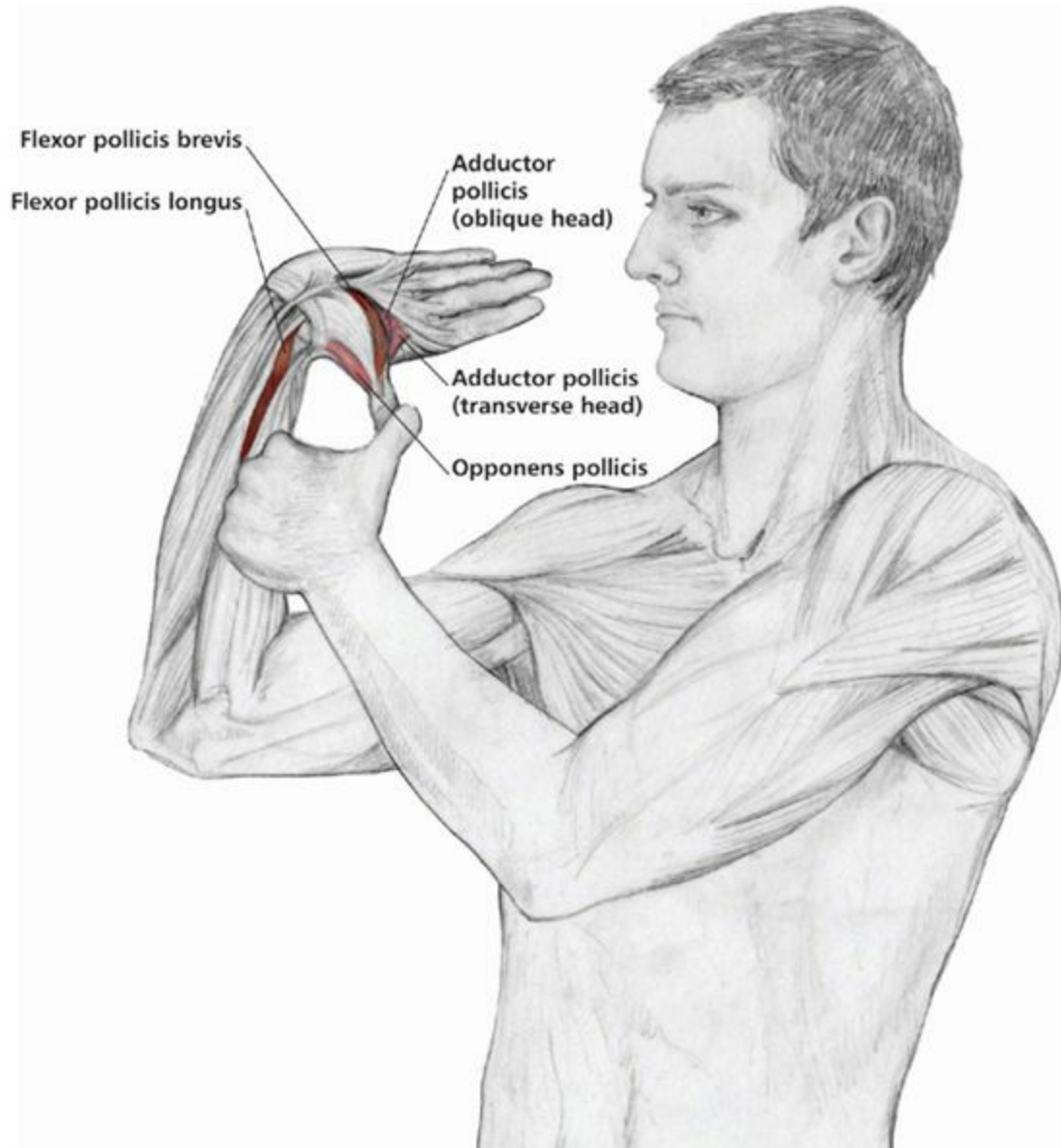
### **Common problems and more information for performing this stretch correctly**

The forearms, wrists, and fingers comprise a multitude of small muscles, tendons, and ligaments. Do not overstretch this area by applying too much force too quickly.

### **Complementary stretch**

[B13](#).

## B15: THUMB STRETCH



### Technique

Start with your fingers pointing up and your thumb out to one side, then use your other hand to pull your thumb down.

### Muscles being stretched

Primary muscles: Flexor pollicis longus. Flexor pollicis brevis.

Secondary muscles: Adductor pollicis. Opponens pollicis.

### Sports that benefit from this stretch

Basketball. Netball. Cricket. Baseball. Softball. Ice hockey. Field hockey. Martial arts. Tennis. Badminton. Squash. Rowing. Canoeing. Kayaking. Swimming. Cricket. Baseball. Field events. Volleyball. Wrestling.

### **Sports injury where stretch may be useful**

Tennis elbow. Golfer's elbow. Thrower's elbow. Wrist sprain. Wrist dislocation. Wrist tendonitis. Carpal tunnel syndrome. Ulnar tunnel syndrome.

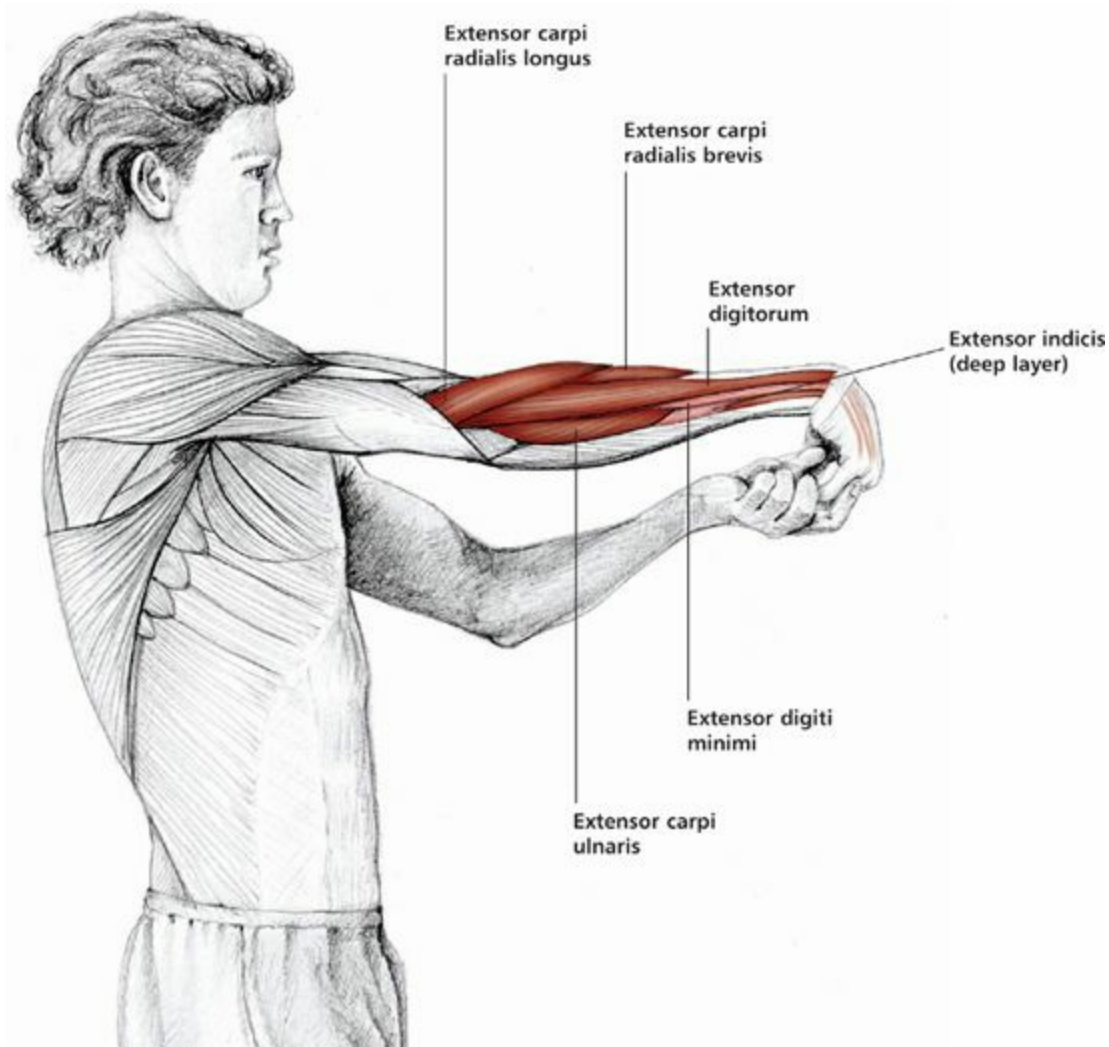
### **Common problems and more information for performing this stretch correctly**

The palm and thumb comprise a multitude of small muscles, tendons, and ligaments. Do not overstretch this area by applying too much force too quickly.

### **Complementary stretches**

[B12](#), [B14](#).

# B16: FINGERS-DOWN WRIST STRETCH



## Technique

Hold on to your fingers while straightening your arm. Pull your fingers towards your body.

## Muscles being stretched

Primary muscles: Extensor carpi ulnaris. Extensor carpi radialis longus and brevis. Extensor digitorum.

Secondary muscles: Extensor digiti minimi. Extensor indicis.

## Sports that benefit from this stretch

Basketball. Netball. Cricket. Baseball. Softball. Ice hockey. Field hockey. Martial arts. Tennis. Badminton. Squash. Rowing. Canoeing. Kayaking. Swimming. Athletics throwing field events. Volleyball. Wrestling.

## Sports injury where stretch may be useful

Tennis elbow. Golfer's elbow. Thrower's elbow. Wrist sprain. Wrist dislocation. Wrist tendonitis. Carpal tunnel syndrome. Ulnar tunnel syndrome.



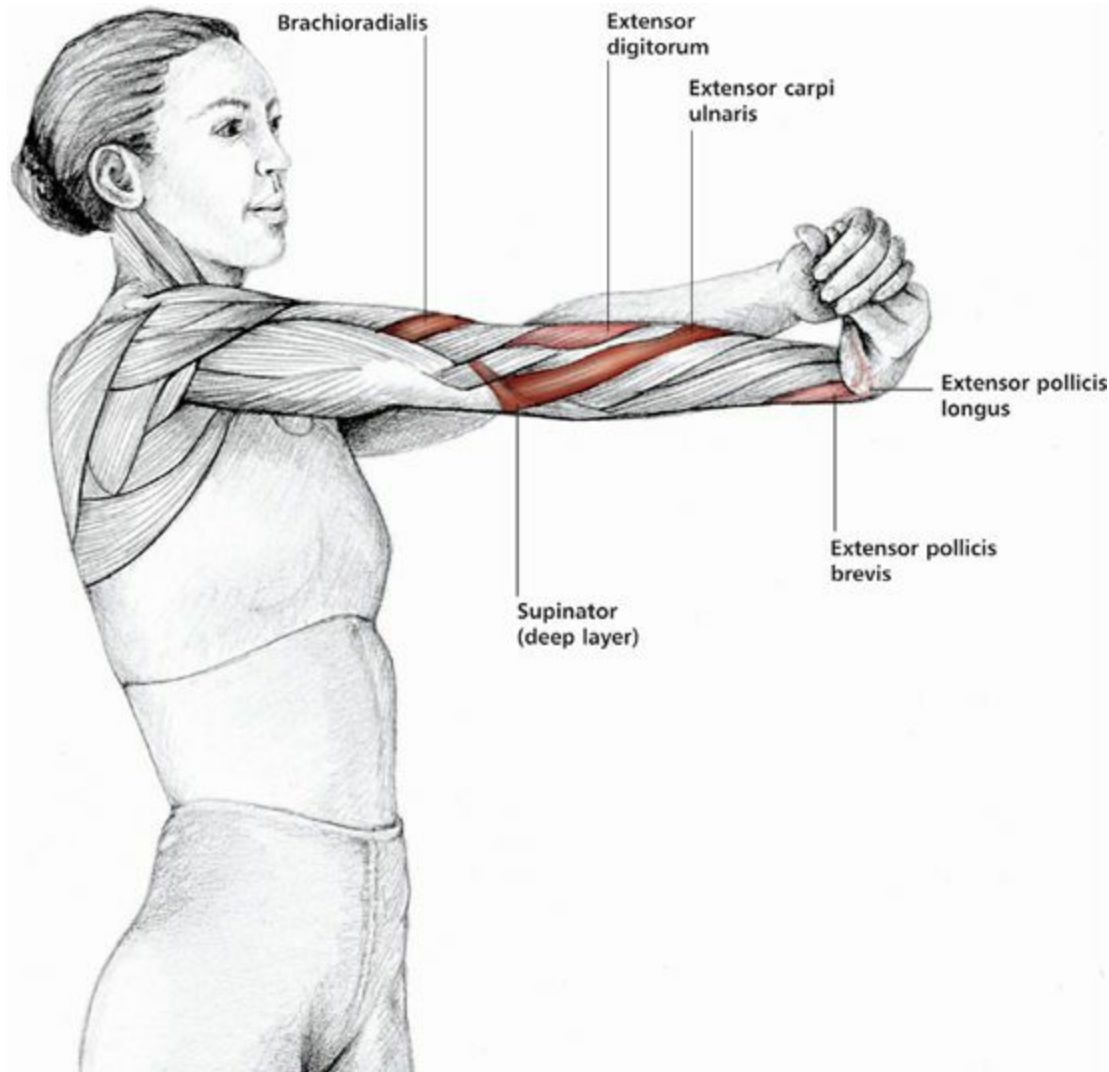
## **Common problems and more information for performing this stretch correctly**

The forearms, wrists, and fingers comprise a multitude of small muscles, tendons, and ligaments. Do not overstretch this area by applying too much force too quickly.

## **Complementary stretch**

[B17](#).

# B17: ROTATING WRIST STRETCH



## Technique

Place one arm straight out in front and parallel to the ground. Rotate your wrist down and outwards and then use your other hand to further rotate your hand upwards.

## Muscles being stretched

Primary muscles: Brachioradialis. Extensor carpi ulnaris. Supinator.

Secondary muscles: Extensor digitorum. Extensor pollicis longus and brevis.

## Sports that benefit from this stretch

Basketball. Netball. Cricket. Baseball. Softball. Ice hockey. Field hockey. Martial arts. Tennis. Badminton. Squash. Rowing. Canoeing. Kayaking. Swimming. Athletics throwing field events. Volleyball. Wrestling.

## Sports injury where stretch may be useful

Tennis elbow. Golfer's elbow. Thrower's elbow. Wrist sprain. Wrist dislocation. Wrist tendonitis.

Carpal tunnel syndrome. Ulnar tunnel syndrome.

### **Common problems and more information for performing this stretch correctly**

The forearms, wrists, and fingers comprise a multitude of small muscles, tendons, and ligaments. Do not overstretch this area by applying too much force too quickly.

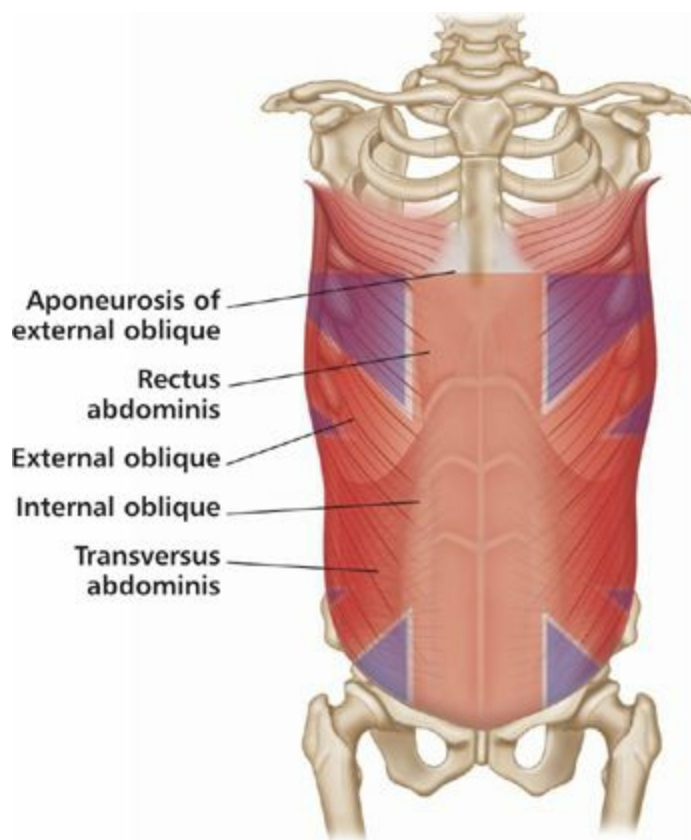
### **Complementary stretch**

[B16](#).



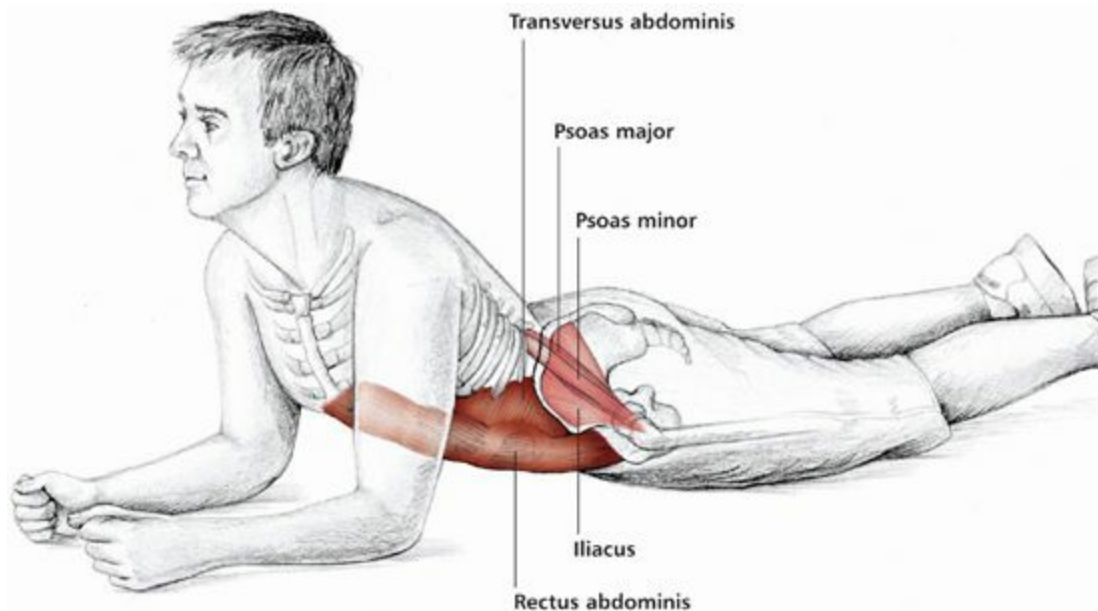
## Stomach

The anterior abdominal wall muscles occur between the ribs and the pelvis, encircling the internal organs, and act to support the trunk, permit movement (primarily flex and rotate the lumbar spine), and support the lower back. There are three layers of muscle, with fibers running in the same direction as the corresponding three layers of muscle in the thoracic wall. The deepest layer consists of the **transversus abdominis**, whose fibers run approximately horizontally. Transversus abdominis spans around the trunk to attach into the *thoraco-lumbar fascia*, a thick connective tissue sheath, that helps to stabilise the trunk and pelvis when muscles connecting into it are under tension. The middle layer comprises the **internal oblique**, whose fibers are crossed by the outermost layer known as the **external oblique**, forming a pattern of fibers resembling a St. Andrew's cross. Overlying these three layers is the **rectus abdominis**, which runs vertically, on either side of the midline of the abdomen, and is associated with the *six-pack* muscles seen in conditioned athletes. Rectus abdominis is active in trunk flexion, bringing the rib cage closer to the pubic bone, for example in the crunch or sit-up. Like the other abdominals, it acts as a stabilising muscle, and also acts as a restraint to hyperextension in the lumbar vertebrae.



Sports that benefit from these stomach stretches include: basketball and netball; batting sports like cricket, baseball and softball; boxing; contact sports like football, gridiron and rugby; golf; hiking, backpacking, mountaineering, and orienteering; ice hockey and field hockey; ice-skating, roller-skating, and inline skating; martial arts; rowing, canoeing, and kayaking; running, track, and cross-country; running sports like soccer, American football (gridiron), and rugby; snow skiing and water skiing; surfing; walking and race walking; wrestling.

# C01: ON ELBOWS STOMACH STRETCH



## Technique

Lie face down and bring your hands close to your shoulders. Keep your hips on the ground, look forward, and rise up onto your elbows.

## Muscles being stretched

Primary muscles: Transversus abdominis. Rectus abdominis.

Secondary muscles: Psoas major and minor. Iliacus.

## Sports that benefit from this stretch

Basketball. Netball. Cricket. Baseball. Softball. Boxing. Golf. Hiking. Backpacking. Mountaineering. Orienteering. Ice hockey. Field hockey. Ice-skating. Roller-skating. Inline skating. Martial arts. Rowing. Canoeing. Kayaking. Running. Track. Cross-country. American football (gridiron). Soccer. Rugby. Snow skiing. Water skiing. Surfing. Walking. Race walking. Wrestling.

## Sports injury where stretch may be useful

Abdominal muscle strain.

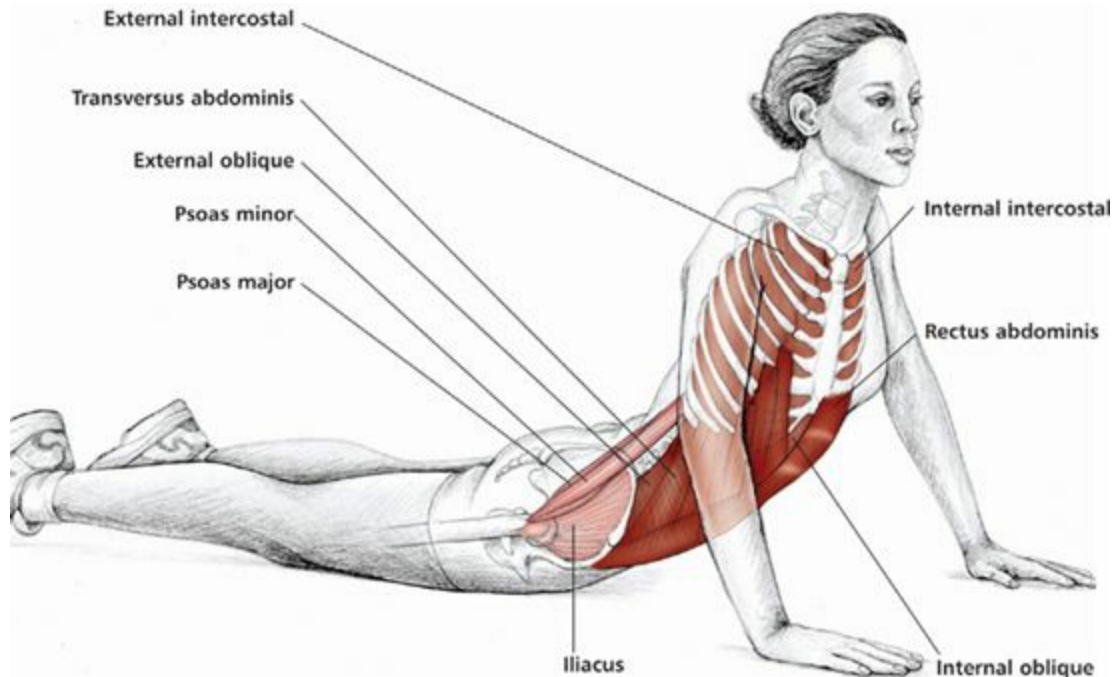
## Common problems and more information for performing this stretch correctly

For most people who spend their day in a seated position, (office workers, drivers, etc.) the muscles in the front of the body can become extremely tight and inflexible. Exercise caution when performing this stretch for the first time and allow plenty of rest time between each repetition.

## Complementary stretch

C03.

## C02: RISING STOMACH STRETCH



### Technique

Lie face down and bring your hands close to your shoulders. Keep your hips on the ground, look forward, and rise up by straightening your arms.

### Muscles being stretched

Primary muscles: External and internal intercostals. External and internal obliques. Transversus abdominis. Rectus abdominis.

Secondary muscles: Psoas major and minor. Iliacus.

### Sports that benefit from this stretch

Basketball. Netball. Cricket. Baseball. Softball. Boxing. Golf. Hiking. Backpacking. Mountaineering. Orienteering. Ice hockey. Field hockey. Ice-skating. Roller-skating. Inline skating. Martial arts. Rowing. Canoeing. Kayaking. Running. Track. Cross-country. American football (gridiron). Soccer. Rugby. Snow skiing. Water skiing. Surfing. Walking. Race walking. Wrestling.

### Sports injury where stretch may be useful

Abdominal muscle strain. Hip flexor strain. Iliopsoas tendonitis.

### Common problems and more information for performing this stretch correctly

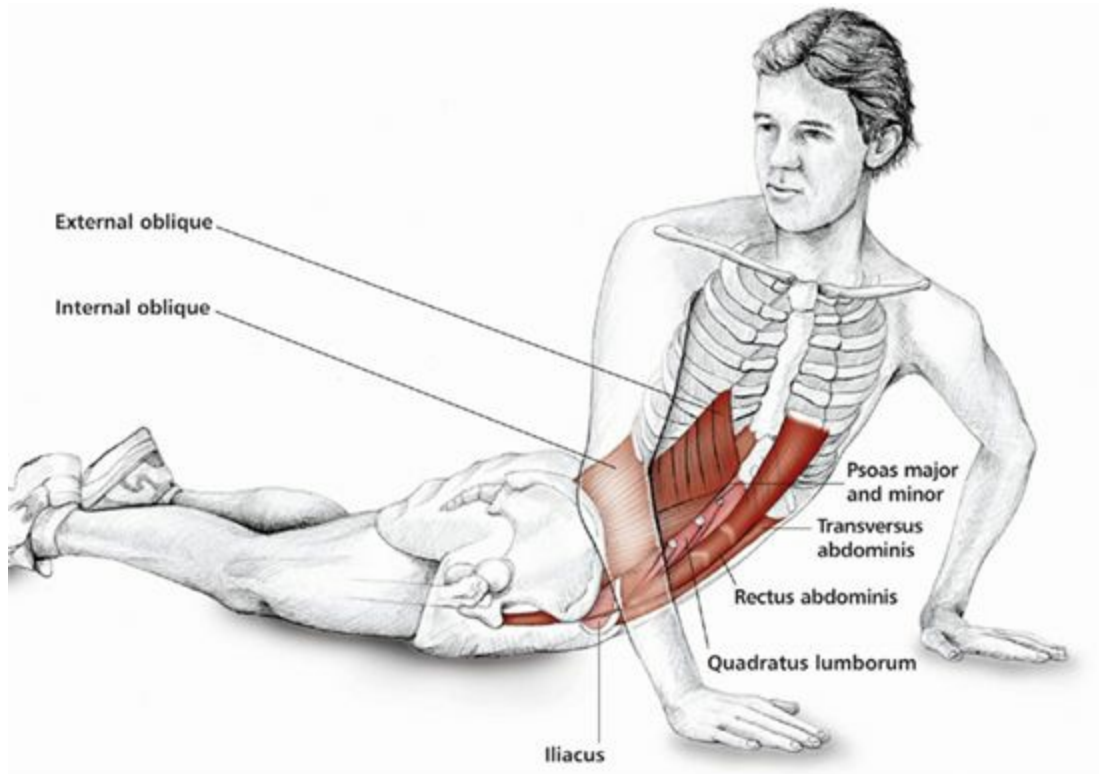
For most people who spend their day in a seated position, (office workers, drivers, etc.) the muscles in the front of the body can become extremely tight and inflexible. Exercise caution when performing this stretch for the first time and allow plenty of rest time between each repetition.

# Complementary stretch

C03.



## C03: ROTATING STOMACH STRETCH



### Technique

Lie face down and bring your hands close to your shoulders. Keep your hips on the ground, look forward, and rise up by straightening your arms. Then slowly bend one arm and rotate that shoulder towards the ground.

### Muscles being stretched

Primary muscles: External and internal obliques. Transversus abdominis. Rectus abdominis.

Secondary muscles: Quadratus lumborum. Psoas major and minor. Iliacus.

### Sports that benefit from this stretch

Basketball. Netball. Cricket. Baseball. Softball. Boxing. Golf. Hiking. Backpacking. Mountaineering. Orienteering. Ice hockey. Field hockey. Ice-skating. Roller-skating. Inline skating. Martial arts. Rowing. Canoeing. Kayaking. Running. Track. Cross-country. American football (gridiron). Soccer. Rugby. Snow skiing. Water skiing. Surfing. Walking. Race walking. Wrestling.

### Sports injury where stretch may be useful

Abdominal muscle strain. Hip flexor strain. Iliopsoas tendonitis.

### Common problems and more information for performing this stretch correctly

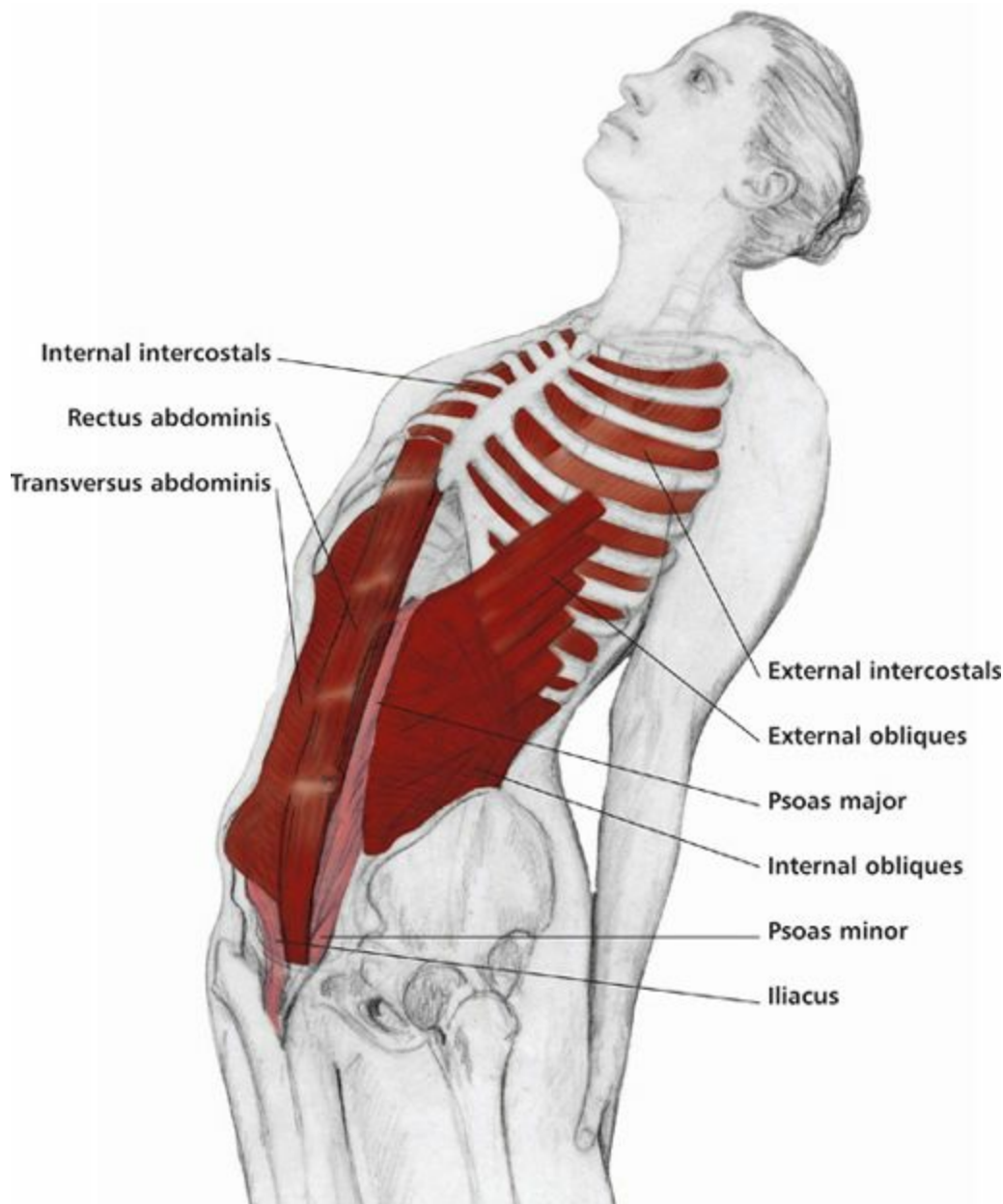
For most people who spend their day in a seated position, (office workers, drivers, etc.) the muscles in the front of the body can become extremely tight and inflexible. Exercise caution when performing

this stretch for the first time and allow plenty of rest time between each repetition.

## **Complementary stretch**

[C06](#).

## C04: STANDING LEAN-BACK STOMACH STRETCH



### Technique

Stand upright with your feet shoulder-width apart and place your hands on your buttocks for support. Look upwards and slowly lean backwards at the waist.

### Muscles being stretched

Primary muscles: External and internal intercostals. External and internal obliques. Transversus abdominis. Rectus abdominis.

Secondary muscles: Psoas major and minor. Iliacus.

### Sports that benefit from this stretch

Basketball. Netball. Cricket. Baseball. Softball. Boxing. Golf. Hiking. Backpacking. Mountaineering.

Orienteering. Ice hockey. Field hockey. Ice-skating. Roller-skating. Inline skating. Martial arts. Rowing. Canoeing. Kayaking. Running. Track. Cross-country. American football (gridiron). Soccer. Rugby. Snow skiing. Water skiing. Surfing. Walking. Race walking. Wrestling.

### **Sports injury where stretch may be useful**

Abdominal muscle strain. Hip flexor strain. Iliopsoas tendonitis.

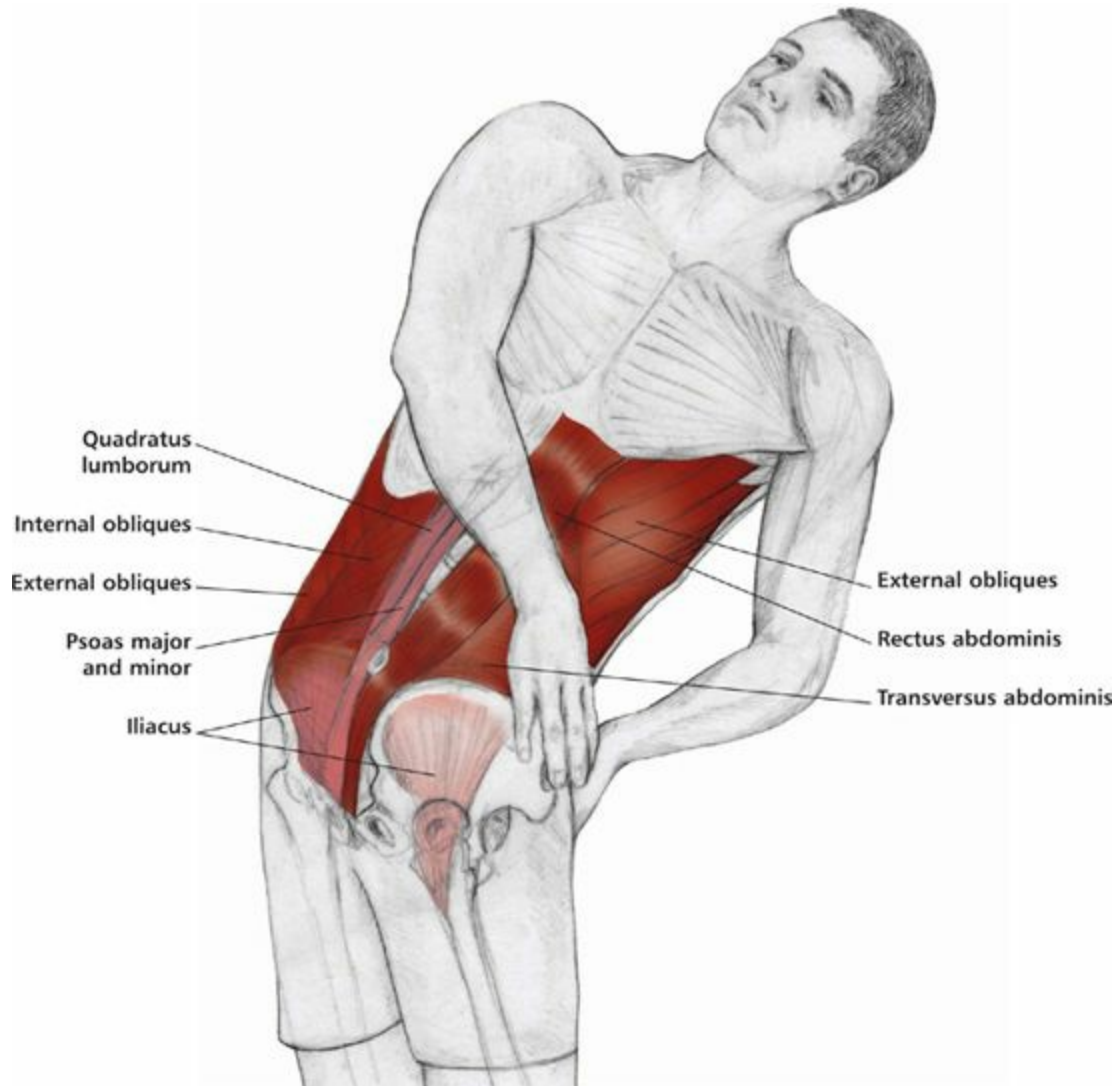
### **Common problems and more information for performing this stretch correctly**

Do not perform this stretch if you suffer from lower back pain or have sustained an injury to your lower back. Exercise caution when performing for the first time and allow plenty of rest time between each repetition of this stretch.

### **Complementary stretch**

[C02](#).

## C05: STANDING LEAN-BACK SIDE STOMACH STRETCH



### Technique

Stand upright with your feet shoulder-width apart and place one hand on your buttocks. Look up and slowly lean backwards at the waist, then reach over with your opposite hand and rotate at the waist.

### Muscles being stretched

Primary muscles: External and internal obliques. Transversus abdominis. Rectus abdominis.

Secondary muscles: Quadratus lumborum. Psoas major and minor. Iliacus.

### Sports that benefit from this stretch

Basketball. Netball. Cricket. Baseball. Softball. Boxing. Golf. Hiking. Backpacking. Mountaineering. Orienteering. Ice hockey. Field hockey. Ice-skating. Roller-skating. Inline skating. Martial arts. Rowing. Canoeing. Kayaking. Running. Track. Cross-country. Football. Soccer. American football (gridiron). Rugby. Snow skiing. Water skiing. Surfing. Walking. Race walking. Wrestling.

### Sports injury where stretch may be useful

Abdominal muscle strain. Hip flexor strain. Iliopsoas tendonitis.

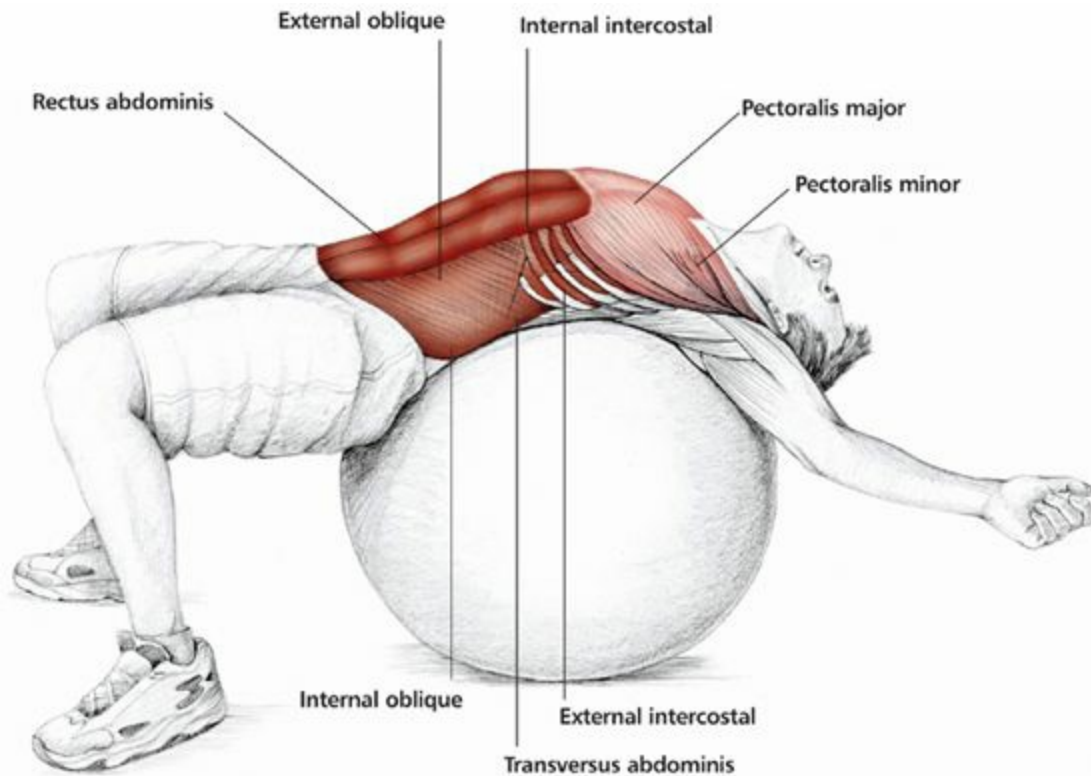
### **Common problems and more information for performing this stretch correctly**

Do not perform this stretch if you suffer from lower back pain or have sustained an injury to your lower back. Exercise caution when performing for the first time and allow plenty of rest time between each repetition of this stretch.

### **Complementary stretch**

[C03](#).

## C06: BACK ARCHING STOMACH STRETCH



### Technique

Sit on a Swiss ball and slowly roll the ball forward while leaning back. Allow your back and shoulders to rest on the ball and your arms to hang to each side.

### Muscles being stretched

Primary muscles: External and internal intercostals. External and internal obliques. Transversus abdominis. Rectus abdominis.

Secondary muscles: Pectoralis major and minor.

### Sports that benefit from this stretch

Basketball. Netball. Cricket. Baseball. Softball. Boxing. Golf. Hiking. Backpacking. Mountaineering. Orienteering. Ice hockey. Field hockey. Ice-skating. Roller-skating. Inline skating. Martial arts. Rowing. Canoeing. Kayaking. Running. Track. Cross-country. American football (gridiron). Soccer. Rugby. Snow skiing. Water skiing. Surfing. Walking. Race walking. Wrestling.

### Sports injury where stretch may be useful

Abdominal muscle strain. Chest strain. Pectoral muscle insertion inflammation.

### Common problems and more information for performing this stretch correctly

For most people who spend their day in a seated position, (office workers, drivers, etc.) the muscles in the front of the body can become extremely tight and inflexible. Exercise caution when performing

this stretch for the first time and allow plenty of rest time between each repetition.

## **Complementary stretch**

C02.





## **Back and Sides**

### **(Upper, Middle, and Lower)**

The muscles around the spine, and the broader area of the back, are primarily responsible for stabilising the spinal column and keeping the back in an upright position. The muscles of the back and sides allow the upper body and spine to move in flexion, lateral flexion, extension, hyperextension, and rotation.

**Latissimus dorsi**, the broadest muscle of the back, is one of the chief climbing muscles, since it pulls the shoulders downwards and backwards, and pulls the trunk up to the fixed arms. It is therefore heavily used in sports such as climbing, gymnastics (in particular rings and parallel bars), swimming, and rowing. The **rhomboid** muscles are situated between the scapula and vertebral column, and are so named because of their shape (rhombus); major being larger than minor. **Quadratus lumborum** runs across the waist from the iliac crest to the pelvis and iliolumbar ligament to the lowest rib and transverse processes of L1 to L4. Its action is to side bend the trunk, and also to resist the trunk being pulled sideways in the opposite direction.

The lower **external intercostal** muscles may blend with the fibers of external oblique, which overlap them, thus effectively forming one continuous sheet of muscle, with the external intercostal fibers seemingly stranded between the ribs. **Internal intercostal** fibers lie deep to, and run obliquely across, the external intercostals. There are eleven external and internal intercostals on each side of the rib cage.

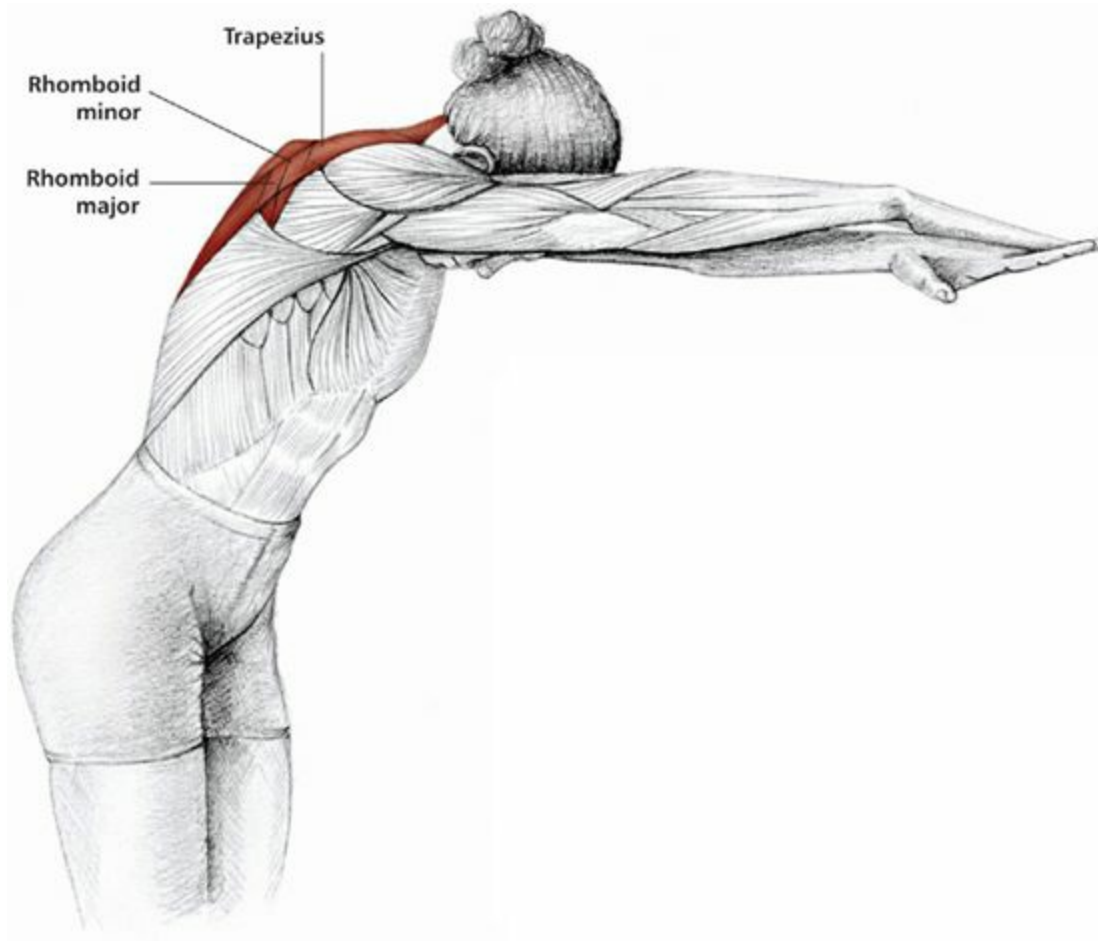
**Erector spinae**, also called sacrospinalis, comprises three sets of muscles organised in parallel columns. From lateral to medial, they are: iliocostalis, longissimus, and spinalis. Longissimus is the intermediate part of the erector spinae. It may be subdivided into thoracis, cervicis, and capitis portions. The spinalis is the most medial part of the erector spinae. It may also be subdivided into thoracis, cervicis, and capitis portions. The **transversospinalis** muscles are a composite of three small muscle groups situated deep to erector spinae. However, unlike erector spinae, each group lies successively deeper from the surface rather than side-by-side. The muscle groups are, from more superficial to deep: semispinalis, multifidus, and rotatores. Their fibers generally extend upward and

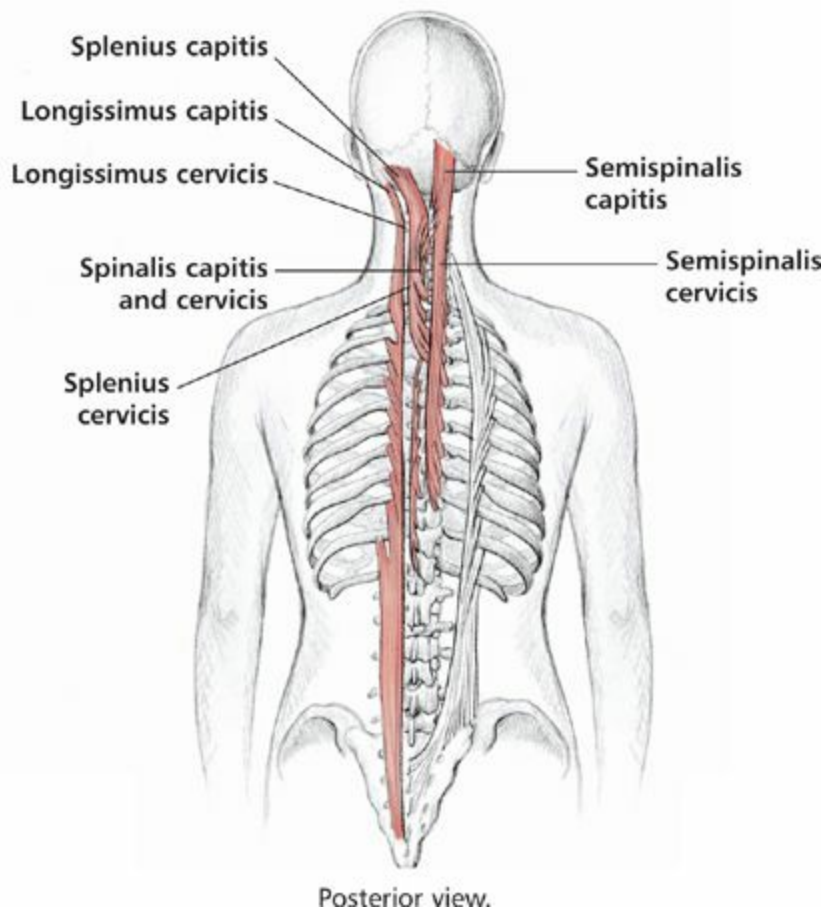
medially from transverse processes to higher spinous processes. **Multifidus** is the part of the transversospinalis group that lies in the furrow between the vertebrae of the spine and their transverse processes. It lies deep to semispinalis and erector spinae. **Rotatores** are the deepest layer of the transversospinalis group.

**Interspinales** are short and insignificant muscles positioned on either side of the interspinous ligament. Like the interspinales, the **intertransversarii** are also short and insignificant muscles. The cervical and thoracic regions encompass intertransversarii anteriores and intertransversarii posteriores, and the lumbar region encompasses intertransversarii laterales and intertransversarii mediales.

Sports that benefit from these back and side stretches include: archery; basketball and netball; batting sports like cricket, baseball, and softball; boxing; contact sports like football, rugby, and gridiron; cycling; golf; hiking, backpacking, mountaineering, and orienteering; ice hockey and field hockey; ice-skating, roller-skating, and inline skating; martial arts; racquet sports like tennis, badminton, and squash; rowing, canoeing, and kayaking; running, track, and cross-country; running sports like soccer, American football (gridiron), and rugby; snow skiing and water skiing; surfing; swimming; throwing sports like cricket, baseball, and field events; volleyball; walking and race walking; wrestling.

# D01: REACHING FORWARD UPPER BACK STRETCH





### **Technique**

Stand with your arms out in front and crossed over. Push your hands forward as far as possible and let your head fall forward.

### **Muscles being stretched**

Primary muscles: Trapezius. Rhomboids.

Secondary muscles: Semispinalis capitis and cervicis. Spinalis capitis and cervicis. Longissimus capitis and cervicis. Splenius capitis and cervicis.

### **Sports that benefit from this stretch**

Archery. Boxing. Cycling. Golf. Tennis. Badminton. Squash. Rowing. Canoeing. Kayaking. Snow skiing. Water skiing. Swimming.

### **Sports injury where stretch may be useful**

Neck muscle strain. Whiplash (neck sprain). Cervical nerve stretch syndrome. Wryneck (acute torticollis). Upper back muscle strain. Upper back ligament sprain.

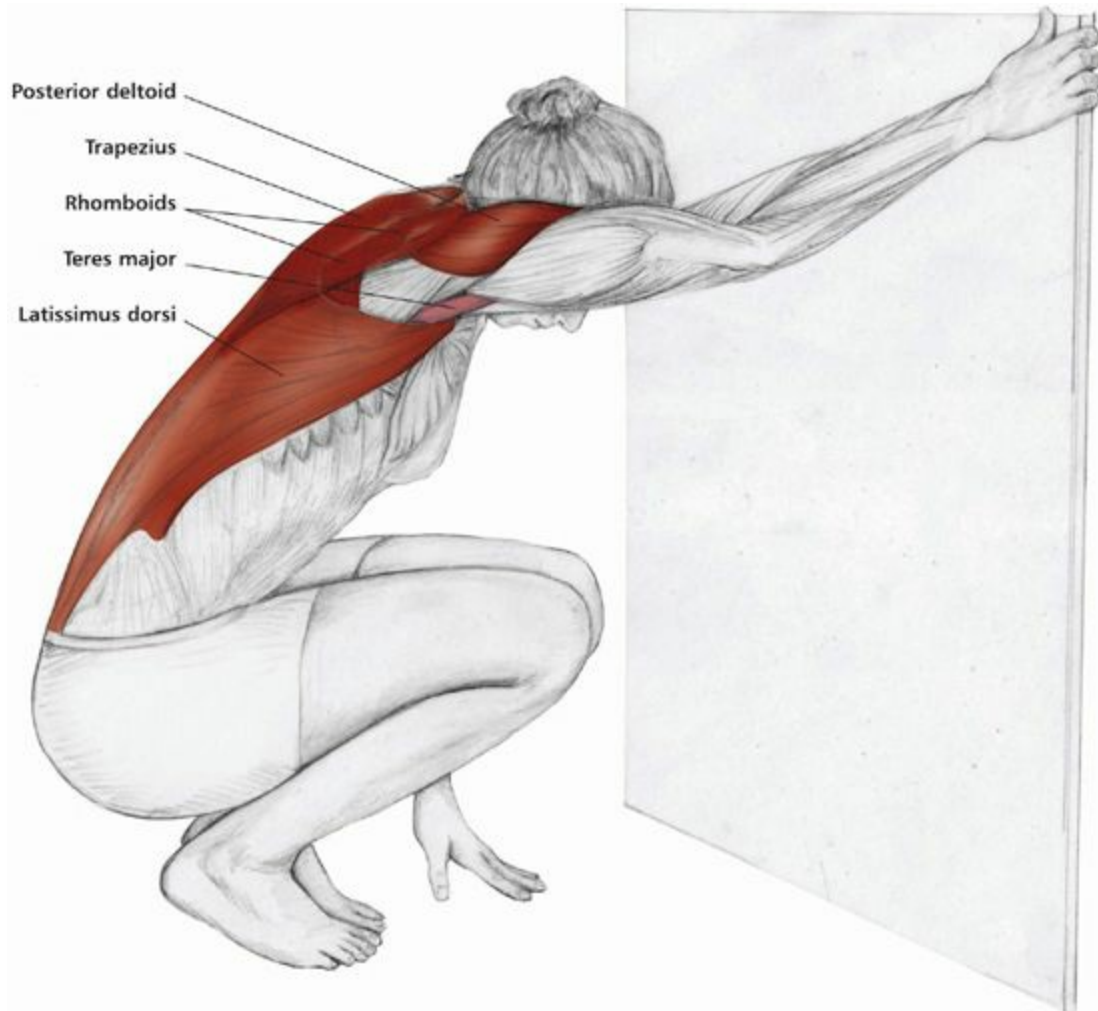
### **Additional information for performing this stretch correctly**

Concentrate on reaching forward with your hands and separating your shoulder-blades.

### **Complementary stretch**

[D05](#).

## D02: REACHING UPPER BACK STRETCH



### Technique

Sit in a squatting position while facing a door edge or pole, then hold onto the door edge with one hand and lean backwards away from the door.

### Muscles being stretched

Primary muscles: Trapezius. Rhomboids. Latissimus dorsi. Posterior deltoid.

Secondary muscle: Teres major.

### Sports that benefit from this stretch

Archery. Boxing. Cycling. Golf. Tennis. Badminton. Squash. Rowing. Canoeing. Kayaking. Snow skiing. Water skiing. Swimming.

### Sports injury where stretch may be useful

Neck muscle strain. Whiplash (neck sprain). Cervical nerve stretch syndrome. Wryneck (acute torticollis). Upper back muscle strain. Upper back ligament sprain. Impingement syndrome. Rotator cuff tendonitis. Shoulder bursitis. Frozen shoulder (adhesive capsulitis).

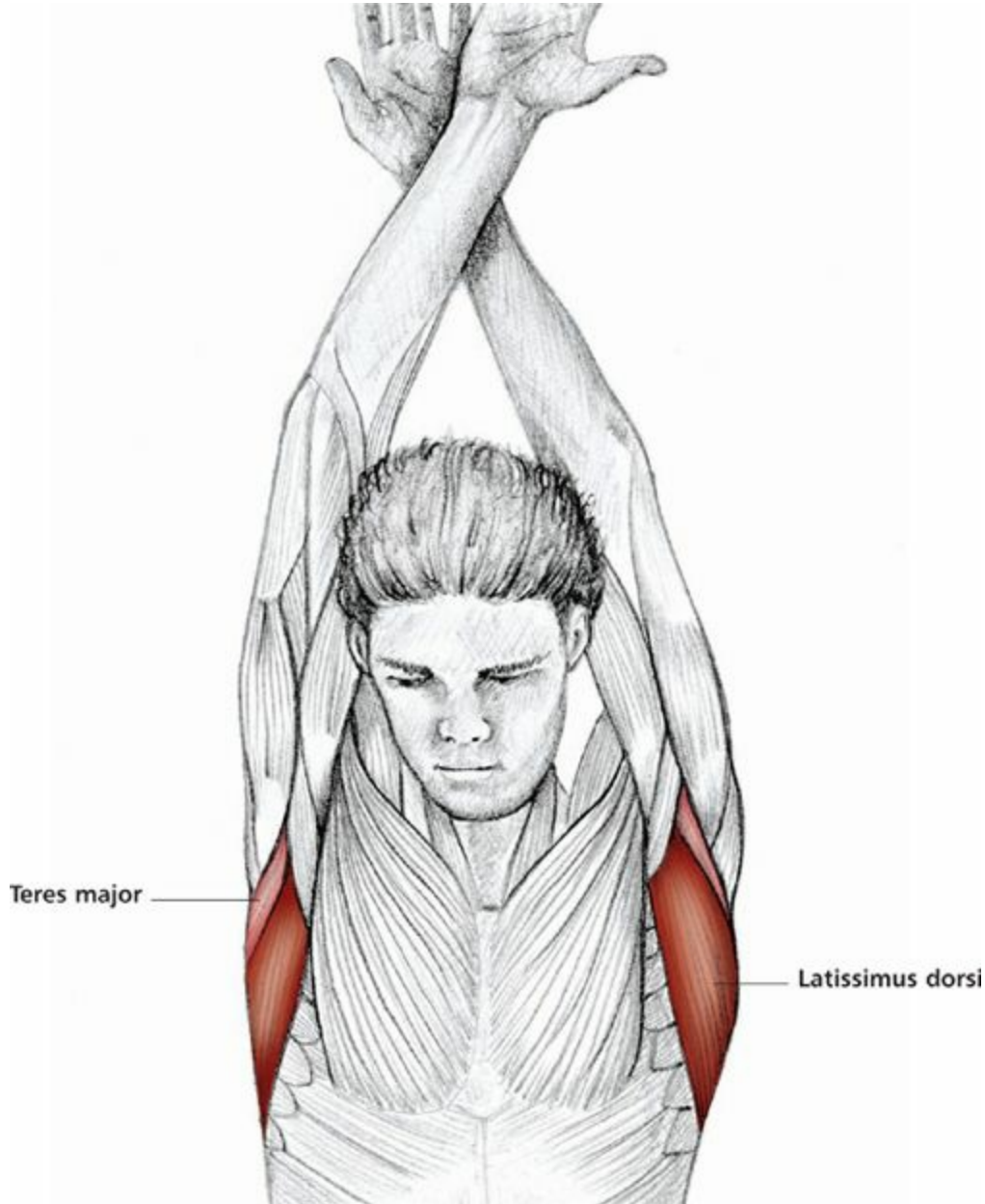
## **Common problems and more information for performing this stretch correctly**

Lean backwards and let the weight of your body do the stretching. Relax your upper back, allowing it to round out and your shoulder-blades to separate.

## **Complementary stretches**

[D01](#), [A08](#).

## D03: REACH-UP BACK STRETCH



### **Technique**

Stand with your arms crossed over and then raise them above your head. Reach up as far as you can.

### **Muscles being stretched**

Primary muscle: Latissimus dorsi.

Secondary muscle: Teres major.

### **Sports that benefit from this stretch**

Basketball. Netball. Swimming. Volleyball.

### **Sports injury where stretch may be useful**

Neck muscle strain. Whiplash (neck sprain). Cervical nerve stretch syndrome. Wryneck (acute torticollis). Upper back muscle strain. Upper back ligament sprain.

**Additional information for performing this stretch correctly**

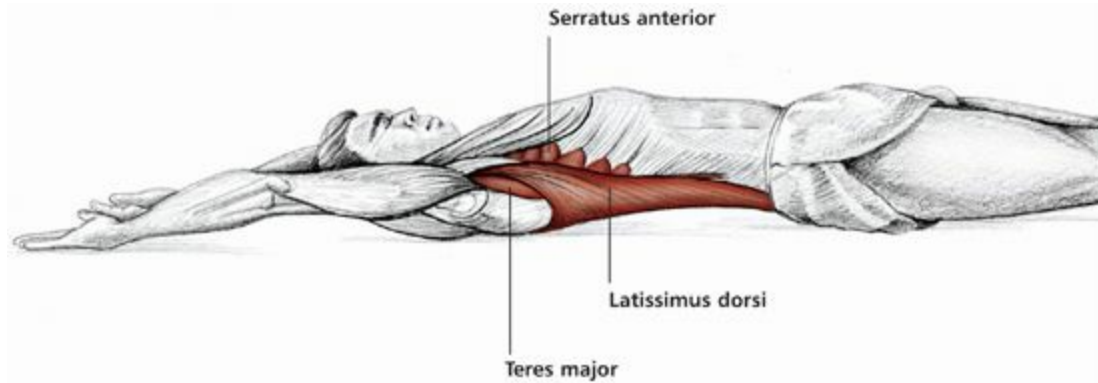
Let your head fall forward so that your arms can reach straight upwards without touching your head.

**Complementary stretch**

[D04](#).



## D04: LYING WHOLE BODY STRETCH



### **Technique**

Lie on your back and extend your arms behind you. Raise your toes and then lengthen your body as much as you can.

### **Muscles being stretched**

Primary muscles: Serratus anterior. Latissimus dorsi.

Secondary muscle: Teres major.

### **Sports that benefit from this stretch**

Basketball. Netball. Swimming. Volleyball.

### **Sports injury where stretch may be useful**

Back muscle strain. Back ligament sprain.

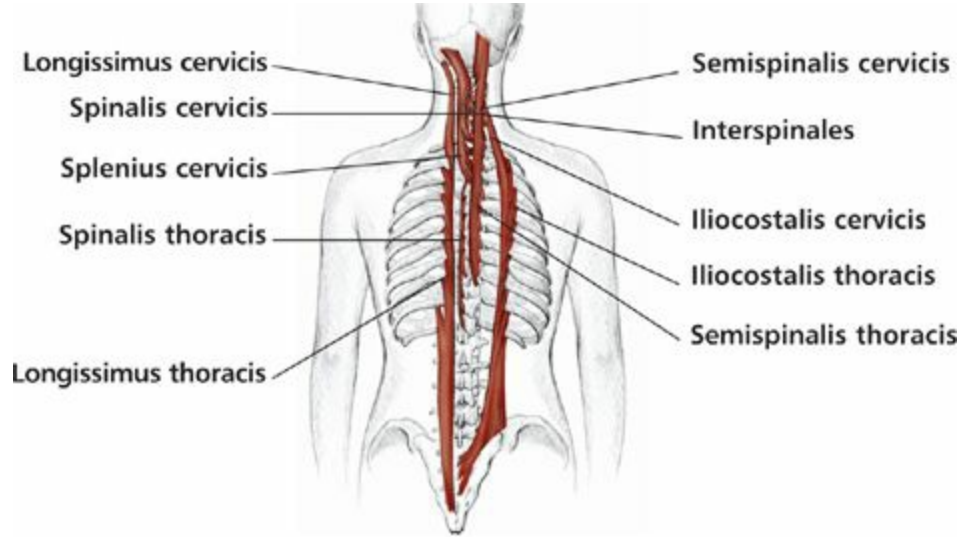
### **Additional information for performing this stretch correctly**

Concentrate on extending your legs by pushing with your heels, rather than your toes.

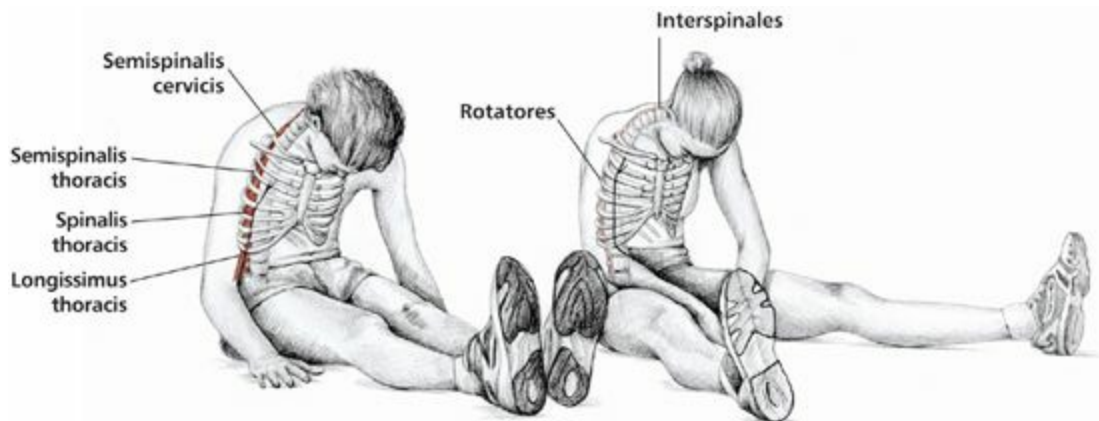
### **Complementary stretch**

[D03](#).

# D05: SITTING BENT-OVER BACK STRETCH



Posterior view.



## Technique

Sit on the ground with your legs straight out in front or at 45 degrees apart. Keep your toes pointing upwards and rest your arms by your side or on your lap. Relax your back and neck and then let your head and chest fall forward.

## Muscles being stretched

Primary muscles: Semispinalis cervicis and thoracis. Spinalis cervicis and thoracis. Longissimus cervicis and thoracis. Splenius cervicis. Iliocostalis cervicis and thoracis.

Secondary muscles: Interspinales. Rotatores.

## Sports that benefit from this stretch

Cricket. Baseball. Softball. American football (gridiron). Rugby. Cycling. Golf. Hiking. Backpacking. Mountaineering. Orienteering. Ice hockey. Field hockey. Tennis. Badminton. Squash. Rowing. Canoeing. Kayaking. Swimming.

## Sports injury where stretch may be useful

Neck muscle strain. Whiplash (neck sprain). Cervical nerve stretch syndrome. Wryneck (acute torticollis). Back muscle strain. Back ligament sprain.

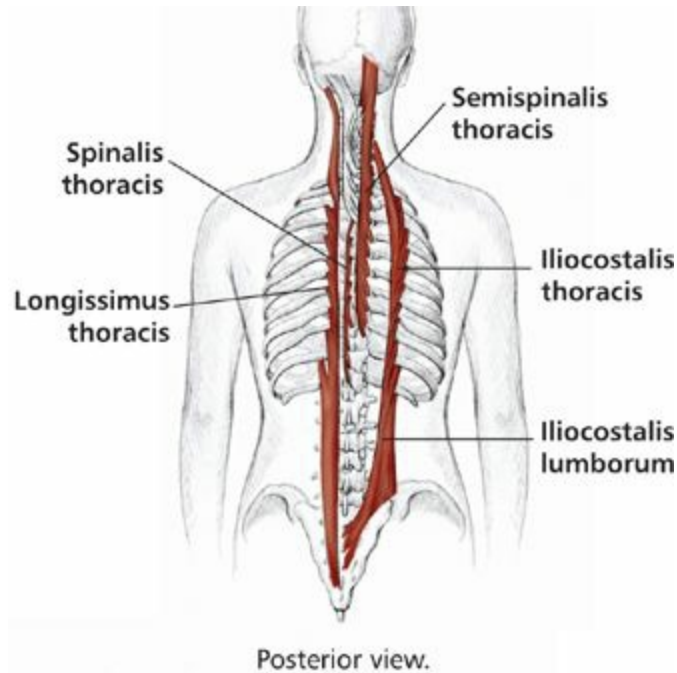
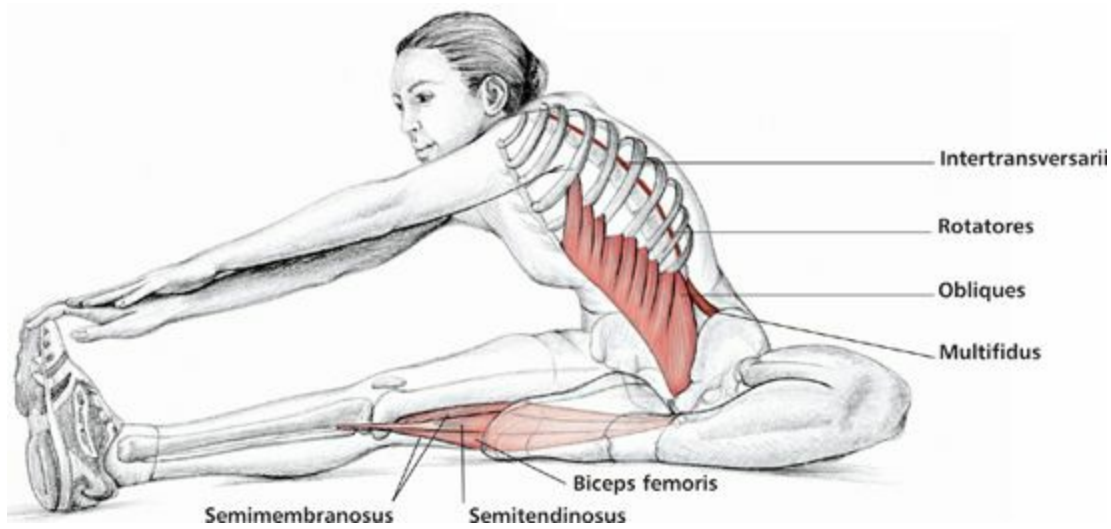
### **Common problems and more information for performing this stretch correctly**

Where this stretch is primarily felt will depend on where you are most tight. Some people will feel most tension in the neck and upper back, whereas others will feel most tension in the lower back and hamstrings. This stretch gives a good indication of where you need to improve your flexibility.

### **Complementary stretch**

[D01](#).

## D06: SITTING SIDE REACH STRETCH



### Technique

Sit with one leg straight out to the side and your toes pointing up. Then bring your other foot up to your knee and let your head fall forward. Reach towards the outside of your toes with both hands.

### Muscles being stretched

Primary muscles: Semispinalis thoracis. Spinalis thoracis. Longissimus thoracis. Iliocostalis thoracis. Iliocostalis lumborum. Intertransversarii. Rotatores. Multifidus.

Secondary muscles: Obliques. Semimembranosus. Semitendinosus. Biceps femoris.

### Sports that benefit from this stretch

Cricket. Baseball. Softball. Boxing. American football (gridiron). Rugby. Cycling. Golf. Hiking. Backpacking. Mountaineering. Orienteering. Ice hockey. Field hockey. Tennis. Badminton. Squash.

Rowing. Canoeing. Kayaking. Swimming. Running. Walking. Race walking.

**Sports injury where stretch may be useful**

Neck muscle strain. Whiplash (neck sprain). Cervical nerve stretch syndrome. Wryneck (acute torticollis). Back muscle strain. Back ligament sprain.

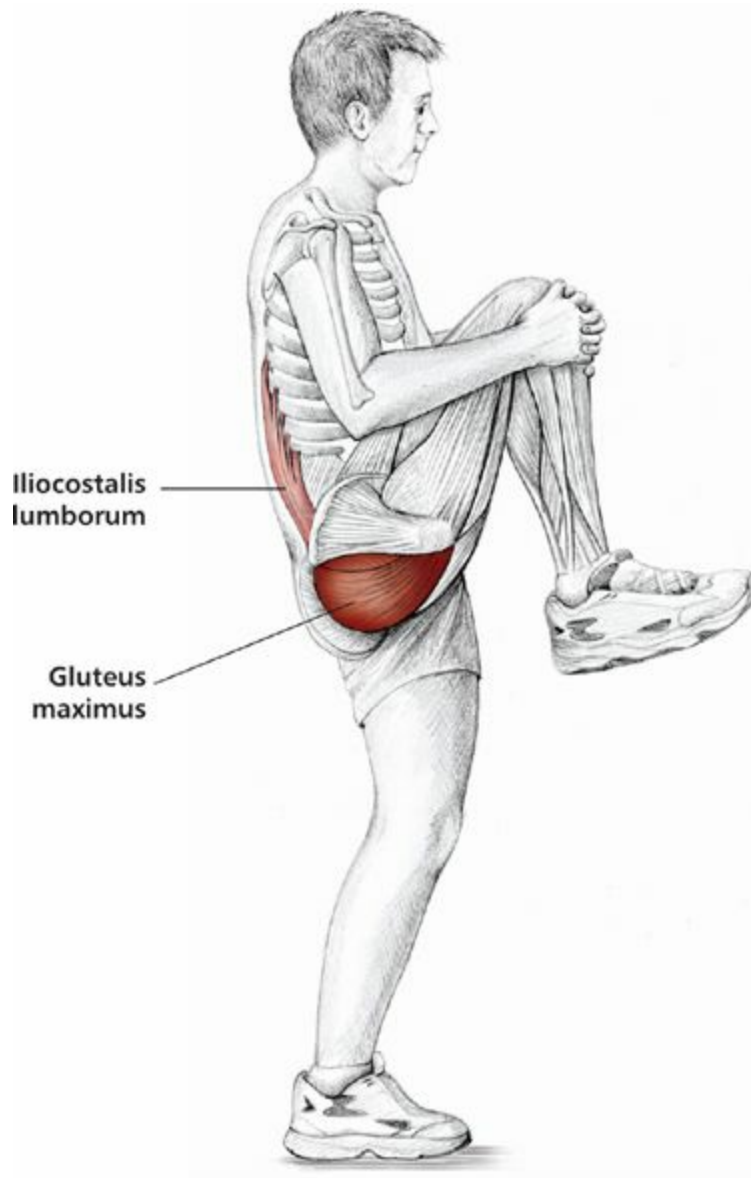
**Additional information for performing this stretch correctly**

It is not important to be able to touch your toes. Simply reaching towards the outside of your toes is sufficient.

**Complementary stretch**

[D21](#).

## D07: STANDING KNEE-TO-CHEST STRETCH



### Technique

While standing, use your hands to bring one knee into your chest.

### Muscles being stretched

Primary muscle: Gluteus maximus.

Secondary muscle: Iliocostalis lumborum.

### Sports that benefit from this stretch

Basketball. Netball. Cycling. Hiking. Backpacking. Mountaineering. Orienteering. Ice hockey. Field hockey. Ice-skating. Roller-skating. Inline skating. Martial arts. Running. Track. Cross-country. American football (gridiron). Soccer. Rugby. Snow skiing. Water skiing. Surfing. Walking. Race walking.

### **Sports injury where stretch may be useful**

Lower back muscle strain. Lower back ligament sprain. Hamstring strain.

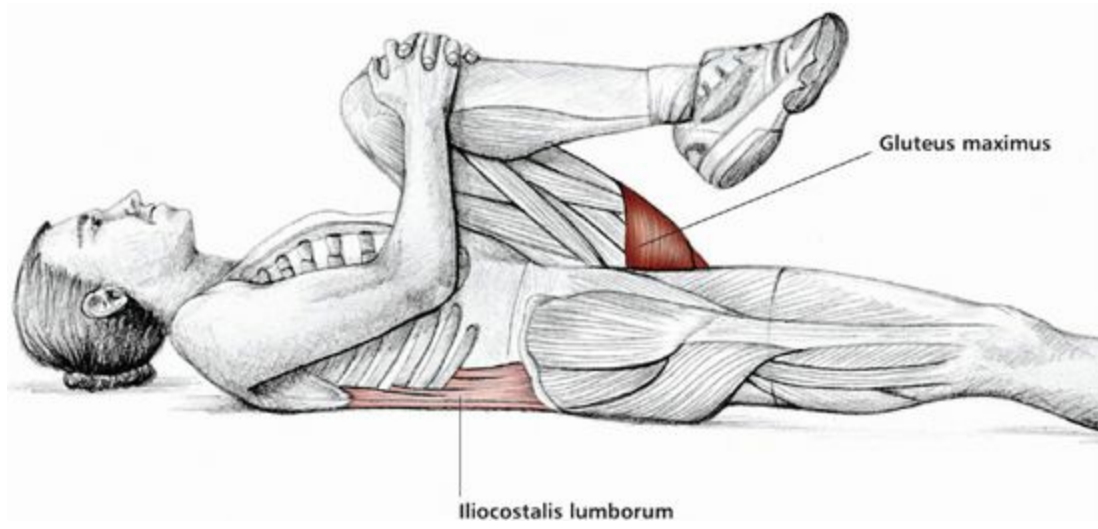
### **Additional information for performing this stretch correctly**

Make sure you have good balance when performing this stretch, or lean against an object to stop yourself from falling over.

### **Complementary stretch**

[D08](#).

## D08: LYING KNEE-TO-CHEST STRETCH



### Technique

Lie on your back and keep one leg flat on the ground. Use your hands to bring your other knee into your chest.

### Muscles being stretched

Primary muscle: Gluteus maximus.

Secondary muscle: Iliocostalis lumborum.

### Sports that benefit from this stretch

Basketball. Netball. Cycling. Hiking. Backpacking. Mountaineering. Orienteering. Ice hockey. Field hockey. Ice-skating. Roller-skating. Inline skating. Martial arts. Running. Track. Cross-country. American football (gridiron). Soccer. Rugby. Snow skiing. Water skiing. Surfing. Walking. Race walking.

### Sports injury where stretch may be useful

Lower back muscle strain. Lower back ligament sprain. Hamstring strain.

### Additional information for performing this stretch correctly

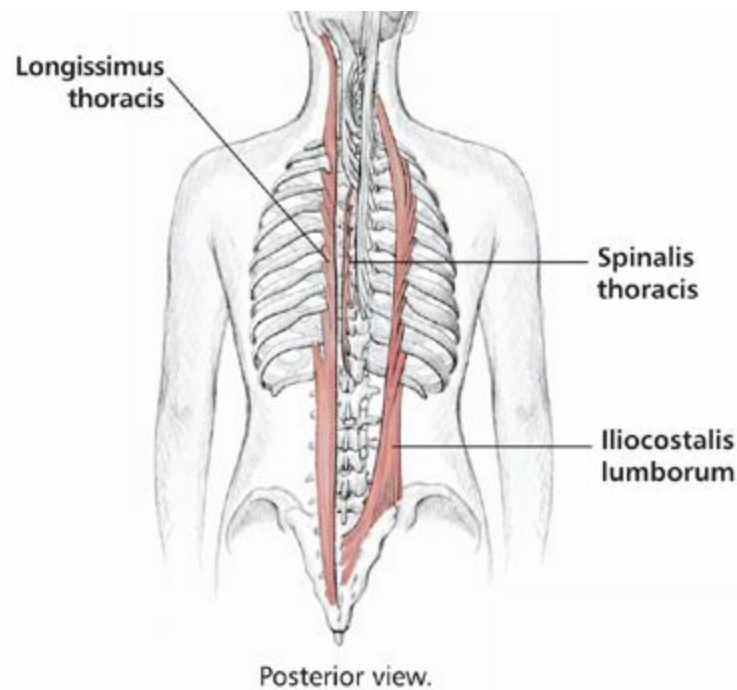
Rest your back, head, and neck on the ground and do not be tempted to raise your head off the ground.

### Complementary stretch

[D08](#).



# D09: LYING DOUBLE KNEE-TO-CHEST STRETCH



## Technique

Lie on your back and use your hands to bring both knees into your chest.

## Muscles being stretched

Primary muscle: Gluteus maximus.

Secondary muscles: Iliocostalis lumborum. Spinalis thoracis. Longissimus thoracis.

## Sports that benefit from this stretch

Basketball. Netball. Cycling. Hiking. Backpacking. Mountaineering. Orienteering. Ice hockey. Field hockey. Ice-skating. Rollerskating. Inline skating. Martial arts. Running. Track. Cross-country. American football (gridiron). Soccer. Rugby. Snow skiing. Water skiing. Surfing. Walking. Race walking.

**Sports injury where stretch may be useful**

Lower back muscle strain. Lower back ligament sprain. Hamstring strain.

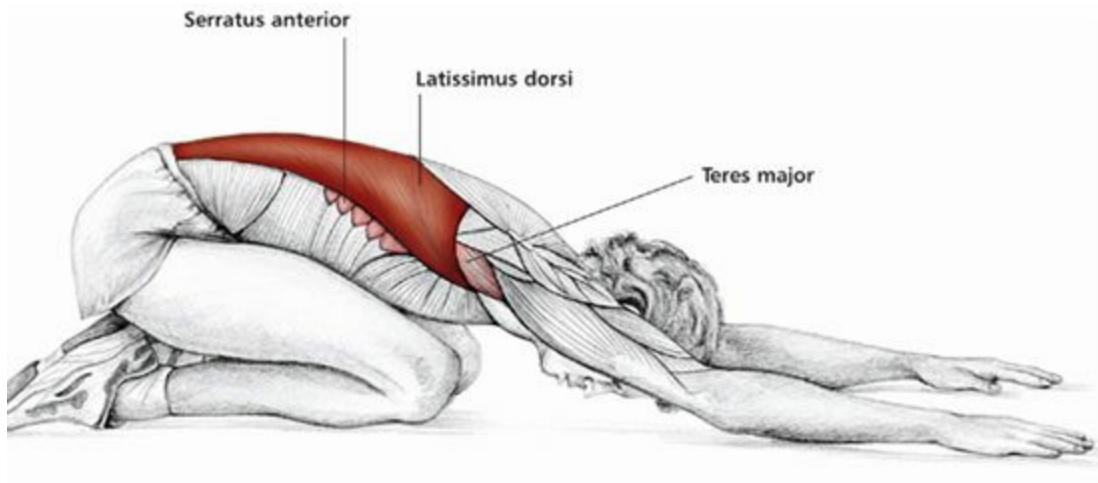
**Additional information for performing this stretch correctly**

Rest your back, head, and neck on the ground and don't be tempted to raise your head off the ground.

**Complementary stretch**

[D07](#).

## D10: KNEELING REACH FORWARD STRETCH



### **Technique**

Kneel on the ground and reach forward with your hands. Let your head fall forward and push your buttocks towards your feet.

### **Muscles being stretched**

Primary muscle: Latissimus dorsi.

Secondary muscles: Teres major. Serratus anterior.

### **Sports that benefit from this stretch**

Basketball. Netball. Swimming. Volleyball.

### **Sports injury where stretch may be useful**

Lower back muscle strain. Lower back ligament sprain.

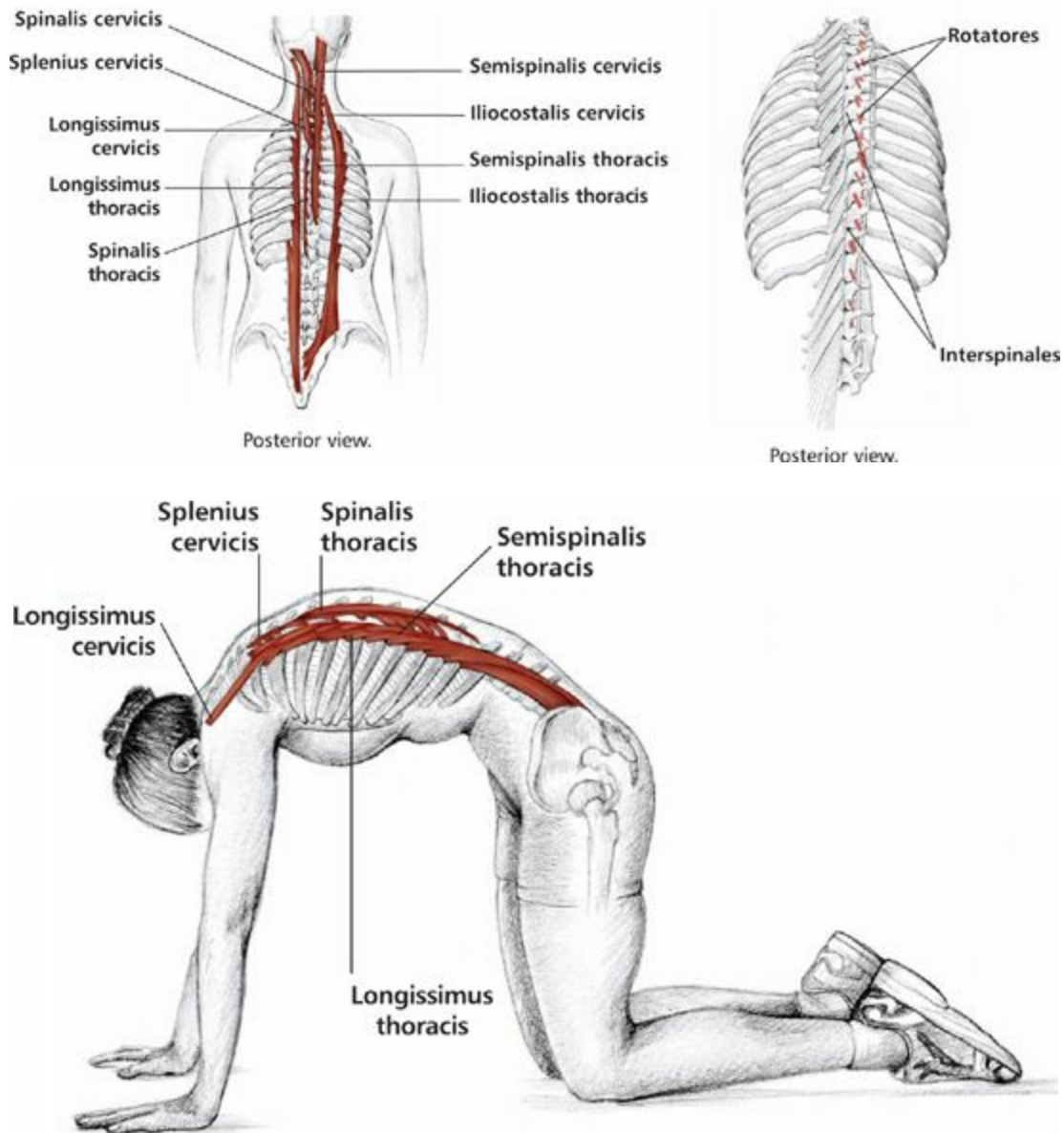
### **Additional information for performing this stretch correctly**

Use your hands and fingers to walk your arms forward and extend this stretch, but do not lift your backside off your feet.

### **Complementary stretch**

[D04](#).

# D11: KNEELING BACK-ARCH STRETCH



## Technique

Kneel on your hands and knees. Let your head fall forwards and arch your back upwards.

## Muscles being stretched

Primary muscles: Semispinalis cervicis and thoracis. Spinalis cervicis and thoracis. Longissimus cervicis and thoracis. Splenius cervicis. Iliocostalis cervicis and thoracis.

Secondary muscles: Interspinales. Rotatores.

## Sports that benefit from this stretch

Cricket. Baseball. Softball. Cycling. Golf. Hiking. Backpacking. Mountaineering. Orienteering. Ice hockey. Field hockey. Tennis. Badminton. Squash. Rowing. Canoeing. Kayaking. Running. Track Cross-country. Soccer. American football (gridiron). Rugby. Swimming. Walking. Race walking.

### **Sports injury where stretch may be useful**

Neck muscle strain. Whiplash (neck sprain). Cervical nerve stretch syndrome. Wryneck (acute torticollis). Back muscle strain. Back ligament sprain.

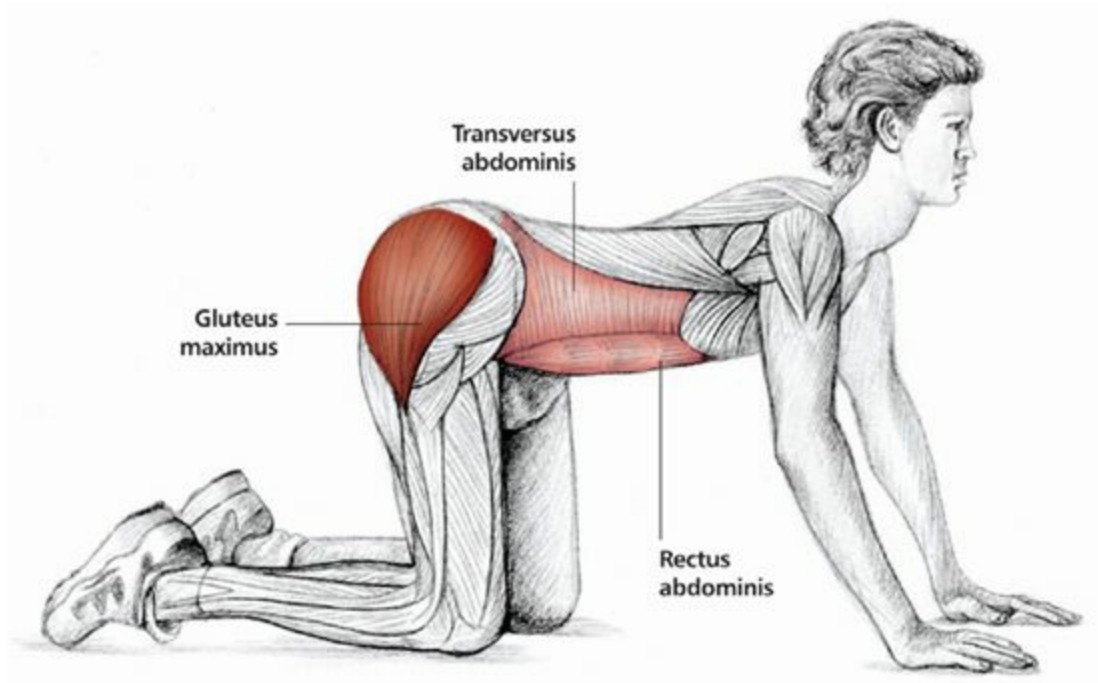
### **Common problems and more information for performing this stretch correctly**

Perform this stretch slowly and deliberately, resting your weight evenly on both your knees and hands.

### **Complementary stretches**

[D05](#), [D09](#).

## D12: KNEELING BACK-SLUMP STRETCH



### Technique

Kneel on your hands and knees. Look up and let your back slump downwards.

### Muscles being stretched

Primary muscle: Gluteus maximus.

Secondary muscles: Transversus abdominis. Rectus abdominis.

### Sports that benefit from this stretch

Cricket. Baseball. Softball. Cycling. Golf. Hiking. Backpacking. Mountaineering. Orienteering. Ice hockey. Field hockey. Tennis. Badminton. Squash. Rowing. Canoeing. Kayaking. Running. Track. Cross-country. Soccer. American football (gridiron). Rugby. Swimming. Walking. Race walking.

### Sports injury where stretch may be useful

Neck muscle strain. Whiplash (neck sprain). Cervical nerve stretch syndrome. Wryneck (acute torticollis). Back muscle strain. Back ligament sprain.

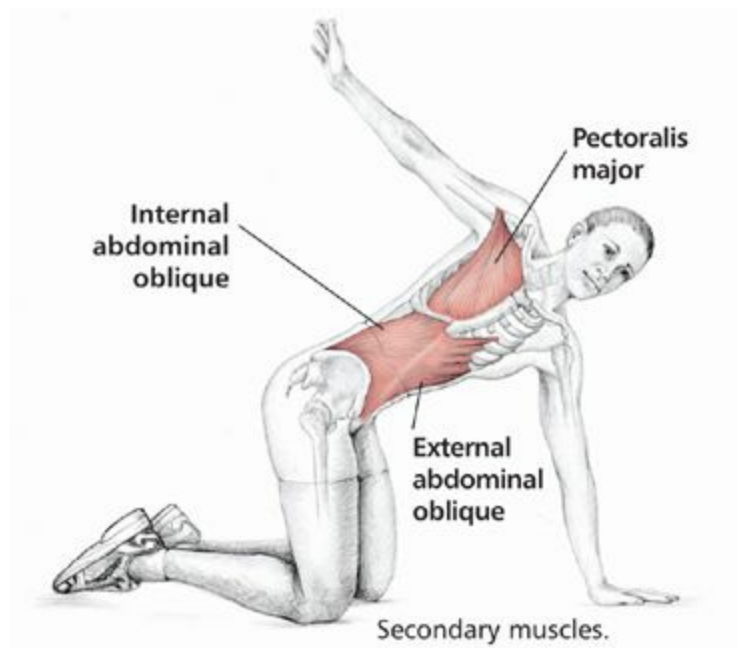
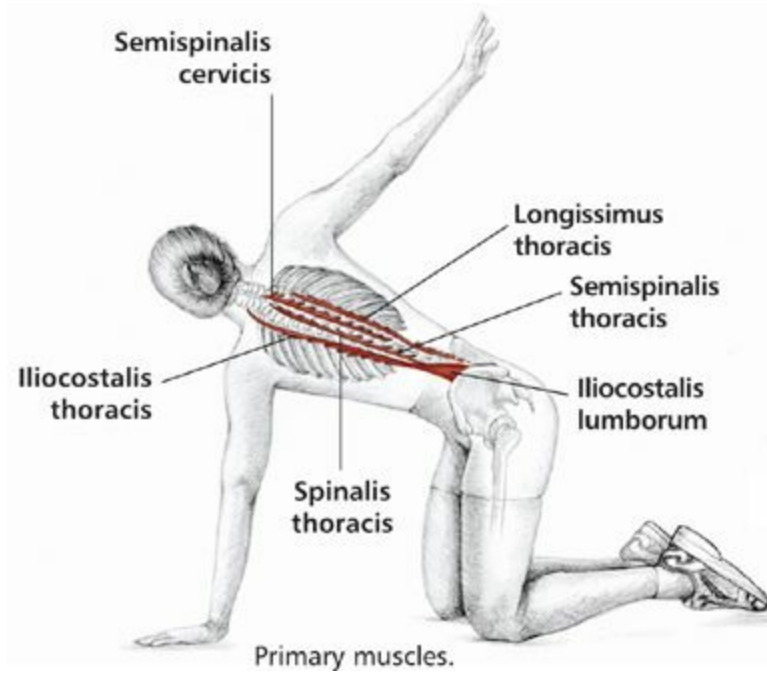
### Common problems and more information for performing this stretch correctly

Perform this stretch slowly and deliberately, resting your weight evenly on both your knees and hands.

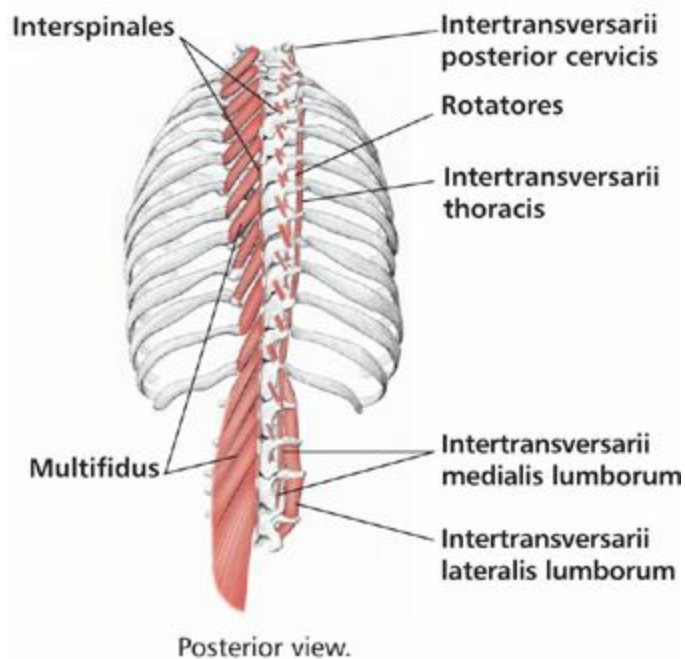
### Complementary stretches

[C02](#), [C03](#).

# D13: KNEELING BACK ROTATION STRETCH







## Technique

Kneel on the ground and raise one arm. Then rotate your shoulders and middle back while looking upwards.

## Muscles being stretched

Primary muscles: Semispinalis thoracis. Spinalis thoracis. Longissimus thoracis. Iliocostalis thoracis. Iliocostalis lumborum. Multifidus. Rotatores. Intertransversarii. Interspinales.

Secondary muscles: External and internal obliques. Pectoralis major.

## Sports that benefit from this stretch

Archery. Basketball. Netball. Cricket. Baseball. Softball. Boxing. Cycling. Golf. Hiking. Backpacking. Mountaineering. Orienteering. Ice hockey. Field hockey. Ice-skating. Rollerskating. Inline skating. Martial arts. Tennis. Badminton. Squash. Rowing. Canoeing. Kayaking. Running. Track. Cross-country. American football (gridiron). Soccer. Rugby. Snow skiing. Water skiing. Surfing. Swimming. Athletics field events. Walking. Race walking. Wrestling.

## Sports injury where stretch may be useful

Back muscle strain. Back ligament sprain. Abdominal muscle strain (obliques).

## Additional information for performing this stretch correctly

Keep your arm pointing straight upward and follow your hand with your eyes. This will help to further extend the stretch into your neck.

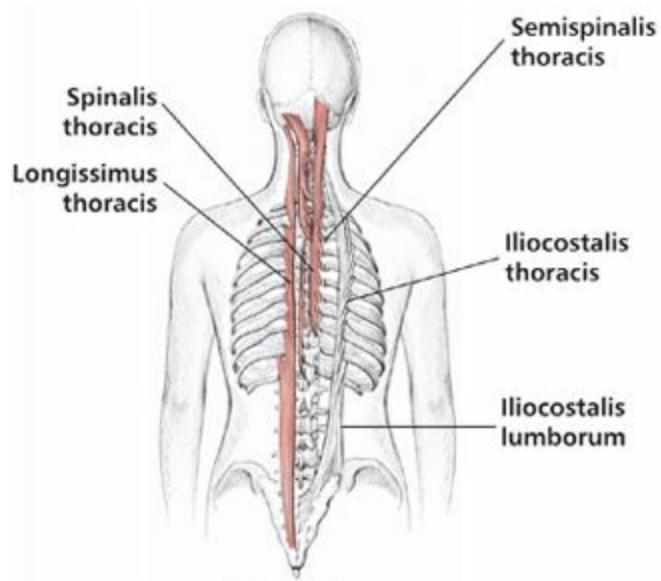
## Complementary stretch

[D14.](#)

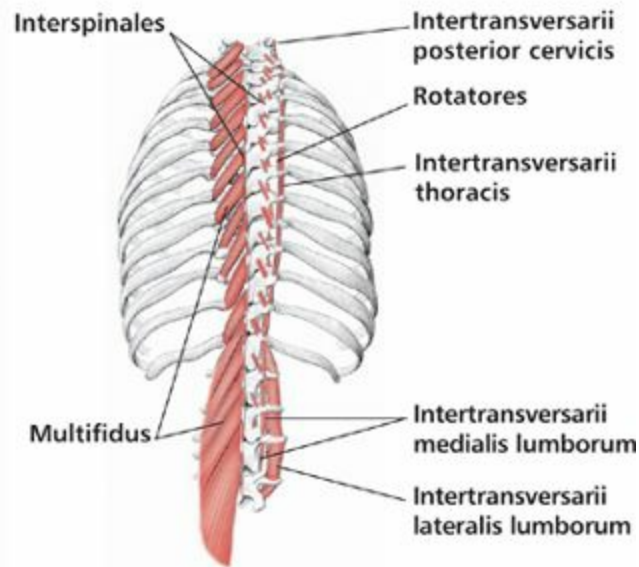


# D14: STANDING BACK ROTATION STRETCH





Posterior view.



Posterior view.

## Technique

Stand with your feet shoulder-width apart. Place your hands across your chest while keeping your back and shoulders upright. Slowly rotate your shoulders to one side.

## Muscles being stretched

Primary muscles: Semispinalis thoracis. Spinalis thoracis. Longissimus thoracis. Iliocostalis thoracis. Iliocostalis lumborum. Multifidus. Rotatores. Intertransversarii. Interspinales.

Secondary muscles: Quadratus lumborum. External and internal obliques.

## Sports that benefit from this stretch

Archery. Basketball. Netball. Cricket. Baseball. Softball. Boxing. American football (gridiron) Rugby. Cycling. Golf. Hiking. Backpacking. Mountaineering. Orienteering. Ice hockey. Field hockey Ice-skating. Roller-skating. Inline skating. Martial arts. Tennis. Badminton. Squash. Rowing Canoeing. Kayaking. Water skiing. Surfing. Swimming. Running. Track. Cross-country. Soccer. Snow skiing. Athletic field events. Walking. Race walking. Wrestling.

## Sports injury where stretch may be useful

Back muscle strain. Back ligament sprain. Abdominal muscle strain (obliques).

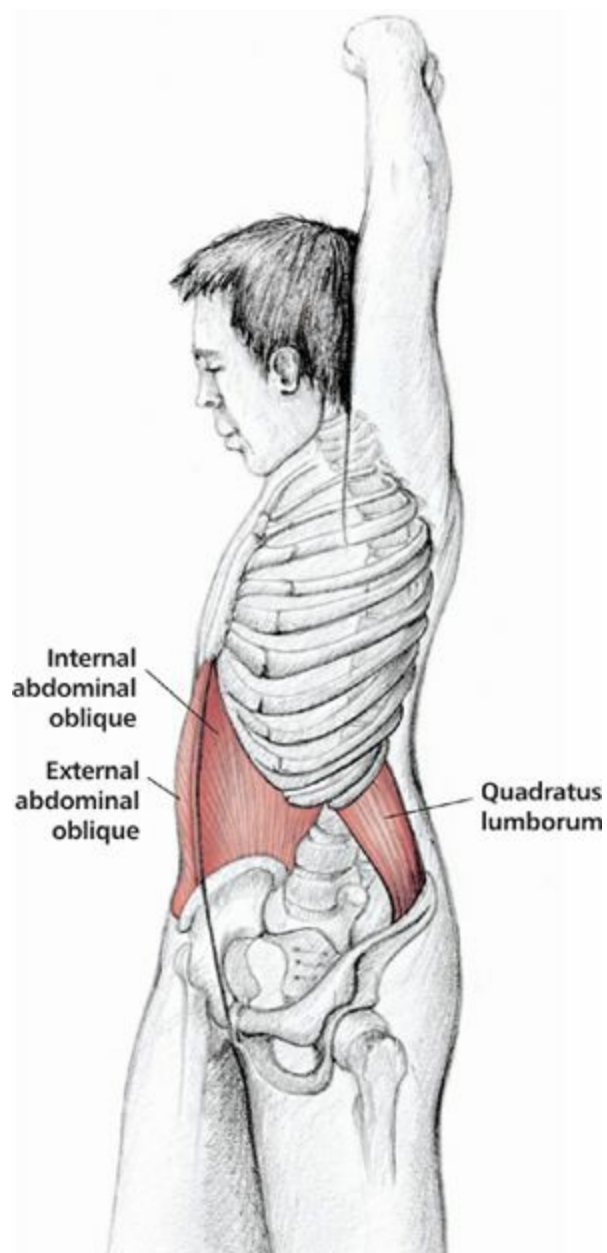
**Additional information for performing this stretch correctly**

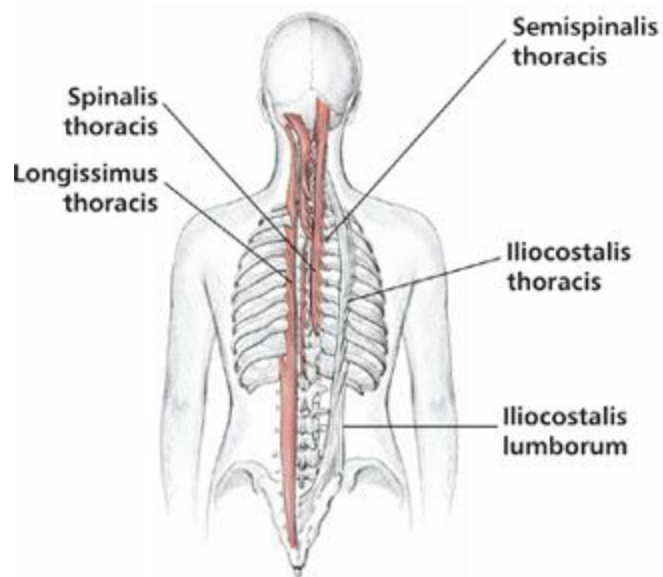
To further extend this stretch use your hands to pull your upper body further around.

**Complementary stretch**

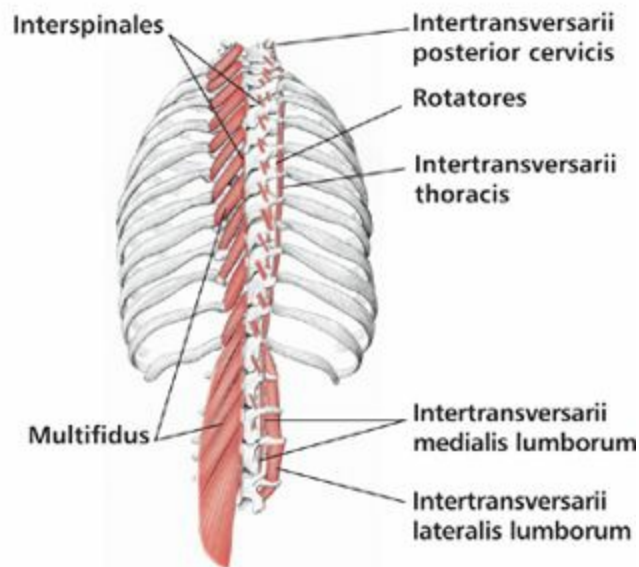
[D16.](#)

# D15: STANDING REACH-UP BACK ROTATION STRETCH





Posterior view.



Posterior view.

## Technique

Stand with your feet shoulder-width apart. Place your hands above your head while keeping your back and shoulders upright. Slowly rotate your shoulders to one side.

## Muscles being stretched

Primary muscles: Semispinalis thoracis. Spinalis thoracis. Longissimus thoracis. Iliocostalis thoracis. Iliocostalis lumborum. Multifidus. Rotatores. Intertransversarii. Interspinales.

Secondary muscles: Quadratus lumborum. External and internal obliques.

## Sports that benefit from this stretch

Archery. Basketball. Netball. Cricket. Baseball. Softball. Boxing. American football (gridiron) Rugby. Cycling. Golf. Hiking. Backpacking. Mountaineering. Orienteering. Ice hockey. Field hockey Ice-skating. Roller-skating. Inline skating. Martial arts. Tennis. Badminton. Squash. Rowing Canoeing. Kayaking. Running. Track. Cross-country. Snow skiing. Water skiing. Surfing. Swimming Athletics field events. Walking. Race walking. Wrestling.

## Sports injury where stretch may be useful

Back muscle strain. Back ligament sprain. Abdominal muscle strain (obliques).

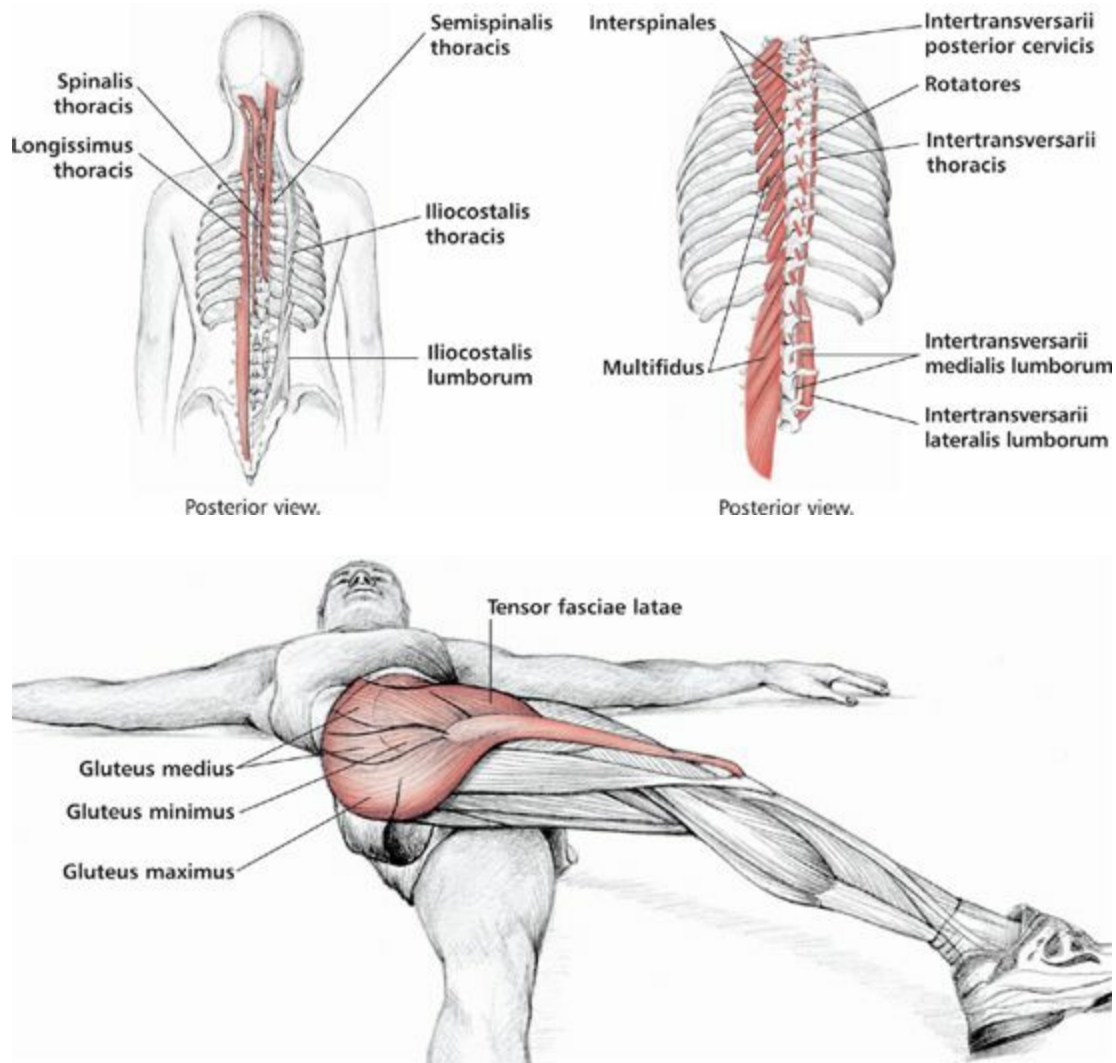
**Common problems and more information for performing this stretch correctly**

Lean back slightly to emphasize the *oblique* muscles. Do not perform if you suffer from lower back pain.

**Complementary stretch**

[D13](#).

# D16: LYING LEG CROSS-OVER STRETCH



## Technique

Lie on your back and cross one leg over the other. Keep your arms out to the side and both legs straight. Let your back and hips rotate with your leg.

## Muscles being stretched

Primary muscles: Semispinalis thoracis. Spinalis thoracis. Longissimus thoracis. Iliocostalis thoracis. Iliocostalis lumborum. Multifidus. Rotatores. Intertransversarii. Interspinales.

Secondary muscles: Gluteus maximus, medius, and minimus. Tensor fasciae latae.

## Sports that benefit from this stretch

Cycling. Hiking. Backpacking. Mountaineering. Orienteering. Ice hockey. Field hockey. Iceskating. Roller-skating. Inline skating. Martial arts. Running. Track. Cross-country. American football (gridiron). Soccer. Rugby. Snow skiing. Water skiing. Surfing. Walking. Race walking. Wrestling.

## Sports injury where stretch may be useful

Lower back muscle strain. Lower back ligament sprain. Iliotibial band syndrome.

**Additional information for performing this stretch correctly**

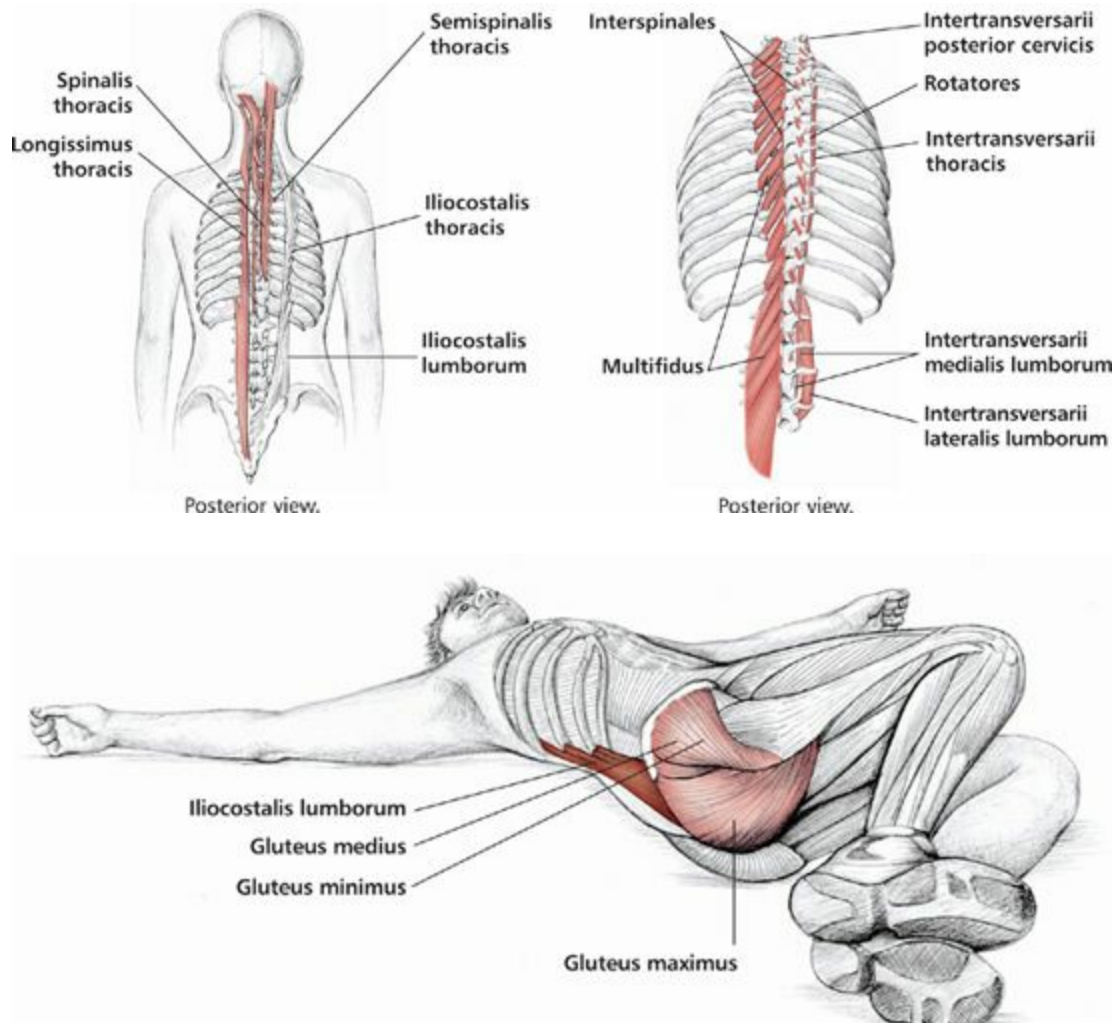
Keep your shoulders on the ground and avoid lifting them during this stretch. Do not throw your leg over to the side; simply let the weight of your leg do most of the stretching for you.

**Complementary stretch**

[D17](#).



# D17: LYING KNEE ROLL-OVER STRETCH



## Technique

Lie on your back, keep your knees together and raise them slightly. Keep your arms out to the side and then let your back and hips rotate with your knees.

## Muscles being stretched

Primary muscles: Semispinalis thoracis. Spinalis thoracis. Longissimus thoracis. Iliocostalis thoracis. Iliocostalis lumborum. Multifidus. Rotatores. Intertransversarii. Interspinales.

Secondary muscles: Gluteus maximus, medius, and minimus.

## Sports that benefit from this stretch

Cycling. Hiking. Backpacking. Mountaineering. Orienteering. Ice hockey. Field hockey. Iceskating. Roller-skating. Inline skating. Martial arts. Running. Track. Cross-country. American football (gridiron). Soccer. Rugby. Snow skiing. Water skiing. Surfing. Walking. Race walking. Wrestling.

## Sports injury where stretch may be useful

Lower back muscle strain. Lower back ligament sprain. Iliotibial band syndrome.

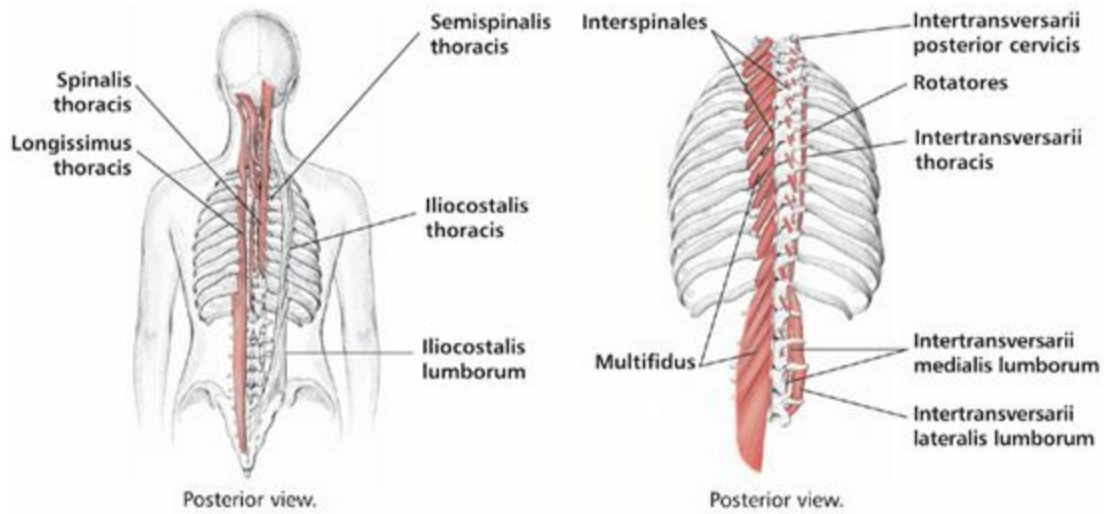
### **Additional information for performing this stretch correctly**

Keep your shoulders on the ground and avoid lifting them during this stretch. Do not throw your legs over to the side; simply let the weight of your legs do most of the stretching for you.

### **Complementary stretch**

[D14](#).

# D18: SITTING KNEE-UP ROTATION STRETCH



## Technique

Sit with one leg straight and the other leg crossed over your knee. Turn your shoulders and put your arm onto your raised knee to help rotate your shoulders and back.

## Muscles being stretched

Primary muscles: Gluteus maximus, medius, and minimus. Tensor fasciae latae.

Secondary muscles: Semispinalis thoracis. Spinalis thoracis. Longissimus thoracis. Iliocostalis thoracis. Iliocostalis lumborum. Multifidus. Rotatores. Intertransversarii. Interspinales.

## Sports that benefit from this stretch

Cycling. Hiking. Backpacking. Mountaineering. Orienteering. Ice hockey. Field hockey. Iceskating. Roller-skating. Inline skating. Martial arts. Running. Track. Cross-country. American football (gridiron). Soccer. Rugby. Snow skiing. Water skiing. Walking. Race walking. Wrestling.

**Sports injury where stretch may be useful**

Lower back muscle strain. Lower back ligament sprain. Abdominal muscle strain (obliques). Iliotibial band syndrome.

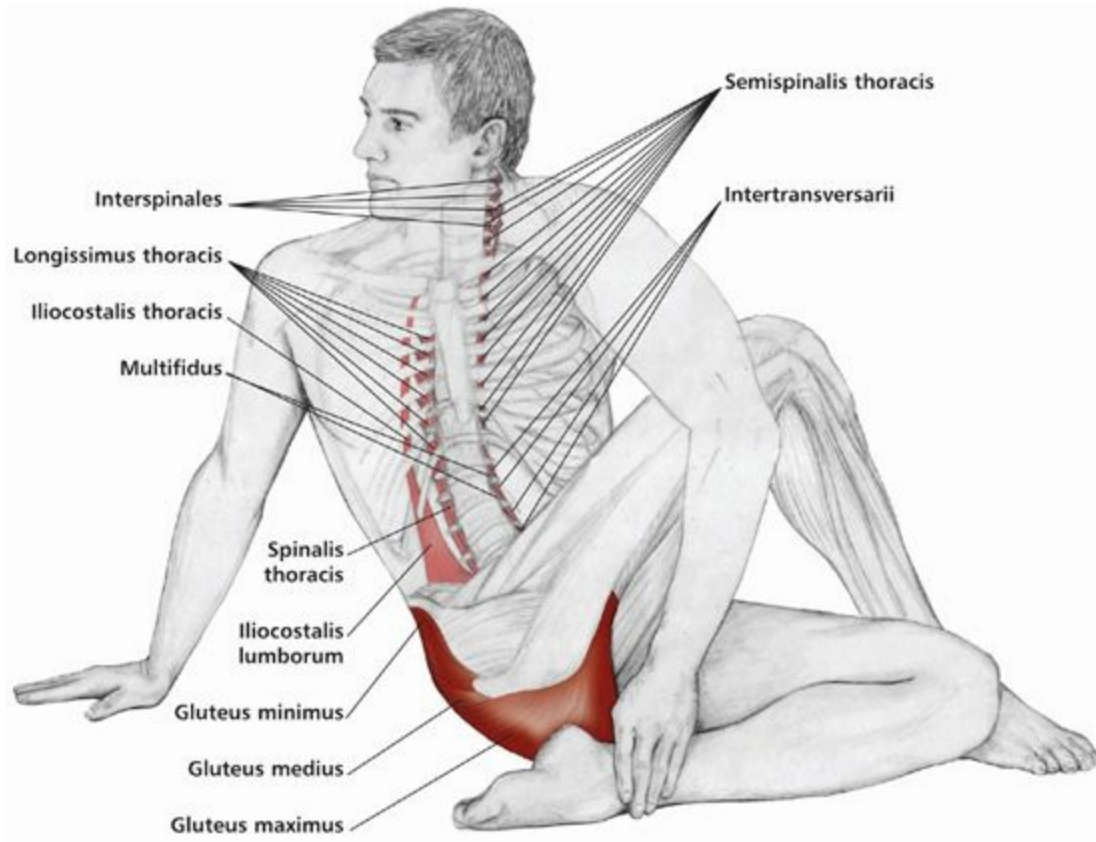
**Additional information for performing this stretch correctly**

Keep your hips straight and concentrate on rotating your lower back.

**Complementary stretch**

[D16](#).

# D19: SITTING KNEE-UP EXTENDED ROTATION STRETCH



## Technique

Sit with one leg crossed under the other and the other foot crossed over your knee; then turn your shoulders and put your arm onto your raised knee to help rotate your shoulders and back.

## Muscles being stretched

Primary muscles: Gluteus maximus, medius, and minimus.

Secondary muscles: Semispinalis thoracis. Spinalis thoracis. Longissimus thoracis. Iliocostalis thoracis. Iliocostalis lumborum. Multifidus. Rotatores. Intertransversarii. Interspinales.

## Sports that benefit from this stretch

Cycling. Hiking. Backpacking. Mountaineering. Orienteering. Ice hockey. Field hockey. Ice-skating. Roller-skating. Inline skating. Martial arts. Running. Track. Cross-country. Soccer. American football (gridiron). Rugby. Snow skiing. Water skiing. Walking. Race walking. Wrestling.

## Sports injury where stretch may be useful

Lower back muscle strain. Lower back ligament sprain. Abdominal muscle strain (obliques). Iliotibial band syndrome.

## Common problems and more information for performing this stretch correctly

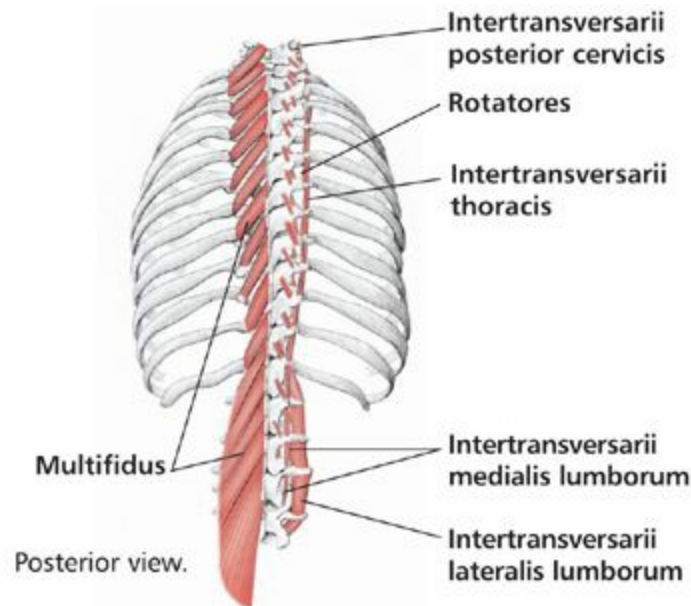
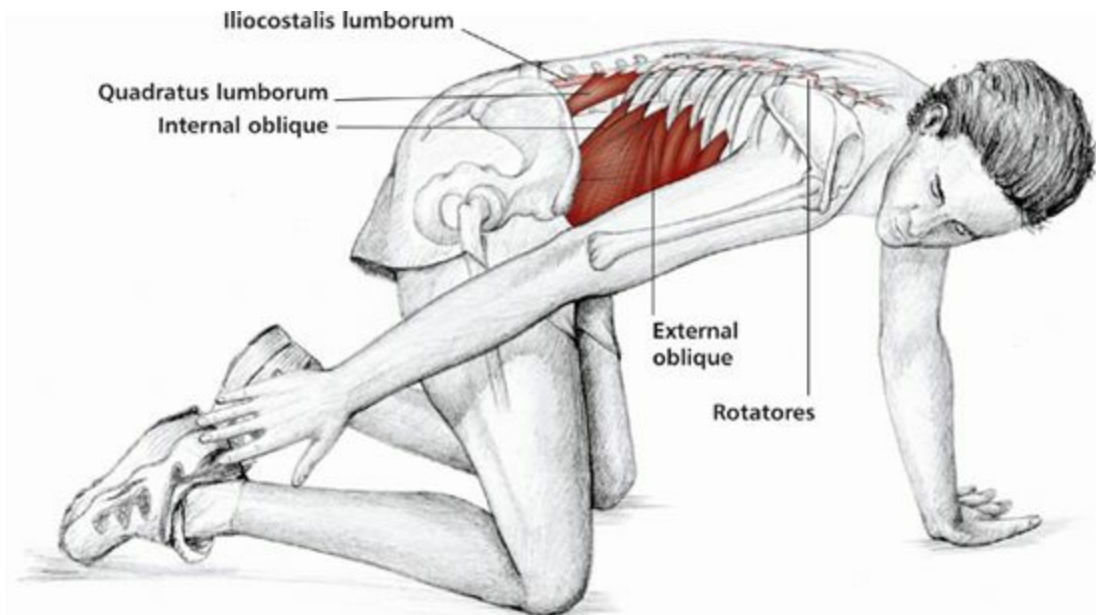
Keep your hips straight and concentrate on rotating your lower back. This stretch also requires a good

level of hip flexibility; do not perform if you experience pain or excessive tension in the hips.

### **Complementary stretches**

[D17](#), [D21](#).

# D20: KNEELING REACH-AROUND STRETCH



## Technique

Kneel on your hands and knees and then take one hand and reach around towards your ankle. Keep your back parallel to the ground.

## Muscles being stretched

Primary muscles: Quadratus lumborum. External and internal obliques.

Secondary muscles: Iliocostalis lumborum. Intertransversarii. Rotatores. Multifidus.

## Sports that benefit from this stretch

Cricket. Baseball. Softball. Boxing. American football (gridiron). Rugby. Hiking. Backpacking. Mountaineering. Orienteering. Ice hockey. Field hockey. Martial arts. Rowing. Canoeing. Kayaking.

Surfing. Wrestling.

**Sports injury where stretch may be useful**

Lower back muscle strain. Lower back ligament sprain. Abdominal muscle strain (obliques).

**Additional information for performing this stretch correctly**

Keep your thighs vertical, (straight up and down) and your back straight and parallel to the ground.

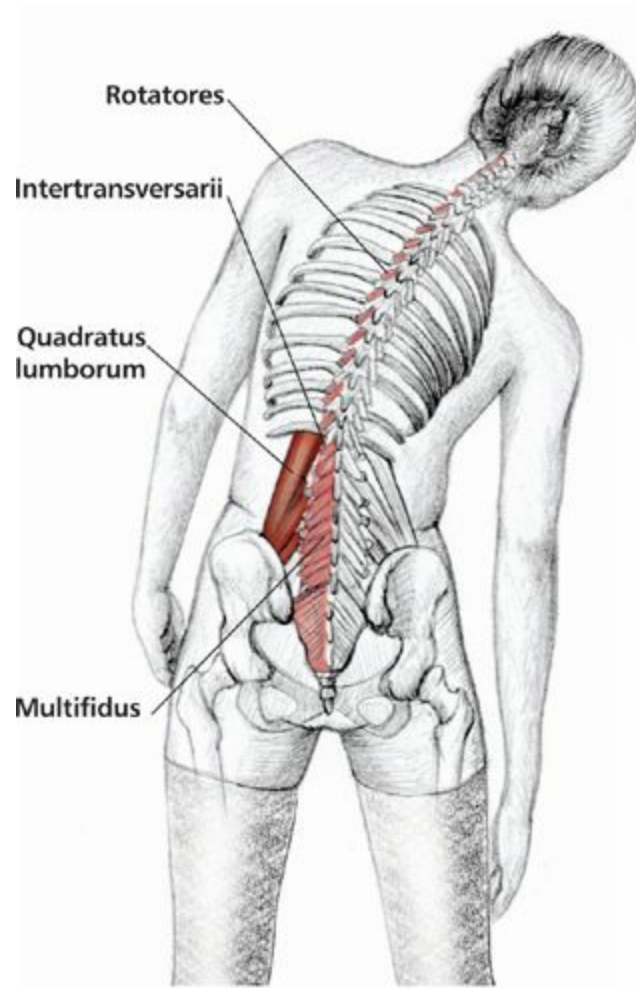
Balance your weight evenly on both your knees and your hand.

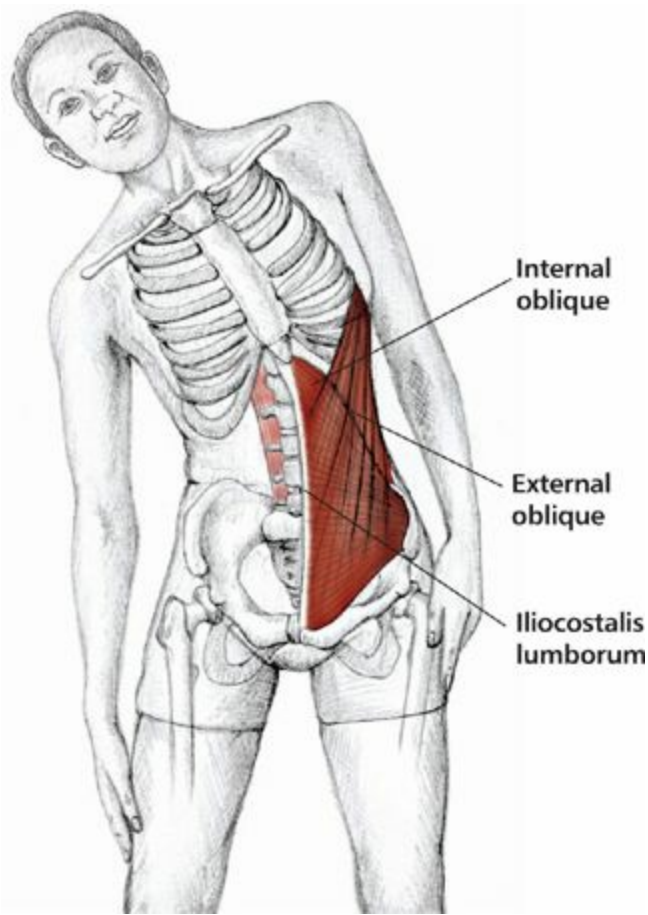
**Complementary stretch**

[D23](#).



## D21: STANDING LATERAL SIDE STRETCH





### **Technique**

Stand with your feet about shoulder-width apart and look forward. Keep your body upright and slowly bend to the left or right. Reach down your leg with your hand and do not bend forward.

### **Muscles being stretched**

Primary muscles: Quadratus lumborum. External and internal obliques.

Secondary muscles: Iliocostalis lumborum. Intertransversarii. Rotatores. Multifidus.

### **Sports that benefit from this stretch**

Cricket. Baseball. Softball. Boxing. American football (gridiron). Rugby. Hiking. Backpacking. Mountaineering. Orienteering. Ice hockey. Field hockey. Martial arts. Rowing. Canoeing. Kayaking. Surfing. Wrestling.

### **Sports injury where stretch may be useful**

Lower back muscle strain. Lower back ligament sprain. Abdominal muscle strain (obliques).

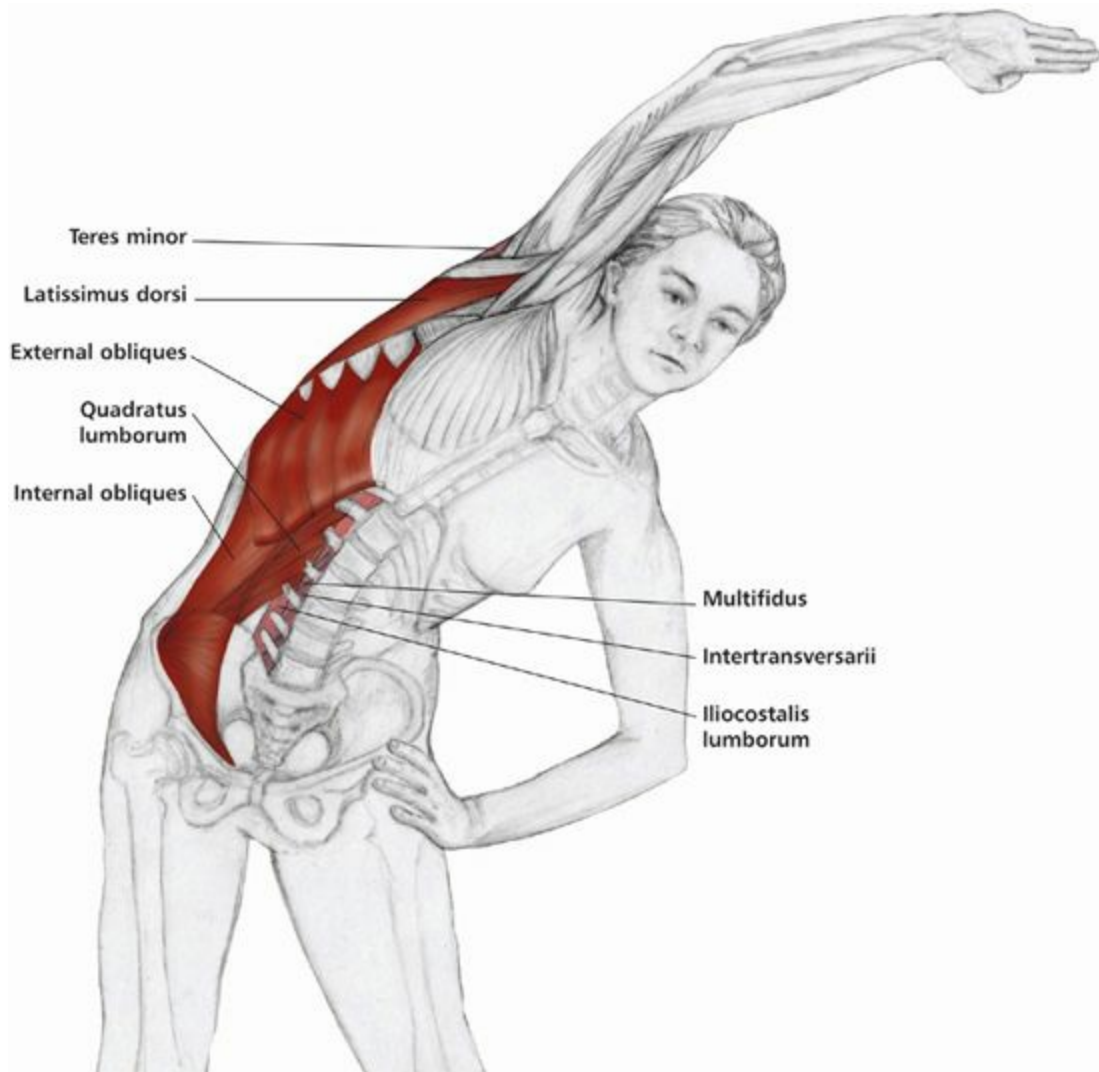
### **Additional information for performing this stretch correctly**

Do not lean forward or backward: concentrate on keeping your upper body straight.

### **Complementary stretch**

[D23](#).

## D22: REACHING LATERAL SIDE STRETCH



### Technique

Stand with your feet shoulder-width apart, then slowly bend to the side and reach over the top of your head with your hand. Do not bend forward.

### Muscles being stretched

Primary muscles: Quadratus lumborum. External and internal obliques. Latissimus dorsi.

Secondary muscles: Teres minor. Iliocostalis lumborum. Intertransversarii. Rotatores. Multifidus.

### Sports that benefit from this stretch

Cricket. Baseball. Softball. Boxing. Soccer. American football (gridiron). Rugby. Hiking. Backpacking. Mountaineering. Orienteering. Ice hockey. Field hockey. Martial arts. Rowing. Canoeing. Kayaking. Surfing. Wrestling.

### Sports injury where stretch may be useful

Lower back muscle strain. Lower back ligament sprain. Abdominal muscle strain (obliques).

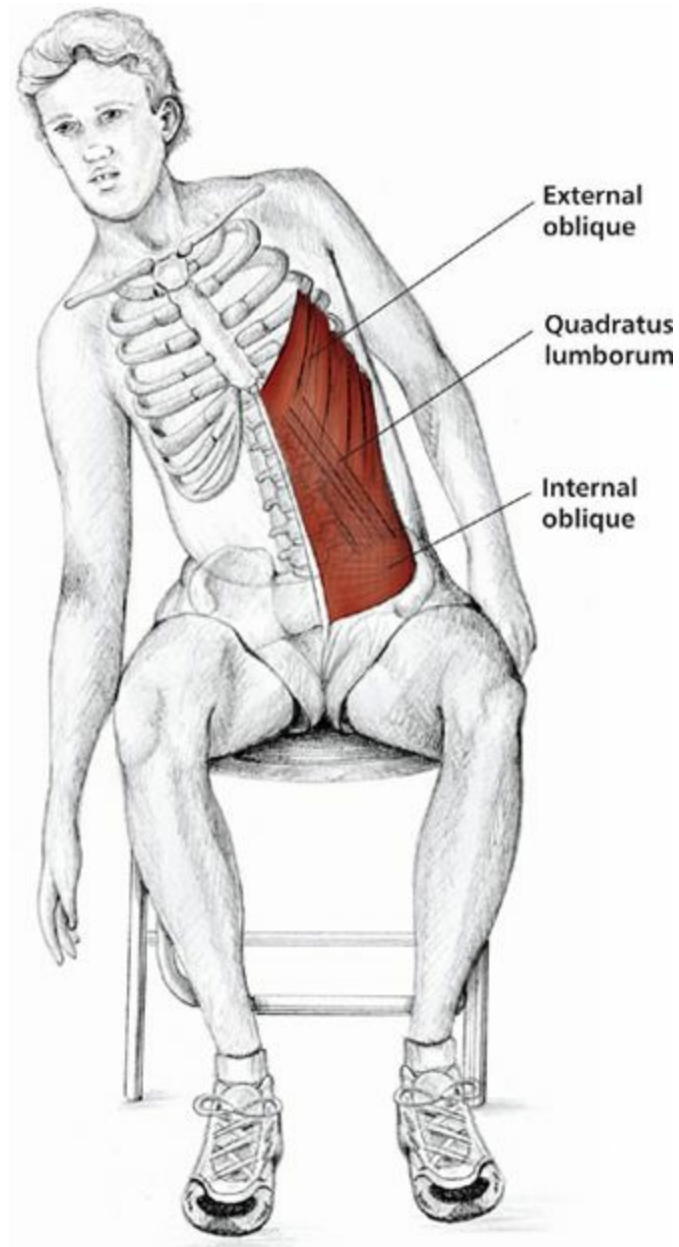
## **Common problems and more information for performing this stretch correctly**

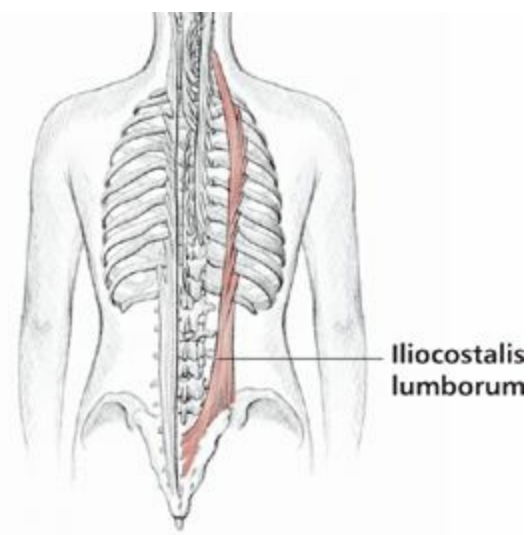
Do not lean forward or backward; concentrate on keeping your upper body straight.

## **Complementary stretches**

[D20](#), [D23](#).

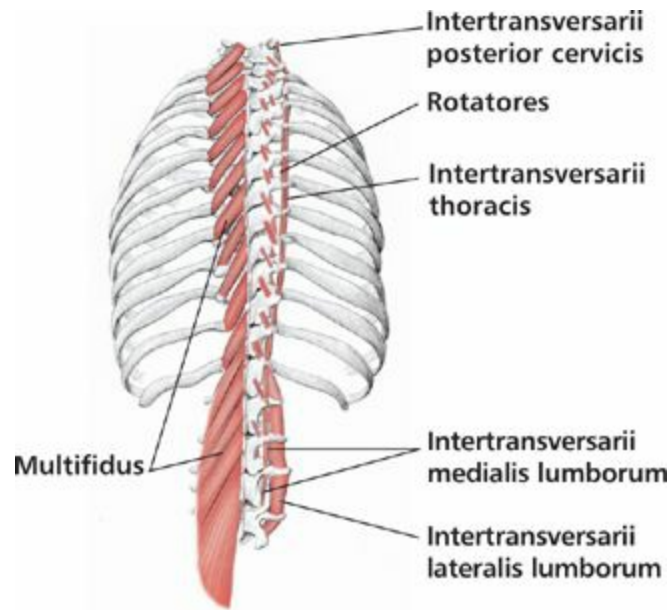
## D23: SITTING LATERAL SIDE STRETCH





Iliocostalis lumborum

Posterior view.



Posterior view.

## Technique

While sitting on a chair with your feet flat on the ground, look straight ahead and keep your body upright. Slowly bend to the left or right while reaching towards the ground with one hand. Do not bend forward.

## Muscles being stretched

Primary muscles: Quadratus lumborum. External and internal obliques.

Secondary muscles: Iliocostalis lumborum. Intertransversarii. Rotatores. Multifidus.

## Sports that benefit from this stretch

Cricket. Baseball. Softball. Boxing. American football (gridiron). Rugby. Hiking. Backpacking. Mountaineering. Orienteering. Ice hockey. Field hockey. Martial arts. Rowing. Canoeing. Kayaking. Surfing. Wrestling.

## Sports injury where stretch may be useful

Lower back muscle strain. Lower back ligament sprain. Abdominal muscle strain (obliques).

### **Additional information for performing this stretch correctly**

Do not lean forward or backward: concentrate on keeping your upper body straight.

### **Complementary stretch**

[D06](#).



## Hips and Buttocks

The hips and buttocks are comprised of a number of both large muscles (e.g., gluteus maximus) and small muscles (e.g., piriformis). These muscles are primarily responsible for hip stabilisation and lower leg movement. The muscles around the hip and buttocks, along with the structure of the hip joint, allow for a large range of movement of the lower leg; including flexion, extension, adduction, abduction, and rotation.

The **psoas major** runs downwards to be joined by the **iliacus**, together called the *iliopsoas*. Together, these muscles act as padding for various abdominal viscera, and leave the abdomen to become the main flexors of the hip joint, and stabilisers of the low back. Note that some upper fibers of psoas major may insert by a long tendon into the iliopubic eminence to form the **psoas minor**, which has little function and is absent in about 40% of people. Bilateral contracture of this muscle will increase lumbar lordosis.

The bulk of the buttock is mainly formed by the **gluteus maximus**, which is the largest and most superficial muscle of the group, lying posterior to smaller muscles such as gluteus medius and gluteus minimus. Gluteus maximus contributes to powerful hip extension for explosive activities such as sprinting.

**Piriformis** is a small, tubular muscle that originates at the internal surface of the sacrum, inserts at the superior border of the greater trochanter of the femur, and leaves the pelvis by passing through the greater sciatic foramen. The muscle assists in laterally rotating the hip joint, abducting the thigh when the hip is flexed, and helps to hold the head (ball) of the femur in the *acetabulum* (socket).

The **gemellus superior** and **gemellus inferior** (the *gemelli*) are small, thin muscles that cross the hip joint from the area of the ischium to the greater trochanter of the femur. Their path is almost horizontal across the joint.

Lying between the two gemelli, the **obturator internus** has a broad origin on a part of the pelvis called the *obturator foramen*, along with portions of the lower iliac bone. Besides being an outward rotator, it is a strong stabiliser of the hip.

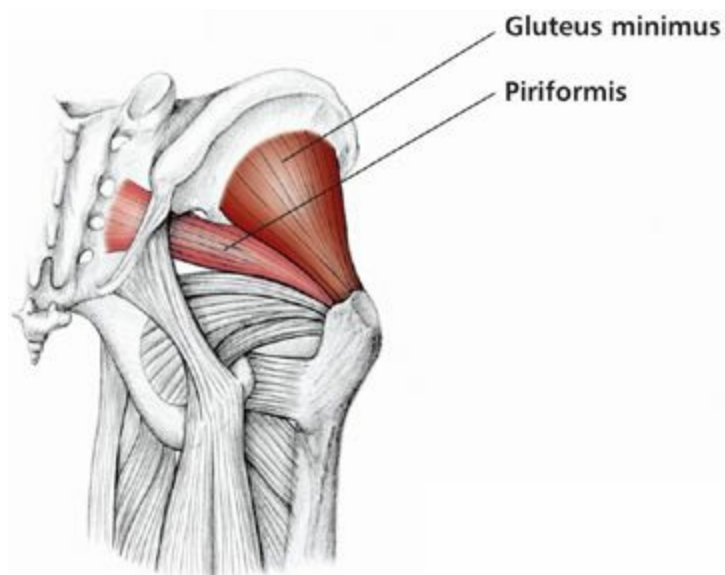
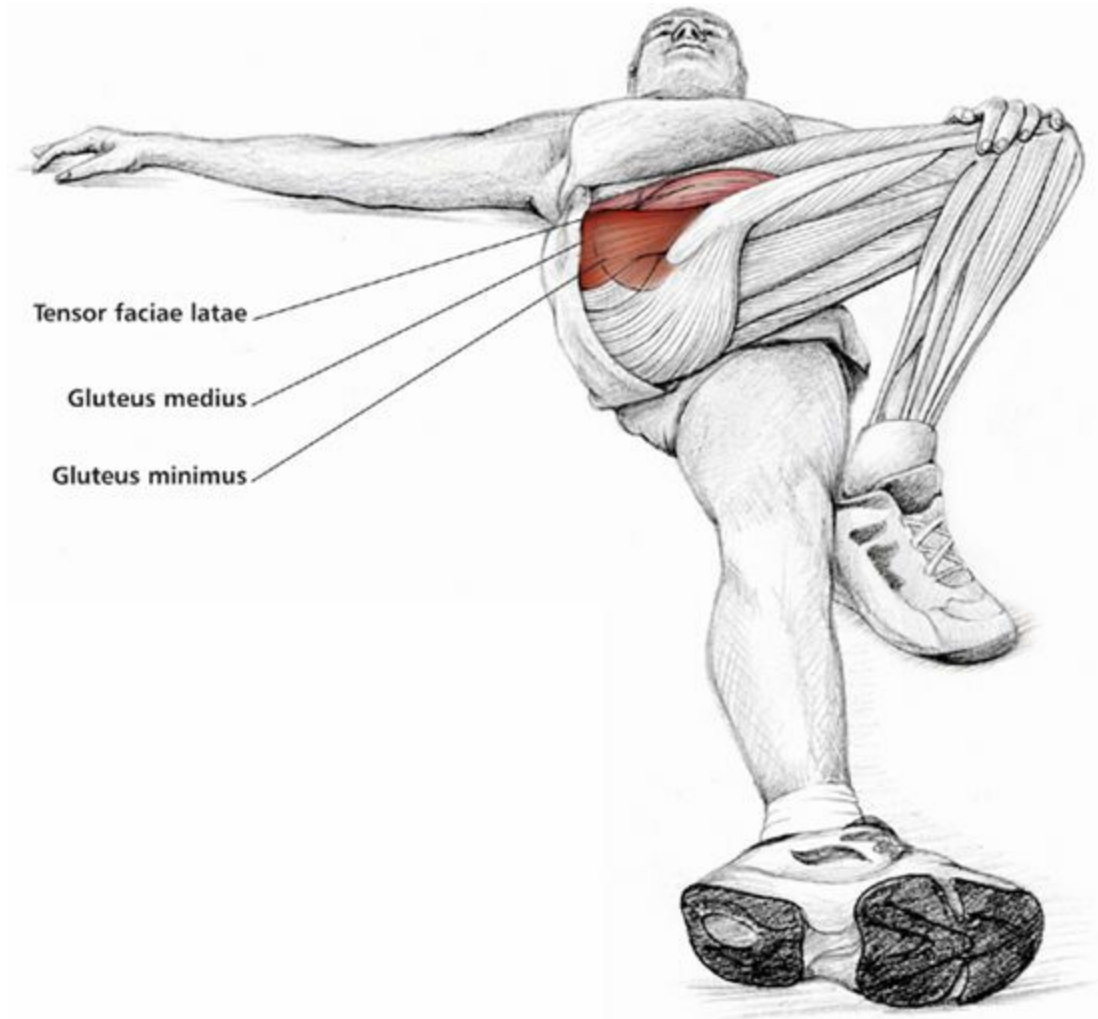


The **obturator externus** is an ideal rotator of the hip due to its position. It passes from the lower end of the obturator foramen, then behind the neck of the femur to attach to the greater trochanter of the femur on the medial side. Its line of pull allows the head of the femur to roll laterally inside the socket of the pelvis, creating outward, or external rotation.

The most inferior (lowest) deep rotator is the **quadratus femoris**; it is a short muscle running almost horizontal from the upper portion of the ischial tuberosity to the femur.

Sports that benefit from these hip and buttock stretches include: cycling; hiking, backpacking, mountaineering, and orienteering; ice hockey and field hockey; ice-skating, roller-skating and inline skating; martial arts; rowing, canoeing, and kayaking; running, track, and cross-country; running sports like soccer, American football (gridiron), and rugby; snow skiing and water skiing; walking and race walking.

# E01: LYING CROSS-OVER KNEE PULL-DOWN STRETCH



Right leg, posterolateral view.

## Technique

Lie on your back and cross one leg over the other. Bring your foot up to your opposite knee and with

your opposite arm pull your raised knee towards the ground.

### **Muscles being stretched**

Primary muscles: Gluteus medius and minimus.

Secondary muscles: Tensor fasciae latae. Piriformis.

### **Sports that benefit from this stretch**

Cycling. Hiking. Backpacking. Mountaineering. Orienteering. Ice hockey. Field hockey. Ice-skating. Roller-skating. Inline skating. Martial arts. Running. Track. Cross-country. American football (gridiron). Soccer. Rugby. Snow skiing. Water skiing. Walking. Race walking.

### **Sports injury where stretch may be useful**

Lower back muscle strain. Lower back ligament sprain. Iliotibial band syndrome.

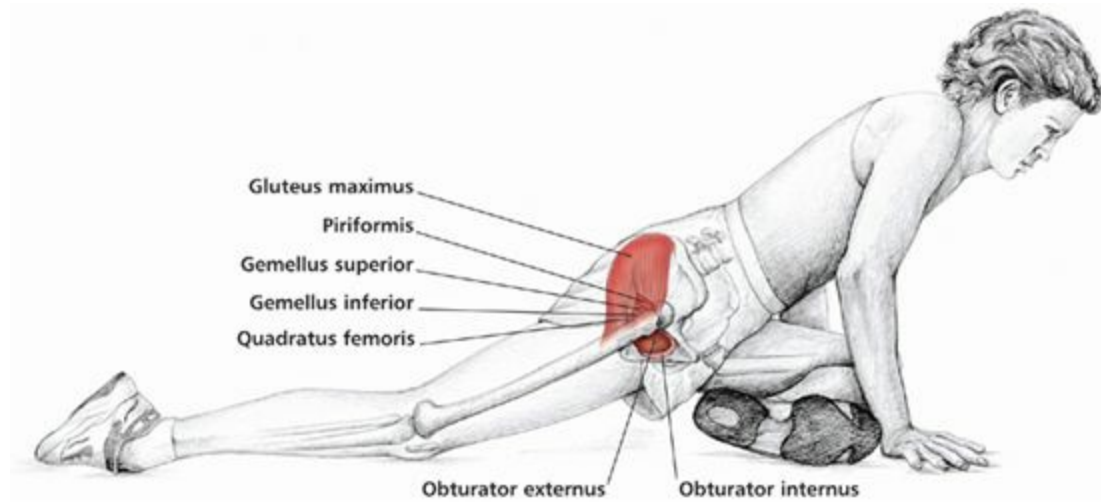
### **Additional information for performing this stretch correctly**

Keep your shoulders on the ground and concentrate on pulling your raised knee to the ground, not up towards your chest.

### **Complementary stretch**

[E09](#).

## E02: LYING LEG TUCK HIP STRETCH



### Technique

Lie on your stomach and bend one leg under your stomach. Lean towards the ground.

### Muscles being stretched

Primary muscles: Piriformis. Gemellus superior and inferior. Obturator internus and externus. Quadratus femoris.

Secondary muscle: Gluteus maximus.

### Sports that benefit from this stretch

Cycling. Hiking. Backpacking. Mountaineering. Orienteering. Ice hockey. Field hockey. Ice-skating. Roller-skating. Inline skating. Martial arts. Running. Track. Cross-country. American football (gridiron). Soccer. Rugby. Snow skiing. Water skiing. Walking. Race walking.

### Sports injury where stretch may be useful

Piriformis syndrome. Snapping hip syndrome. Trochanteric bursitis.

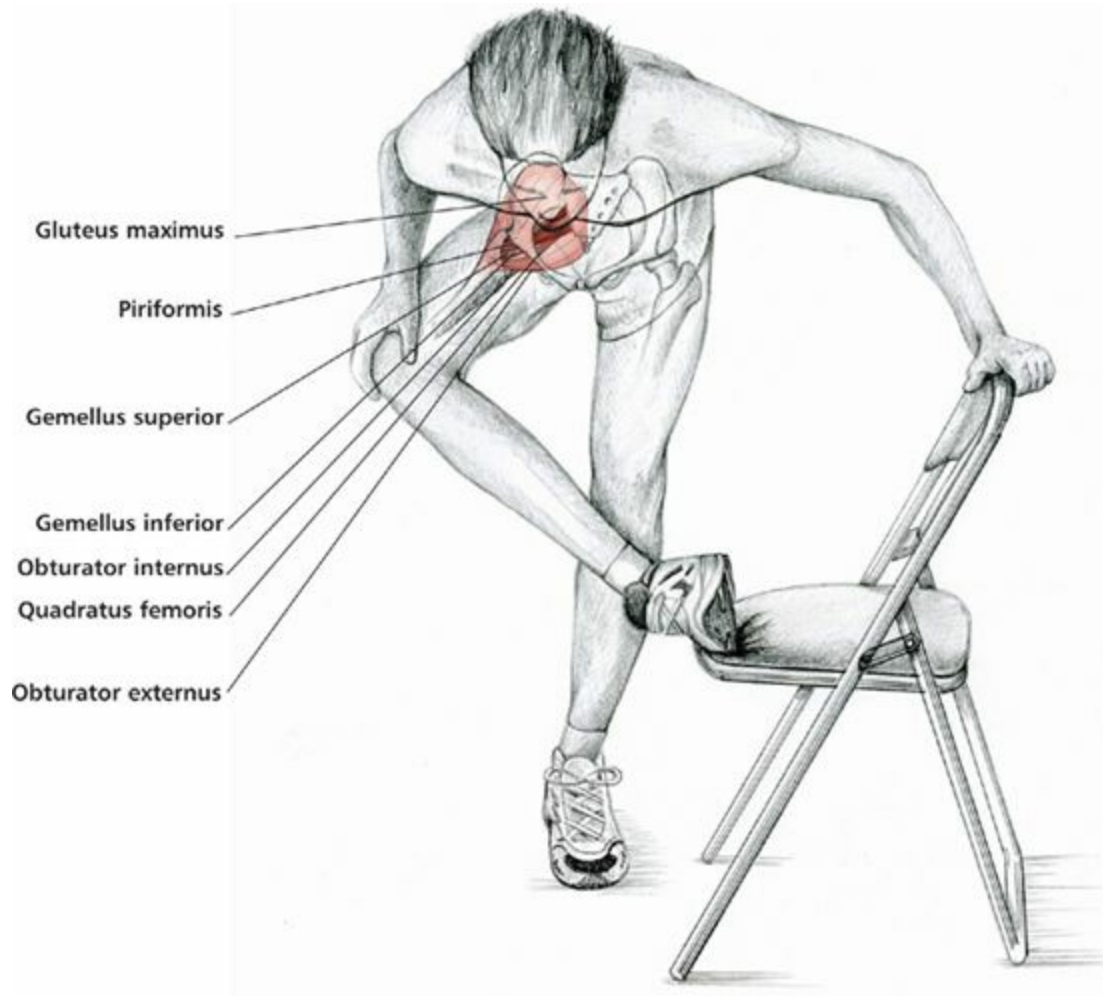
### Common problems and additional information for performing this stretch correctly

This position can be a little hard to get into, so make sure you are well supported and use your hands for balance.

### Complementary stretch

[E04.](#)

## E03: STANDING LEG TUCK HIP STRETCH



### **Technique**

Stand beside a chair or table and place the foot furthest from the object onto the object. Relax your leg, lean forward, and bend your other leg, lowering yourself towards the ground.

### **Muscles being stretched**

Primary muscles: Piriformis. Gemellus superior and inferior. Obturator internus and externus. Quadratus femoris.

Secondary muscle: Gluteus maximus.

### **Sports that benefit from this stretch**

Cycling. Hiking. Backpacking. Mountaineering. Orienteering. Ice hockey. Field hockey. Ice-skating. Roller-skating. Inline skating. Martial arts. Running. Track. Cross-country. American football (gridiron). Soccer. Rugby. Snow skiing. Water skiing. Walking. Race walking.

### **Sports injury where stretch may be useful**

Piriformis syndrome. Snapping hip syndrome. Trochanteric bursitis.

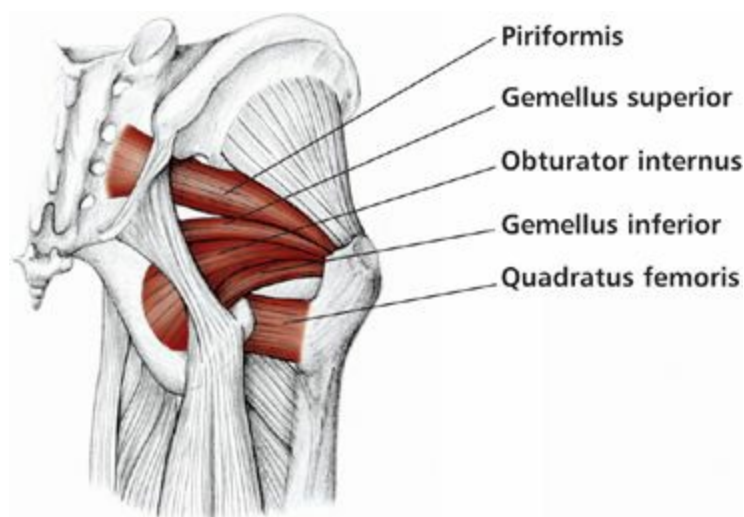
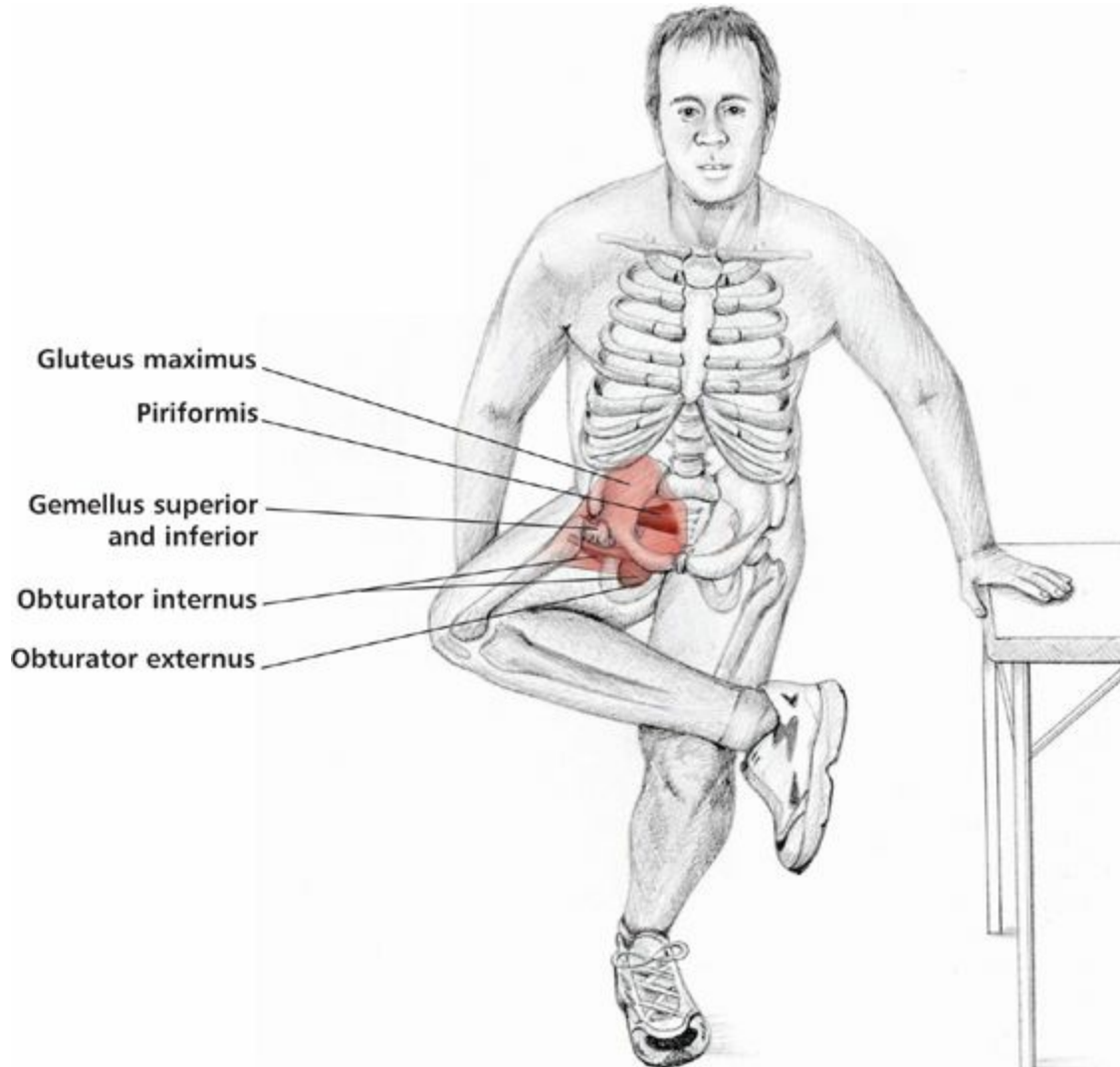
## **Common problems and additional information for performing this stretch correctly**

Use the leg you are standing on to regulate the intensity of this stretch. The lower you go, the more tension you will feel.

## **Complementary stretch**

[E02.](#)

# E04: STANDING LEG RESTING BUTTOCKS STRETCH



Right leg, posterolateral view.

## Technique

Stand beside a chair or table for balance, and place one ankle on your opposite knee. Slowly lower

yourself towards the ground.

### **Muscles being stretched**

Primary muscles: Piriformis. Gemellus superior and inferior. Obturator internus and externus. Quadratus femoris.

Secondary muscle: Gluteus maximus.

### **Sports that benefit from this stretch**

Cycling. Hiking. Backpacking. Mountaineering. Orienteering. Ice hockey. Field hockey. Iceskating. Roller-skating. Inline skating. Martial arts. Running. Track. Cross-country. American football (gridiron). Soccer. Rugby. Snow skiing. Water skiing. Walking. Race walking.

### **Sports injury where stretch may be useful**

Piriformis syndrome. Snapping hip syndrome. Trochanteric bursitis.

### **Common problems and additional information for performing this stretch correctly**

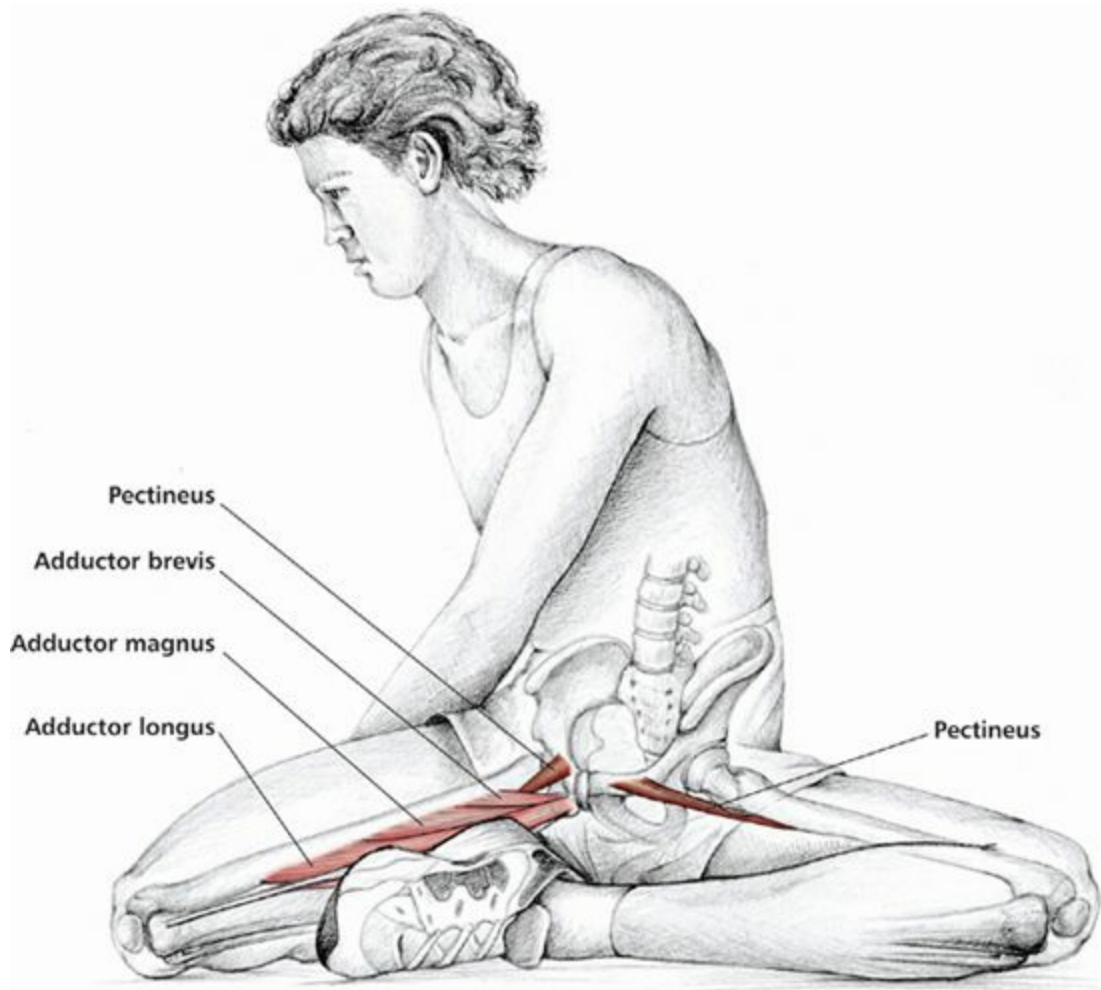
Use the leg you are standing on to regulate the intensity of this stretch. The lower you go, the more tension you will feel.

### **Complementary stretch**

[E10](#).



## E05: SITTING ROTATIONAL HIP STRETCH



### Technique

Sit with one leg crossed and your other leg behind your buttocks. Lean your whole body towards the leg that is behind your buttocks.

### Muscles being stretched

Primary muscle: Pectineus.

Secondary muscles: Adductor longus, brevis, and magnus.

### Sports that benefit from this stretch

Cycling. Hiking. Backpacking. Mountaineering. Orienteering. Ice hockey. Field hockey. Ice-skating. Roller-skating. Inline skating. Martial arts. Running. Track. Cross-country. American football (gridiron). Soccer. Rugby. Snow skiing. Water skiing. Walking. Race walking.

### Sports injury where stretch may be useful

Groin strain. Tendonitis of the adductor muscles. Snapping hip syndrome. Trochanteric bursitis.

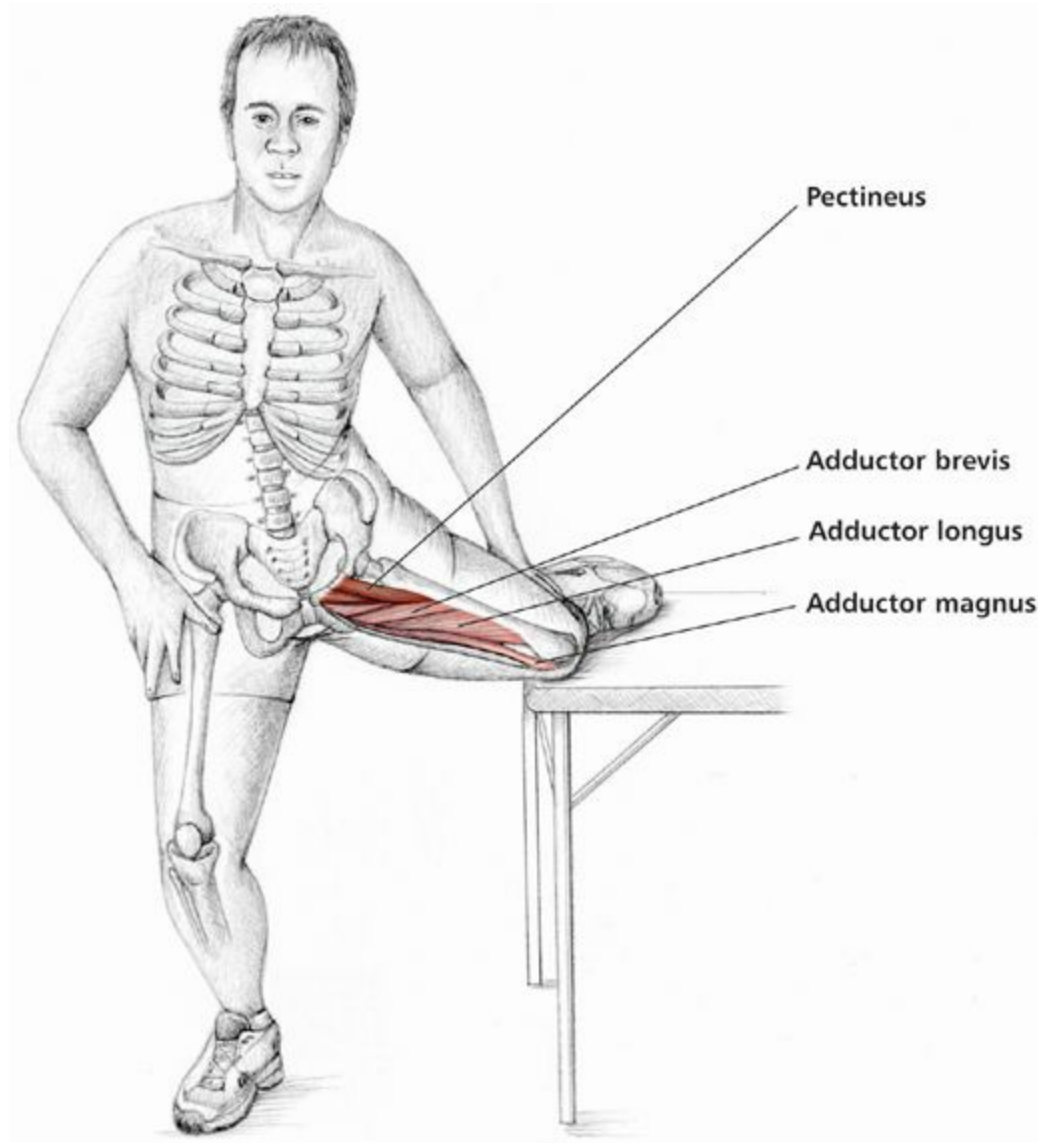
### **Additional information for performing this stretch correctly**

The more you lean your whole body towards the leg that is behind your buttocks, the more tension you will feel.

### **Complementary stretch**

[E06](#).

## E06: STANDING ROTATIONAL HIP STRETCH



### **Technique**

Stand beside a table and raise your lower leg out to the side and up onto the table. Then slowly lower your body.

### **Muscles being stretched**

Primary muscle: Pectineus.

Secondary muscles: Adductor longus, brevis, and magnus.

### **Sports that benefit from this stretch**

Cycling. Hiking. Backpacking. Mountaineering. Orienteering. Ice hockey. Field hockey. Iceskating. Roller-skating. Inline skating. Martial arts. Running. Track. Cross-country. American football (gridiron). Soccer. Rugby. Snow skiing. Water skiing. Walking. Race walking.

### **Sports injury where stretch may be useful**

Groin strain. Tendonitis of the adductor muscles. Snapping hip syndrome. Trochanteric bursitis.

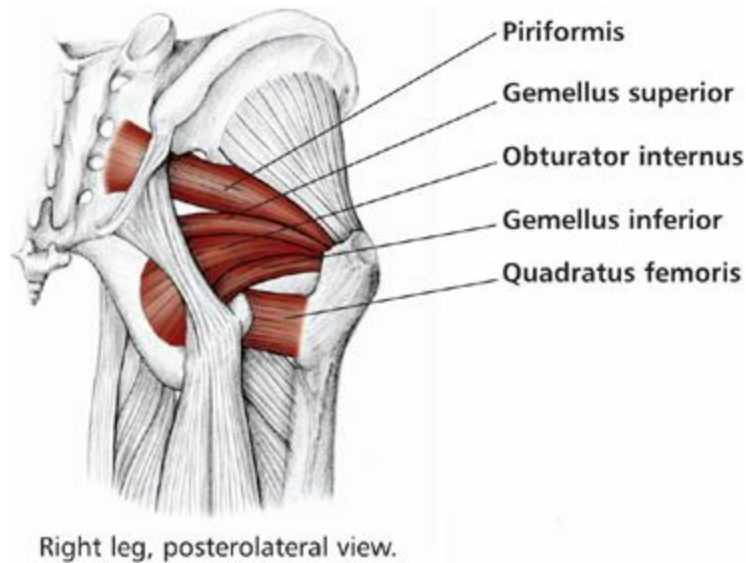
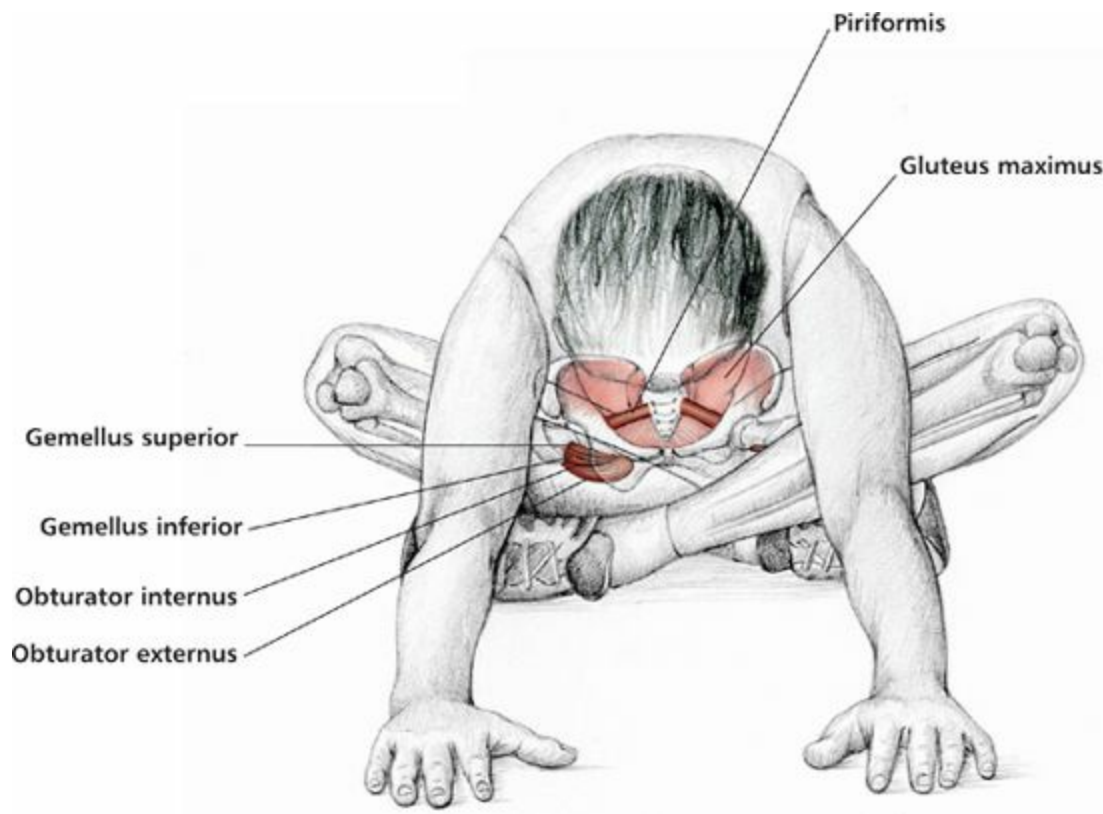
**Common problems and additional information for performing this stretch correctly**

Use the leg you are standing on to regulate the intensity of this stretch. The lower you go, the more tension you will feel.

**Complementary stretch**

[E05](#).

# E07: SITTING CROSS-LEGGED REACH FORWARD STRETCH



## Technique

Sit cross-legged and keep your back straight. Then gently lean forward.

## Muscles being stretched

Primary muscles: Piriformis. Gemellus superior and inferior. Obturator internus and externus. Quadratus femoris.

Secondary muscle: Gluteus maximus.

### **Sports that benefit from this stretch**

Cycling. Hiking. Backpacking. Mountaineering. Orienteering. Ice hockey. Field hockey. Iceskating. Roller-skating. Inline skating. Martial arts. Rowing. Canoeing. Kayaking. Running. Track. Cross country. American football (gridiron). Soccer. Rugby. Snow skiing. Water skiing. Walking. Race walking.

### **Sports injury where stretch may be useful**

Piriformis syndrome. Groin strain. Tendonitis of the adductor muscles. Snapping hip syndrome. Trochanteric bursitis.

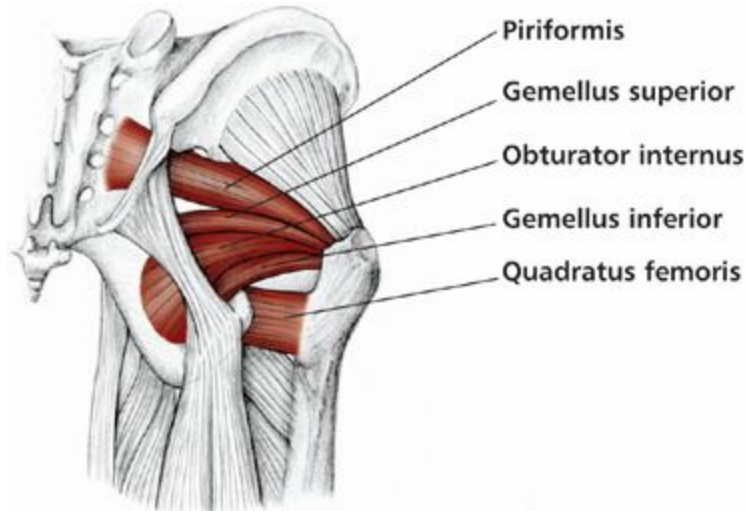
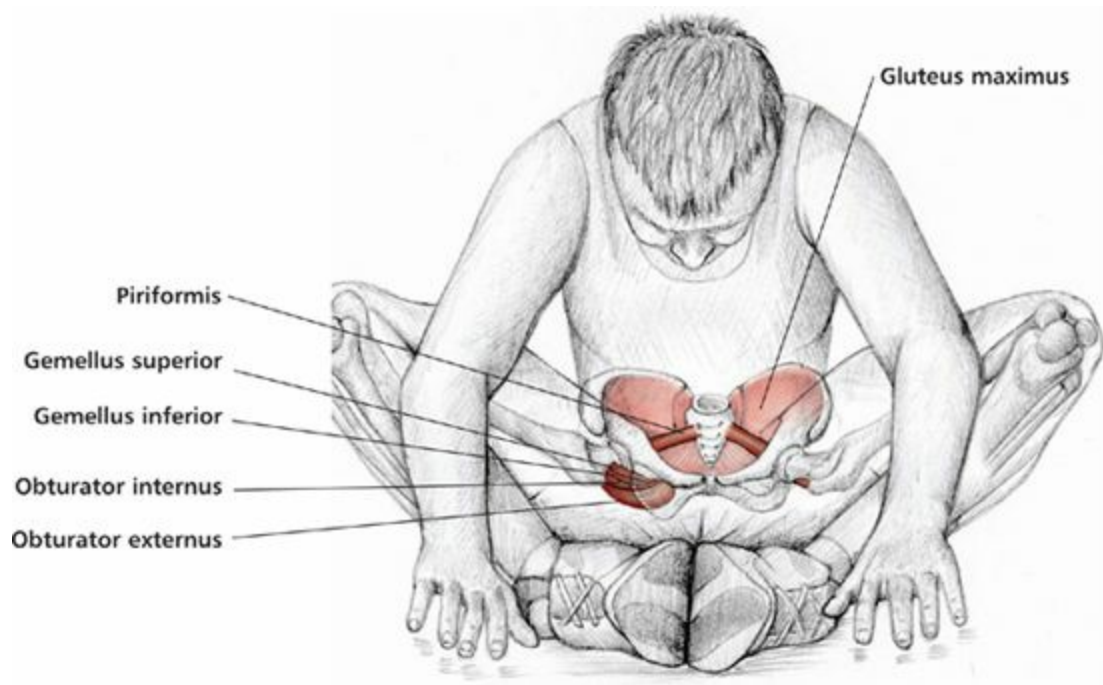
### **Common problems and additional information for performing this stretch correctly**

Make the emphasis of this stretch keeping your back straight, rather than trying to lean too far forward.

### **Complementary stretch**

[E08](#).

# E08: SITTING FEET-TOGETHER REACH FORWARD STRETCH



Right leg, posterolateral view.

## Technique

Sit with the soles of your feet together and keep your back straight. Then gently lean forward.

## Muscles being stretched

Primary muscles: Piriformis. Gemellus superior and inferior. Obturator internus and externus. Quadratus femoris.

Secondary muscle: Gluteus maximus.

## Sports that benefit from this stretch

Cycling. Hiking. Backpacking. Mountaineering. Orienteering. Ice hockey. Field hockey. Iceskating. Roller-skating. Inline skating. Martial arts. Rowing. Canoeing. Kayaking. Running. Track. Cross country. American football (gridiron). Soccer. Rugby. Snow skiing. Water skiing. Walking. Race walking.

**Sports injury where stretch may be useful**

Piriformis syndrome. Groin strain. Tendonitis of the adductor muscles. Snapping hip syndrome. Trochanteric bursitis.

**Common problems and additional information for performing this stretch correctly**

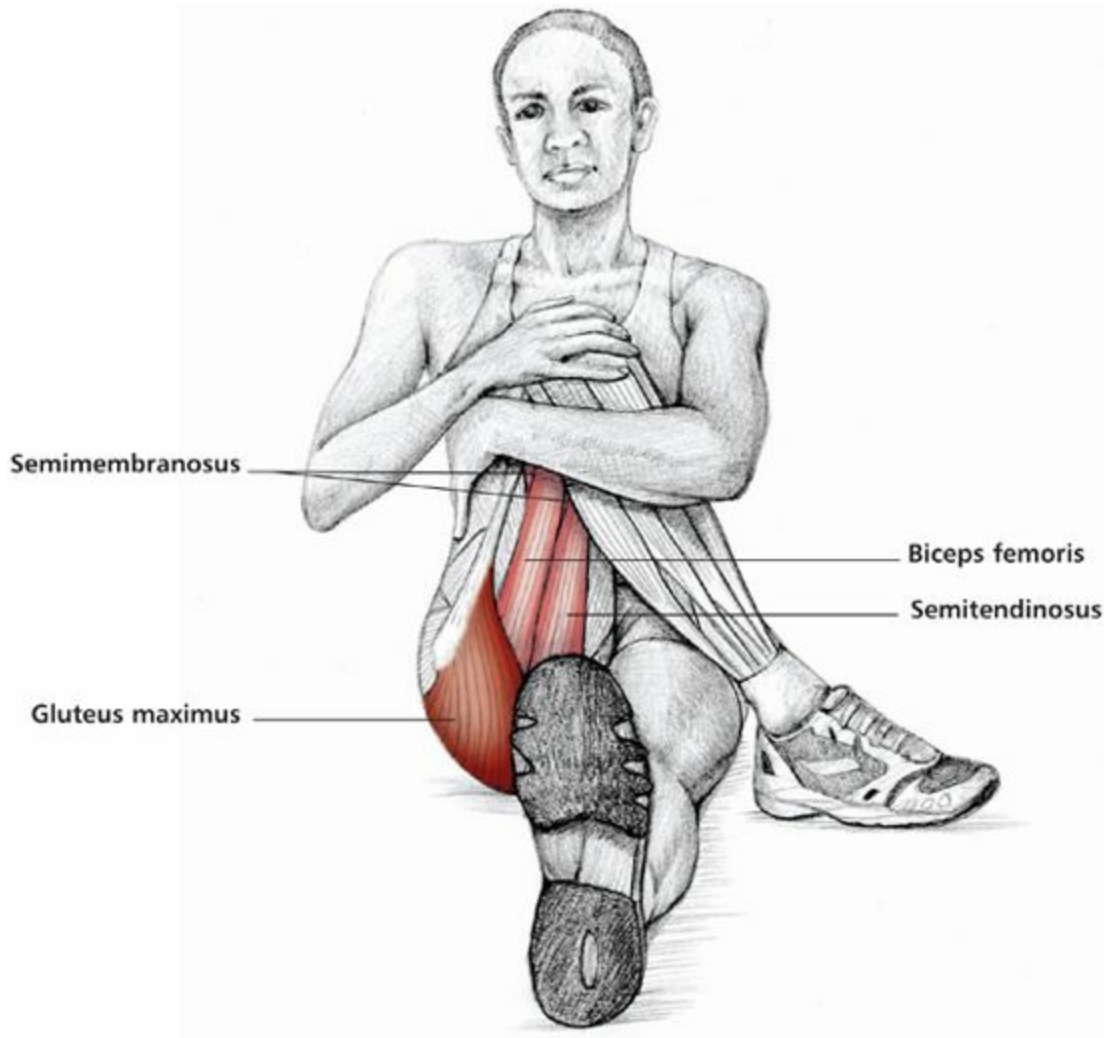
Make the emphasis of this stretch keeping your back straight, rather than trying to lean too far forward.

**Complementary stretch**

[E07](#).



## E09: SITTING KNEE-TO-CHEST BUTTOCKS STRETCH



### Technique

Sit with one leg straight and the other leg crossed over your knee. Pull the raised knee towards your opposite shoulder while keeping your back straight and your shoulders facing forward.

### Muscles being stretched

Primary muscle: Gluteus maximus.

Secondary muscles: Semimembranosus. Semitendinosus. Biceps femoris.

### Sports that benefit from this stretch

Cycling. Hiking. Backpacking. Mountaineering. Orienteering. Ice hockey. Field hockey. Ice-skating. Roller-skating. Inline skating. Martial arts. Running. Track. Cross-country. American football (gridiron). Soccer. Rugby. Snow skiing. Water skiing. Walking. Race walking.

### Sports injury where stretch may be useful

Lower back muscle strain. Lower back ligament sprain. Hamstring strain. Iliotibial band syndrome.

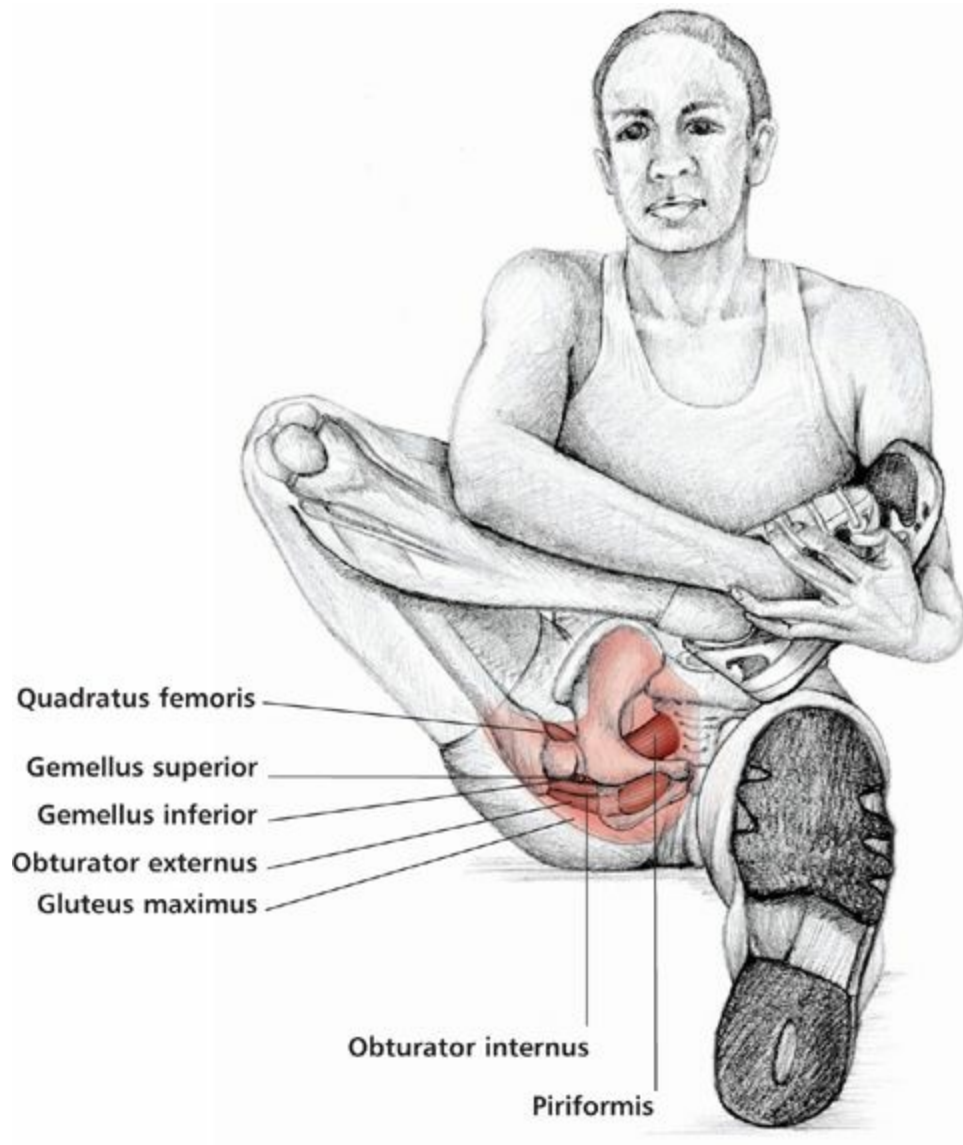
## **Common problems and additional information for performing this stretch correctly**

Keeping your back straight and your shoulders facing forward will ensure that your buttocks get the maximum benefit from this stretch. Resist the temptation to rotate your shoulders towards your knee.

## **Complementary stretch**

[E01](#).

# E10: SITTING FOOT-TO-CHEST BUTTOCKS STRETCH



## Technique

Sit with one leg straight and hold onto your other ankle. Pull it directly towards your chest.

## Muscles being stretched

Primary muscles: Piriformis. Gemellus superior and inferior. Obturator internus and externus. Quadratus femoris.

Secondary muscle: Gluteus maximus.

## Sports that benefit from this stretch

Cycling. Hiking. Backpacking. Mountaineering. Orienteering. Ice hockey. Field hockey. Ice-skating. Roller-skating. Inline skating. Martial arts. Running. Track. Cross-country. American football (gridiron). Soccer. Rugby. Snow skiing. Water skiing. Walking. Race walking.

## **Sports injury where stretch may be useful**

Piriformis syndrome. Snapping hip syndrome. Trochanteric bursitis.

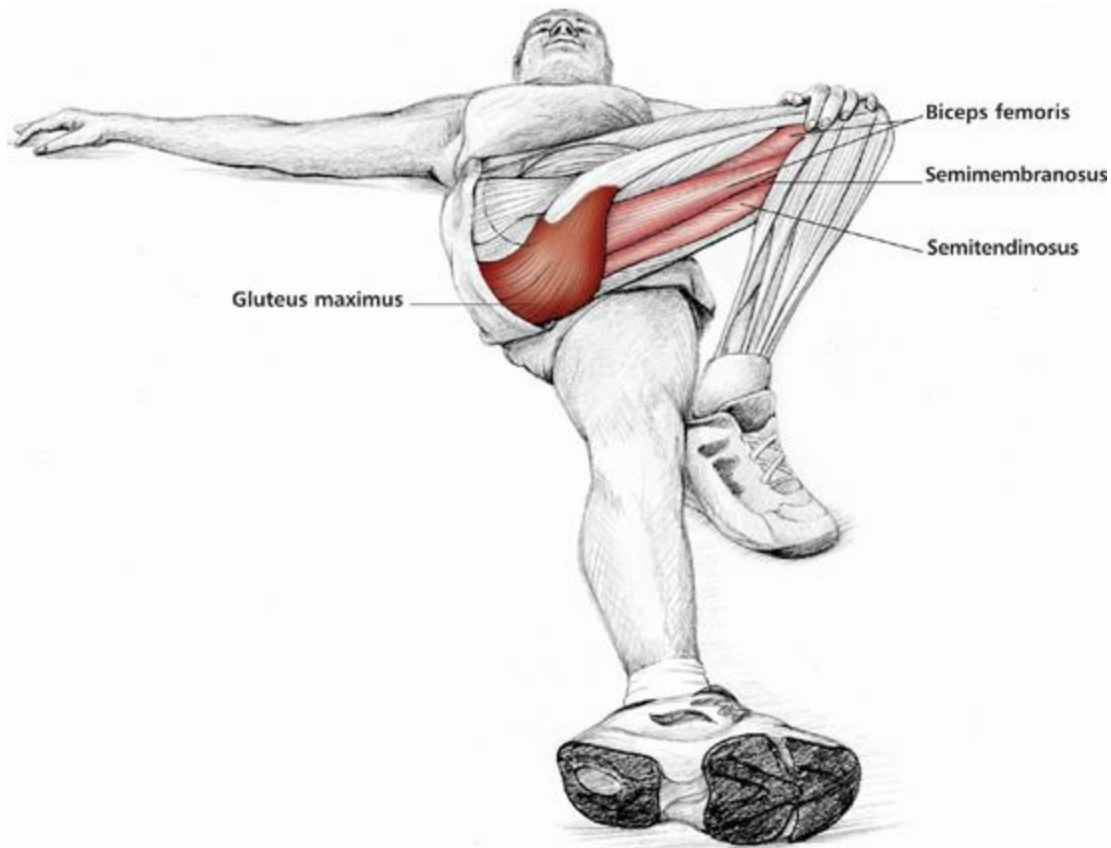
## **Common problems and additional information for performing this stretch correctly**

Use your hands and arms to regulate the intensity of this stretch. The closer you pull your foot to your chest, the more intense the stretch.

## **Complementary stretch**

[E04](#).

# E11: LYING CROSS-OVER KNEE PULL-UP STRETCH



## **Technique**

Lie on your back and cross one leg over the other. Bring your foot up to your opposite knee and with your opposite arm pull your raised knee up towards your chest.

## **Muscles being stretched**

Primary muscle: Gluteus maximus.

Secondary muscles: Semimembranosus. Semitendinosus. Biceps femoris.

## **Sports that benefit from this stretch**

Cycling. Hiking. Backpacking. Mountaineering. Orienteering. Ice hockey. Field hockey. Ice-skating. Roller-skating. Inline skating. Martial arts. Running. Track. Cross-country. American football (gridiron). Soccer. Rugby. Snow skiing. Water skiing. Walking. Race walking.

## **Sports injury where stretch may be useful**

Lower back muscle strain. Lower back ligament sprain. Hamstring strain. Iliotibial band syndrome.

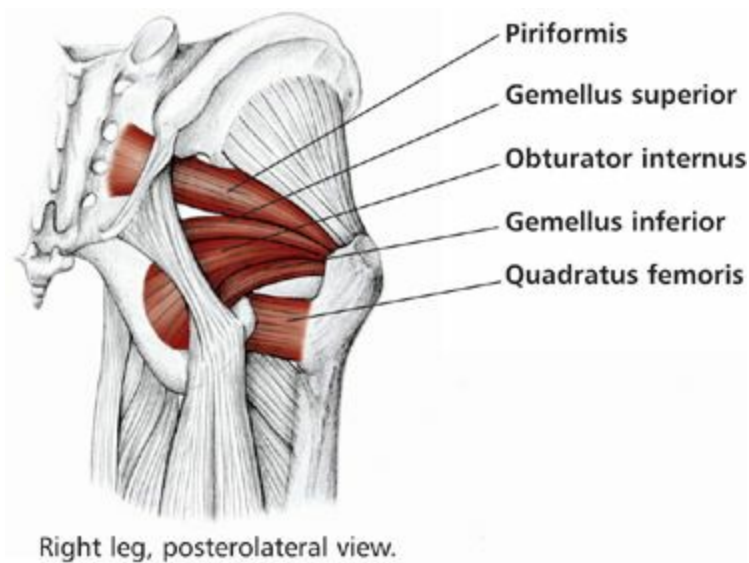
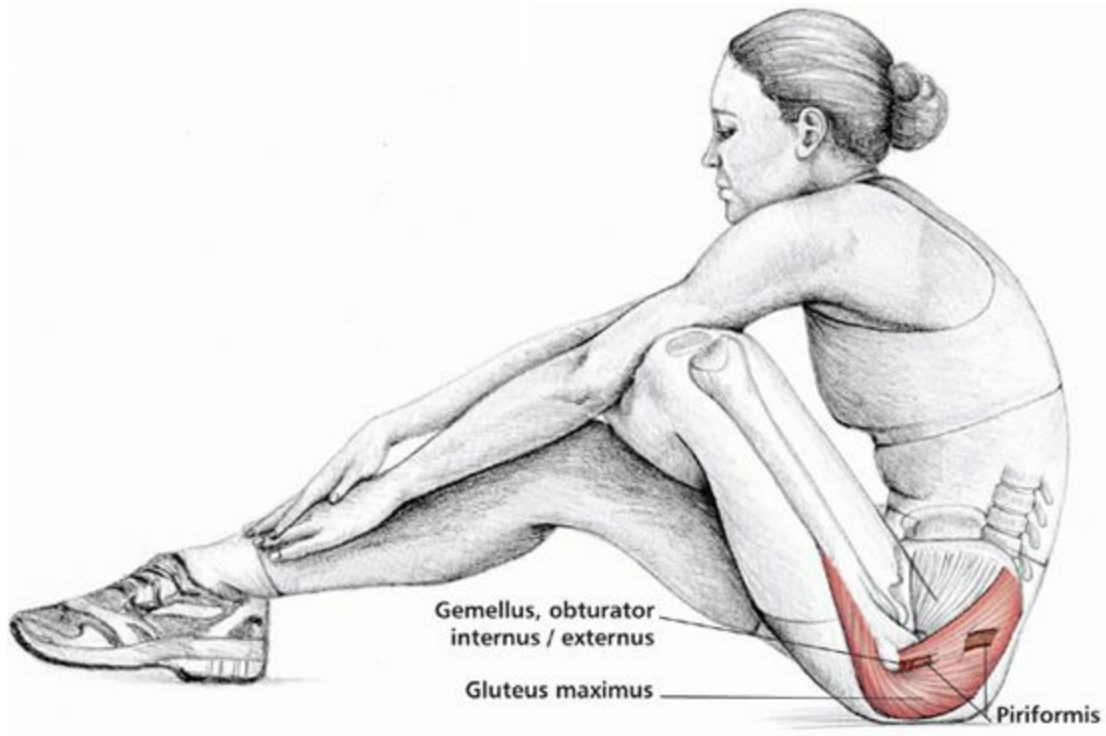
## **Additional information for performing this stretch correctly**

Keep your shoulders on the ground and concentrate on pulling your raised knee up towards your chest, not down towards the ground.

## Complementary stretch

E09.

## E12: SITTING LEG RESTING BUTTOCKS STRETCH



### Technique

Sit with one leg slightly bent. Raise the other foot up onto your raised leg and rest it on your thigh, then slowly lean forward.

### Muscles being stretched

Primary muscles: Piriformis. Gemellus superior and inferior. Obturator internus and externus. Quadratus femoris.

Secondary muscle: Gluteus maximus.

### **Sports that benefit from this stretch**

Cycling. Hiking. Backpacking. Mountaineering. Orienteering. Ice hockey. Field hockey. Iceskating. Roller-skating. Inline skating. Martial arts. Running. Track. Cross-country. American football (gridiron). Soccer. Rugby. Snow skiing. Water skiing. Walking. Race walking.

### **Sports injury where stretch may be useful**

Piriformis syndrome. Snapping hip syndrome. Trochanteric bursitis.

### **Common problems and additional information for performing this stretch correctly**

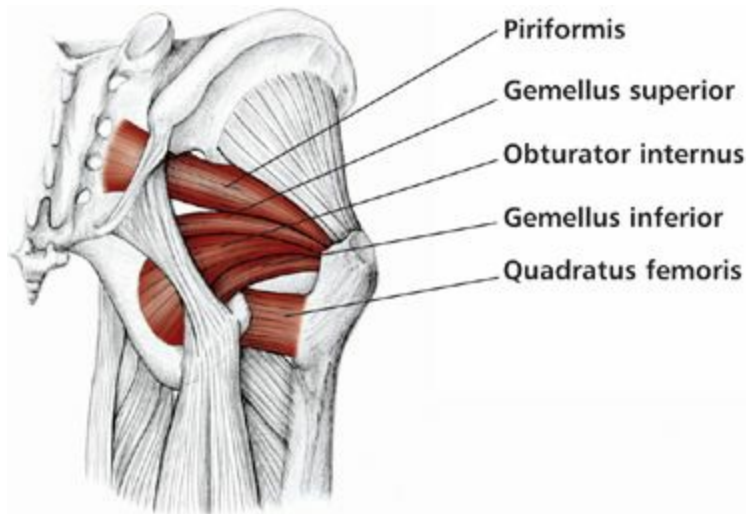
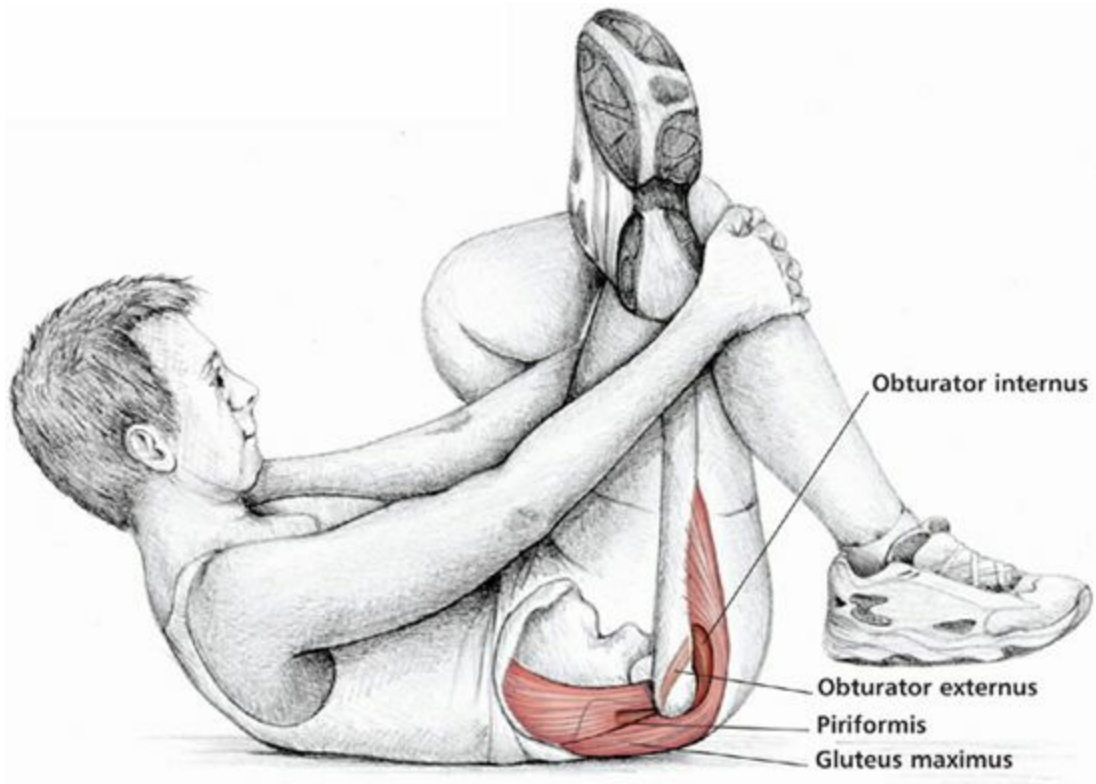
This position can be a little hard to get into, so make sure that you are well supported and use your hands for balance if you need to. To increase the intensity of this stretch, straighten your back and lean forward.

### **Complementary stretch**

[E10](#).



## E13: LYING LEG RESTING BUTTOCKS STRETCH



Right leg, posterolateral view.

### Technique

Lie on your back and slightly bend one leg. Raise the other foot up onto your bent leg and rest it on your thigh. Then reach forward, holding onto your knee and pull it towards you.

### Muscles being stretched

Primary muscles: Piriformis. Gemellus superior and inferior. Obturator internus and externus. Quadratus femoris.

Secondary muscle: Gluteus maximus.

### **Sports that benefit from this stretch**

Cycling. Hiking. Backpacking. Mountaineering. Orienteering. Ice hockey. Field hockey. Iceskating. Roller-skating. Inline skating. Martial arts. Running. Track. Cross-country. American football (gridiron). Soccer. Rugby. Snow skiing. Water skiing. Walking. Race walking.

### **Sports injury where stretch may be useful**

Piriformis syndrome. Snapping hip syndrome. Trochanteric bursitis.

### **Additional information for performing this stretch correctly**

Regulate the intensity of this stretch by pulling your knee towards you.

### **Complementary stretch**

[E12.](#)

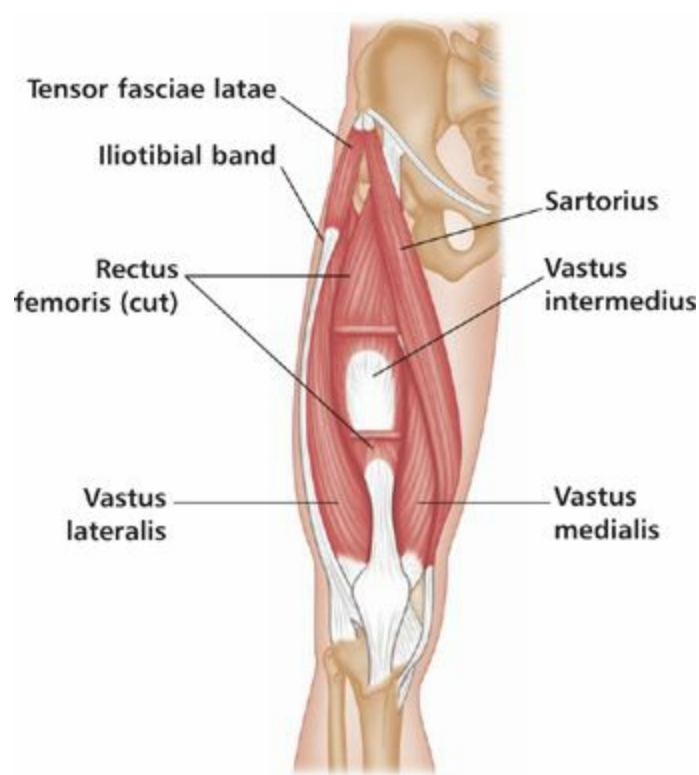


## Quadriceps

The quadriceps is a large group of muscles, the most massive of the leg, located in the anterior (front) of the thigh. They originate from above the hip joint and extend to below the knee. The primary action of the quadriceps is to extend the knee joint, but in conjunction with a number of other muscles in the front of the hip, they are also associated with hip flexion.

**Rectus femoris** is part of the quadriceps femoris, which also includes the vasti group: **vastus lateralis**, **vastus medialis**, and **vastus intermedius**. It has two heads of origin. The reflected head is in the line of pull of the muscle in four-footed animals, whereas the straight head seems to have developed in humans as a result of the upright posture. It is a spindle shaped bi-pennate muscle.

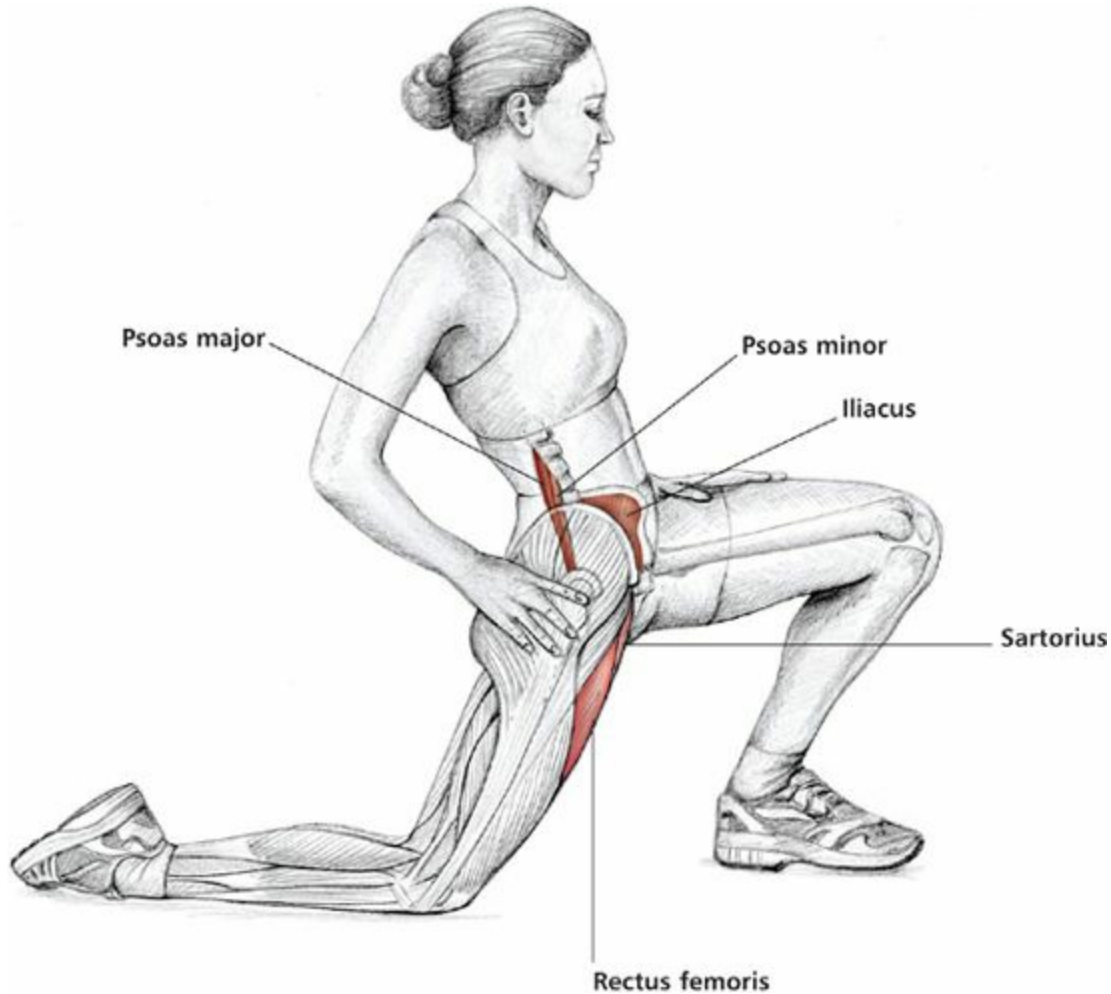
The quadriceps straighten the knee when rising from sitting, during walking, and climbing. The vasti muscles cross only the knee, and thus are limited to knee extension or resistance to knee flexion; they spread out to control the movement of sitting down. Vastus medialis is larger and heavier than vastus lateralis. Vastus intermedius is the deepest part of the quadriceps femoris, and has a membranous tendon on its anterior surface to allow a gliding movement between itself and the rectus femoris that overlies it. The quadriceps tendon attaches to, and covers the patella, becoming the patellar tendon below this and attaching to the tibia.



Included here is **sartorius**, not part of the quadriceps femoris group, but the most superficial muscle of the anterior thigh; it is also the longest strap muscle in the body. The medial border of the upper third of this muscle forms the lateral boundary of the femoral triangle (adductor longus forms the medial boundary; the inguinal ligament forms the superior boundary). The action of sartorius is to put the lower limbs in the cross-legged seated position of the tailor (hence its name from the Latin).

Sports that benefit from these quadriceps stretches include: cycling; hiking, backpacking, mountaineering, and orienteering; ice hockey and field hockey; ice-skating, roller-skating, and inline skating; martial arts; running, track, and cross-country; running sports like soccer, American football (gridiron), and rugby; snow skiing and water skiing; surfing; walking and race walking.

# F01: KNEELING QUAD STRETCH



## Technique

Kneel on one foot and the other knee. If needed, hold on to something to keep your balance. Push your hips forward.

## Muscles being stretched

Primary muscles: Iliacus. Psoas major and minor.

Secondary muscles: Rectus femoris. Sartorius.

## Sports that benefit from this stretch

Cycling. Hiking. Backpacking. Mountaineering. Orienteering. Ice hockey. Field hockey. Ice-skating. Roller-skating. Inline skating. Martial arts. Running. Track. Cross-country. American football (gridiron). Soccer. Rugby. Snow skiing. Water skiing. Surfing. Walking. Race walking.

## Sports injury where stretch may be useful

Hip flexor strain. Avulsion fracture in the pelvic area. Osteitis pubis. Iliopsoas tendonitis. Trochanteric bursitis. Quadriceps strain. Quadriceps tendonitis.

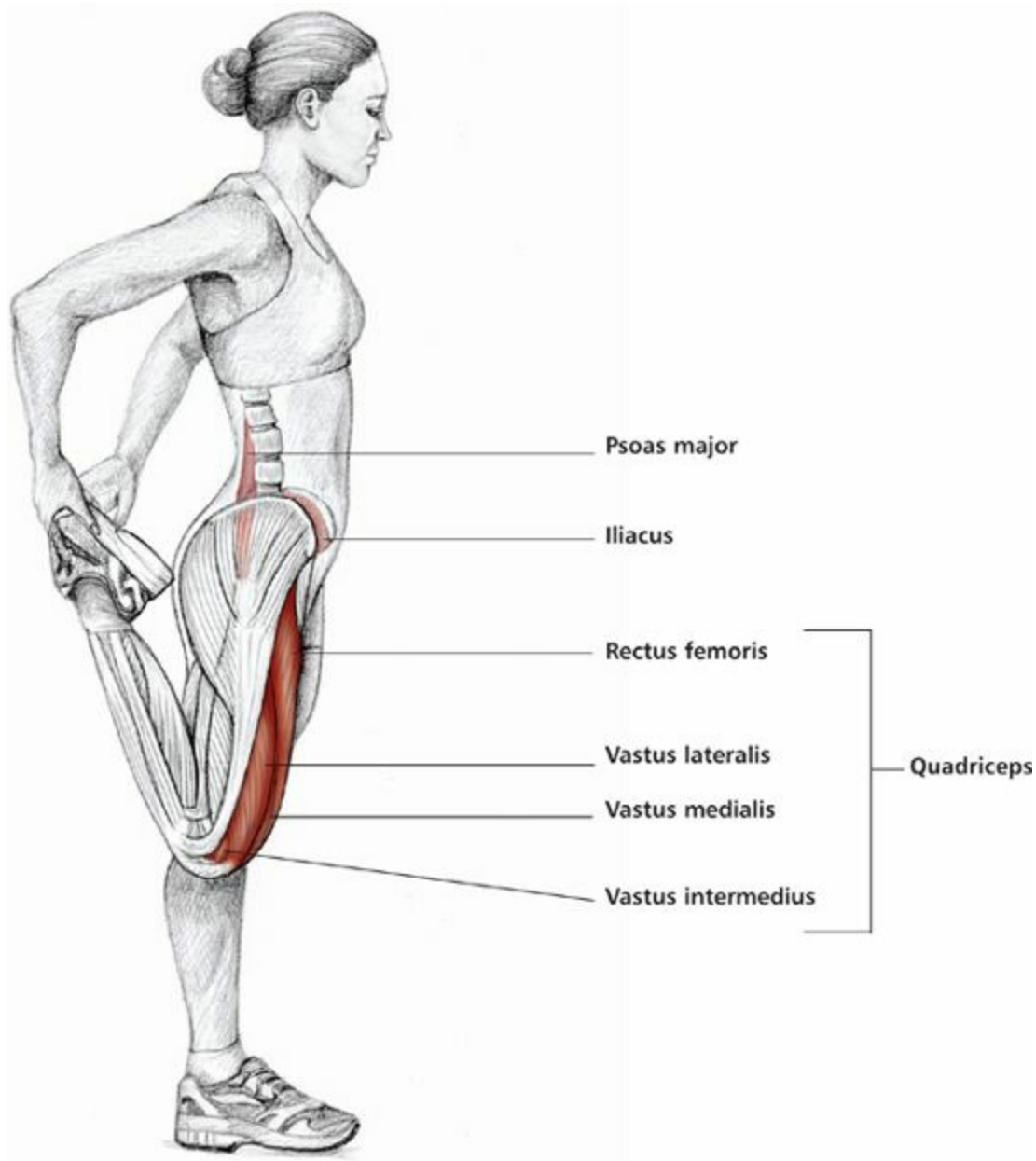
## **Common problems and more information for performing this stretch correctly**

Regulate the intensity of this stretch by pushing your hips forward. If need be, place a towel or mat under your knee for comfort.

## **Complementary stretch**

[F05](#).

## F02: STANDING QUAD STRETCH



### Technique

Stand upright while balancing on one leg. Pull your other foot up behind your buttocks and keep your knees together while pushing your hips forward. Hold on to something for balance.

### Muscles being stretched

Primary muscles: Rectus femoris. Vastus medialis, lateralis, and intermedius.

Secondary muscles: Iliacus. Psoas major.

### Sports that benefit from this stretch

Cycling. Hiking. Backpacking. Mountaineering. Orienteering. Ice hockey. Field hockey. Ice-skating. Roller-skating. Inline skating. Martial arts. Running. Track. Cross-country. American football.

(gridiron). Soccer. Rugby. Snow skiing. Water skiing. Surfing. Walking. Race walking.

### **Sports injury where stretch may be useful**

Hip flexor strain. Avulsion fracture in the pelvic area. Osteitis pubis. Iliopsoas tendonitis. Trochanteric bursitis. Quadriceps strain. Quadriceps tendonitis. Patellofemoral pain syndrome. Patellar tendonitis. Subluxing kneecap.

### **Common problems and more information for performing this stretch correctly**

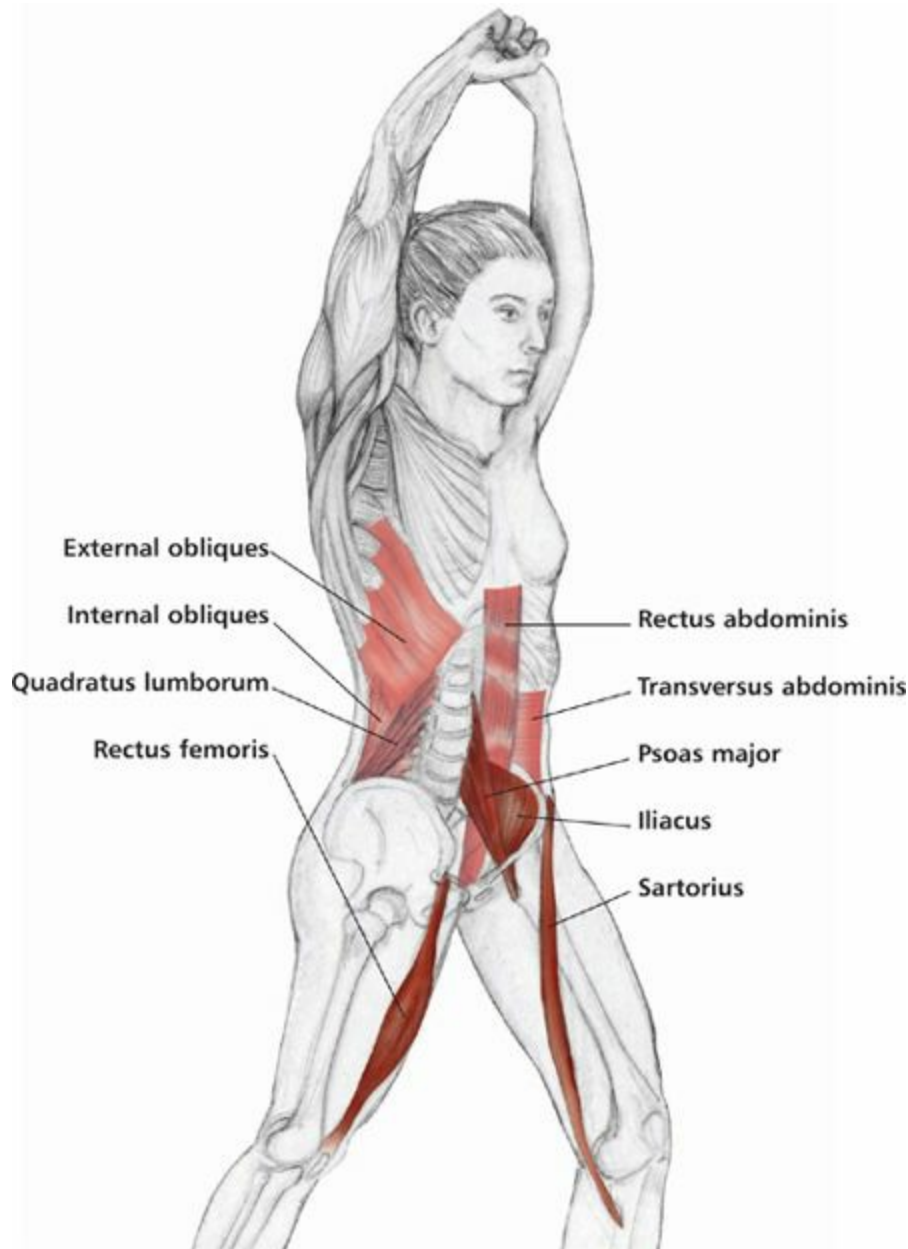
This position can put undue pressure on the knee joint and ligaments. Anyone with knee pain or knee injury should avoid this stretch.

### **Complementary stretch**

[F04](#).



## F03: STANDING REACH-UP QUAD STRETCH



### Technique

Stand upright and take one small step forward. Reach up with both hands, push your hips forward, lean back, and then lean away from your back leg.

### Muscles being stretched

Primary muscles: Rectus femoris. Psoas major. Iliacus. Sartorius.

Secondary muscles: Rectus abdominis. Transversus abdominis. External and internal obliques. Quadratus lumborum.

### Sports that benefit from this stretch

Cycling. Hiking. Backpacking. Mountaineering. Orienteering. Ice hockey. Field hockey. Ice-skating

Roller-skating. Inline skating. Martial arts. Running. Track. Cross-country. Soccer. American football (gridiron). Rugby. Snow skiing. Water skiing. Surfing. Walking. Race walking.

**Sports injury where stretch may be useful**

Hip flexor strain. Avulsion fracture in the pelvic area. Osteitis pubis. Iliopsoas tendonitis. Trochanteric bursitis. Quadriceps strain. Quadriceps tendonitis.

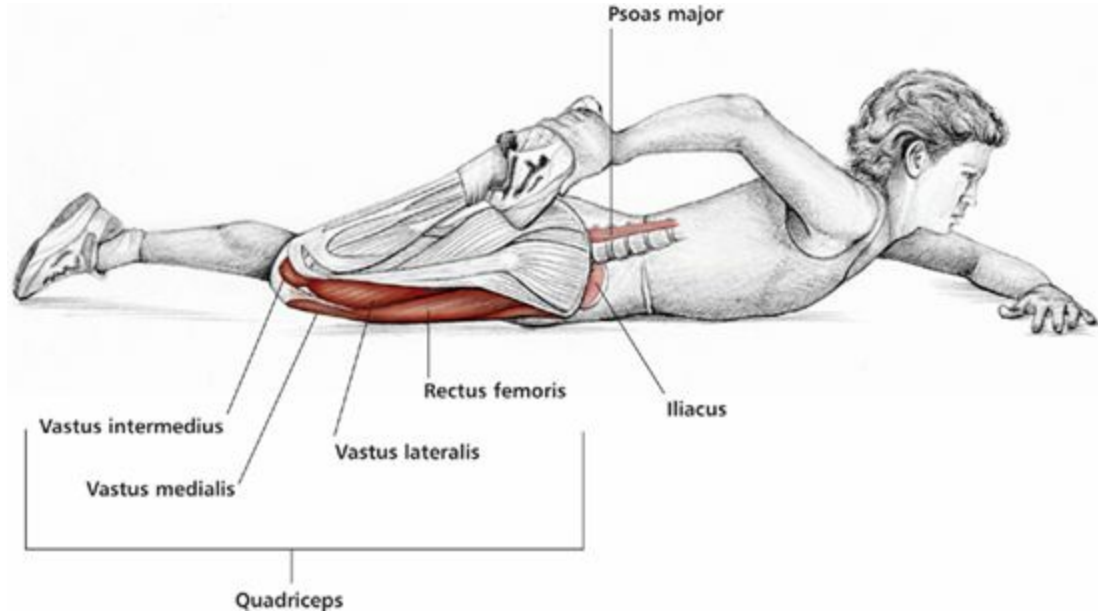
**Additional information for performing this stretch correctly**

Regulate the intensity of this stretch by pushing your hips forward.

**Complementary stretches**

[F01](#), [C03](#).

## F04: LYING QUAD STRETCH



### Technique

Lie face down and pull one foot up behind your buttocks.

### Muscles being stretched

Primary muscles: Rectus femoris. Vastus medialis, lateralis, and intermedius.

Secondary muscles: Iliacus. Psoas major.

### Sports that benefit from this stretch

Cycling. Hiking. Backpacking. Mountaineering. Orienteering. Ice hockey. Field hockey. Ice-skating. Roller-skating. Inline skating. Martial arts. Running. Track. Cross-country. American football (gridiron). Soccer. Rugby. Snow skiing. Water skiing. Surfing. Walking. Race walking.

### Sports injury where stretch may be useful

Hip flexor strain. Avulsion fracture in the pelvic area. Osteitis pubis. Iliopsoas tendonitis. Trochanteric bursitis. Quadriceps strain. Quadriceps tendonitis. Patellofemoral pain syndrome. Patellar tendonitis. Subluxing kneecap.

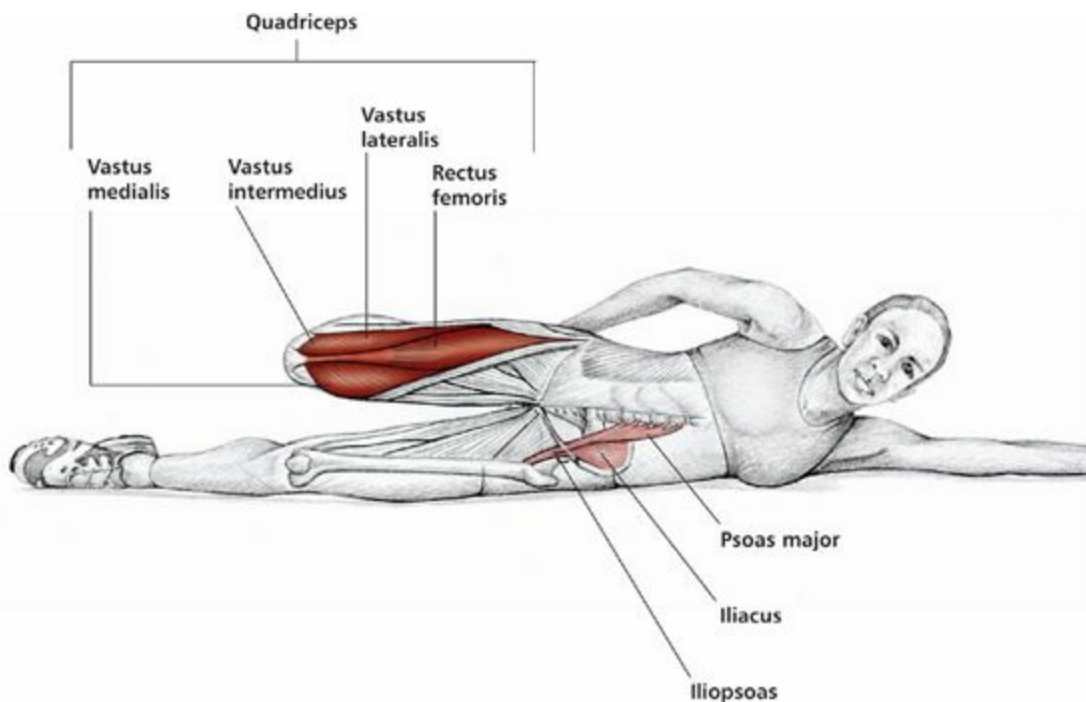
### Common problems and more information for performing this stretch correctly

This position can put undue pressure on the knee joint and ligaments. Anyone with knee pain or knee injury should avoid this stretch.

### Complementary stretch

[F02](#).

# F05: ON-YOUR-SIDE QUAD STRETCH



## Technique

Lie on your side and pull your top leg behind your buttocks. Keep your knees together and push your hips forward.

## Muscles being stretched

Primary muscles: Rectus femoris. Vastus medialis, lateralis, and intermedius.

Secondary muscles: Iliacus. Psoas major.

## Sports that benefit from this stretch

Cycling. Hiking. Backpacking. Mountaineering. Orienteering. Ice hockey. Field hockey. Ice-skating. Roller-skating. Inline skating. Martial arts. Running. Track. Cross-country. American football (gridiron). Soccer. Rugby. Snow skiing. Water skiing. Surfing. Walking. Race walking.

## Sports injury where stretch may be useful

Hip flexor strain. Avulsion fracture in the pelvic area. Osteitis pubis. Iliopsoas tendonitis. Trochanteric bursitis. Quadriceps strain. Quadriceps tendonitis. Patellofemoral pain syndrome. Patellar tendonitis. Subluxing kneecap.

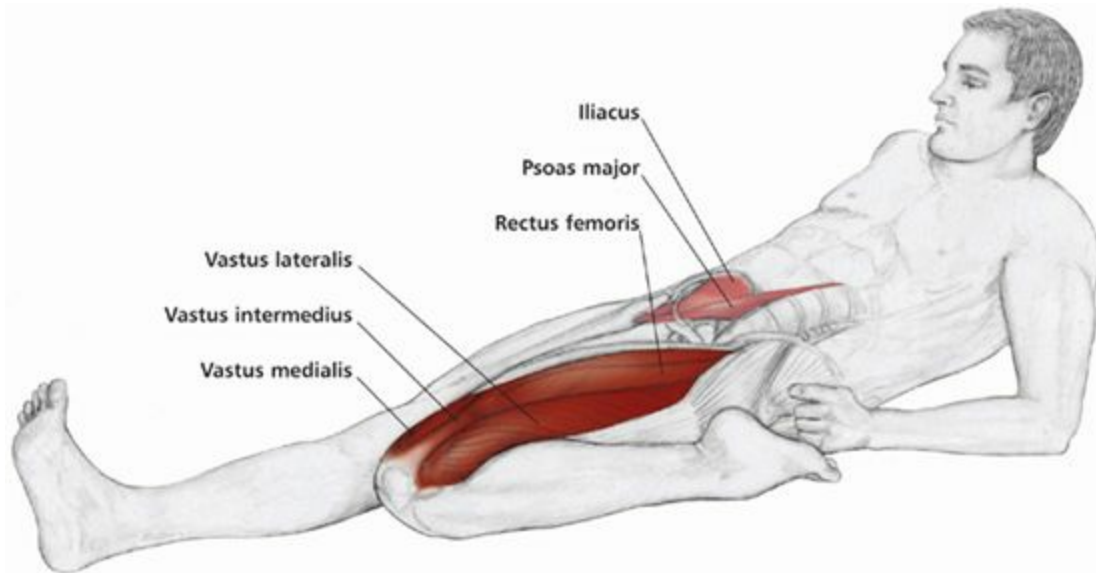
## Common problems and more information for performing this stretch correctly

This position can put undue pressure on the knee joint and ligaments. Anyone with knee pain or knee injury should avoid this stretch.

## Complementary stretch



## F06: SINGLE LEAN-BACK QUAD STRETCH



### Technique

Sit on the ground, bend one knee and place that foot next to your buttocks. Then slowly lean backwards.

### Muscles being stretched

Primary muscles: Rectus femoris. Vastus medialis, lateralis, and intermedius.

Secondary muscles: Iliacus. Psoas major.

### Sports that benefit from this stretch

Cycling. Hiking. Backpacking. Mountaineering. Orienteering. Ice hockey. Field hockey. Ice-skating. Roller-skating. Inline skating. Martial arts. Running. Track. Cross-country. Soccer. American football (gridiron). Rugby. Snow skiing. Water skiing. Surfing. Walking. Race walking.

### Sports injury where stretch may be useful

Hip flexor strain. Avulsion fracture in the pelvic area. Osteitis pubis. Iliopsoas tendonitis. Trochanteric bursitis. Quadriceps strain. Quadriceps tendonitis. Patellofemoral pain syndrome. Patellar tendonitis. Subluxing kneecap.

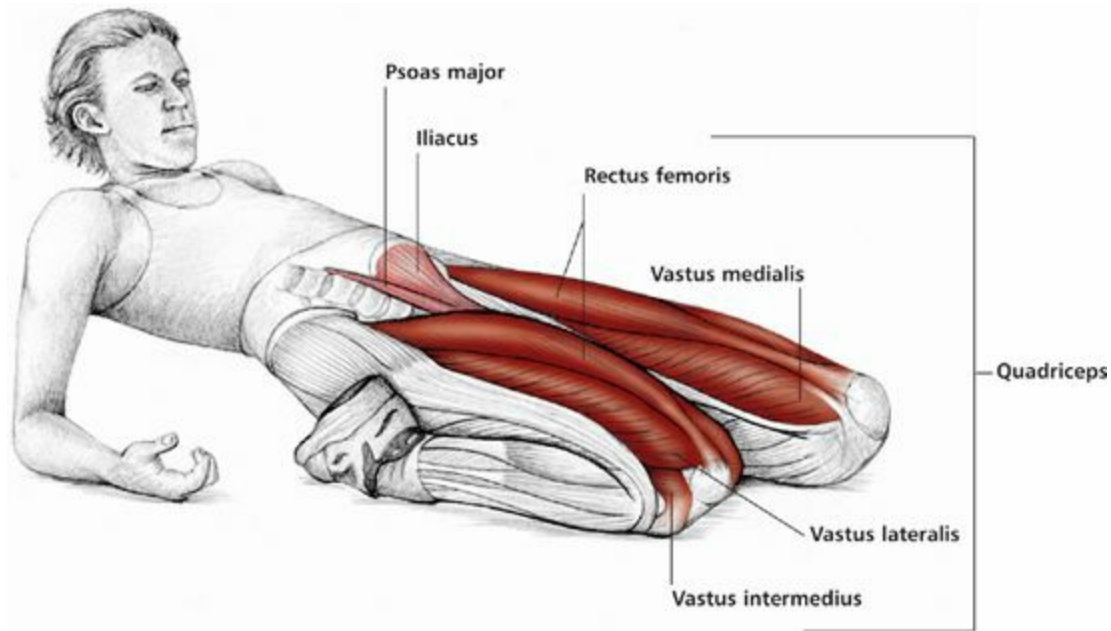
### Common problems and more information for performing this stretch correctly

This position can put undue pressure on the knee joint and ligaments. Anyone with knee pain or knee injury should avoid this stretch.

### Complementary stretches

[F05](#), [C03](#).

## F07: DOUBLE LEAN-BACK QUAD STRETCH



### Technique

Sit on the ground and bend one or both knees and place your legs under your buttocks. Then slowly lean backwards.

### Muscles being stretched

Primary muscles: Rectus femoris. Vastus medialis, lateralis, and intermedius.

Secondary muscles: Iliacus. Psoas major.

### Sports that benefit from this stretch

Cycling. Hiking. Backpacking. Mountaineering. Orienteering. Ice hockey. Field hockey. Ice-skating. Roller-skating. Inline skating. Martial arts. Running. Track. Cross-country. American football (gridiron). Soccer. Rugby. Snow skiing. Water skiing. Surfing. Walking. Race walking.

### Sports injury where stretch may be useful

Hip flexor strain. Avulsion fracture in the pelvic area. Osteitis pubis. Iliopsoas tendonitis. Trochanteric bursitis. Quadriceps strain. Quadriceps tendonitis. Patellofemoral pain syndrome. Patellar tendonitis. Subluxing kneecap.

### Common problems and more information for performing this stretch correctly

This position can put undue pressure on the knee joint and ligaments. Anyone with knee pain or knee injury should avoid this stretch.

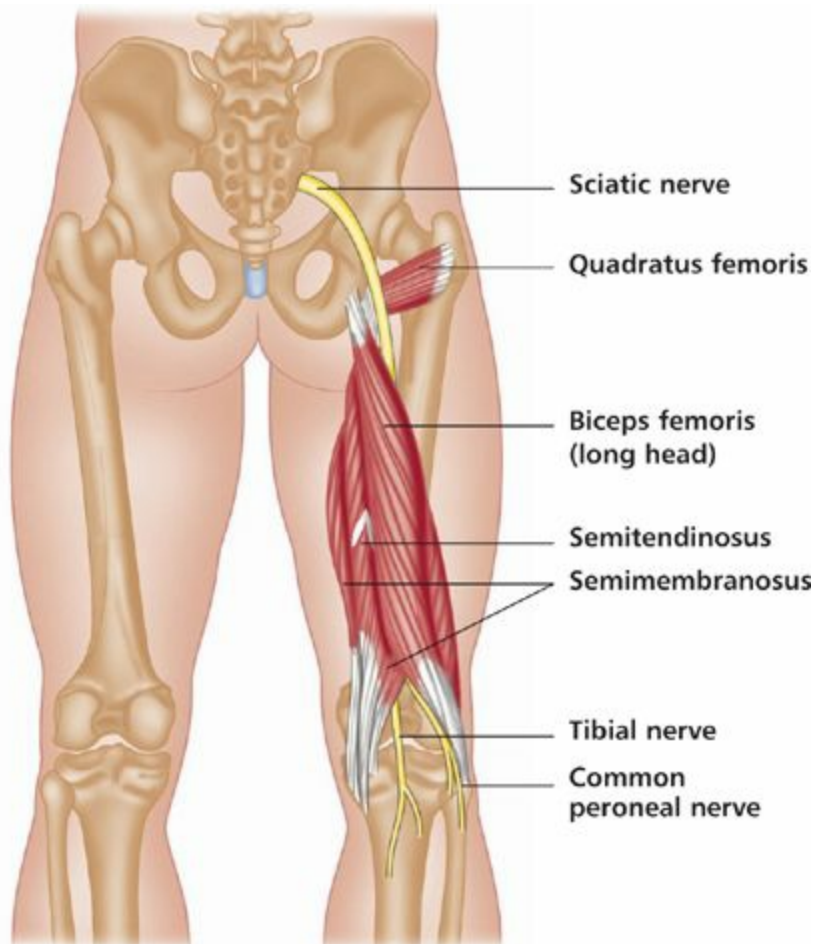
### Complementary stretch

[F02](#).

# 9

## Hamstrings

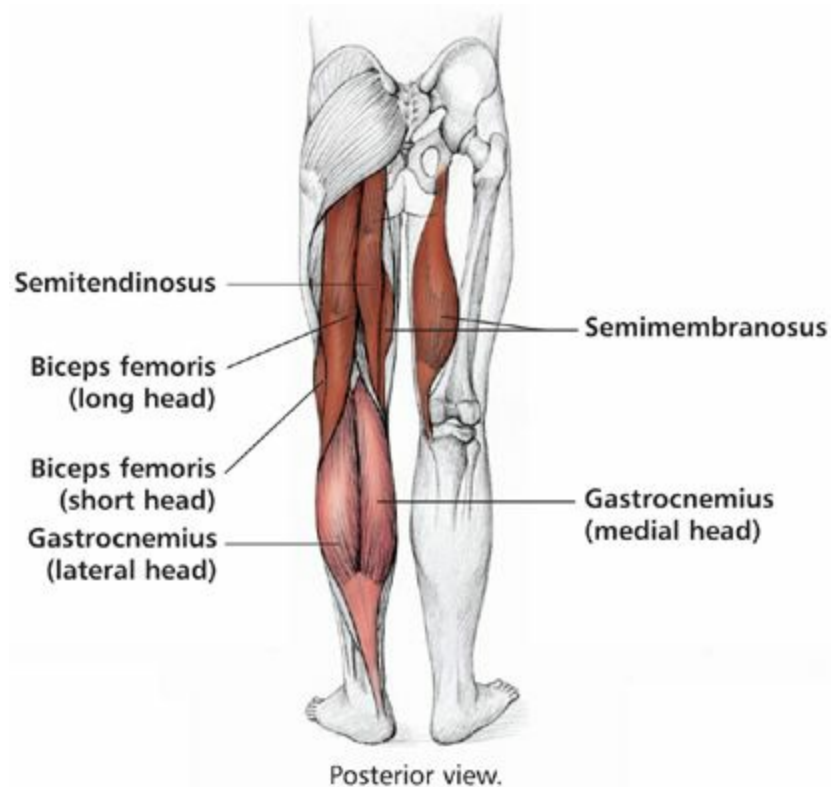
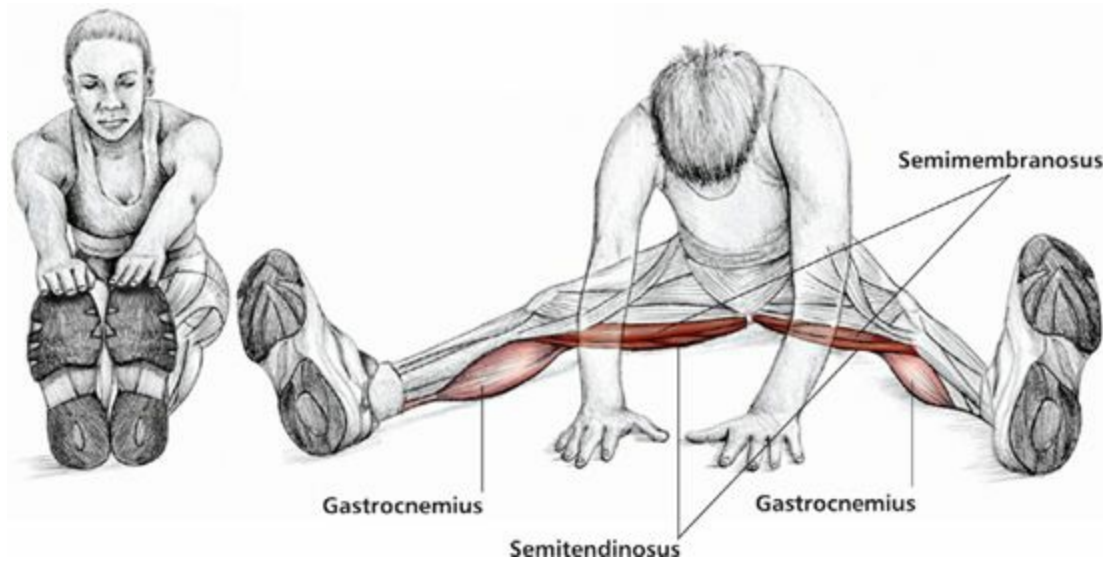
The hamstrings are a large group of three separate muscles located in the posterior (rear) of the thigh. They originate from the bottom of the hip bone and extend to below the knee, and work together to extend the hip and flex the knee; they correspond to the flexors of the elbow in the upper limb. During running, the hamstrings slow down the leg at the end of its forward swing and prevent the trunk from flexing at the hip joint. The three muscles are, from medial to lateral, **semimembranosus**, **semitendinosus**, and **biceps femoris**. Biceps femoris is usually the largest hamstring, and has two heads, the long and short; the long head crosses the hip joint to work it. Semitendinosus and semimembranosus are completely synergistic, meaning they both do the exact same actions.





Sports that benefit from these hamstring stretches include: basketball and netball; cycling; hiking, backpacking, mountaineering, and orienteering; ice hockey and field hockey; ice-skating, roller-skating, and inline skating; martial arts; running, track, and cross-country; running sports like soccer, American football (gridiron), and rugby; snow skiing and water skiing; surfing; walking and race walking; wrestling.

# G01: SITTING REACH FORWARD HAMSTRING STRETCH



## Technique

Sit with both legs straight out in front and keep your toes pointing straight up. Make sure your back is straight and then reach forward towards your toes.

## Muscles being stretched

Primary muscles: Semimembranosus. Semitendinosus. Biceps femoris.  
Secondary muscle: Gastrocnemius.

## Sports that benefit from this stretch

Basketball. Netball. Cycling. Hiking. Backpacking. Mountaineering. Orienteering. Ice hockey. Field hockey. Ice-skating. Roller-skating. Inline skating. Martial arts. Running. Track. Cross-country. American football (gridiron). Soccer. Rugby. Snow skiing. Water skiing. Surfing. Walking. Race walking. Wrestling.

### **Sports injury where stretch may be useful**

Lower back muscle strain. Lower back ligament sprain. Hamstring strain.

### **Common problems and additional information for performing this stretch correctly**

It is important to keep your toes pointing straight upwards. Letting your toes fall to one side will cause this stretch to put uneven tension on the hamstring muscles. Over an extended period of time, this could lead to a muscle imbalance.

### **Complementary stretch**

[G06](#).

# G02: STANDING TOE-POINTED HAMSTRING STRETCH



## Technique

Stand with one knee bent and the other leg straight out in front. Point your toes towards the ground and lean forward. Keep your back straight and rest your hands on your bent knee.

## Muscles being stretched

Primary muscles: Semimembranosus. Semitendinosus. Biceps femoris.

Secondary muscle: Gastrocnemius.

## Sports that benefit from this stretch

Basketball. Netball. Cycling. Hiking. Backpacking. Mountaineering. Orienteering. Ice hockey. Field hockey. Ice-skating. Roller-skating. Inline skating. Martial arts. Running. Track. Cross-country

American football (gridiron). Soccer. Rugby. Snow skiing. Water skiing. Surfing. Walking. Race walking. Wrestling.

**Sports injury where stretch may be useful**

Lower back muscle strain. Lower back ligament sprain. Hamstring strain.

**Additional information for performing this stretch correctly**

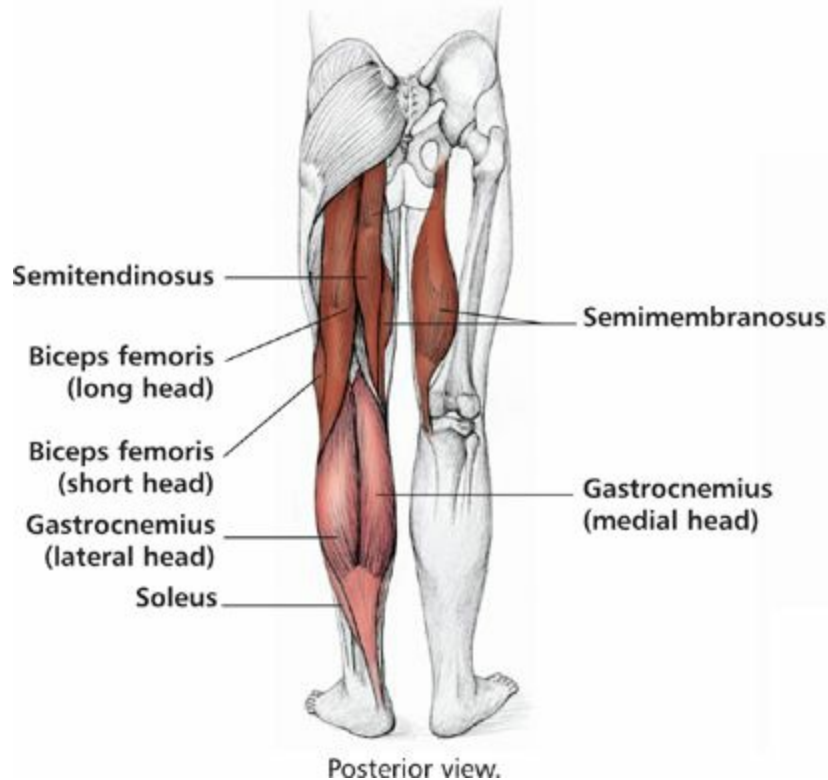
Regulate the intensity of this stretch by keeping your back straight and leaning forward.

**Complementary stretch**

[G03](#).

# G03: STANDING TOE-RAISED HAMSTRING STRETCH





## Technique

Stand with one knee bent and the other leg straight out in front. Point your toes towards your body and lean forward. Keep your back straight and rest your hands on your bent knee.

## Muscles being stretched

Primary muscles: Semimembranosus. Semitendinosus. Biceps femoris.

Secondary muscles: Gastrocnemius. Soleus.

## Sports that benefit from this stretch

Basketball. Netball. Cycling. Hiking. Backpacking. Mountaineering. Orienteering. Ice hockey. Field hockey. Ice-skating. Roller-skating. Inline skating. Martial arts. Running. Track. Cross-country. American football (gridiron). Soccer. Rugby. Snow skiing. Water skiing. Surfing. Walking. Race walking. Wrestling.

## Sports injury where stretch may be useful

Lower back muscle strain. Lower back ligament sprain. Hamstring strain. Calf strain.

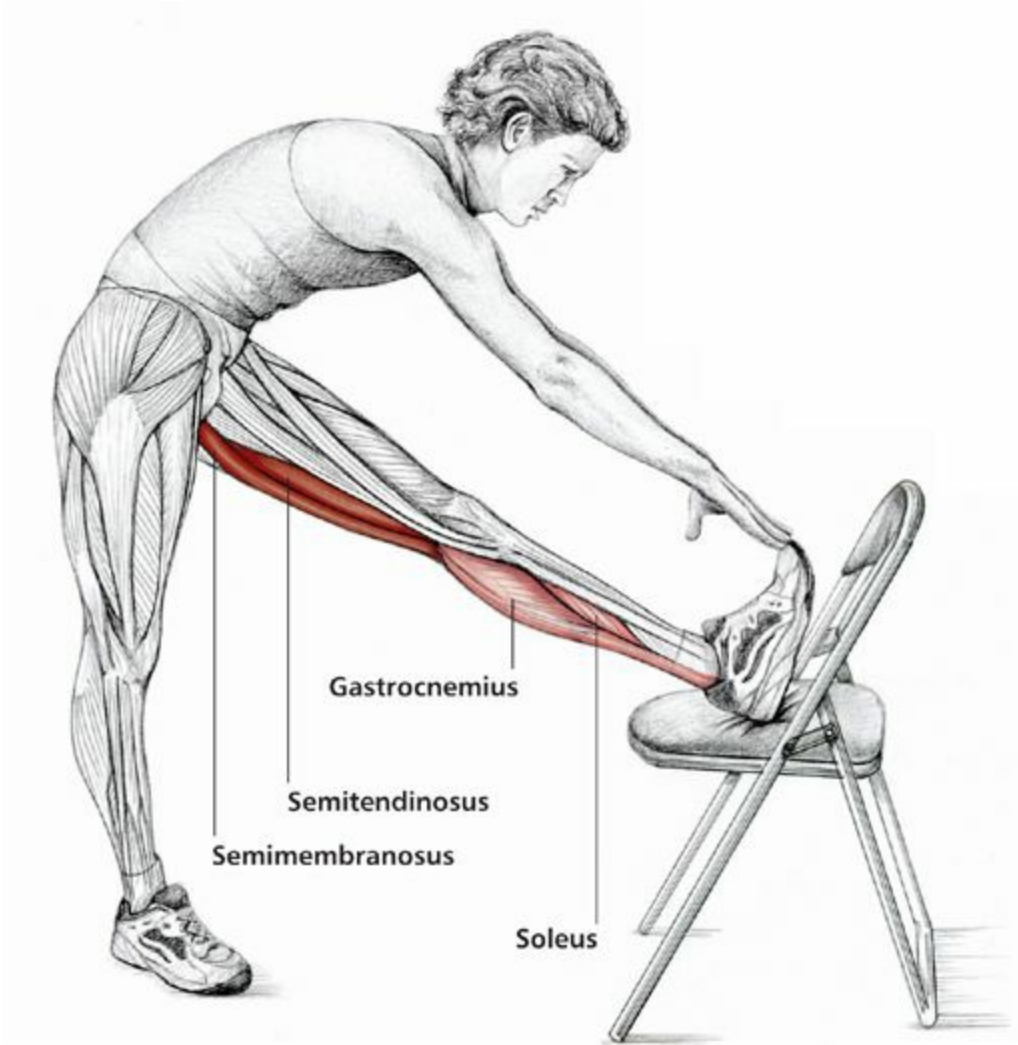
## Additional information for performing this stretch correctly

Regulate the intensity of this stretch by keeping your back straight and flexing your ankle so that your toes are pointing upwards.

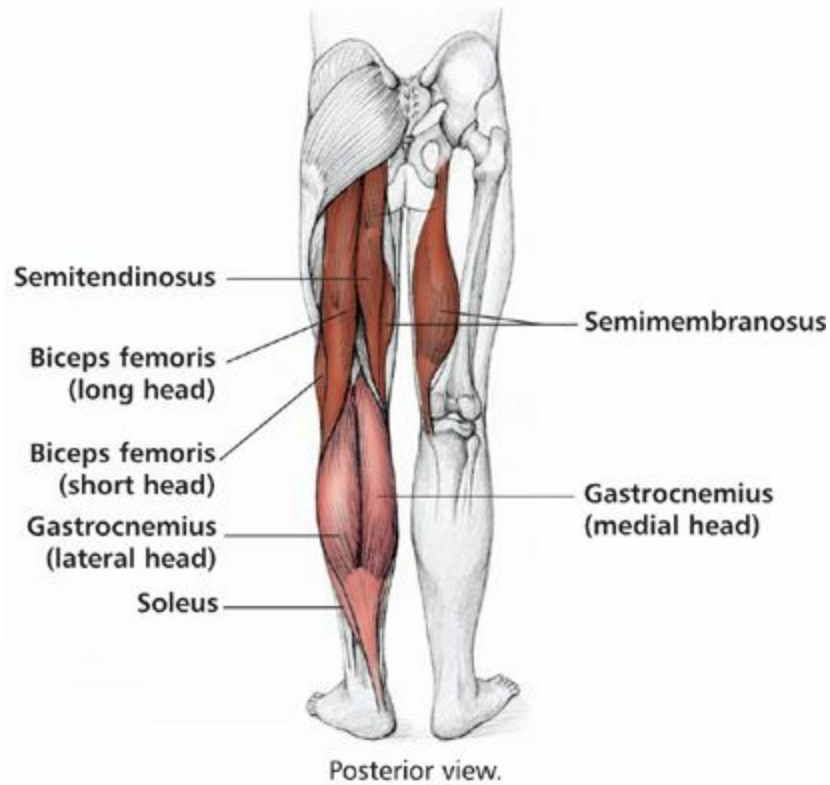
## Complementary stretch

G04.

# G04: STANDING LEG-UP HAMSTRING STRETCH







Posterior view.

### **Technique**

Stand upright and raise one leg on to an object. Keep that leg straight and your toes pointing straight up. Lean forward while keeping your back straight.

### **Muscles being stretched**

Primary muscles: Semimembranosus. Semitendinosus. Biceps femoris.

Secondary muscles: Gastrocnemius. Soleus.

### **Sports that benefit from this stretch**

Basketball. Netball. Cycling. Hiking. Backpacking. Mountaineering. Orienteering. Ice hockey. Field hockey. Ice-skating. Roller-skating. Inline skating. Martial arts. Running. Track. Cross-country. American football (gridiron). Soccer. Rugby. Snow skiing. Water skiing. Surfing. Walking. Race walking. Wrestling.

### **Sports injury where stretch may be useful**

Lower back muscle strain. Lower back ligament sprain. Hamstring strain. Calf strain.

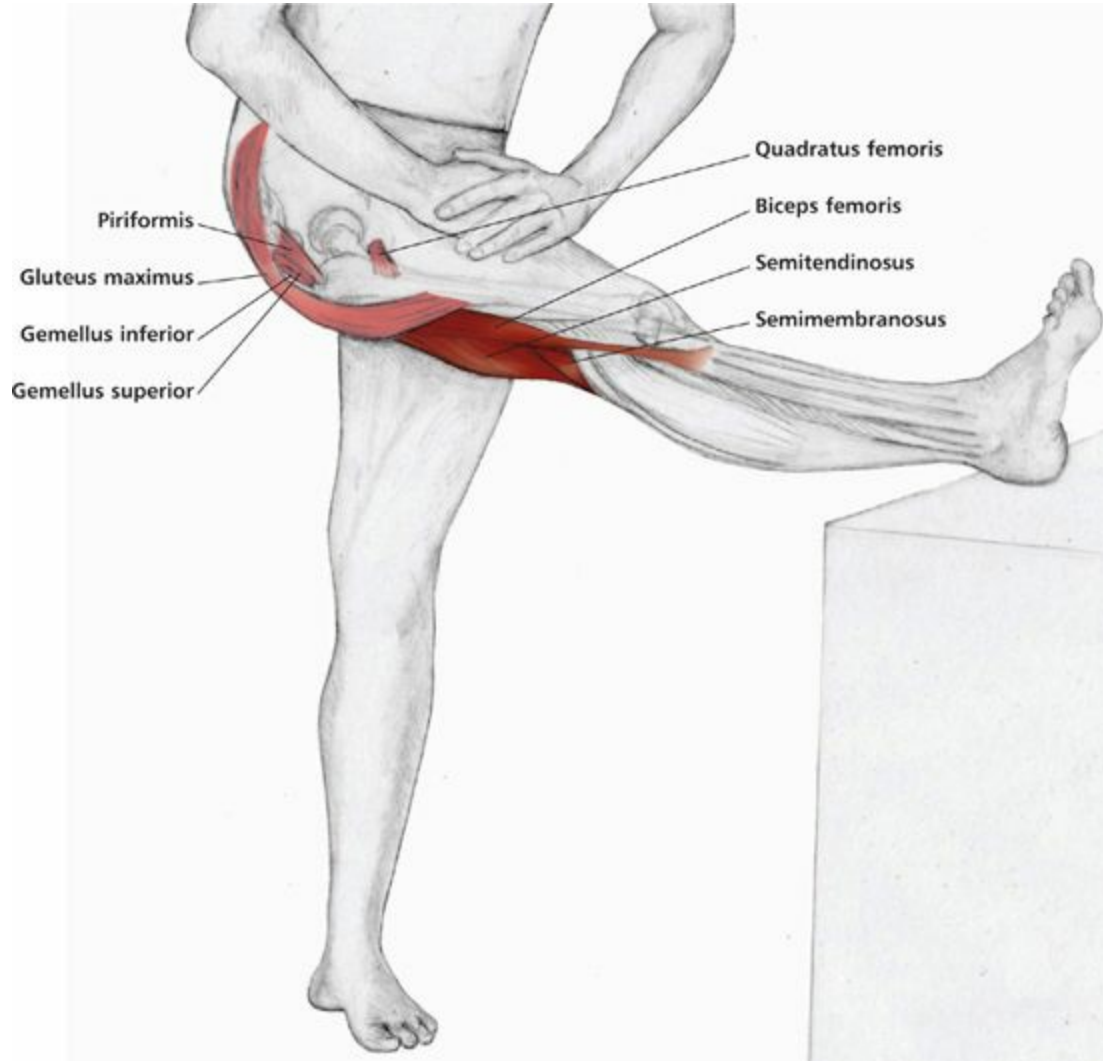
### **Common problems and additional information for performing this stretch correctly**

Regulate the intensity of this stretch by keeping your back straight and leaning forward.

### **Complementary stretch**

[G01.](#)

# G05: STANDING LEG-UP TOE-IN HAMSTRING STRETCH



## Technique

Stand upright and raise one leg on to an object. Keep that leg straight and point your toes upwards. Then turn the other foot inward and lean forward whilst keeping your back straight.

## Muscles being stretched

Primary muscles: Semimembranosus. Semitendinosus. Biceps femoris.

Secondary muscles: Gluteus maximus. Gemellus inferior and superior. Quadratus femoris. Piriformis.

## Sports that benefit from this stretch

Basketball. Netball. Cycling. Hiking. Backpacking. Mountaineering. Orienteering. Ice hockey. Field hockey. Ice-skating. Roller-skating. Inline skating. Martial arts. Running. Track. Cross-country. Soccer. American football (gridiron). Rugby. Snow skiing. Water skiing. Surfing. Walking. Race walking. Wrestling.

## Sports injury where stretch may be useful

Lower back muscle strain. Lower back ligament sprain. Hamstring strain. Calf strain.

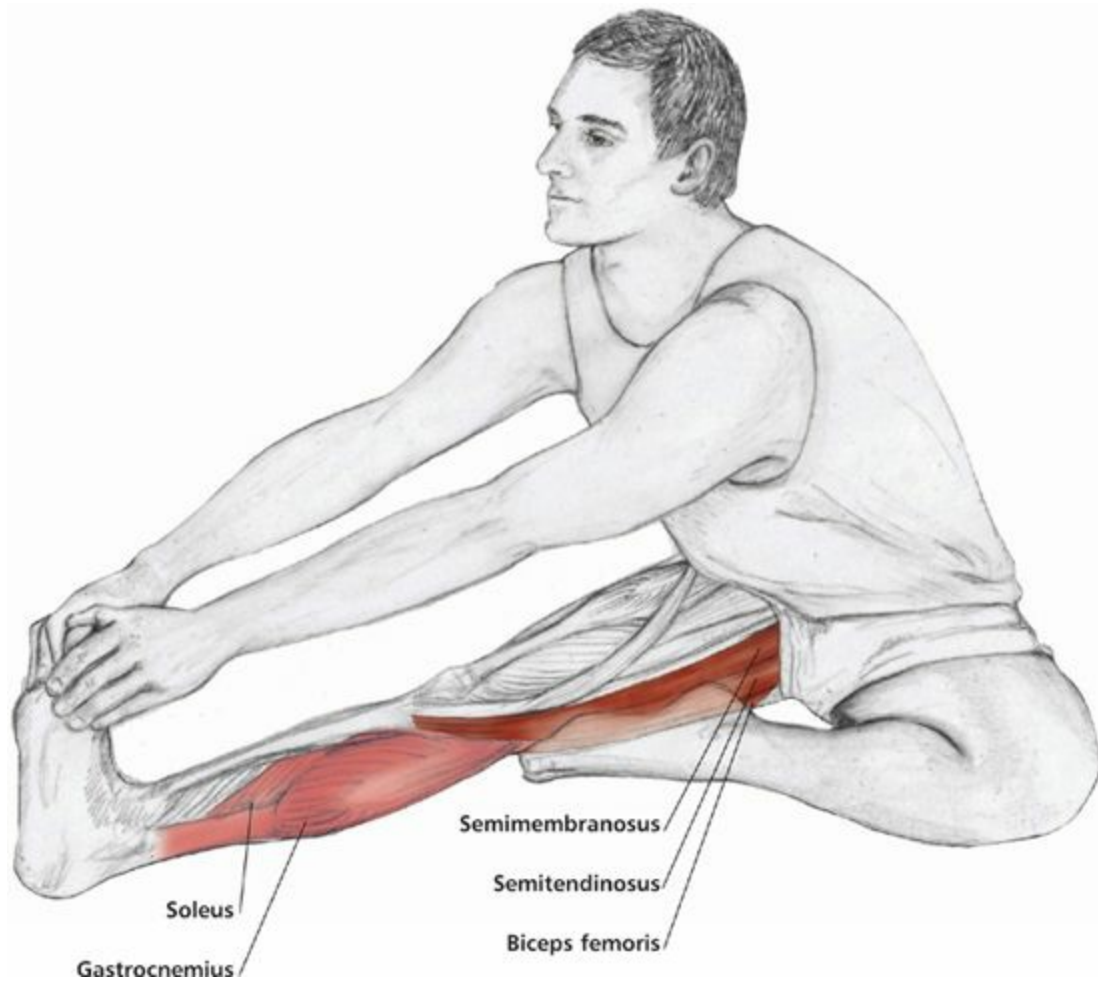
### **Common problems and more information for performing this stretch correctly**

This stretch can put intense pressure on the deep lateral hip rotators. Regulate the intensity of this stretch by keeping your back straight and slowly leaning forward.

### **Complementary stretches**

[G11](#), [E01](#).

## G06: SITTING SINGLE LEG HAMSTRING STRETCH



### Technique

Sit with one leg straight out in front and toes pointing upwards. Bring your other foot towards your knee. Reach toward your toes with both hands.

### Muscles being stretched

Primary muscles: Semimembranosus. Semitendinosus. Biceps femoris.

Secondary muscles: Gastrocnemius. Soleus.

### Sports that benefit from this stretch

Basketball. Netball. Cycling. Hiking. Backpacking. Mountaineering. Orienteering. Ice hockey. Field hockey. Ice-skating. Roller-skating. Inline skating. Martial arts. Running. Track. Cross-country. American football (gridiron). Soccer. Rugby. Snow skiing. Water skiing. Surfing. Walking. Race walking. Wrestling.

### Sports injury where stretch may be useful

Lower back muscle strain. Lower back ligament sprain. Hamstring strain. Calf strain.

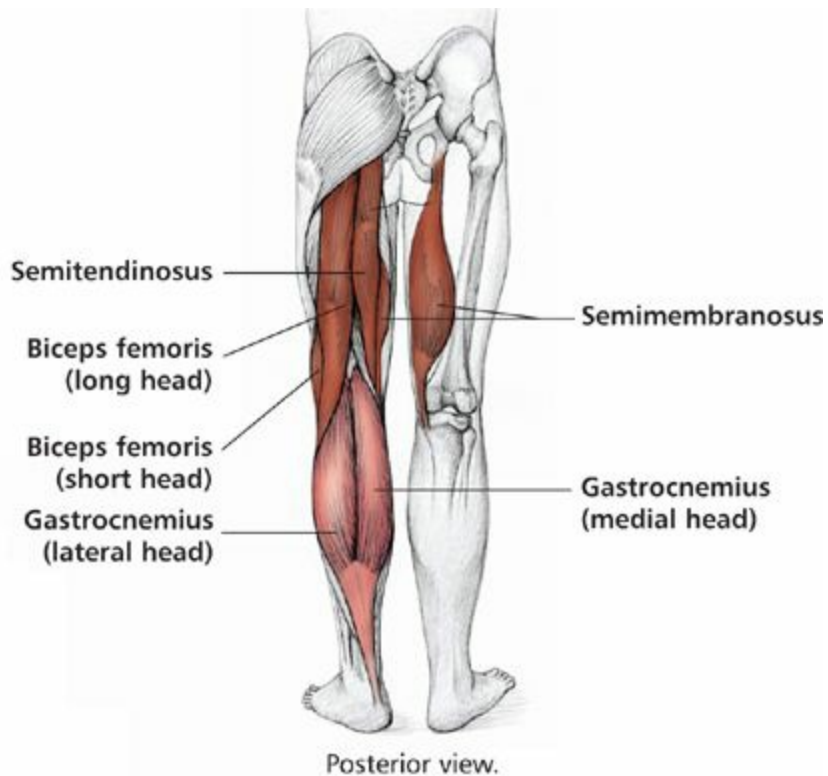
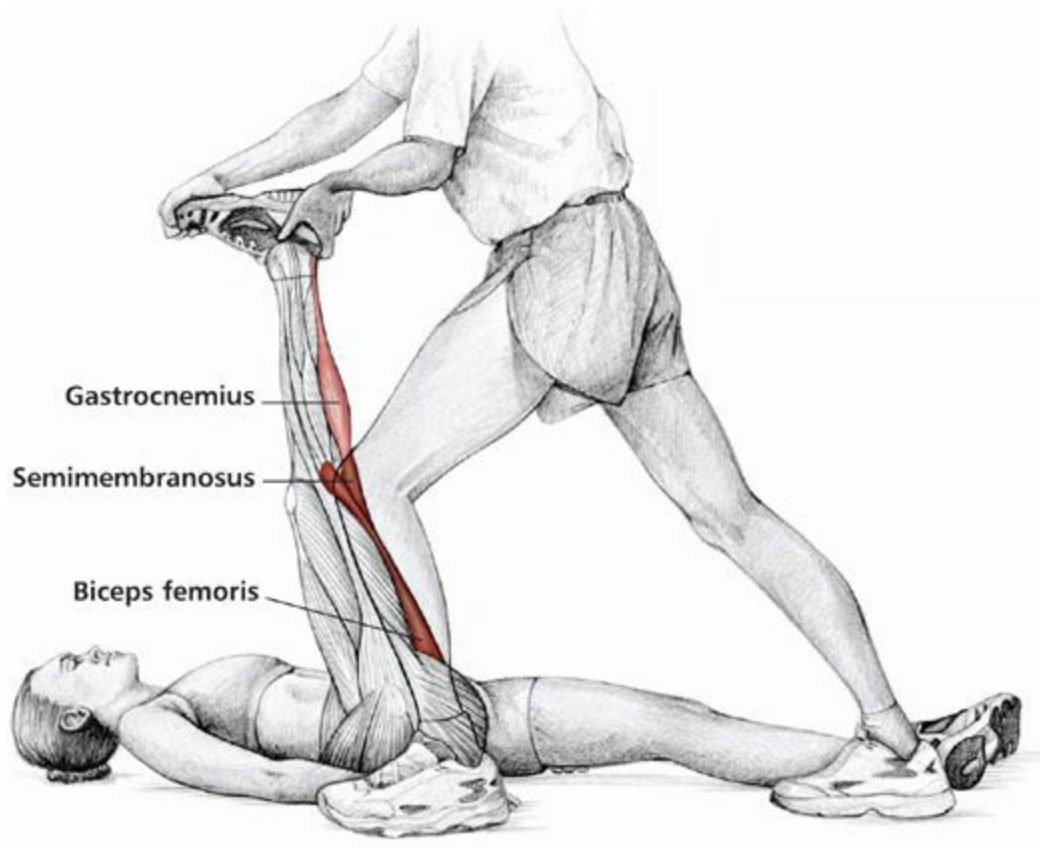
### **Common problems and additional information for performing this stretch correctly**

It is important to keep your toes pointing straight upwards. Letting your toes fall to one side will cause this stretch to put uneven tension on the hamstring muscles. Over an extended period of time, this could lead to a muscle imbalance.

### **Complementary stretch**

[G09](#).

# G07: LYING PARTNER ASSISTED HAMSTRING STRETCH



## Technique

Lie on your back and keep both legs straight. Have a partner raise one of your legs off the ground and

as far back as is comfortable. Make sure your toes are pointing directly backwards.

### **Muscles being stretched**

Primary muscles: Semimembranosus. Semitendinosus. Biceps femoris.

Secondary muscle: Gastrocnemius.

### **Sports that benefit from this stretch**

Basketball. Netball. Cycling. Hiking. Backpacking. Mountaineering. Orienteering. Ice hockey. Field hockey. Ice-skating. Roller-skating. Inline skating. Martial arts. Running. Track. Cross-country. American football (gridiron). Soccer. Rugby. Snow skiing. Water skiing. Surfing. Walking. Race walking. Wrestling.

### **Sports injury where stretch may be useful**

Lower back muscle strain. Lower back ligament sprain. Hamstring strain. Calf strain.

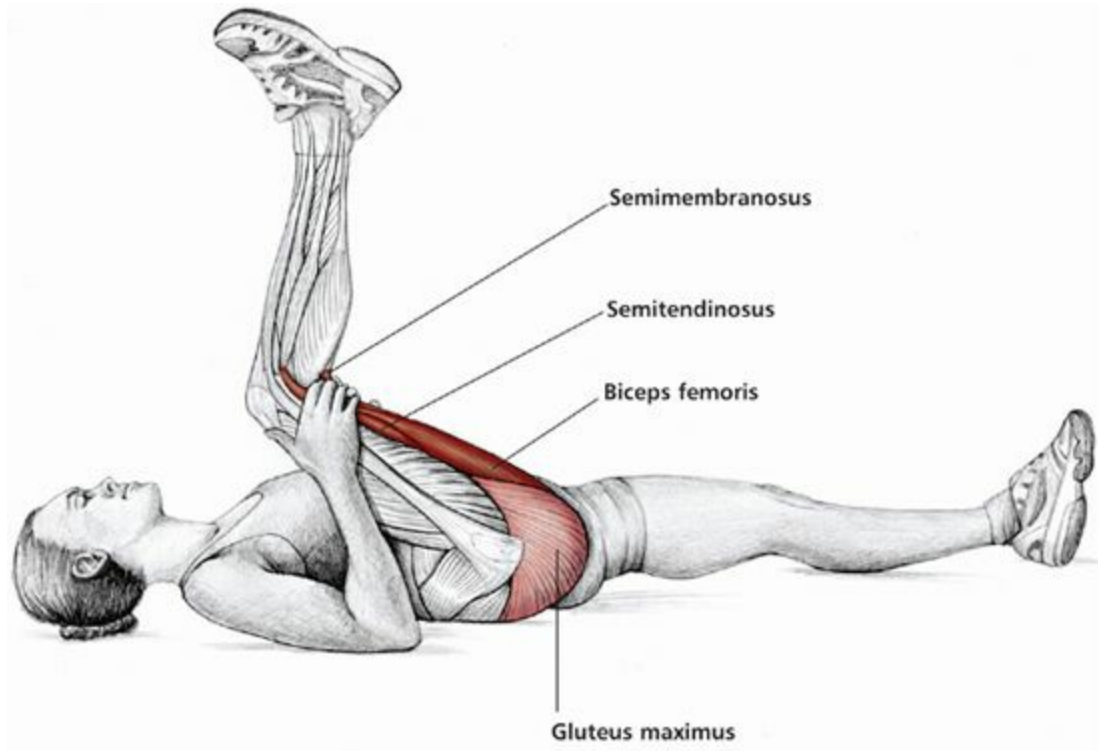
### **Common problems and additional information for performing this stretch correctly**

Choose your stretching partner carefully. They are responsible for your safety while performing this stretch, so make sure you communicate clearly with them at all times.

### **Complementary stretch**

[G04](#).

## G08: LYING BENT KNEE HAMSTRING STRETCH



### **Technique**

Lie on your back and bend one leg. Pull the other knee towards your chest, then slowly and gently straighten your raised leg.

### **Muscles being stretched**

Primary muscles: Semimembranosus. Semitendinosus. Biceps femoris.

Secondary muscle: Gluteus maximus.

### **Sports that benefit from this stretch**

Basketball. Netball. Cycling. Hiking. Backpacking. Mountaineering. Orienteering. Ice hockey. Field hockey. Ice-skating. Roller-skating. Inline skating. Martial arts. Running. Track. Cross-country. American football (gridiron). Soccer. Rugby. Snow skiing. Water skiing. Surfing. Walking. Race walking. Wrestling.

### **Sports injury where stretch may be useful**

Lower back muscle strain. Lower back ligament sprain. Hamstring strain.

### **Additional information for performing this stretch correctly**

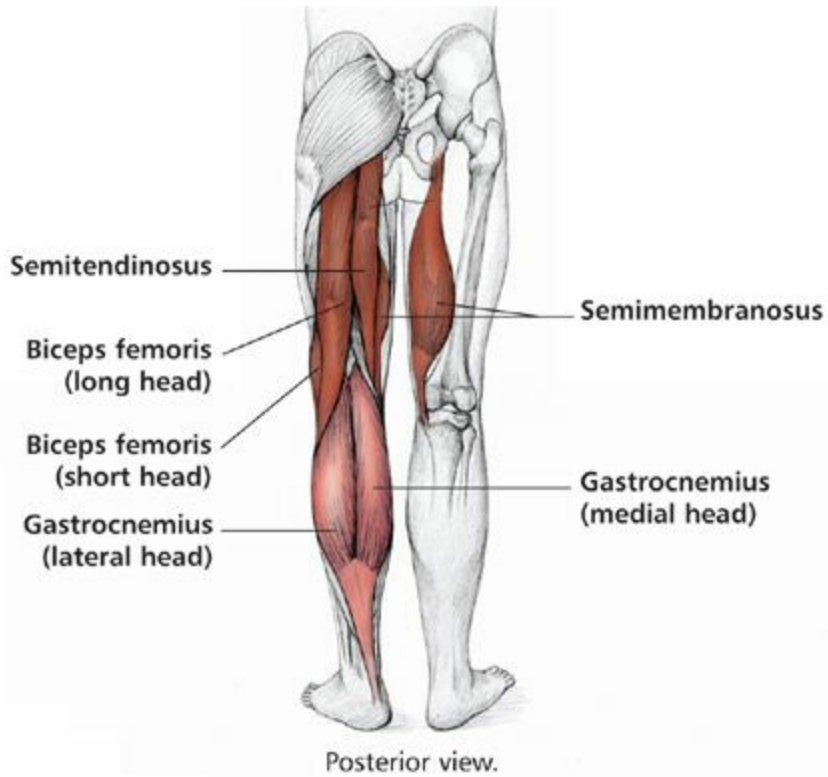
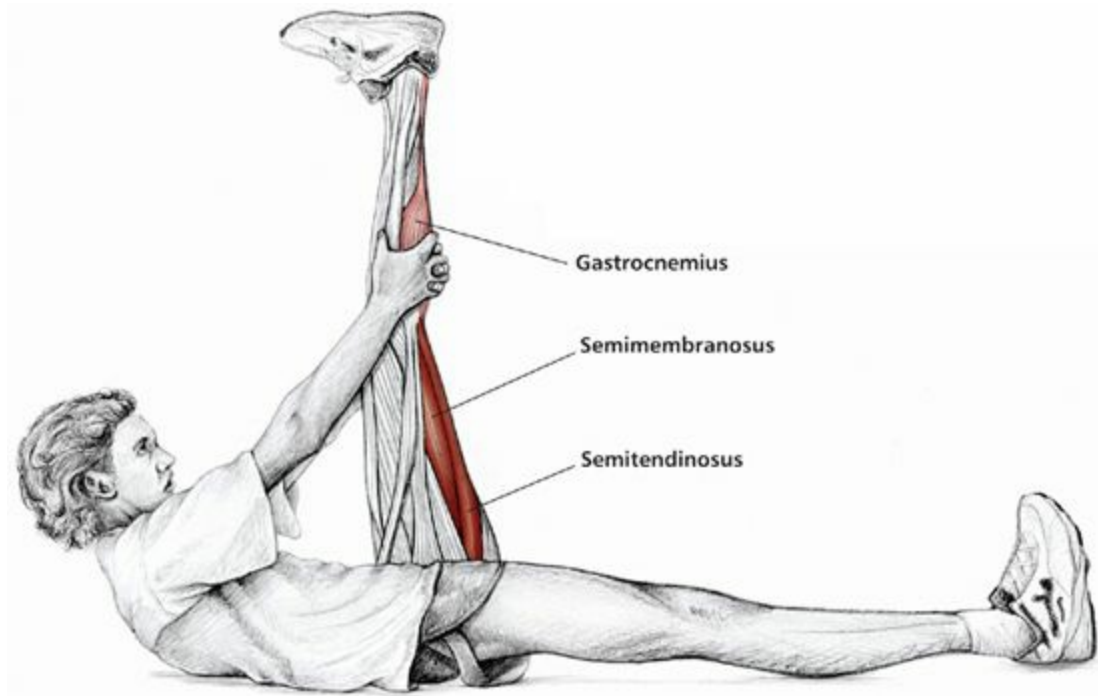
Keep your upper leg (thigh) relatively still, and regulate the intensity of this stretch by straightening your knee.

### **Complementary stretch**





# G09: LYING STRAIGHT KNEE HAMSTRING STRETCH



## Technique

Lie on your back and bend one leg. Raise your straight leg and pull it towards your chest.

## Muscles being stretched

Primary muscles: Semimembranosus. Semitendinosus. Biceps femoris.

Secondary muscle: Gastrocnemius.

### **Sports that benefit from this stretch**

Basketball. Netball. Cycling. Hiking. Backpacking. Mountaineering. Orienteering. Ice hockey. Field hockey. Ice-skating. Roller-skating. Inline skating. Martial arts. Running. Track. Cross-country. American football (gridiron). Soccer. Rugby. Snow skiing. Water skiing. Surfing. Walking. Race walking. Wrestling.

### **Sports injury where stretch may be useful**

Lower back muscle strain. Lower back ligament sprain. Hamstring strain. Calf strain.

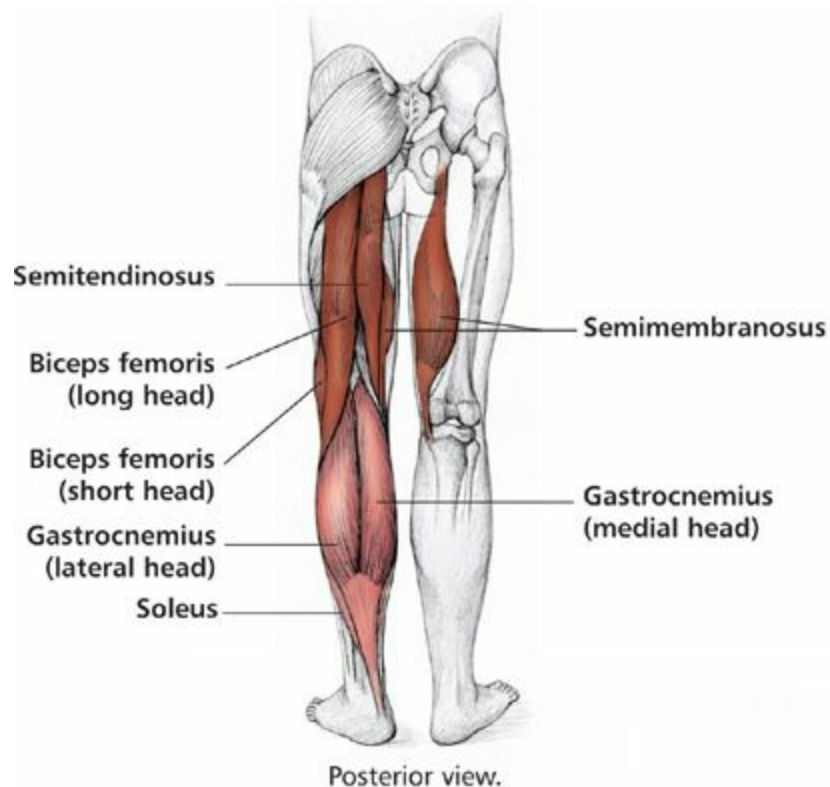
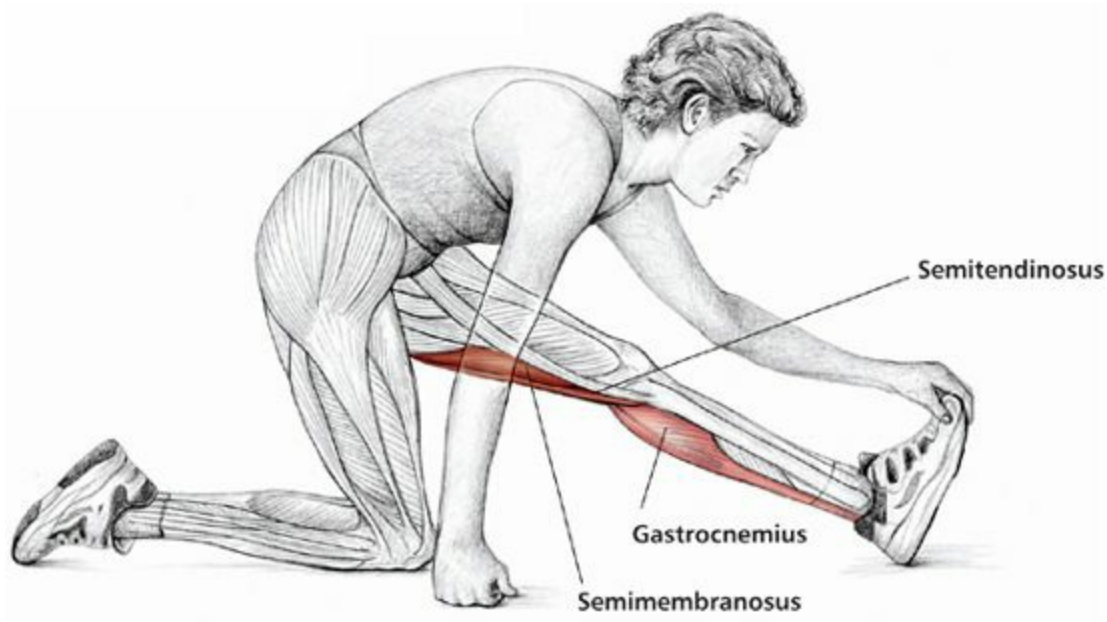
### **Common problems and additional information for performing this stretch correctly**

It is important to keep your toes pointing straight backwards. Letting your toes fall to one side will cause this stretch to put uneven tension on the hamstring muscles. Over an extended period of time, this could lead to a muscle imbalance.

### **Complementary stretch**

[G10](#).

# G10: KNEELING TOE-RAISED HAMSTRING STRETCH



## Technique

Kneel on one knee and place your other leg forward with your heel on the ground. Keep your back straight and point your toes towards your body. Reach towards your toes with one hand.

## Muscles being stretched

Primary muscles: Semimembranosus. Semitendinosus. Biceps femoris.

Secondary muscle: Gastrocnemius. Soleus.

### **Sports that benefit from this stretch**

Basketball. Netball. Cycling. Hiking. Backpacking. Mountaineering. Orienteering. Ice hockey. Field hockey. Ice-skating. Roller-skating. Inline skating. Martial arts. Running. Track. Cross-country. American football (gridiron). Soccer. Rugby. Snow skiing. Water skiing. Surfing. Walking. Race walking. Wrestling.

### **Sports injury where stretch may be useful**

Lower back muscle strain. Lower back ligament sprain. Hamstring strain. Calf strain.

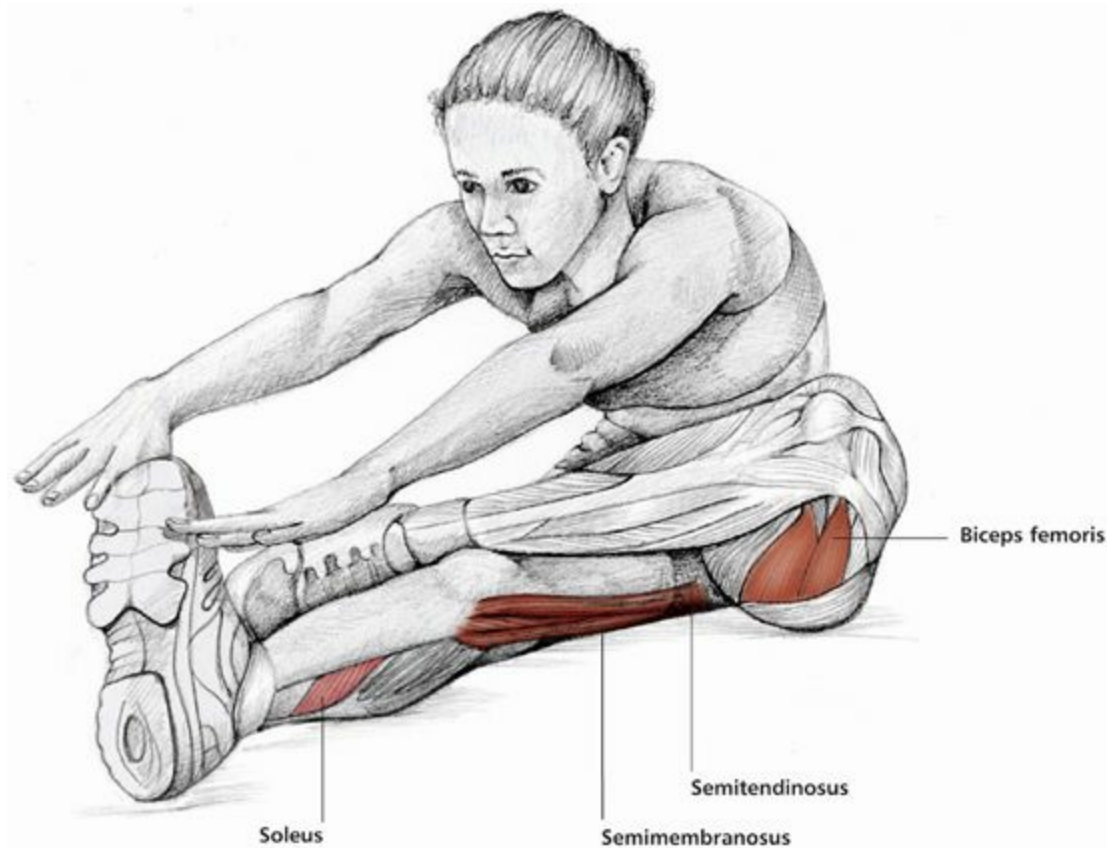
### **Common problems and additional information for performing this stretch correctly**

It is not important to be able to touch your toes. Concentrate on keeping your back straight and your toes pointing up.

### **Complementary stretch**

[G03](#).

# G11: SITTING LEG RESTING HAMSTRING STRETCH



## Technique

Sit with one leg straight out in front and keep your toes pointing up. Cross your other leg over and rest your foot on your thigh. Lean forward, keep your back straight and reach for your toes.

## Muscles being stretched

Primary muscles: Semimembranosus. Semitendinosus. Biceps femoris.

Secondary muscle: Soleus.

## Sports that benefit from this stretch

Basketball. Netball. Cycling. Hiking. Backpacking. Mountaineering. Orienteering. Ice hockey. Field hockey. Ice-skating. Roller-skating. Inline skating. Martial arts. Running. Track. Cross-country. American football (gridiron). Soccer. Rugby. Snow skiing. Water skiing. Surfing. Walking. Race walking. Wrestling.

## Sports injury where stretch may be useful

Lower back muscle strain. Lower back ligament sprain. Hamstring strain. Calf strain.

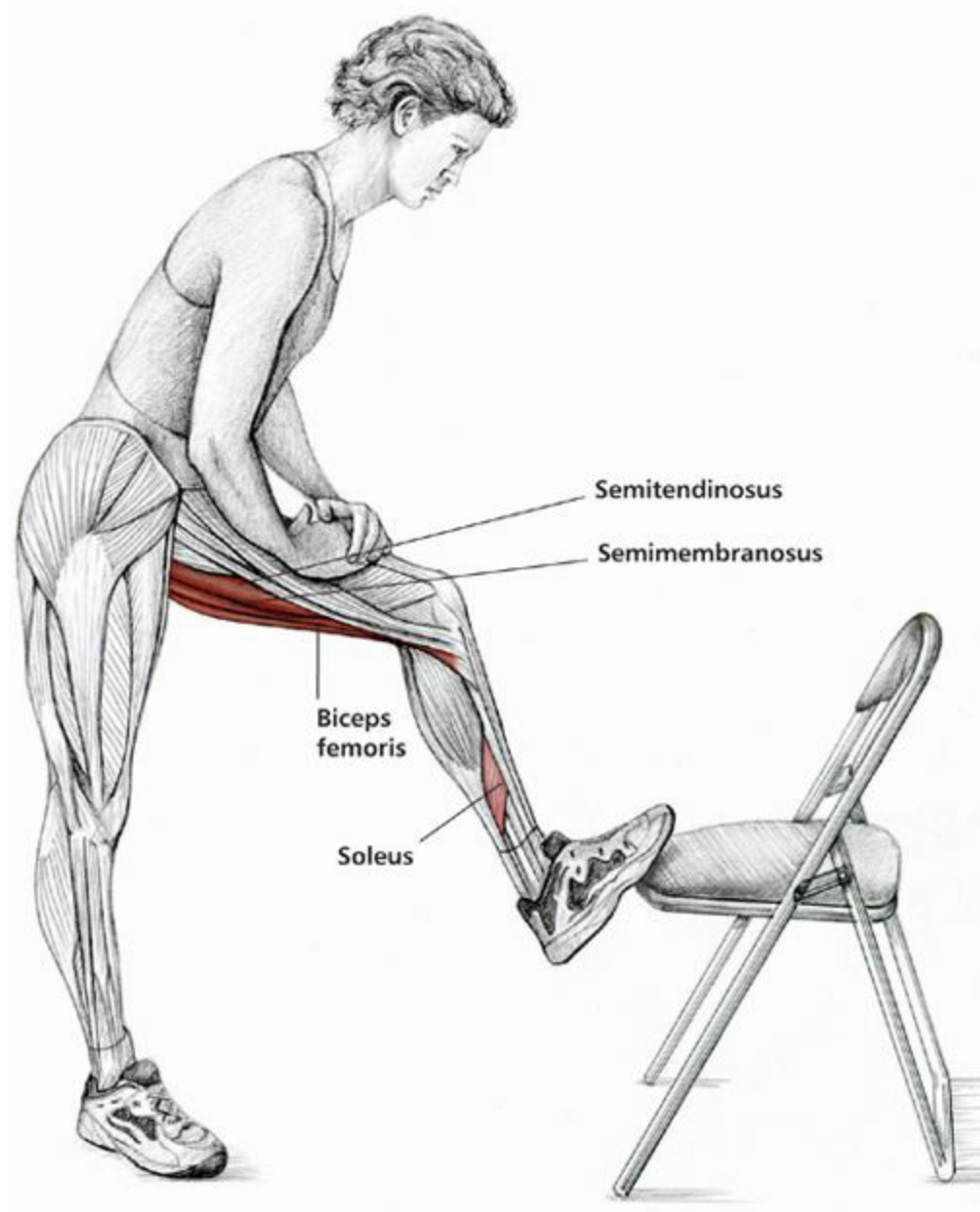
## Additional information for performing this stretch correctly

It is not important to be able to touch your toes. Simply reaching towards your toes is sufficient.

# Complementary stretch

G07.

## G12: STANDING LEG-UP BENT KNEE HAMSTRING STRETCH



### Technique

Stand with one foot raised onto a chair or an object. Keep your leg slightly bent and let your heel drop off the edge of the object. Keep your back straight and move your chest towards your thigh.

### Muscles being stretched

Primary muscles: Semimembranosus. Semitendinosus. Biceps femoris.

Secondary muscle: Soleus.

### Sports that benefit from this stretch

Basketball. Netball. Cycling. Hiking. Backpacking. Mountaineering. Orienteering. Ice hockey. Field



hockey. Ice-skating. Roller-skating. Inline skating. Martial arts. Running. Track. Cross-country American football (gridiron). Soccer. Rugby. Snow skiing. Water skiing. Surfing. Walking. Race walking. Wrestling.

**Sports injury where stretch may be useful**

Hamstring strain. Achilles tendon strain. Achilles tendonitis. Medial tibial pain syndrome (shin splints).

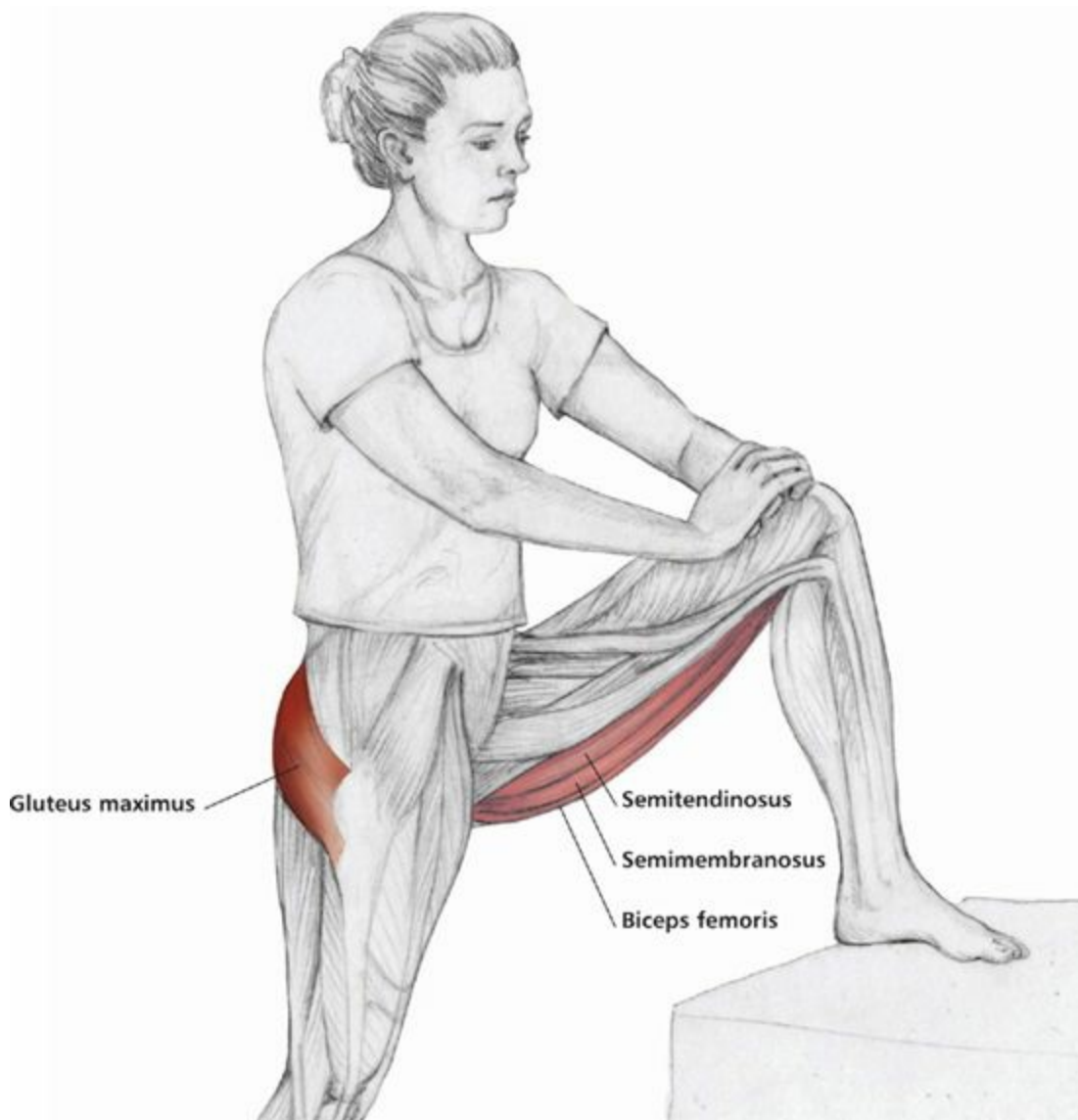
**Additional information for performing this stretch correctly**

Pushing your heel down towards the ground will help to intensify this stretch.

**Complementary stretch**

[G14](#).

# G13: STANDING HIGH-LEG BENT KNEE HAMSTRING STRETCH



## Technique

Stand with one foot raised onto a table. Keep your leg bent and lean your chest into your bent knee.

## Muscles being stretched

Primary muscle: Gluteus maximus.

Secondary muscles: Semimembranosus. Semitendinosus. Biceps femoris.

## Sports that benefit from this stretch

Basketball. Netball. Cycling. Hiking. Backpacking. Mountaineering. Orienteering. Ice hockey. Field hockey. Ice-skating. Roller-skating. Inline skating. Martial arts. Running. Track. Cross-country. Soccer. American football (gridiron). Rugby. Snow skiing. Water skiing. Surfing. Walking. Race walking. Wrestling.

### **Sports injury where stretch may be useful**

Lower back muscle strain. Lower back ligament sprain. Hamstring strain.

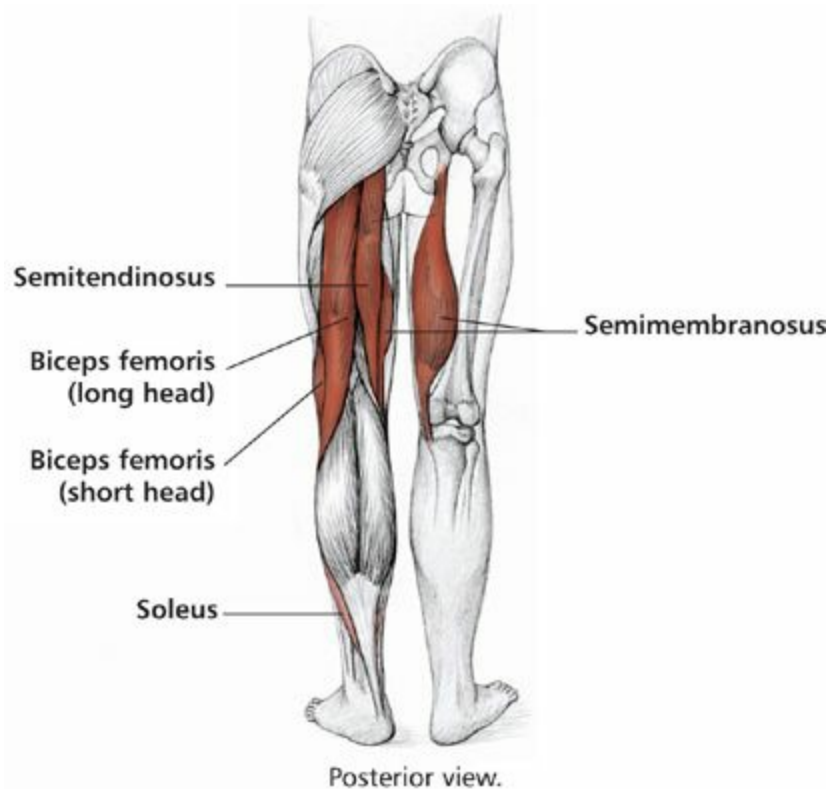
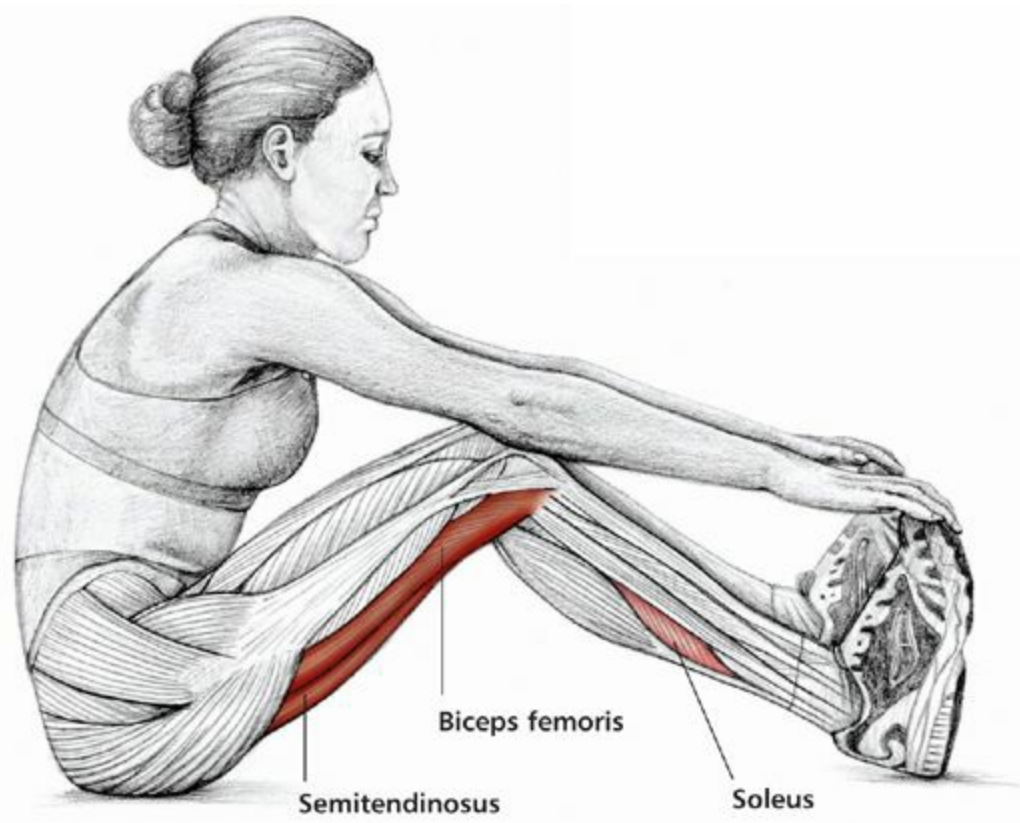
### **Additional information for performing this stretch correctly**

Regulate the intensity of this stretch by keeping your back straight and leaning forward.

### **Complementary stretches**

[G04](#), [D08](#).

# G14: SITTING BENT KNEE TOE-PULL HAMSTRING STRETCH



Sit on the ground with your legs slightly bent. Hold onto your toes with your hands and pull your toes towards your body. Lean forward and keep your back straight.

### **Muscles being stretched**

Primary muscles: Semimembranosus. Semitendinosus. Biceps femoris.

Secondary muscle: Soleus.

### **Sports that benefit from this stretch**

Basketball. Netball. Cycling. Hiking. Backpacking. Mountaineering. Orienteering. Ice hockey. Field hockey. Ice-skating. Roller-skating. Inline skating. Martial arts. Running. Track. Cross-country. American football (gridiron). Soccer. Rugby. Snow skiing. Water skiing. Surfing. Walking. Race walking. Wrestling.

### **Sports injury where stretch may be useful**

Hamstring strain. Achilles tendon strain. Achilles tendonitis. Medial tibial pain syndrome (shin splints).

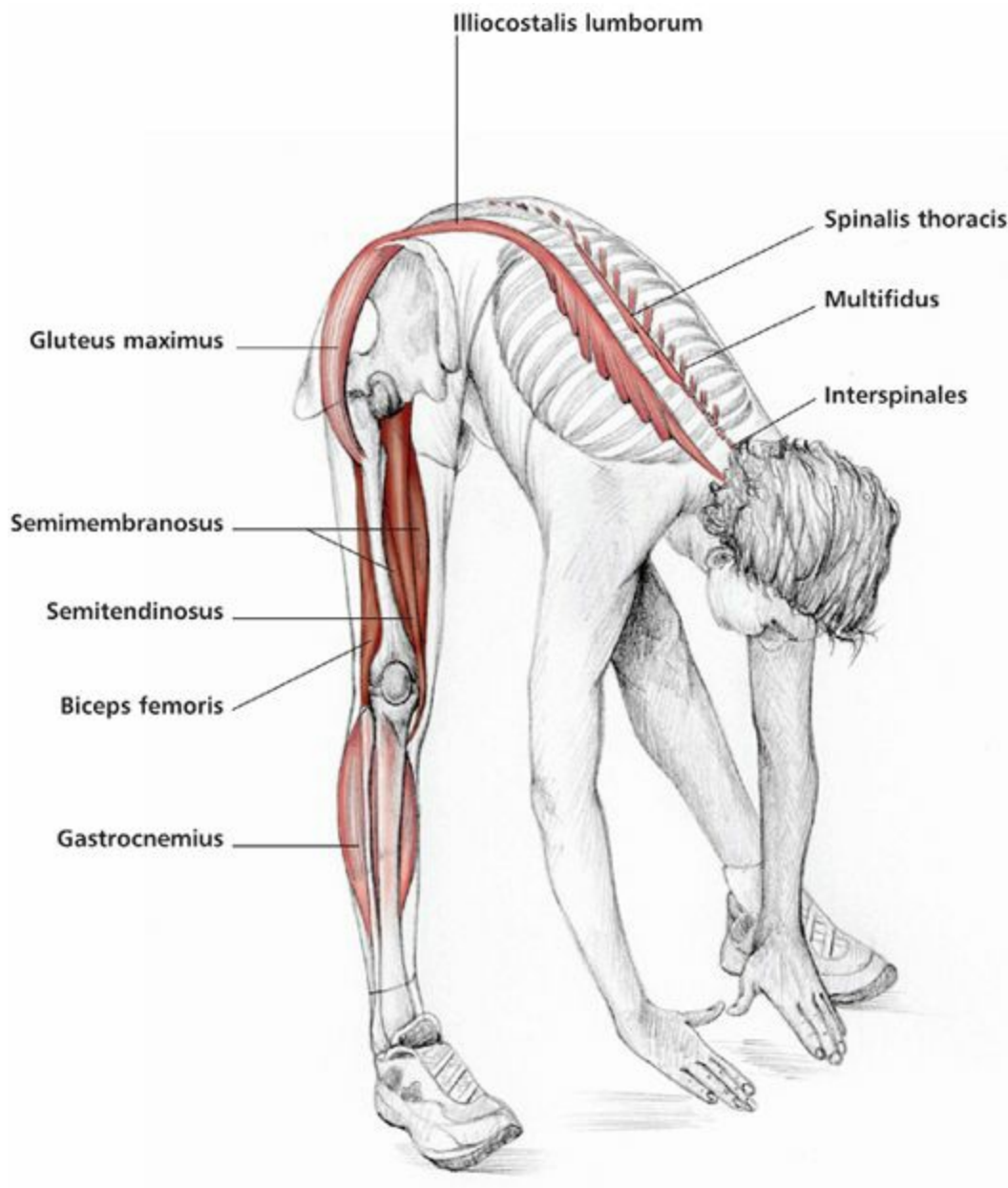
### **Common problems and additional information for performing this stretch correctly**

When pulling back on your toes, make sure they are pointing straight upwards. Letting your toes fall to one side will cause this stretch to put uneven tension on the hamstring muscles. Over an extended period of time, this could lead to a muscle imbalance.

### **Complementary stretch**

[G08](#).

# G15: STANDING REACH DOWN HAMSTRING STRETCH



## Technique

Stand with your feet shoulder-width apart. Bend forward and reach towards the ground.

## Muscles being stretched

Primary muscles: Semimembranosus. Semitendinosus. Biceps femoris.

Secondary muscles: Gastrocnemius. Gluteus maximus. Iliocostalis lumborum. Spinalis thoracis. Interspinales. Multifidus.

## Sports that benefit from this stretch

Basketball. Netball. Cycling. Hiking. Backpacking. Mountaineering. Orienteering. Ice hockey. Field hockey. Ice-skating. Roller-skating. Inline skating. Martial arts. Running. Track. Cross-country

American football (gridiron). Soccer. Rugby. Snow skiing. Water skiing. Surfing. Walking. Race walking. Wrestling.

**Sports injury where stretch may be useful**

Lower back muscle strain. Lower back ligament sprain. Hamstring strain. Calf strain.

**Common problems and additional information for performing this stretch correctly**

This position puts a lot of stress on the lower back muscles and the knees. Avoid this stretch if you have lower back pain or knee pain.

**Complementary stretch**

[G01](#).

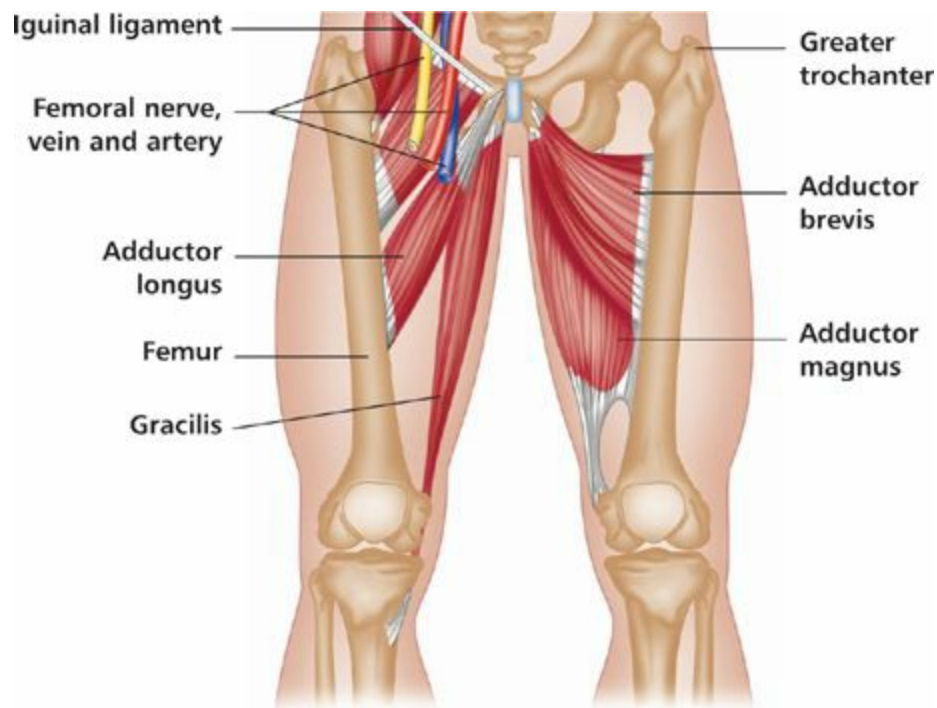
# 10

## Adductors

The adductors are a large group of muscles located on the medial (inner) side of the thigh. They originate at the bottom of the hip bone and extend down the inside of the thigh attaching to the medial side of the femur.

**Pectineus** is the most superior adductor; its primary action is adduction, or bringing the thigh toward the midline of the body. **Gracilis** attaches from the pubis symphysis to the tibia below the knee. It shapes the superficial inner thigh, but is relatively weak. It works the knee as well as the hip.

The three muscles specifically named adductors are the **adductor magnus**, **adductor brevis**, and **adductor longus**. They travel down the inside of the thigh, starting at the anterior pubis area of the pelvis and attaching to the medial length of the femur. The magnus is the largest of the three, and spreads out to cover the fullest area of the inside thigh.



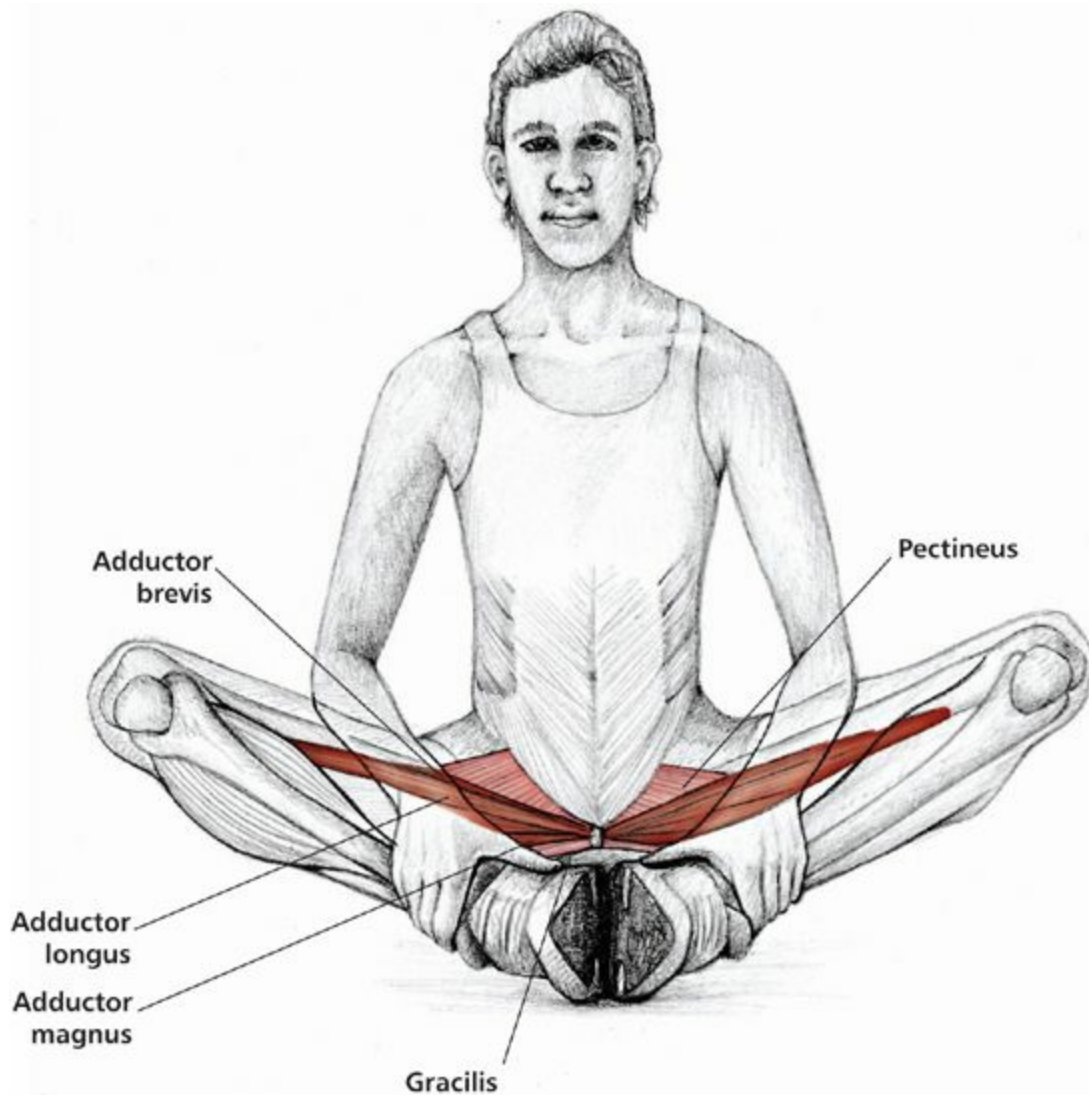
The primary action of the adductors is to adduct (draw towards the midline) the hip joint, but most



also rotate the hip. The pectineus and gracilis inwardly rotate, and the adductor brevis and magnus outwardly rotate. All adductors function as stabilisers of the leg when weight is on it, and stabilise the pelvis.

Sports that benefit from these adductor stretches include: basketball and netball; cycling; hiking, backpacking, mountaineering, and orienteering; ice hockey and field hockey; ice-skating, roller-skating, and inline skating; martial arts; running, track, and cross-country; running sports like soccer, American football (gridiron), and rugby; snow skiing and water skiing; surfing; walking and race walking; wrestling.

# H01: SITTING FEET TOGETHER ADDUCTOR STRETCH



## Technique

Sit with the soles of your feet together and bring your feet towards your groin. Hold onto your ankles and push your knee towards the ground with your elbows. Keep your back straight and upright.

## Muscles being stretched

Primary muscles: Adductor longus, brevis, and magnus.

Secondary muscles: Gracilis. Pectineus.

## Sports that benefit from this stretch

Basketball. Netball. Cycling. Hiking. Backpacking. Mountaineering. Orienteering. Ice hockey. Field hockey. Ice-skating. Roller-skating. Inline skating. Martial arts. Running. Track. Cross-country. American football (gridiron). Soccer. Rugby. Snow skiing. Water skiing. Surfing. Walking. Race walking. Wrestling.

### **Sports injury where stretch may be useful**

Avulsion fracture in the pelvic area. Groin strain. Osteitis pubis. Piriformis syndrome. Tendonitis of the adductor muscles. Trochanteric bursitis.

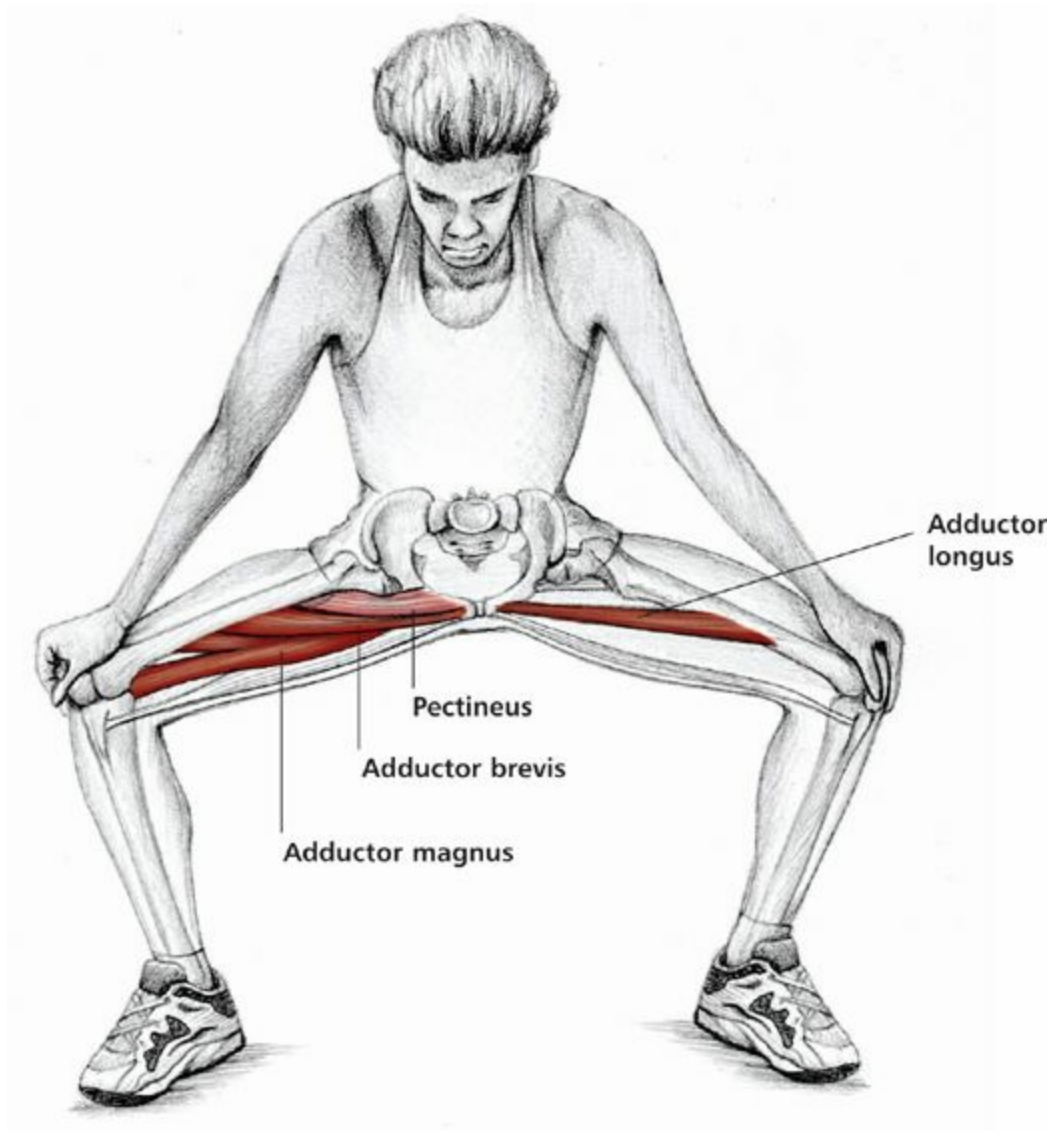
### **Additional information for performing this stretch correctly**

Keep your back straight and use your elbows to regulate the intensity of this stretch.

### **Complementary stretch**

[E08](#).

## H02: STANDING WIDE KNEES ADDUCTOR STRETCH



### Technique

Stand with your feet wide apart and your toes pointing diagonally outwards. Bend at the knees, lean forward and use your hands to push your knees outwards.

### Muscles being stretched

Primary muscles: Adductor longus, brevis, and magnus.

Secondary muscle: Pectineus.

### Sports that benefit from this stretch

Basketball. Netball. Cycling. Hiking. Backpacking. Mountaineering. Orienteering. Ice hockey. Field hockey. Ice-skating. Roller-skating. Inline skating. Martial arts. Running. Track. Cross-country. American football (gridiron). Soccer. Rugby. Snow skiing. Water skiing. Surfing. Walking. Race walking. Wrestling.

### **Sports injury where stretch may be useful**

Avulsion fracture in the pelvic area. Groin strain. Osteitis pubis. Piriformis syndrome. Tendonitis of the adductor muscles. Trochanteric bursitis.

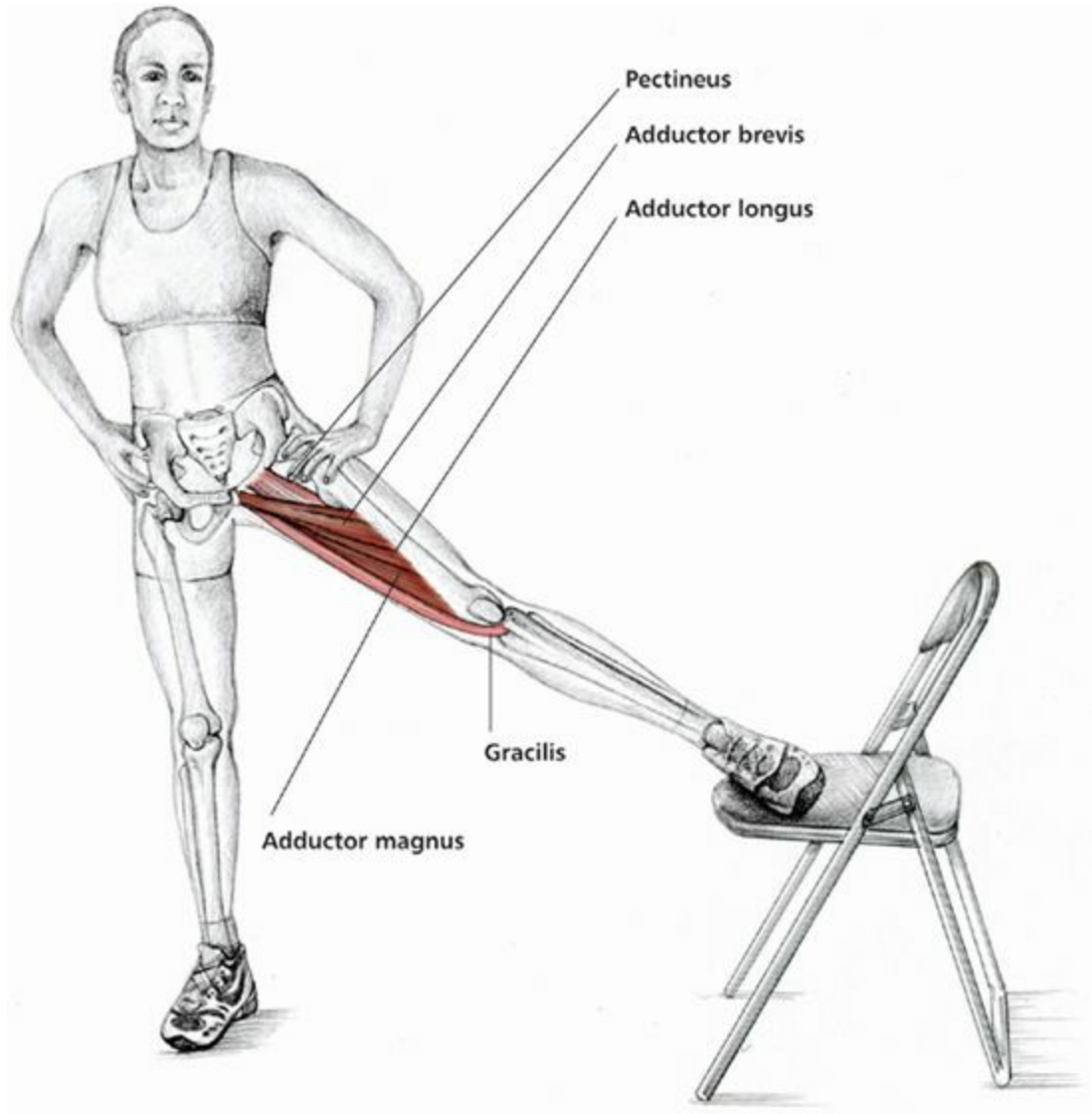
### **Common problems and more information for performing this stretch correctly**

Holding this position for extended periods of time requires a lot of quadriceps strength. If you start to feel your legs getting weak, take a break.

### **Complementary stretch**

[H07](#).

## H03: STANDING LEG-UP ADDUCTOR STRETCH



### Technique

Stand upright and place one leg out to the side and your foot up on a raised object. Keep your toes facing forward and slowly move your other leg away from the object.

### Muscles being stretched

Primary muscles: Adductor longus, brevis, and magnus.

Secondary muscles: Gracilis. Pectineus.

### Sports that benefit from this stretch

Basketball. Netball. Cycling. Hiking. Backpacking. Mountaineering. Orienteering. Ice hockey. Field hockey. Ice-skating. Roller-skating. Inline skating. Martial arts. Running. Track. Cross-country. American football (gridiron). Soccer. Rugby. Snow skiing. Water skiing. Surfing. Walking. Race walking. Wrestling.

### **Sports injury where stretch may be useful**

Avulsion fracture in the pelvic area. Groin strain. Osteitis pubis. Piriformis syndrome. Tendonitis of the adductor muscles. Trochanteric bursitis.

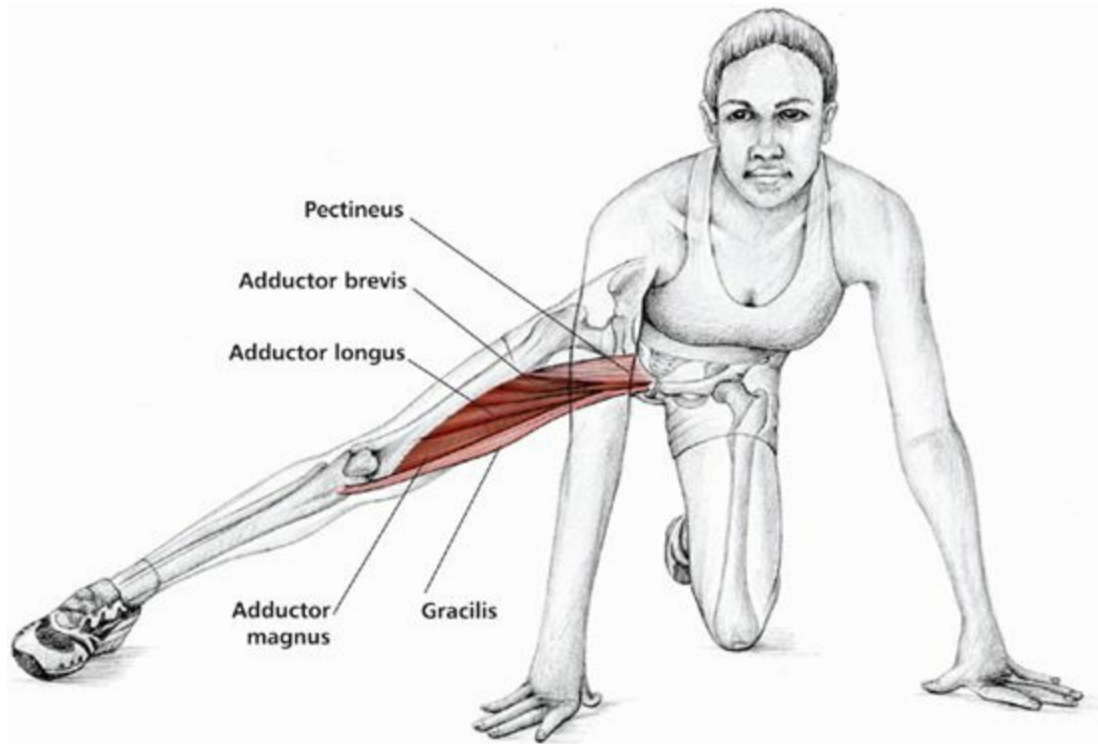
### **Additional information for performing this stretch correctly**

To increase the intensity of this stretch, use a higher object and if you need to, hold onto something for balance.

### **Complementary stretch**

[H01](#).

# H04: KNEELING LEG-OUT ADDUCTOR STRETCH



## Technique

Kneel on one knee and place your other leg out to the side with your toes facing forward. Rest your hands on the ground and slowly move your foot further out to the side.

## Muscles being stretched

Primary muscles: Adductor longus, brevis, and magnus.

Secondary muscles: Gracilis. Pectineus.

## Sports that benefit from this stretch

Basketball. Netball. Cycling. Hiking. Backpacking. Mountaineering. Orienteering. Ice hockey. Field hockey. Ice-skating. Roller-skating. Inline skating. Martial arts. Running. Track. Cross-country. American football (gridiron). Soccer. Rugby. Snow skiing. Water skiing. Surfing. Walking. Race walking. Wrestling.

## Sports injury where stretch may be useful

Avulsion fracture in the pelvic area. Groin strain. Osteitis pubis. Piriformis syndrome. Tendonitis of the adductor muscles. Trochanteric bursitis.

## Additional information for performing this stretch correctly

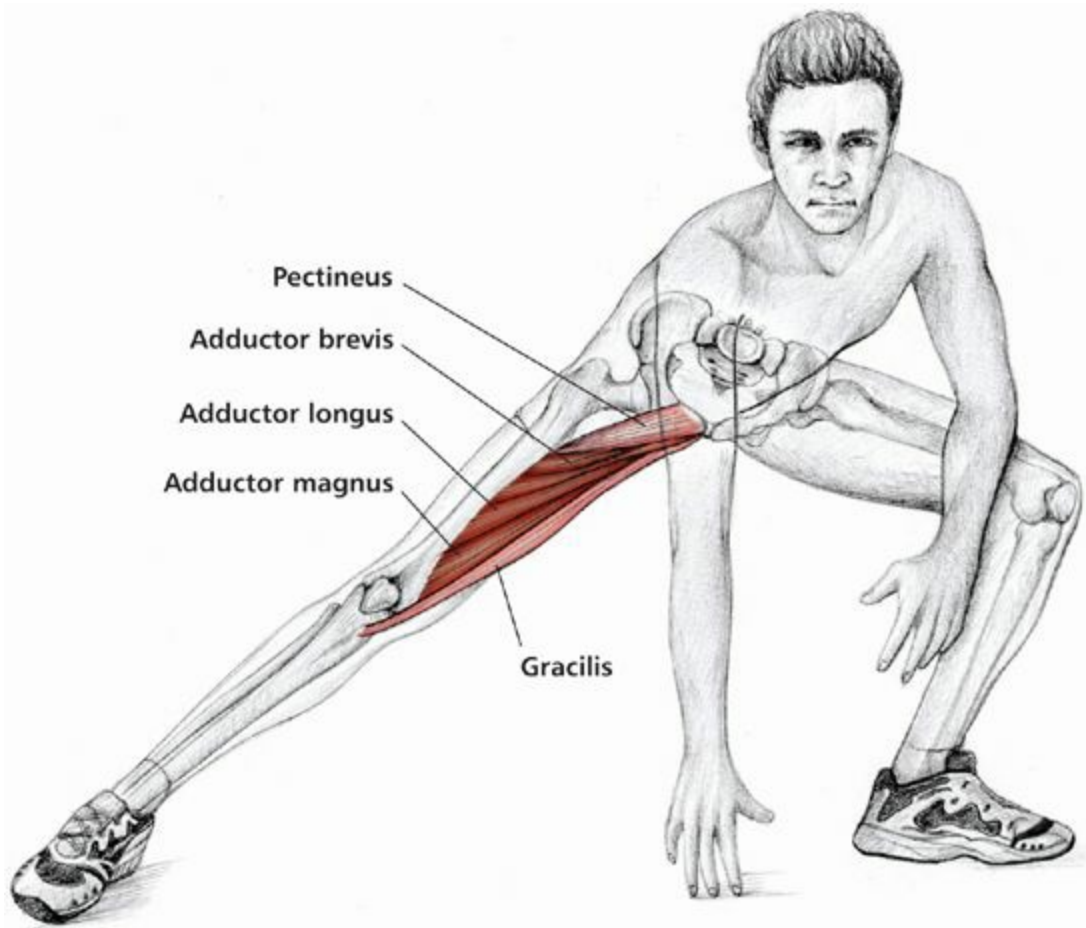
If need be, place a towel or mat under your knee for comfort.

## Complementary stretch





# H05: SQUATTING LEG-OUT ADDUCTOR STRETCH



## Technique

Stand with your feet wide apart. Keep one leg straight and toes facing forward while bending the other leg and turning your toes out to the side. Lower your groin towards the ground and rest your hands on the bent knee or the ground.

## Muscles being stretched

Primary muscles: Adductor longus, brevis, and magnus.

Secondary muscles: Gracilis. Pectineus.

## Sports that benefit from this stretch

Basketball. Netball. Cycling. Hiking. Backpacking. Mountaineering. Orienteering. Ice hockey. Field hockey. Ice skating. Roller skating. Inline skating. Martial arts. Running. Track. Cross country. American football (gridiron). Soccer. Rugby. Snow skiing. Water skiing. Surfing. Walking. Race walking. Wrestling.

## Sports injury where stretch may be useful

Avulsion fracture in the pelvic area. Groin strain. Osteitis pubis. Piriformis syndrome. Tendonitis of the adductor muscles. Trochanteric bursitis.

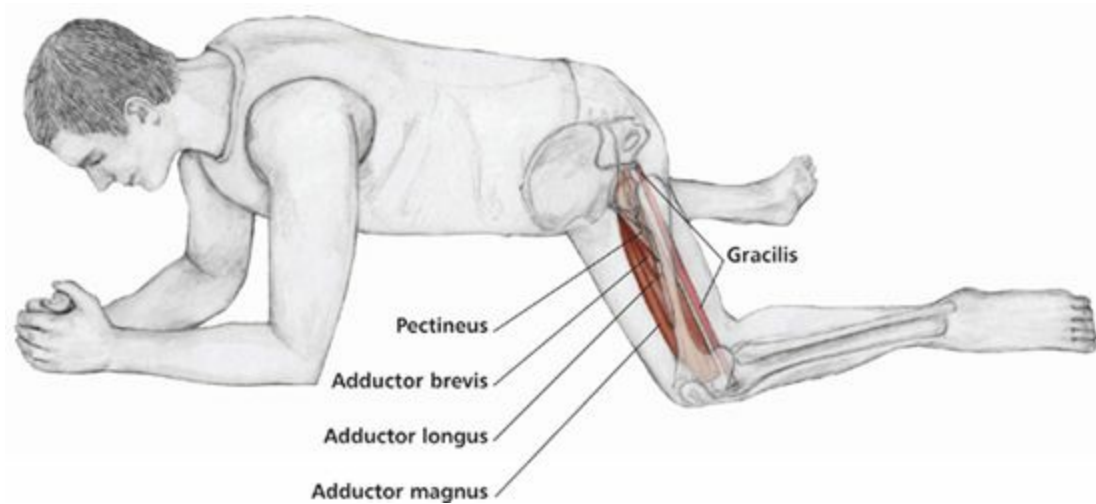
### **Additional information for performing this stretch correctly**

Increase the intensity of this stretch by lowering yourself towards the ground.

### **Complementary stretch**

[H04](#).

# H06: KNEELING FACE-DOWN ADDUCTOR STRETCH



## Technique

Kneel face down with your knees and toes facing out. Lean forward and let your knees move outwards.

## Muscles being stretched

Primary muscles: Adductor longus, brevis, and magnus.

Secondary muscles: Gracilis. Pectineus.

## Sports that benefit from this stretch

Basketball. Netball. Cycling. Hiking. Backpacking. Mountaineering. Orienteering. Ice hockey. Field hockey. Ice-skating. Roller-skating. Inline skating. Martial arts. Running, Track. Cross-country Soccer. American football (gridiron). Rugby. Snow skiing. Water skiing. Surfing. Walking. Race walking. Wrestling.

## Sports injury where stretch may be useful

Avulsion fracture in the pelvic area. Groin strain. Osteitis pubis. Piriformis syndrome. Tendonitis of the adductor muscles. Trochanteric bursitis.

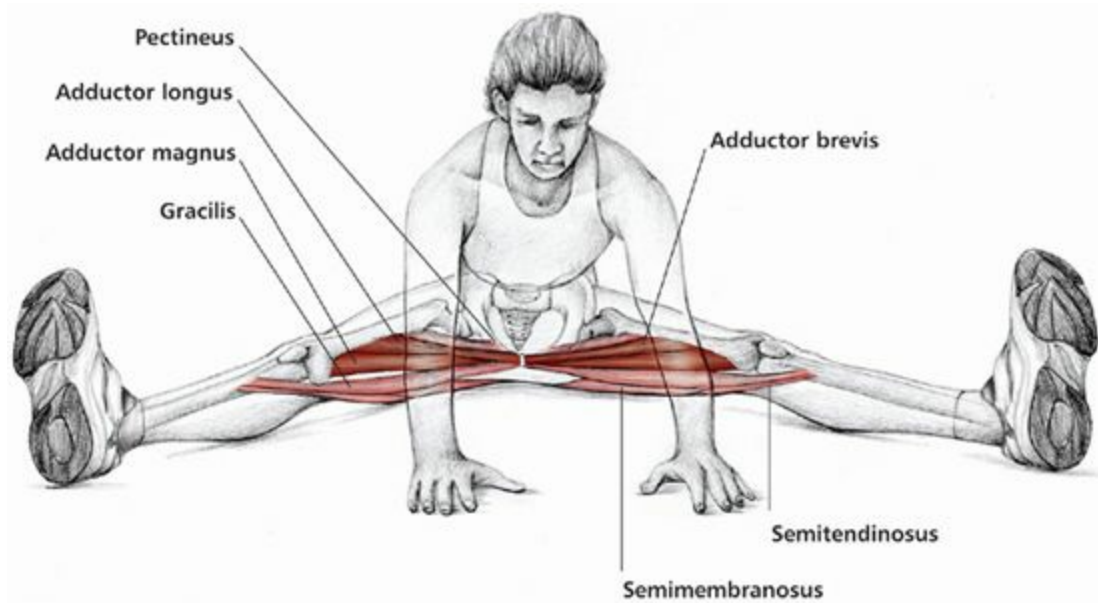
## Additional information for performing this stretch correctly

Increase the intensity by lowering yourself towards the ground.

## Complementary stretches

[H01](#), [H03](#).

# H07: SITTING WIDE LEG ADDUCTOR STRETCH



## Technique

Sit with your legs straight and wide apart. Keep your back straight and lean forward.

## Muscles being stretched

Primary muscles: Adductor longus, brevis, and magnus.

Secondary muscles: Gracilis. Pectineus. Semimembranosus. Semitendinosus.

## Sports that benefit from this stretch

Basketball. Netball. Cycling. Hiking. Backpacking. Mountaineering. Orienteering. Ice hockey. Field hockey. Ice-skating. Roller-skating. Inline skating. Martial arts. Running. Track. Cross-country. American football (gridiron). Soccer. Rugby. Snow skiing. Water skiing. Surfing. Walking. Race walking. Wrestling.

## Sports injury where stretch may be useful

Avulsion fracture in the pelvic area. Groin strain. Osteitis pubis. Piriformis syndrome. Tendonitis of the adductor muscles. Trochanteric bursitis. Hamstring strain.

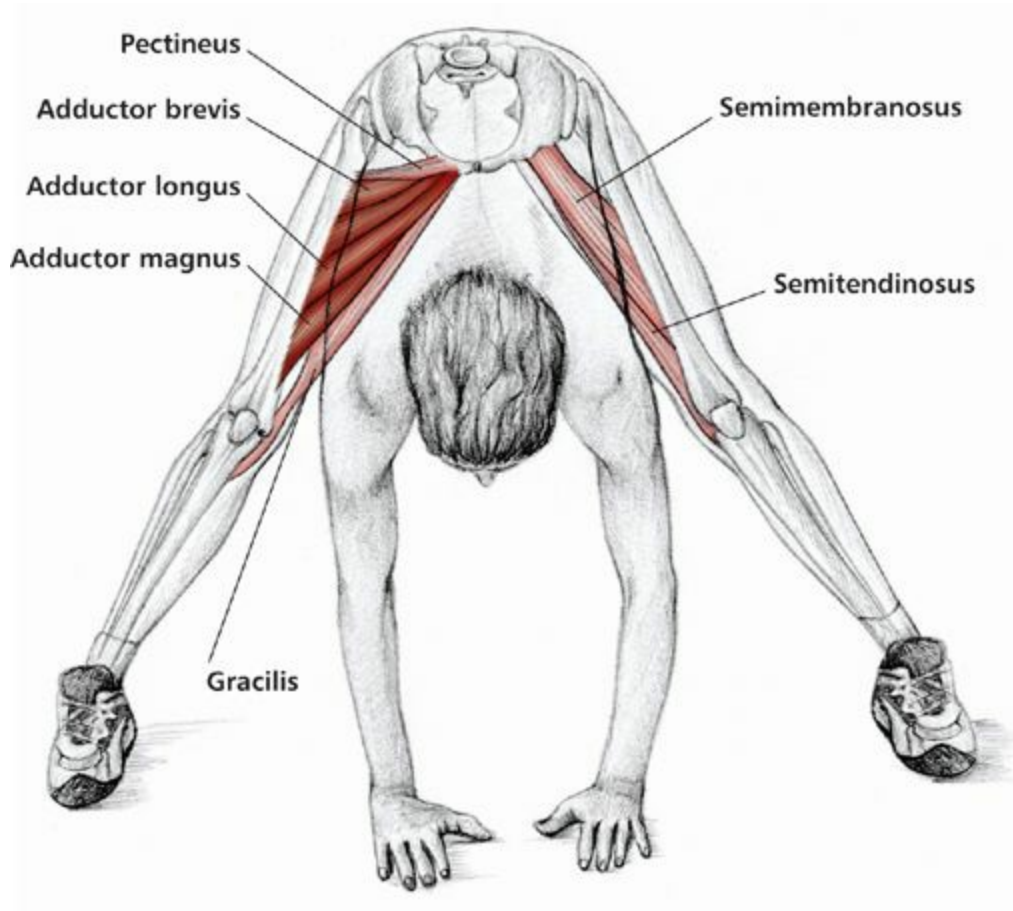
## Additional information for performing this stretch correctly

To increase the intensity of this stretch, move your legs further apart.

## Complementary stretch

[H05](#).

# H08: STANDING WIDE LEG ADDUCTOR STRETCH



## Technique

Stand with your feet wide apart and your toes facing forward. Lean forward and reach towards the ground.

## Muscles being stretched

Primary muscles: Adductor longus, brevis, and magnus.

Secondary muscles: Gracilis. Pectineus. Semimembranosus. Semitendinosus.

## Sports that benefit from this stretch

Basketball. Netball. Cycling. Hiking. Backpacking. Mountaineering. Orienteering. Ice hockey. Field hockey. Ice-skating. Roller-skating. Inline skating. Martial arts. Running. Track. Cross-country. American football (gridiron). Soccer. Rugby. Snow skiing. Water skiing. Surfing. Walking. Race walking. Wrestling.

## Sports injury where stretch may be useful

Avulsion fracture in the pelvic area. Groin strain. Osteitis pubis. Piriformis syndrome. Tendonitis of the adductor muscles. Trochanteric bursitis. Hamstring strain.

## Common problems and more information for performing this stretch correctly

This position puts a lot of stress on the lower back muscles and the knees. Avoid this stretch if you have lower back pain or knee pain.

### **Complementary stretch**

[H03](#).

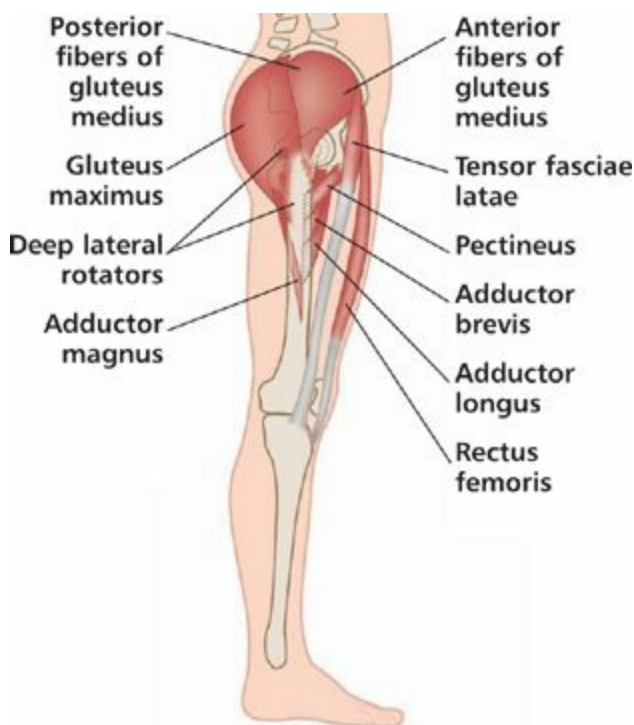


## Abductors

The abductors are located on the lateral side (outside) of the thigh and hip. They originate at the top outer edge of the hip bone and extend down the outside of the thigh attaching to the lateral side of the tibia. The primary action of the abductors is to abduct (draw away from the midline) and medially rotate the hip joint.

**Gluteus medius** is mostly deep to and therefore obscured by gluteus maximus, but appears on the surface between gluteus maximus and tensor fasciae latae. During walking, gluteus medius, along with gluteus minimus, prevents the pelvis from dropping towards the non-weight bearing leg. When gluteus medius is tight, pelvic imbalances may result, leading to pain in the hips, lower back, and knees.

**Gluteus minimus** lies deep to gluteus medius, whose fibers obscure it; as its name implies, it is the smallest of the gluteal muscles. As with gluteus medius, when minimus is tight, pelvic imbalances may occur.



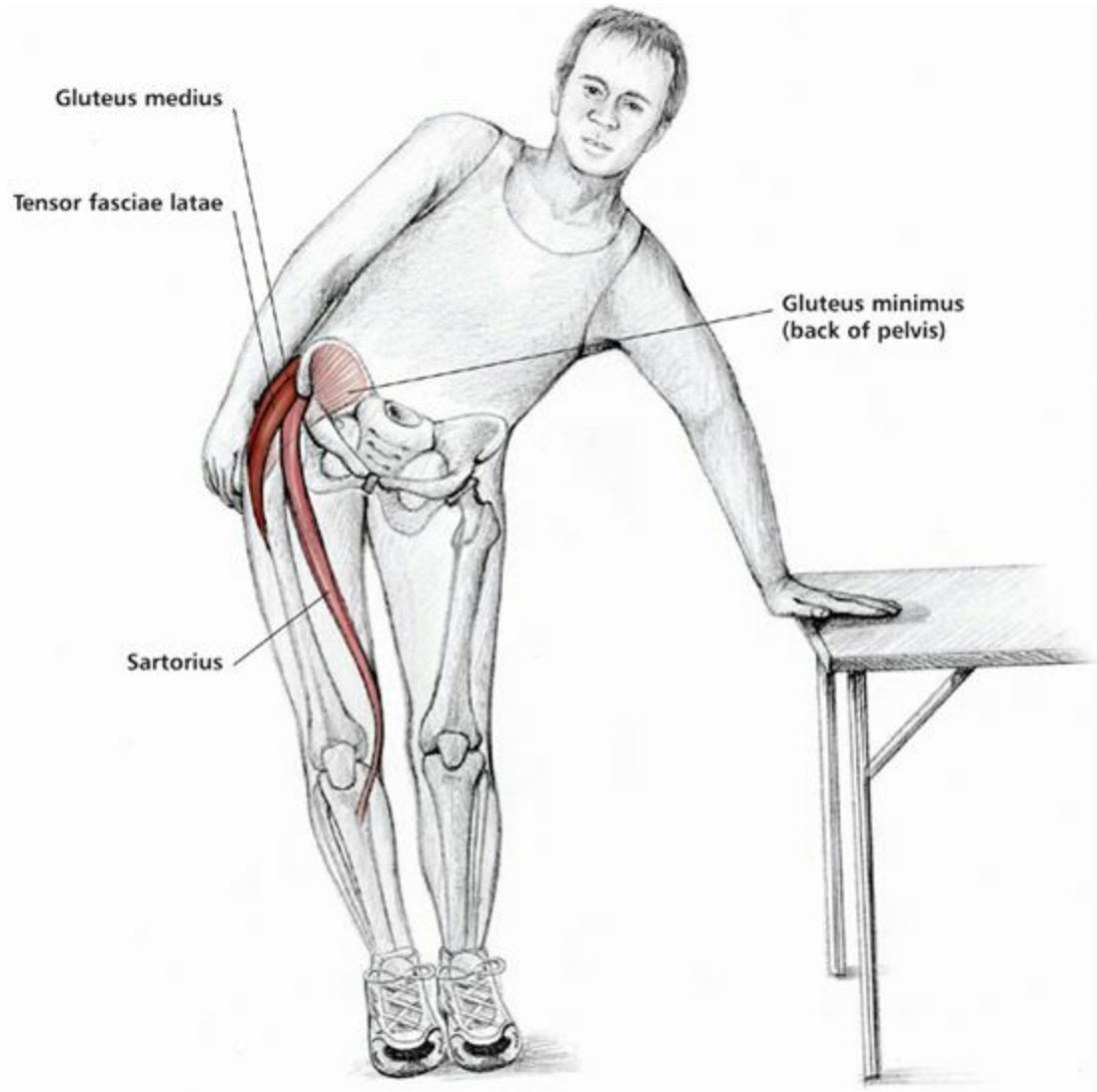
**Tensor fasciae latae** lies anterior to gluteus maximus, and is a superficial muscle of the upper thigh



that keeps your pelvis level, and stabilises your knee as you stand on one leg. It also assists in flexion of the hip joint.

Sports that benefit from these abductor stretches include: cycling; hiking, backpacking, mountaineering, and orienteering; ice hockey and field hockey; ice-skating, roller-skating, and inline skating; martial arts; rowing, canoeing, and kayaking; running, track, and cross-country; running sports like soccer, American football (gridiron), and rugby; snow skiing and water skiing; walking and race walking.

# I01: STANDING HIP-OUT ABDUCTOR STRETCH



## Technique

Stand upright beside a wall or table with both feet together. Lean your upper body towards the wall and push your hips away from the wall. Keep your outside leg straight and your inside leg slightly bent.

## Muscles being stretched

Primary muscles: Tensor fasciae latae. Gluteus medius and minimus.

Secondary muscle: Sartorius.

## Sports that benefit from this stretch

Basketball. Netball. Cycling. Hiking. Backpacking. Mountaineering. Orienteering. Ice hockey. Field hockey. Ice-skating. Roller-skating. Inline skating. Martial arts. Running. Track. Cross-country. American football (gridiron). Soccer. Rugby. Snow skiing. Water skiing. Surfing. Walking. Race walking. Wrestling.

## **Sports injury where stretch may be useful**

Trochanteric bursitis. Iliotibial band syndrome.

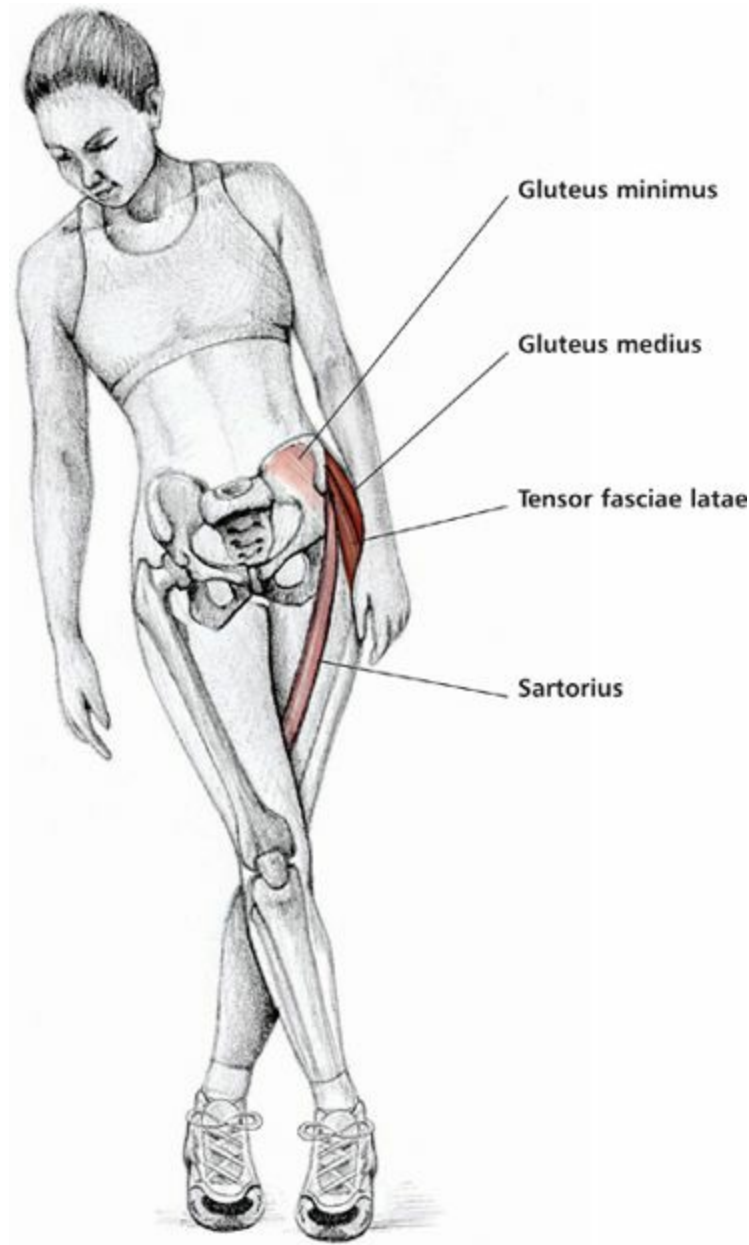
## **Common problems and more information for performing this stretch correctly**

It is important not to bend forward during this stretch. Keep your body upright and concentrate on pushing your hips away from the object you're leaning on.

## **Complementary stretch**

[107](#).

## I02: STANDING LEG CROSS ABDUCTOR STRETCH



### **Technique**

Stand upright and cross one foot behind the other. Lean towards the foot that is behind the other.

### **Muscles being stretched**

Primary muscles: Tensor fasciae latae. Gluteus medius and minimus.

Secondary muscle: Sartorius.

### **Sports that benefit from this stretch**

Basketball. Netball. Cycling. Hiking. Backpacking. Mountaineering. Orienteering. Ice hockey. Field hockey. Ice-skating. Roller-skating. Inline skating. Martial arts. Running. Track. Cross-country. American football (gridiron). Soccer. Rugby. Snow skiing. Water skiing. Surfing. Walking. Race

walking. Wrestling.

**Sports injury where stretch may be useful**

Trochanteric bursitis. Iliotibial band syndrome.

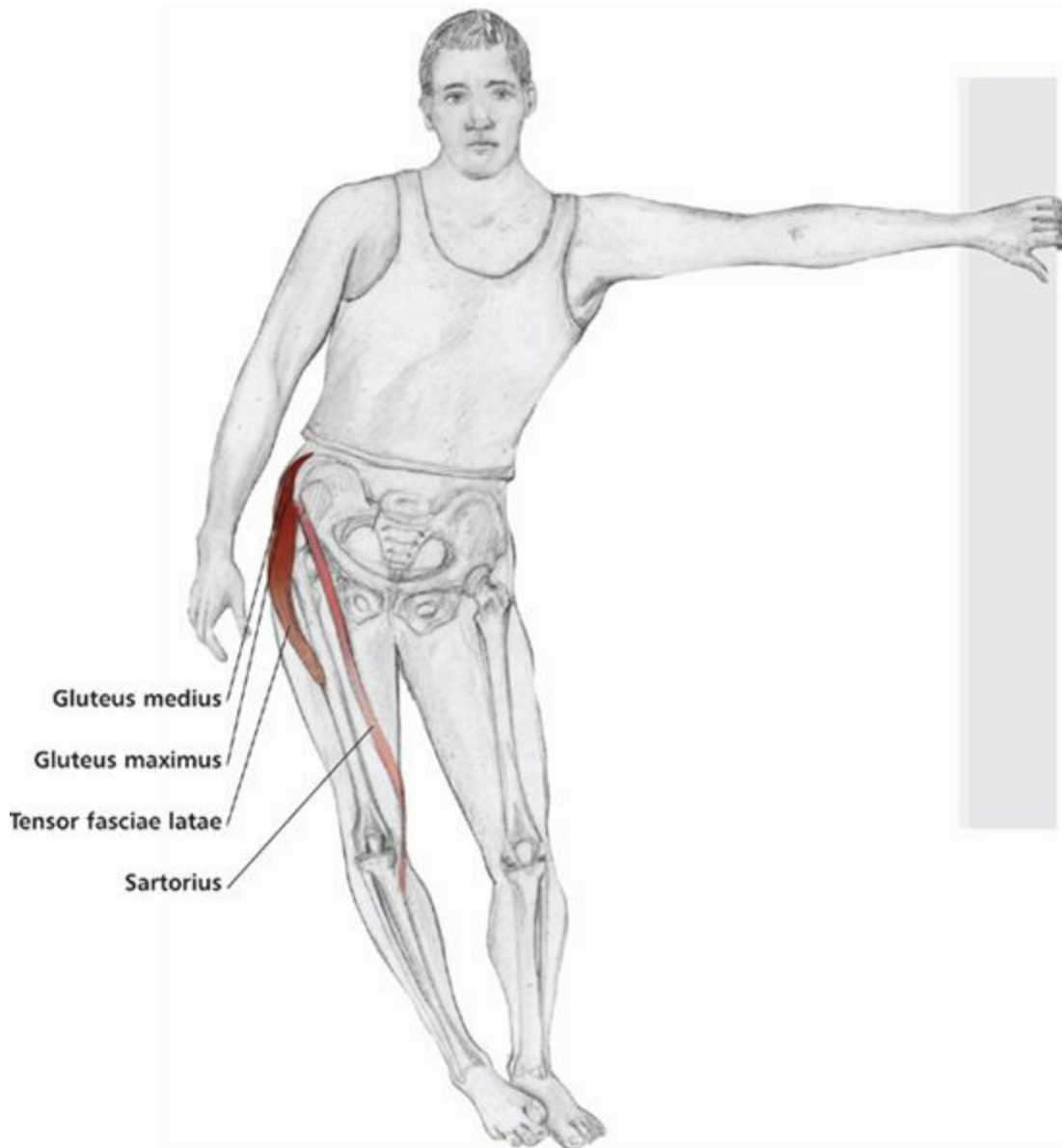
**Additional information for performing this stretch correctly**

If need be, hold onto something for balance. This will allow you to concentrate on the stretch, instead of worrying about falling over.

**Complementary stretch**

[D21](#).

## I03: LEANING ABDUCTOR STRETCH



### **Technique**

Hold onto the pole with one hand, while standing next to a pole or door jam. Keep your feet together, and lean your hips away from the pole. Keep your outside leg straight and bend your inside leg slightly.

### **Muscles being stretched**

Primary muscles: Tensor fasciae latae. Gluteus medius and minimus.

Secondary muscle: Sartorius.

### **Sports that benefit from this stretch**

Basketball. Netball. Cycling. Hiking. Backpacking. Mountaineering. Orienteering. Ice hockey. Field hockey. Ice-skating. Roller-skating. Inline skating. Martial arts. Running. Track. Cross-country

Soccer. American football (gridiron). Rugby. Snow skiing. Water skiing. Surfing. Walking. Race walking. Wrestling.

### **Sports injury where stretch may be useful**

Trochanteric bursitis. Iliotibial band syndrome.

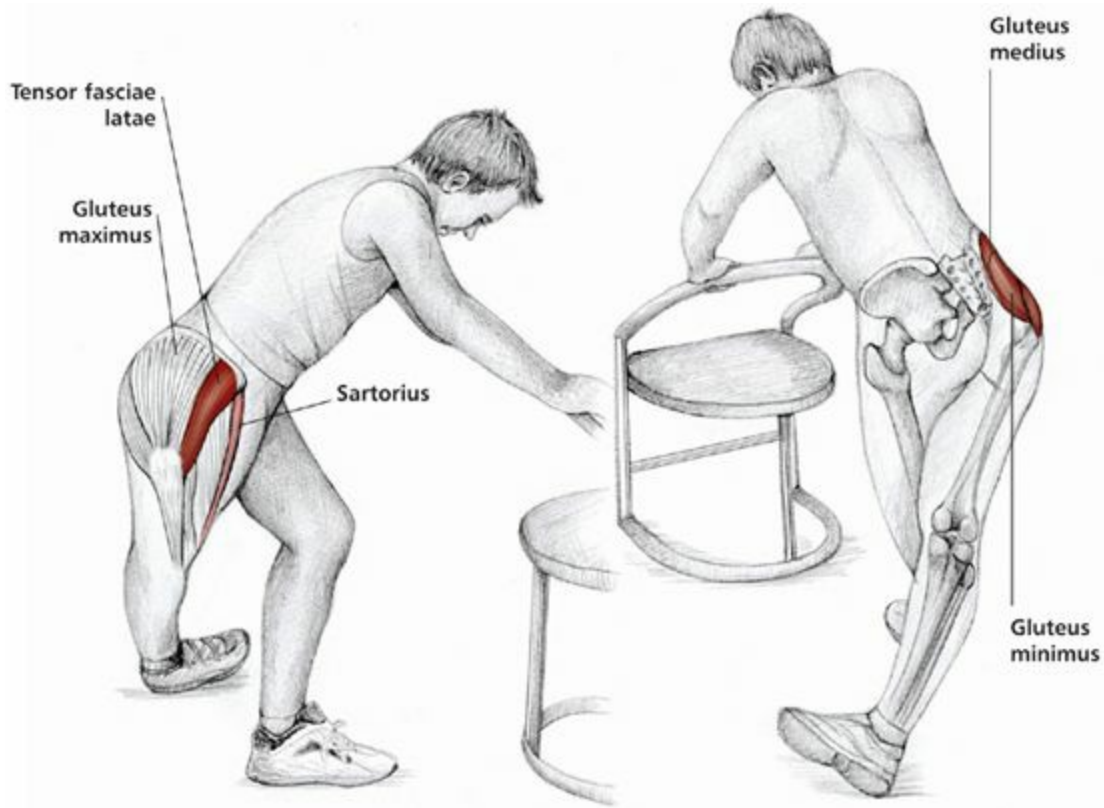
### **Common problems and more information for performing this stretch correctly**

It is important not to bend forward during this stretch. Keep your body upright and concentrate on pushing your hips away from the object you are holding on to.

### **Complementary stretch**

[I04.](#)

# I04: STANDING LEG-UNDER ABDUCTOR STRETCH



## Technique

While standing, lean forward and hold onto a chair or bench to help with balance. Cross one foot behind the other and slide that foot away from your body, keeping your leg straight. Slowly bend your front leg to lower your body.

## Muscles being stretched

Primary muscles: Tensor fasciae latae. Gluteus medius and minimus.

Secondary muscle: Sartorius.

## Sports that benefit from this stretch

Basketball. Netball. Cycling. Hiking. Backpacking. Mountaineering. Orienteering. Ice hockey. Field hockey. Ice-skating. Roller-skating. Inline skating. Martial arts. Running. Track. Cross-country. American football (gridiron). Soccer. Rugby. Snow skiing. Water skiing. Surfing. Walking. Race walking. Wrestling.

## Sports injury where stretch may be useful

Trochanteric bursitis. Iliotibial band syndrome.

## Additional information for performing this stretch correctly

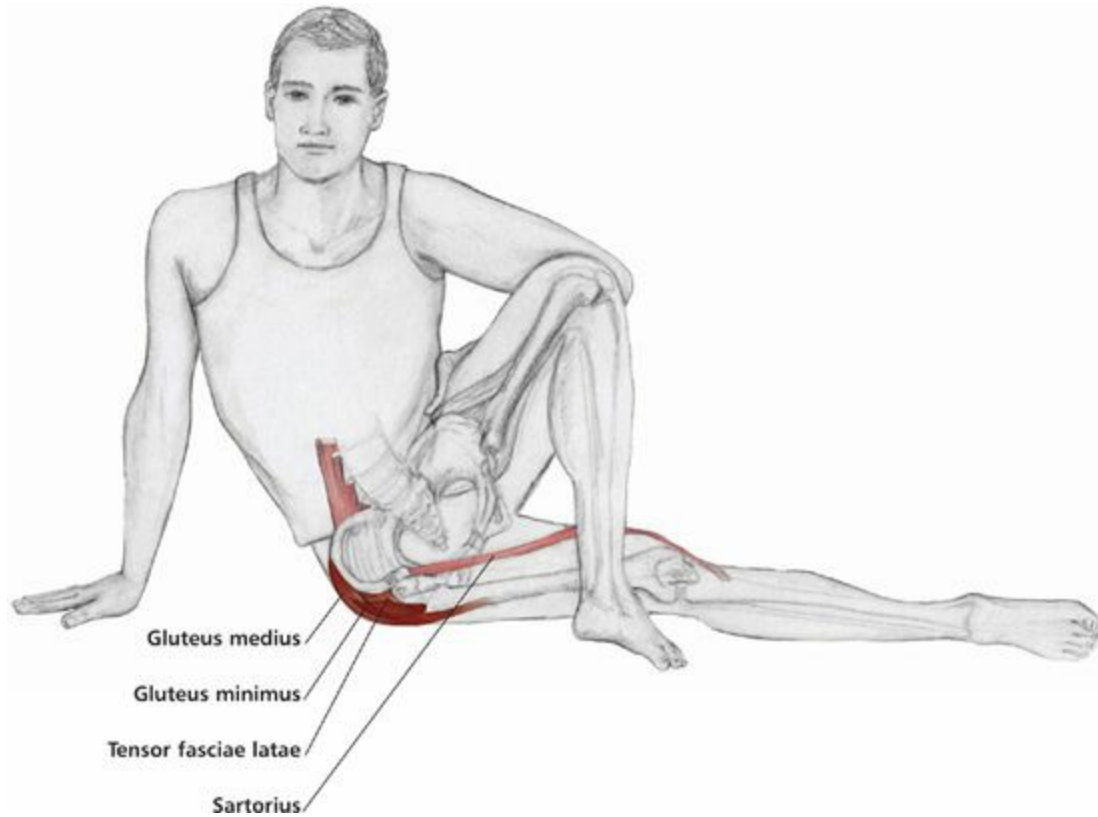
Regulate the intensity of the stretch by using your bent leg to lower your body.



## Complementary stretch

102.

## I05: LYING ABDUCTOR STRETCH



### **Technique**

Lean on your side on the ground and bring your top leg up to your other knee. Push your body up with your arm and keep your hip on the ground.

### **Muscles being stretched**

Primary muscles: Tensor fasciae latae. Gluteus medius and minimus.

Secondary muscles: Sartorius. Quadratus lumborum.

### **Sports that benefit from this stretch**

Basketball. Netball. Cycling. Hiking. Backpacking. Mountaineering. Orienteering. Ice hockey. Field hockey. Ice-skating. Roller-skating. Inline skating. Martial arts. Running. Track. Cross-country. Soccer. American football (gridiron). Rugby. Snow skiing. Water skiing. Surfing. Walking. Race walking. Wrestling.

### **Sports injury where stretch may be useful**

Trochanteric bursitis. Iliotibial band syndrome.

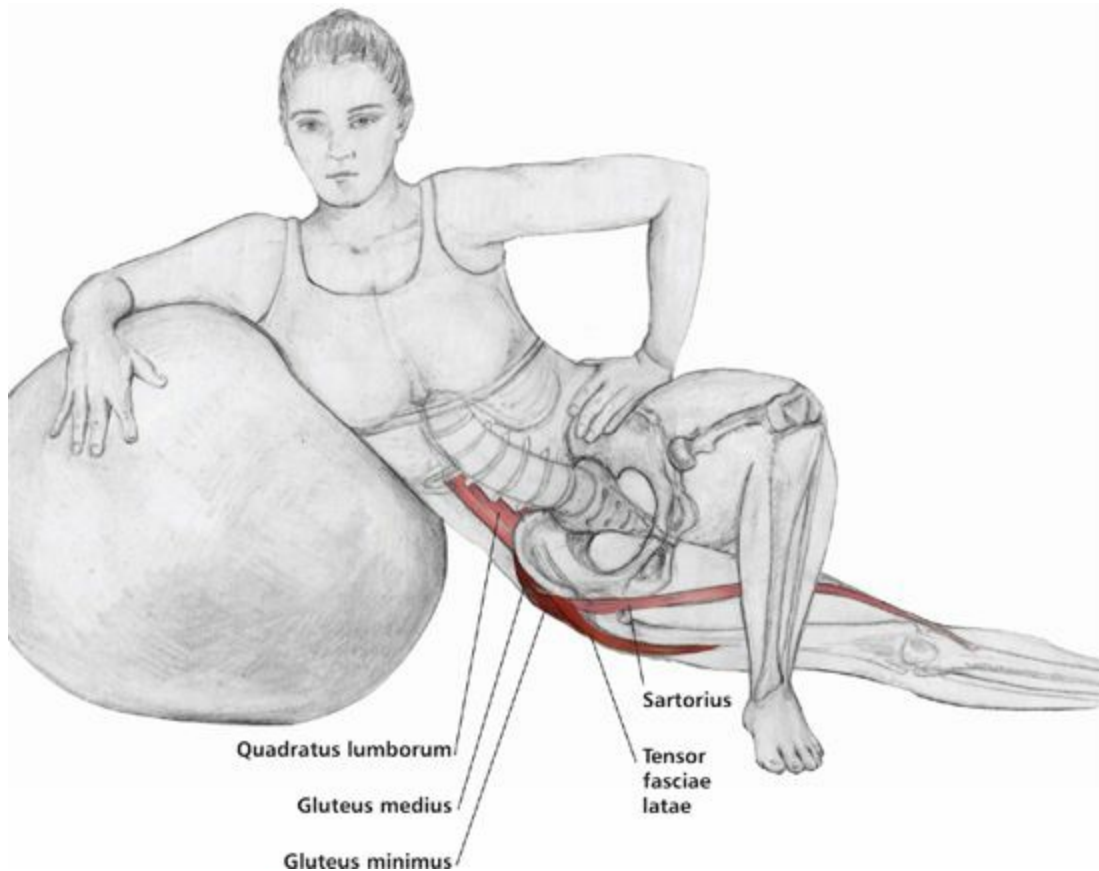
### **Common problems and more information for performing this stretch correctly**

Increase the intensity of this stretch by lowering yourself towards the ground.

### **Complementary stretches**



## I06: LYING SWISS BALL ABDUCTOR STRETCH



### Technique

Lean on your side on a Swiss ball and place one leg straight out to the side. Bring your top leg up to your other knee and push your hip towards the ground.

### Muscles being stretched

Primary muscles: Tensor fasciae latae. Gluteus medius and minimus.

Secondary muscles: Sartorius. Quadratus lumborum.

### Sports that benefit from this stretch

Basketball. Netball. Cycling. Hiking. Backpacking. Mountaineering. Orienteering. Ice hockey. Field hockey. Ice-skating. Rollerskating. Inline skating. Martial arts. Running. Track. Cross-country. Soccer. American football (gridiron). Rugby. Snow skiing. Water skiing. Surfing. Walking. Race walking. Wrestling.

### Sports injury where stretch may be useful

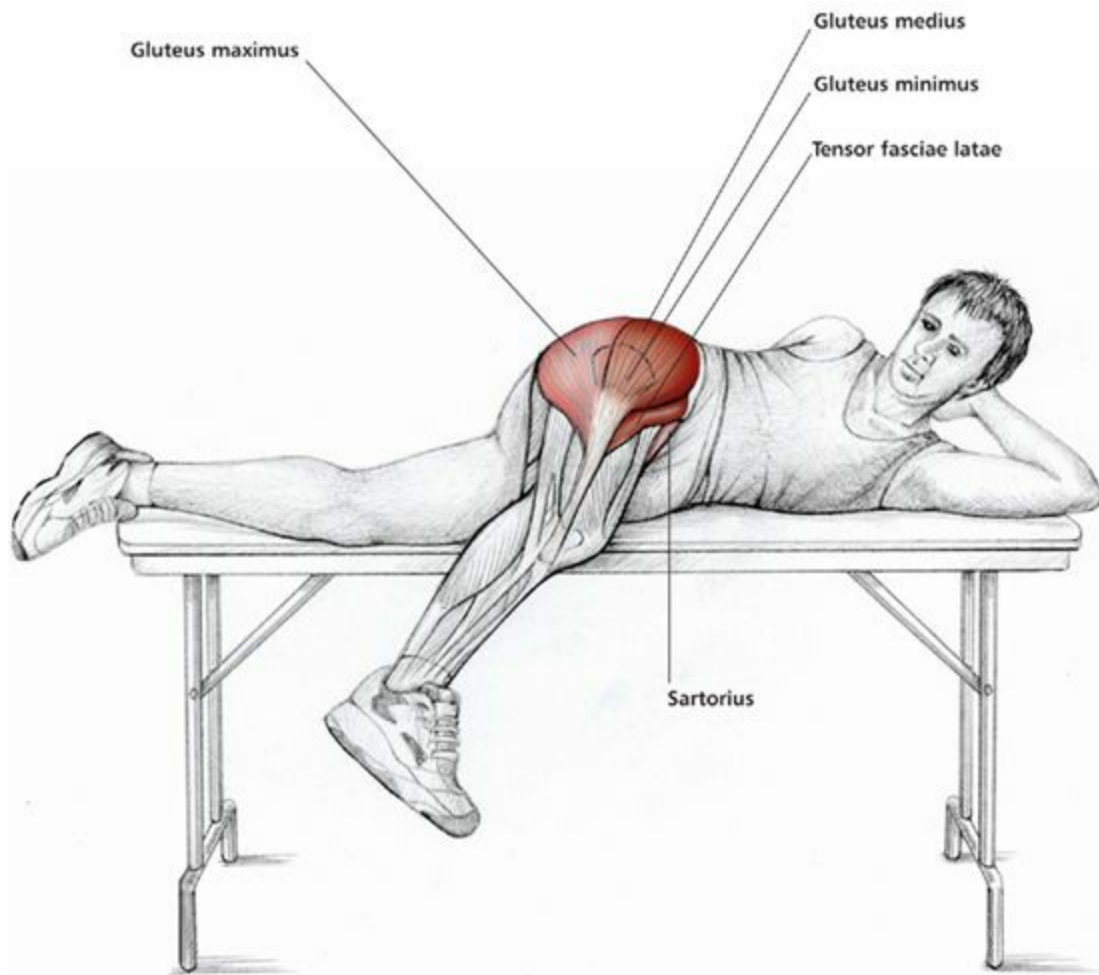
Trochanteric bursitis. Iliotibial band syndrome.

### Common problems and more information for performing this stretch correctly

It is important not to bend forward during this stretch. Keep your body upright and regulate the intensity of the stretch by pushing your hips down and your torso into a more upright position.

**Complementary stretches**  
[I03](#), [I07](#).

# I07: LYING LEG HANG ABDUCTOR STRETCH



## Technique

Lie on a bench on your side. Allow the top leg to fall forward and off the side of the bench.

## Muscles being stretched

Primary muscles: Tensor fasciae latae. Gluteus medius and minimus.

Secondary muscles: Sartorius. Gluteus maximus.

## Sports that benefit from this stretch

Basketball. Netball. Cycling. Hiking. Backpacking. Mountaineering. Orienteering. Ice hockey. Field hockey. Ice-skating. Roller-skating. Inline skating. Martial arts. Running. Track. Cross-country. American football (gridiron). Soccer. Rugby. Snow skiing. Water skiing. Surfing. Walking. Race walking. Wrestling.

## Sports injury where stretch may be useful

Trochanteric bursitis. Iliotibial band syndrome.

## Common problems and more information for performing this stretch correctly

Try not to let your leg fall too far forward and use the weight of your leg to do the stretching for you.

## **Complementary stretch**

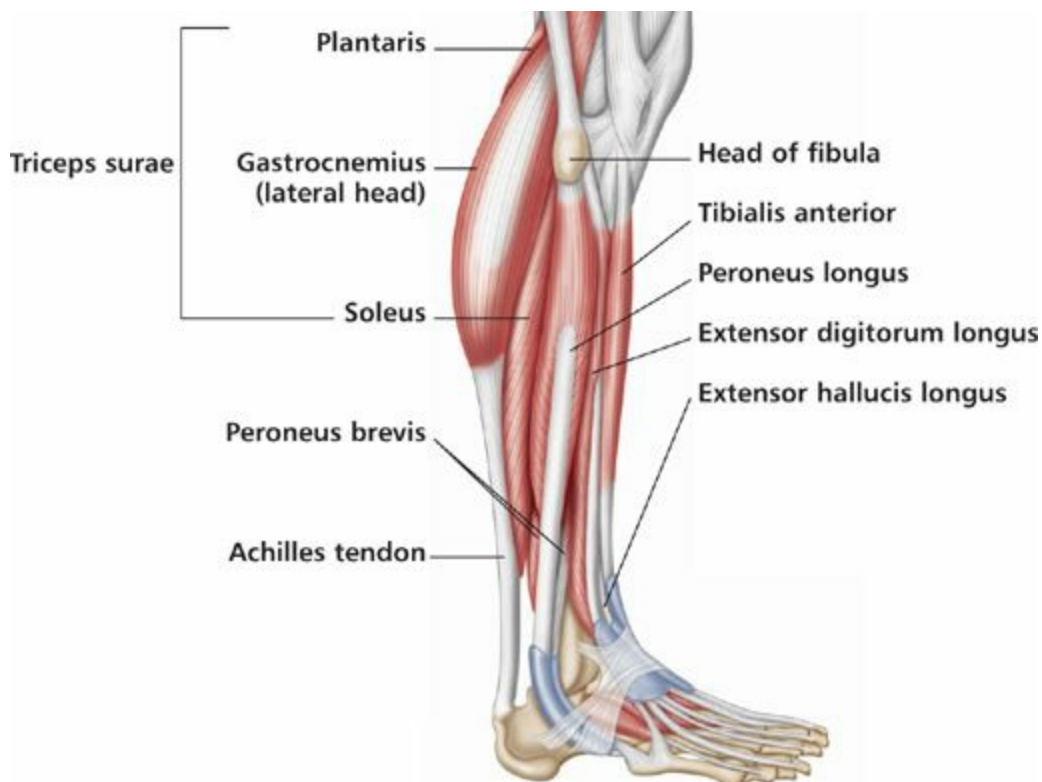
[E09](#).



## Upper Calves

The upper calf muscles are located on the posterior (rear) of the lower leg just underneath the knee joint. They originate at the bottom of the femur, just above the knee joint, and extend down into the Achilles tendon. The primary actions of the upper calf muscles are to plantar flex the ankle joint and flex the knee.

**Plantaris** is a small muscle, which is a weak plantar flexor of the ankle, but plays an important neurological role in assessing and adjusting the tension in the Achilles tendon. The long slender tendon of plantaris is equivalent to the tendon of palmaris longus in the arm. Interestingly, plantaris is thought to be what remains of a larger plantar flexor of the foot.



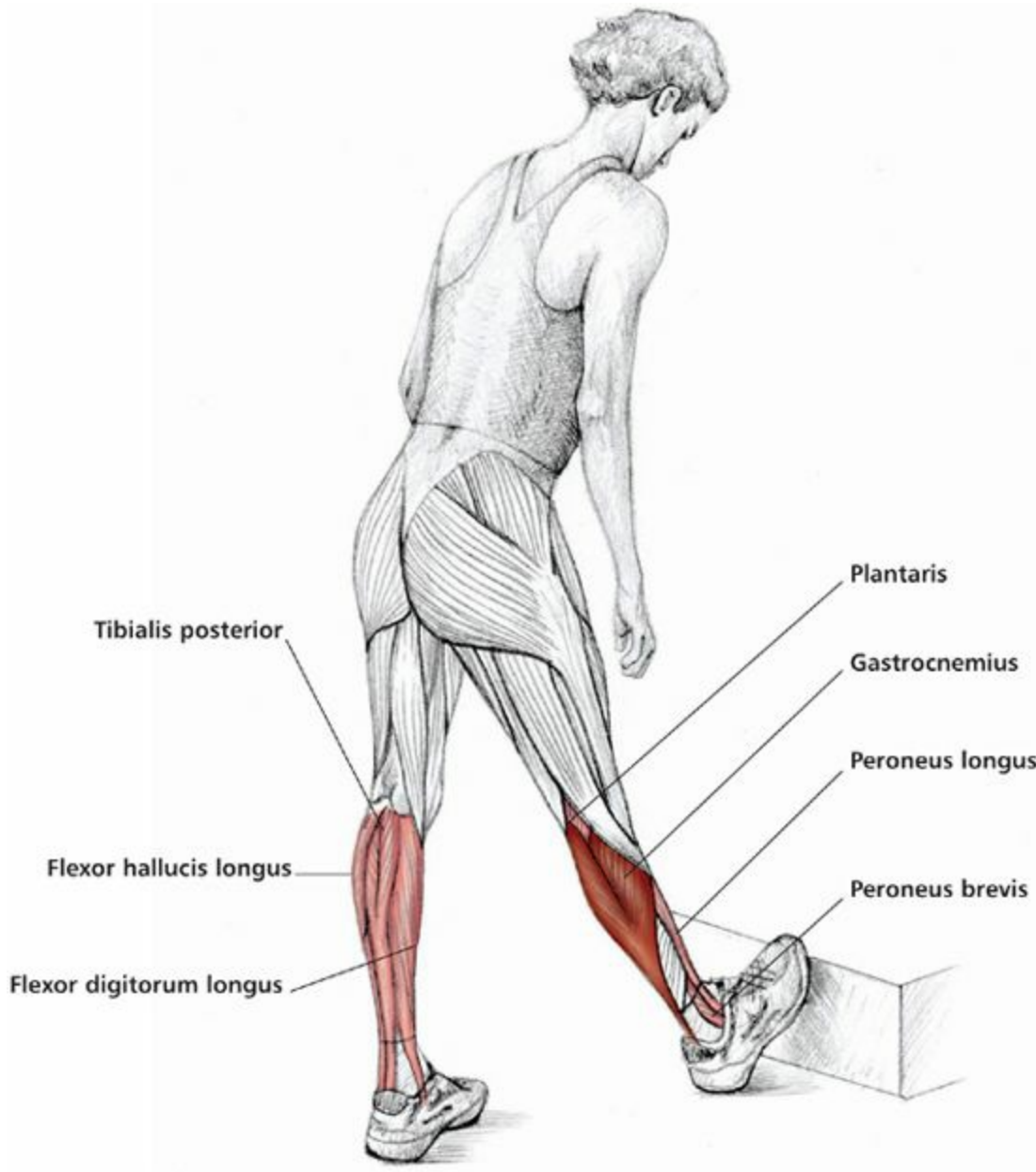
The superficial **gastrocnemius** has two heads and crosses two joints: the knee and the ankle. It is part of the composite muscle known as *triceps surae*, which forms the prominent contour of the calf. The



triceps surae comprises: gastrocnemius, soleus, and plantaris. Gastrocnemius is quite a thin muscle when compared to the thick soleus. (Soleus is featured in [Chapter 13](#).) As well as plantar flexing the ankle, gastrocnemius assists in flexion of the knee joint, and is a main propelling force in walking and running. Explosive sprinting, for example, may rupture the Achilles tendon at its junction with the muscle belly of gastrocnemius, hence the need to keep it well stretched.

Sports that benefit from these upper calf stretches include: basketball and netball; boxing; cycling; hiking, backpacking, mountaineering, and orienteering; ice hockey and field hockey; ice-skating, roller-skating, and inline skating; martial arts; racquet sports like tennis, badminton, and squash; running, track, and cross-country; running sports like soccer, American football (gridiron), and rugby; snow skiing and water skiing; surfing; swimming; walking and race walking.

# J01: STANDING TOE-UP CALF STRETCH



## Technique

Stand upright and place your toes on a step or raised object. Keep your leg straight and lean towards your toes.

## Muscles being stretched

Primary muscle: Gastrocnemius.

Secondary muscles: Tibialis posterior. Flexor hallucis longus. Flexor digitorum longus. Peroneus longus and brevis. Plantaris.

## Sports that benefit from this stretch

Basketball. Netball. Boxing. Cycling. Hiking. Backpacking. Mountaineering. Orienteering. Ice

hockey. Field hockey. Ice-skating. Rollerskating. Inline skating. Martial arts. Tennis. Badminton. Squash. Running. Track. Cross-country. American football (gridiron). Soccer. Rugby. Snow skiing. Water skiing. Surfing. Swimming. Walking. Race walking.

**Sports injury where stretch may be useful**

Calf strain. Achilles tendon strain. Achilles tendonitis. Medial tibial pain syndrome (shin splints).

**Additional information for performing this stretch correctly**

Regulate the intensity of this stretch by keeping your back straight and leaning forward.

**Complementary stretch**

[J03](#).

## J02: STANDING TOE-RAISED CALF STRETCH





## Technique

Stand with one knee bent and the other leg straight out in front. Point your toes towards your body and lean forward. Keep your back straight and rest your hands on your bent knee.

## Muscles being stretched

Primary muscles: Gastrocnemius. Semimembranosus. Semitendinosus. Biceps femoris.

Secondary muscles: Tibialis posterior. Flexor hallucis longus. Flexor digitorum longus. Peroneus longus and brevis. Plantaris.

## Sports that benefit from this stretch

Basketball. Netball. Boxing. Cycling. Hiking. Backpacking. Mountaineering. Orienteering. Ice hockey. Field hockey. Ice-skating. Rollerskating. Inline skating. Martial arts. Tennis. Badminton. Squash. Running. Track. Cross-country. American football (gridiron). Soccer. Rugby. Snow skiing. Water skiing. Surfing. Swimming. Walking. Race walking.

## Sports injury where stretch may be useful

Hamstring strain. Calf strain. Achilles tendon strain. Achilles tendonitis. Medial tibial pain syndrome (shin splints).

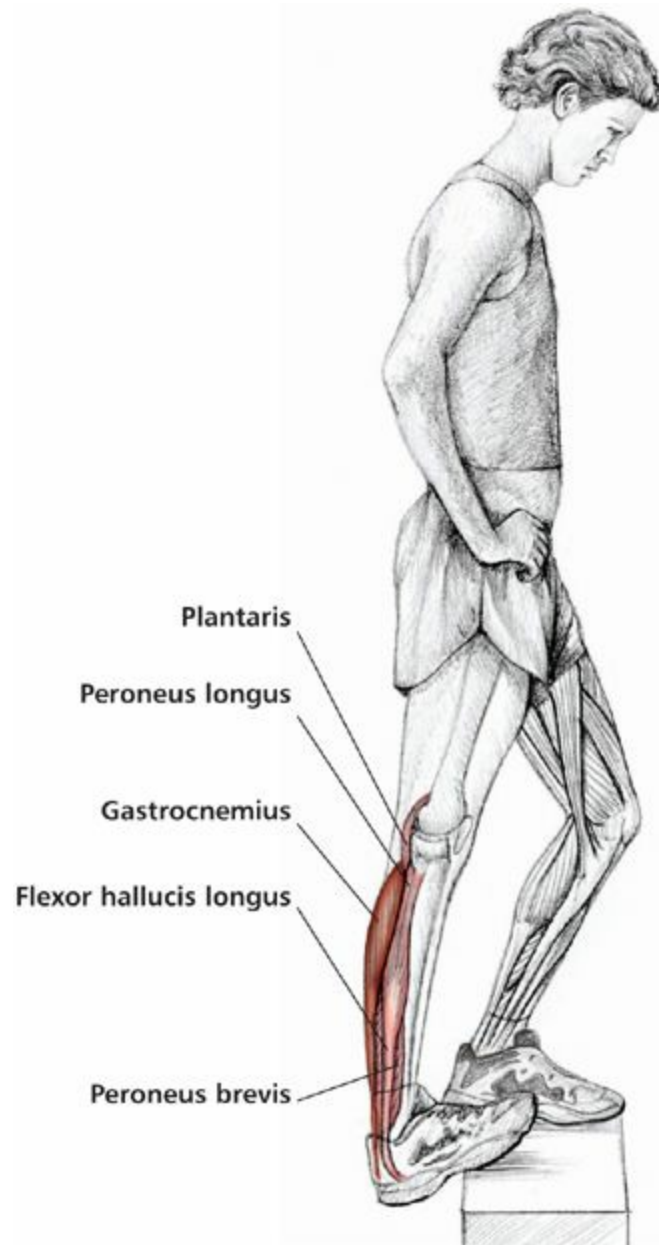
## Common problems and more information for performing this stretch correctly

Make sure your toes are pointing upward. Letting your toes point to one side will cause this stretch to put uneven tension on the calf muscles. Over an extended period of time, this could lead to a muscle imbalance.

## Complementary stretch

[J04](#).

## J03: SINGLE HEEL DROP CALF STRETCH





### **Technique**

Stand on a raised object or step. Put the toes of one foot on the edge of the step and keep your leg straight. Let your heel drop towards the ground.

### **Muscles being stretched**

Primary muscle: Gastrocnemius.

Secondary muscles: Tibialis posterior. Flexor hallucis longus. Flexor digitorum longus. Peroneus longus and brevis. Plantaris.

### **Sports that benefit from this stretch**

Basketball. Netball. Boxing. Cycling. Hiking. Backpacking. Mountaineering. Orienteering. Ice hockey. Field hockey. Ice-skating. Rollerskating. Inline skating. Martial arts. Tennis. Badminton. Squash. Running. Track. Cross-country. American football (gridiron). Soccer. Rugby. Snow skiing. Water skiing. Surfing. Swimming. Walking. Race walking.

### **Sports injury where stretch may be useful**

Calf strain. Achilles tendon strain. Achilles tendonitis. Medial tibial pain syndrome (shin splints).

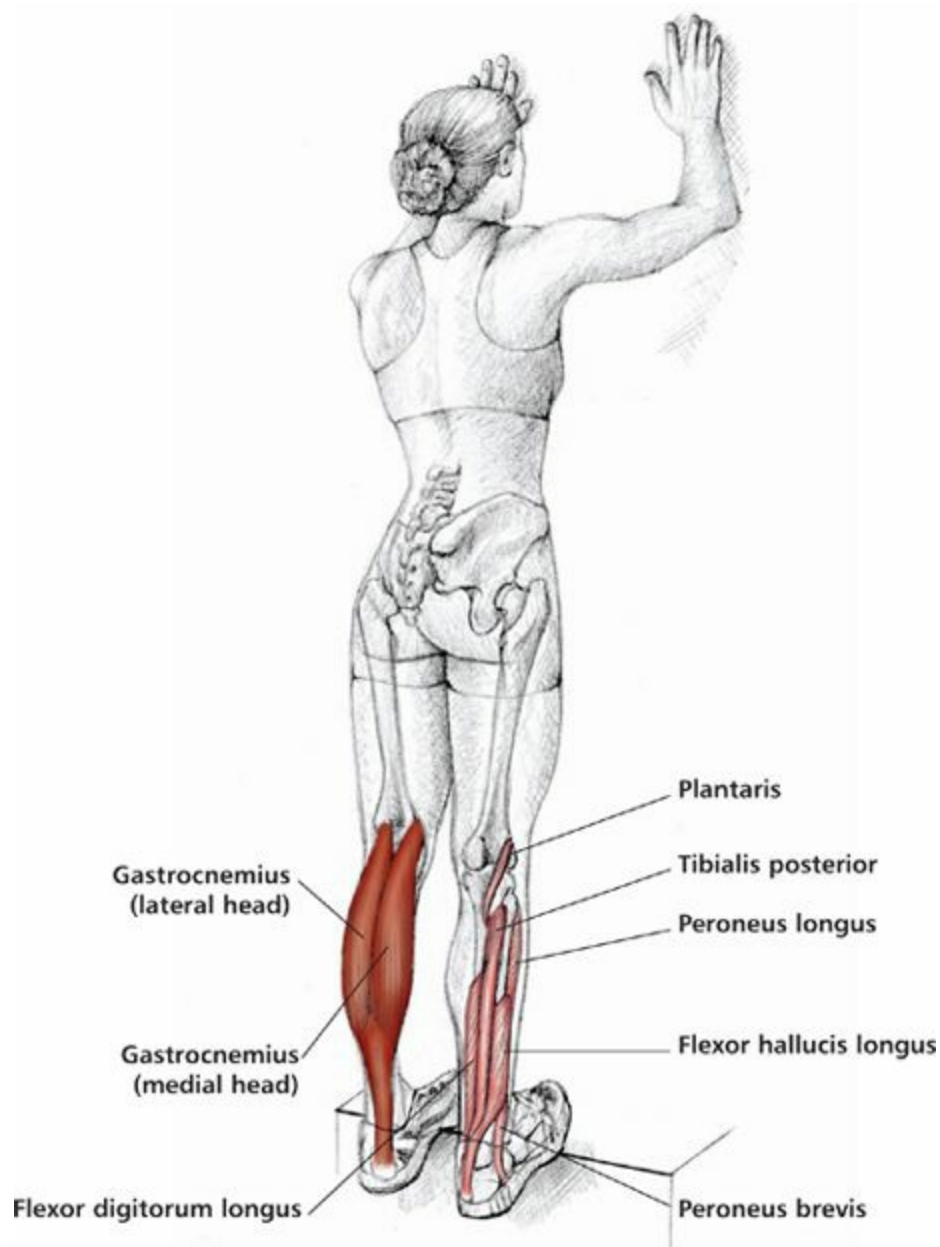
### **Common problems and more information for performing this stretch correctly**

This stretch can put a lot of pressure on the Achilles tendon. Ease into this stretch by slowly lowering your heel.

### **Complementary stretch**

[J02.](#)

## J04: DOUBLE HEEL DROP CALF STRETCH



### Technique

Stand on a raised object or step. Put the toes of both of your feet on the edge of the step and keep your legs straight. Let your heels drop towards the ground and lean forward.

### Muscles being stretched

Primary muscle: Gastrocnemius.

Secondary muscles: Tibialis posterior. Flexor hallucis longus. Flexor digitorum longus. Peroneus longus and brevis. Plantaris.

### Sports that benefit from this stretch

Basketball. Netball. Boxing. Cycling. Hiking. Backpacking. Mountaineering. Orienteering. Ice



hockey. Field hockey. Ice-skating. Rollerskating. Inline skating. Martial arts. Tennis. Badminton. Squash. Running. Track. Cross-country. American football (gridiron). Soccer. Rugby. Snow skiing. Water skiing. Surfing. Swimming. Walking. Race walking.

**Sports injury where stretch may be useful**

Calf strain. Achilles tendon strain. Achilles tendonitis. Medial tibial pain syndrome (shin splints).

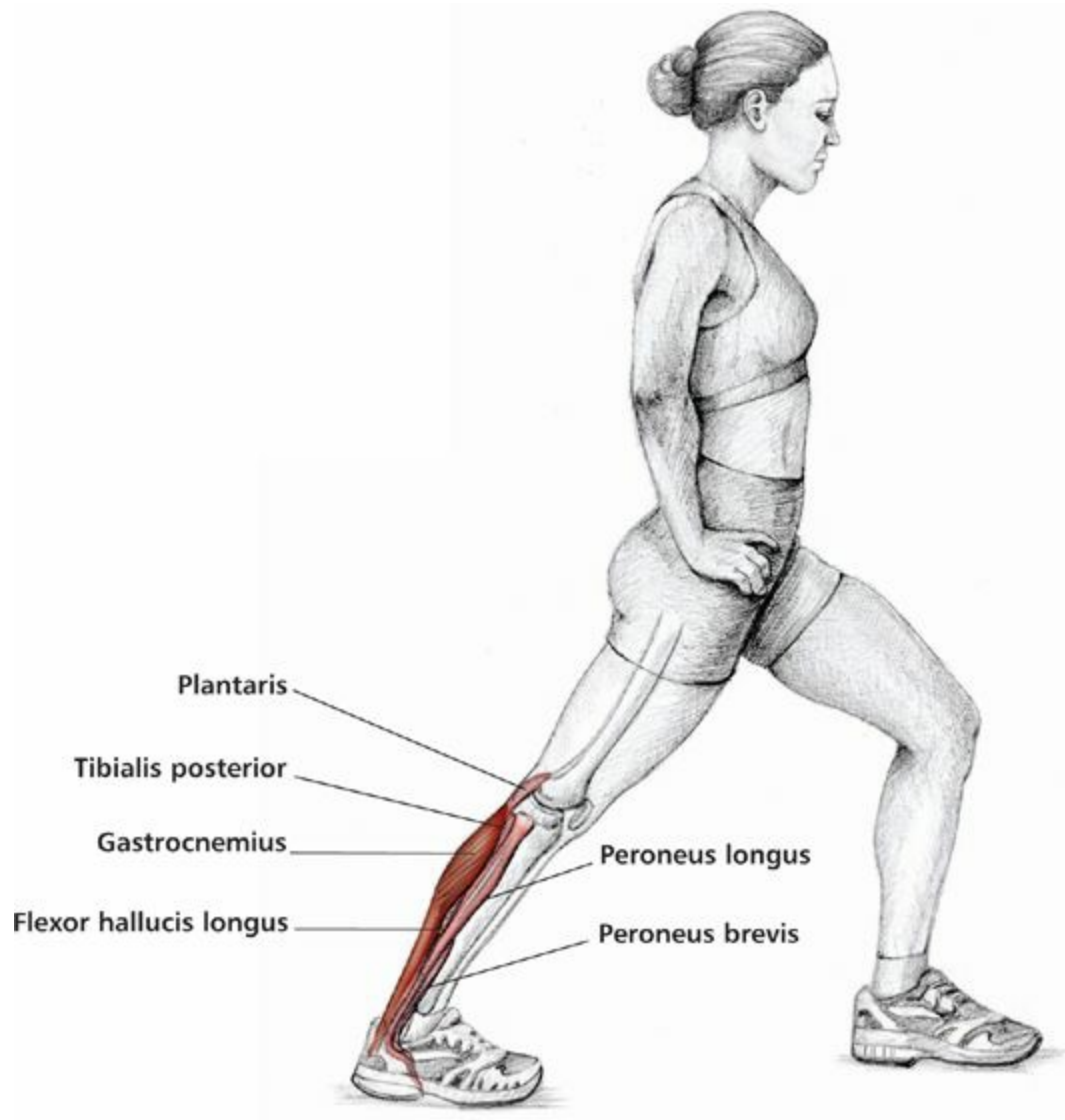
**Additional information for performing this stretch correctly**

Let your body weight regulate the intensity of this stretch.

**Complementary stretch**

[J06](#).

# J05: STANDING HEEL BACK CALF STRETCH



Posterior view.

## **Technique**

Stand upright and then take one big step backwards. Keep your back leg straight and push your heel to the ground.

## **Muscles being stretched**

Primary muscle: Gastrocnemius.

Secondary muscles: Tibialis posterior. Flexor hallucis longus. Flexor digitorum longus. Peroneus longus and brevis. Plantaris.

## **Sports that benefit from this stretch**

Basketball. Netball. Boxing. Cycling. Hiking. Backpacking. Mountaineering. Orienteering. Ice hockey. Field hockey. Ice-skating. Rollerskating. Inline skating. Martial arts. Tennis. Badminton. Squash. Running. Track. Cross-country. American football (gridiron). Soccer. Rugby. Snow skiing. Water skiing. Surfing. Swimming. Walking. Race walking.

## **Sports injury where stretch may be useful**

Calf strain. Achilles tendon strain. Achilles tendonitis. Medial tibial pain syndrome (shin splints).

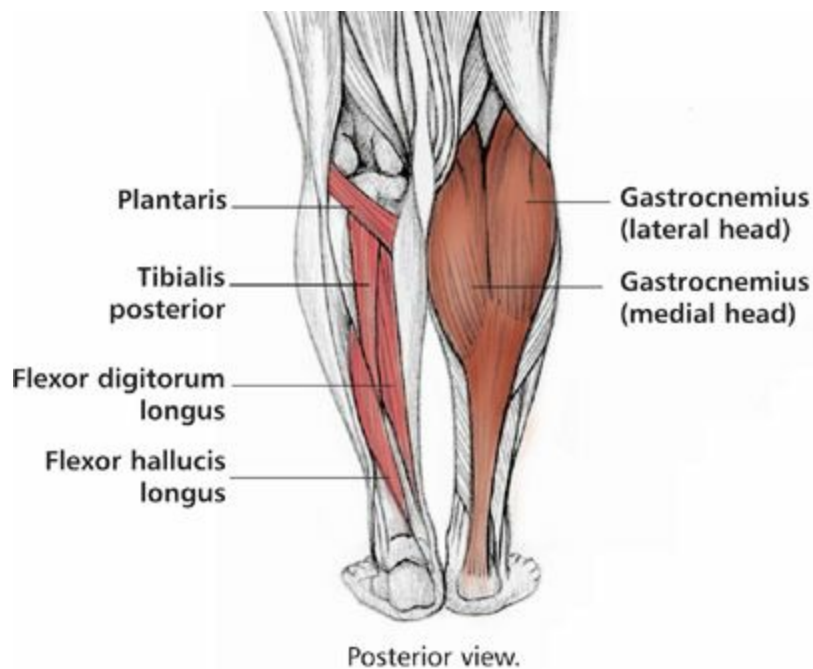
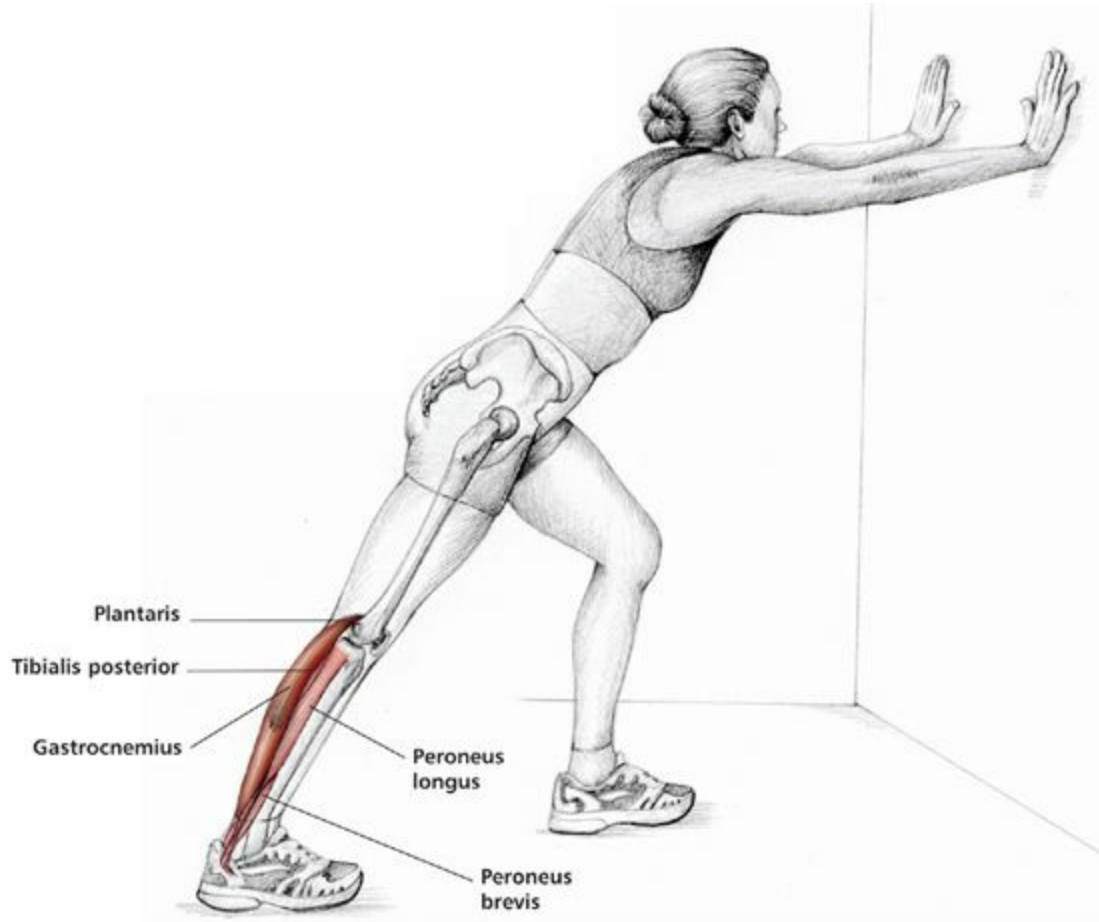
## **Common problems and more information for performing this stretch correctly**

Make sure that the toes of your back leg are facing forward. Letting your toes point to one side will cause this stretch to put uneven tension on the calf muscles. Over an extended period of time, this could lead to a muscle imbalance.

## **Complementary stretch**

[J01](#).

## J06: LEANING HEEL BACK CALF STRETCH



### Technique

Stand upright and lean against a wall. Place one foot as far from the wall as is comfortable and make sure that both toes are facing forward and your heel is on the ground. Keep your back leg straight and

lean towards the wall.

### **Muscles being stretched**

Primary muscle: Gastrocnemius.

Secondary muscles: Tibialis posterior. Flexor hallucis longus. Flexor digitorum longus. Peroneus longus and brevis. Plantaris.

### **Sports that benefit from this stretch**

Basketball. Netball. Boxing. Cycling. Hiking. Backpacking. Mountaineering. Orienteering. Ice hockey. Field hockey. Ice-skating. Rollerskating. Inline skating. Martial arts. Tennis. Badminton. Squash. Running. Track. Cross-country. American football (gridiron). Soccer. Rugby. Snow skiing. Water skiing. Surfing. Swimming. Walking. Race walking.

### **Sports injury where stretch may be useful**

Calf strain. Achilles tendon strain. Achilles tendonitis. Medial tibial pain syndrome (shin splints).

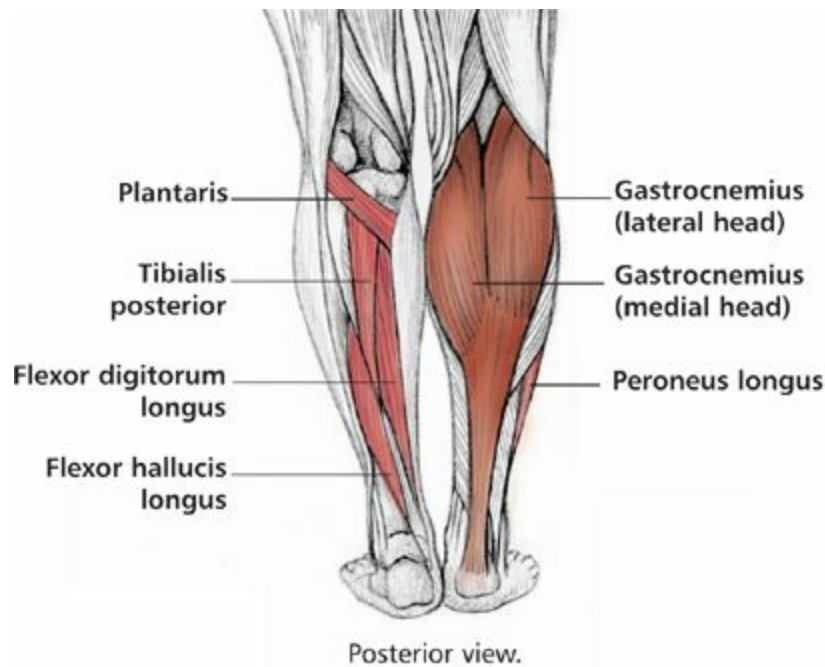
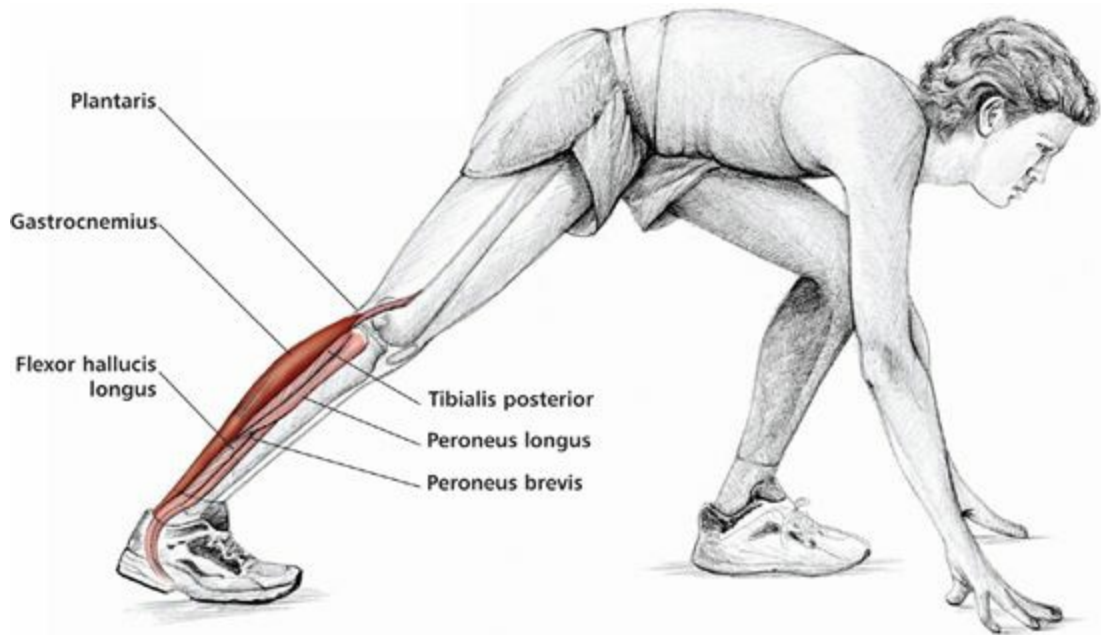
### **Common problems and more information for performing this stretch correctly**

Make sure the toes of your back leg are facing forward. Letting your toes point to one side will cause this stretch to put uneven tension on the calf muscles. Over an extended period of time, this could lead to a muscle imbalance.

### **Complementary stretch**

[J02](#).

# J07: CROUCHING HEEL BACK CALF STRETCH



## Technique

Stand upright and place one foot in front of the other. Bend your front leg and keep your back leg straight. Push your heel to the ground and lean forward. Place your hands on the ground in front of you.

## Muscles being stretched

Primary muscle: Gastrocnemius.

Secondary muscles: Tibialis posterior. Flexor hallucis longus. Flexor digitorum longus. Peroneus longus and brevis. Plantaris.

### **Sports that benefit from this stretch**

Basketball. Netball. Boxing. Cycling. Hiking. Backpacking. Mountaineering. Orienteering. Ice hockey. Field hockey. Ice-skating. Rollerskating. Inline skating. Martial arts. Tennis. Badminton. Squash. Running. Track. Cross-country. American football (gridiron). Soccer. Rugby. Snow skiing. Water skiing. Surfing. Swimming. Walking. Race walking.

### **Sports injury where stretch may be useful**

Calf strain. Achilles tendon strain. Achilles tendonitis. Medial tibial pain syndrome (shin splints).

### **Common problems and more information for performing this stretch correctly**

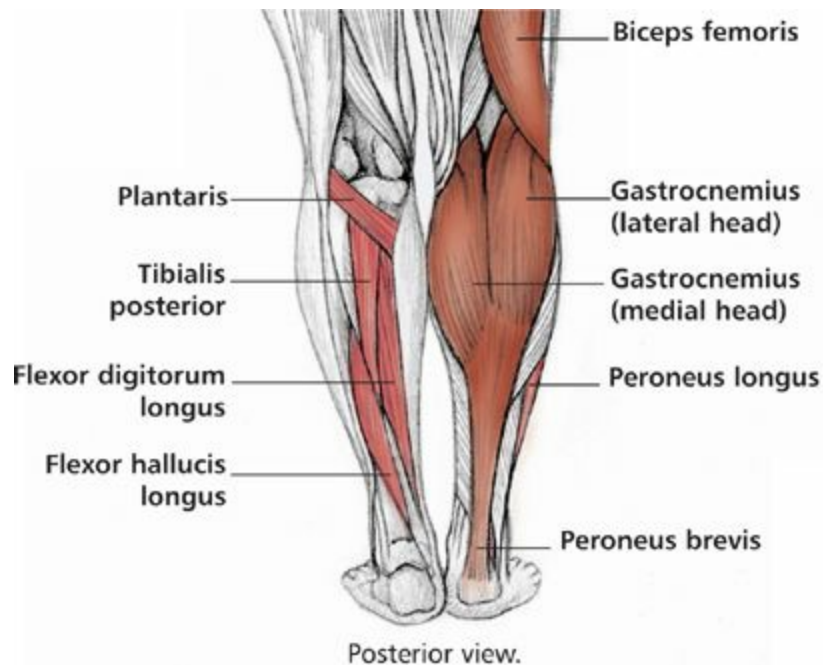
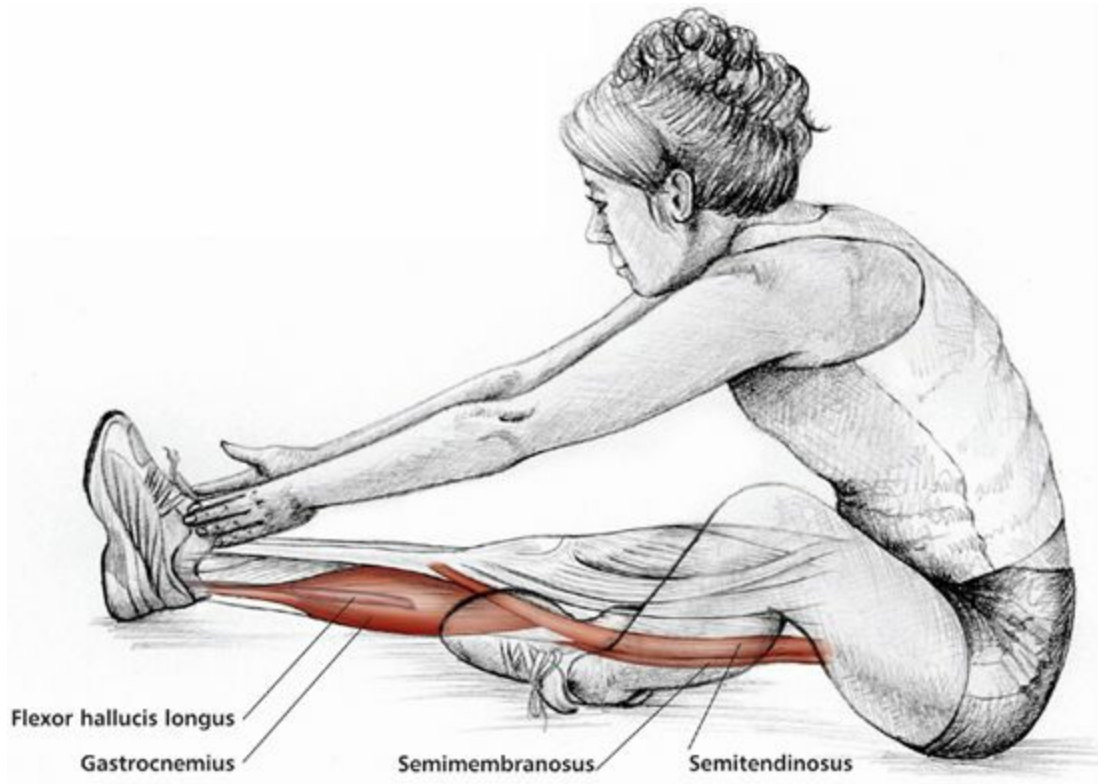
Make sure the toes of your back leg are facing forward. Letting your toes point to one side will cause this stretch to put uneven tension on the calf muscles. Over an extended period of time, this could lead to a muscle imbalance.

### **Complementary stretch**

[J04](#).



# J08: SITTING TOE PULL CALF STRETCH



## Technique

Sit with one leg straight and your toes pointing up. Lean forward and pull your toes back towards your body.

## Muscles being stretched

Primary muscles: Gastrocnemius. Semimembranosus. Semitendinosus. Biceps femoris.



Secondary muscles: Tibialis posterior. Flexor hallucis longus. Flexor digitorum longus. Peroneus longus and brevis. Plantaris.

### **Sports that benefit from this stretch**

Basketball. Netball. Boxing. Cycling. Hiking. Backpacking. Mountaineering. Orienteering. Ice hockey. Field hockey. Ice-skating. Rollerskating. Inline skating. Martial arts. Tennis. Badminton. Squash. Running. Track. Cross-country. American football (gridiron). Soccer. Rugby. Snow skiing. Water skiing. Surfing. Swimming. Walking. Race walking.

### **Sports injury where stretch may be useful**

Hamstring strain. Calf strain. Achilles tendon strain. Achilles tendonitis. Medial tibial pain syndrome (shin splints).

### **Common problems and more information for performing this stretch correctly**

If you have trouble reaching your toes in this position, avoid this stretch.

### **Complementary stretch**

[J07](#).

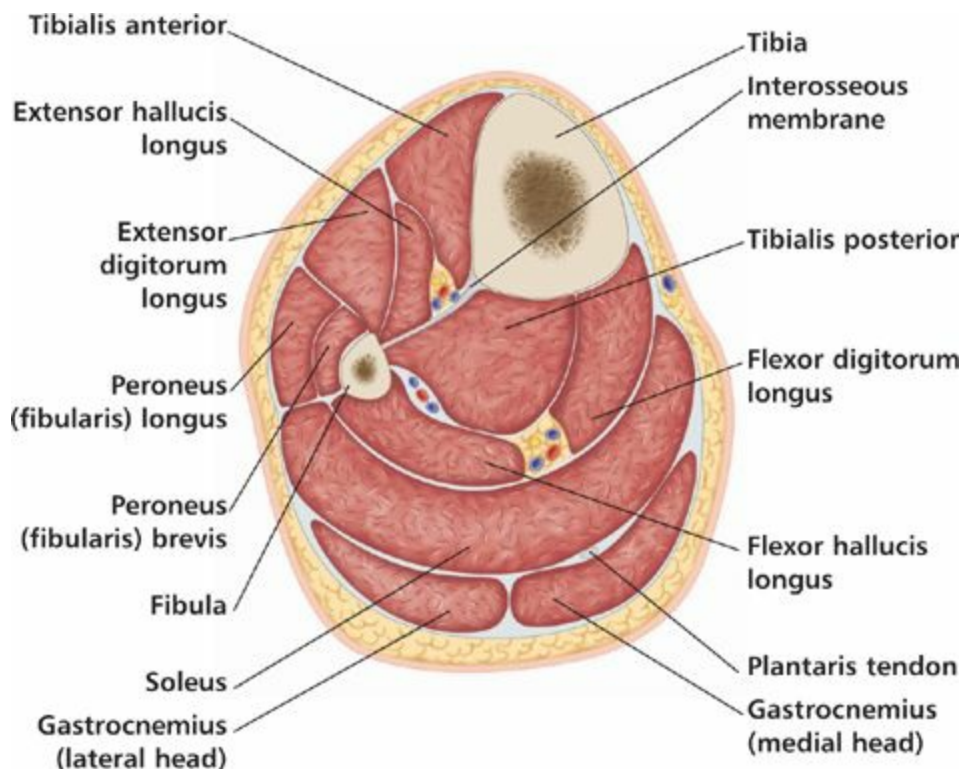


## Lower Calves and Achilles Tendon

The lower calf muscles are located on the posterior (rear) of the lower leg below the knee joint. They originate at the top of the tibia, just below the knee joint, and extend down into the Achilles tendon. The primary action of the lower calf muscles is to plantar flex the ankle joint.

**Peroneus (fibularis) longus** and **peroneus (fibularis) brevis** form the lateral compartment of the lower calf. Both these muscles act as plantar flexors and everters at the ankle joint, but also as preventers of inversion and protectors against ankle sprain. The course of the tendon of insertion of peroneus (fibularis) longus helps maintain the transverse and lateral longitudinal arches of the foot.

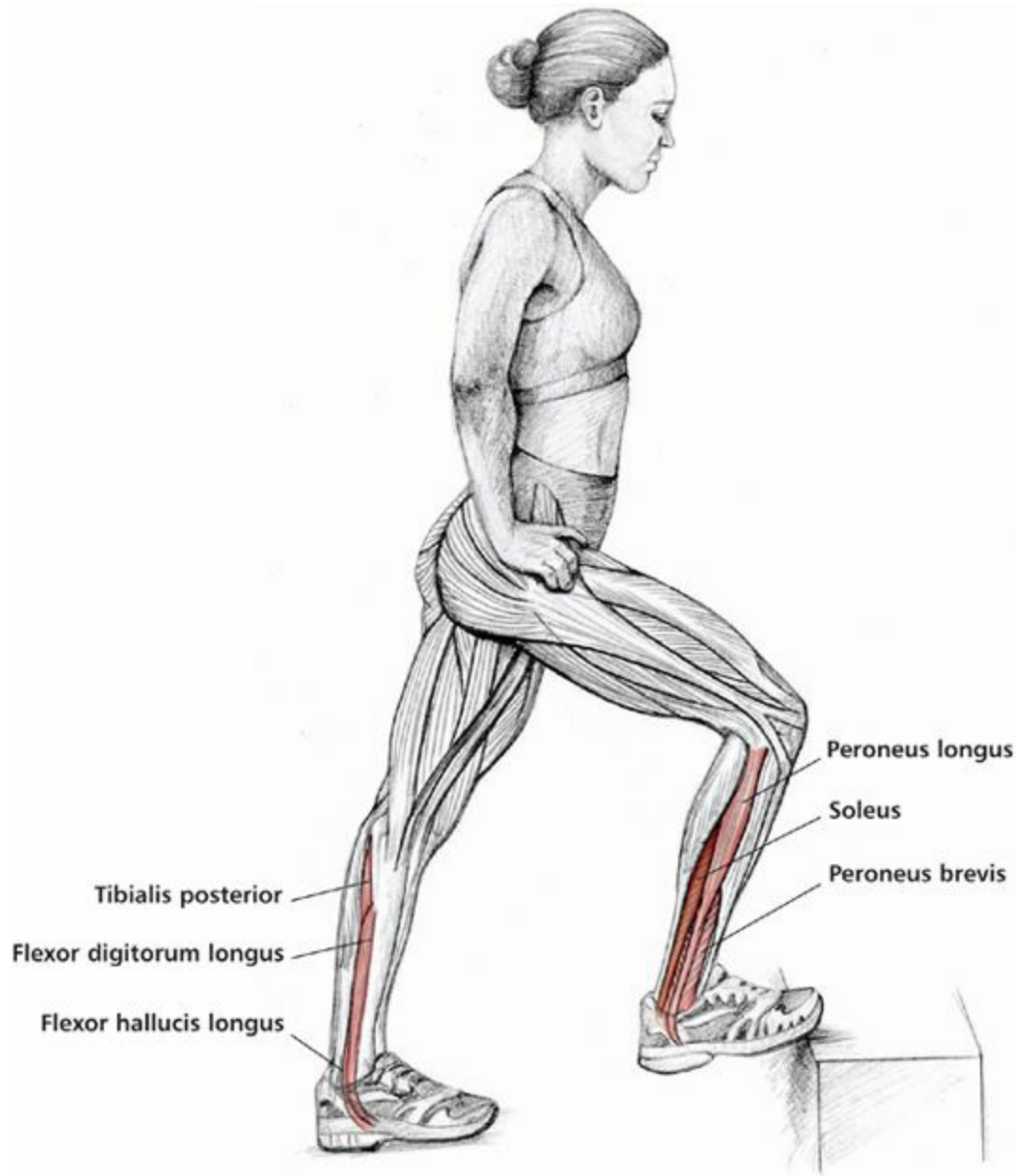
**Flexor digitorum longus**, **flexor hallucis longus**, and **tibialis posterior** form the deep posterior compartment of the lower leg. Tibialis posterior is the deepest muscle and helps maintain the arches of the foot. Flexor hallucis longus helps maintain the medial longitudinal arch of the foot.



Part of the triceps surae, **soleus** is so-called because its shape resembles a fish. It is deep to gastrocnemius, but its medial and lateral fibers bulge from the sides of the leg and extend further distal than gastrocnemius. Constant wearing of high-heeled shoes tends to cause this muscle to shorten, which can affect postural integrity.

Sports that benefit from these lower calf stretches include: basketball and netball; boxing; cycling; hiking, backpacking, mountaineering, and orienteering; ice hockey and field hockey; ice-skating, roller-skating, and inline skating; martial arts; racquet sports like tennis, badminton, and squash; running, track, and cross-country; running sports like soccer, American football (gridiron), and rugby; snow skiing and water skiing; surfing; swimming; walking and race walking.

# K01: STANDING TOE-UP ACHILLES STRETCH



## Technique

Stand upright and place your toes against a step or raised object. Bend your leg and lean towards your toes.

## Muscles being stretched

Primary muscle: Soleus.

Secondary muscles: Tibialis posterior. Flexor hallucis longus. Flexor digitorum longus. Peroneus longus and brevis.

## Sports that benefit from this stretch

Basketball. Netball. Boxing. Cycling. Hiking. Backpacking. Mountaineering. Orienteering. Ice

hockey. Field hockey. Ice-skating. Rollerskating. Inline skating. Martial arts. Tennis. Badminton. Squash. Running. Track. Cross-country. American football (gridiron). Soccer. Rugby. Snow skiing. Water skiing. Surfing. Swimming. Walking. Race walking.

**Sports injury where stretch may be useful**

Calf strain. Achilles tendon strain. Achilles tendonitis. Medial tibial pain syndrome (shin splints). Posterior tibial tendonitis.

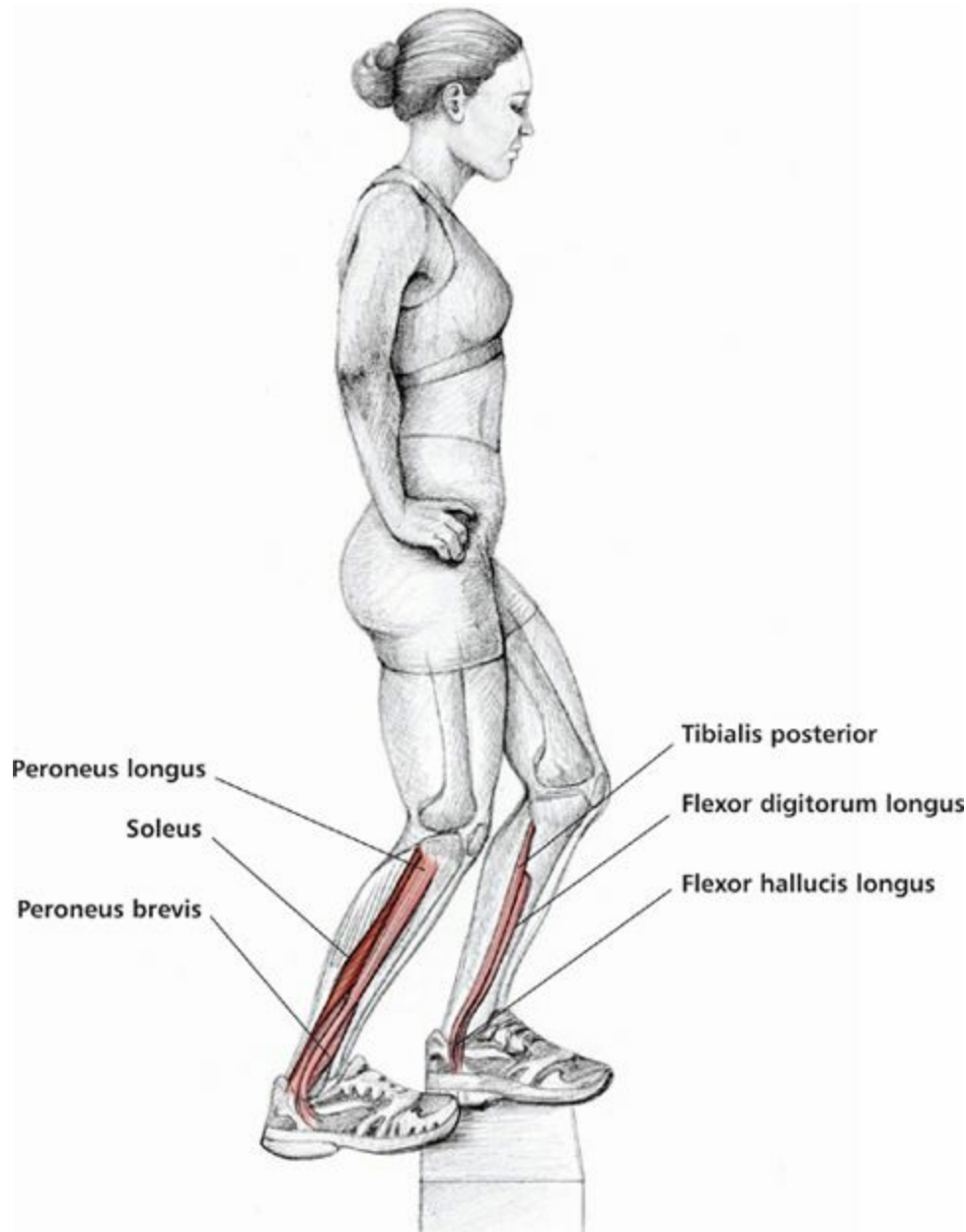
**Additional information for performing this stretch correctly**

Regulate the intensity of this stretch by relaxing your calf muscles and pushing your heel to the ground.

**Complementary stretch**

[K03](#).

## K02: SINGLE HEEL DROP ACHILLES STRETCH



### **Technique**

Stand on a raised object or step and place the toes of one of your feet on the edge of the step. Bend your leg and let your heel drop towards the ground.

### **Muscles being stretched**

Primary muscle: Soleus.

Secondary muscles: Tibialis posterior. Flexor hallucis longus. Flexor digitorum longus. Peroneus longus and brevis.

### **Sports that benefit from this stretch**

Basketball. Netball. Boxing. Cycling. Hiking. Backpacking. Mountaineering. Orienteering. Ice

hockey. Field hockey. Ice-skating. Rollerskating. Inline skating. Martial arts. Tennis. Badminton. Squash. Running. Track. Cross-country. American football (gridiron). Soccer. Rugby. Snow skiing. Water skiing. Surfing. Swimming. Walking. Race walking.

### **Sports injury where stretch may be useful**

Calf strain. Achilles tendon strain. Achilles tendonitis. Medial tibial pain syndrome (shin splints). Posterior tibial tendonitis.

### **Common problems and more information for performing this stretch correctly**

This stretch can put a lot of pressure on the Achilles tendon. Ease into this stretch by slowly lowering your heel.

### **Complementary stretch**

[K04](#).

# K03: STANDING HEEL BACK ACHILLES STRETCH



## Technique

Stand upright and take one big step backwards. Bend your back leg and push your heel towards the ground.

## Muscles being stretched

Primary muscle: Soleus.

Secondary muscles: Tibialis posterior. Flexor hallucis longus. Flexor digitorum longus. Peroneus longus and brevis.

## Sports that benefit from this stretch

Basketball. Netball. Boxing. Cycling. Hiking. Backpacking. Mountaineering. Orienteering. Ice hockey. Field hockey. Ice-skating. Rollerskating. Inline skating. Martial arts. Tennis. Badminton. Squash. Running. Track. Cross-country. American football (gridiron). Soccer. Rugby. Snow skiing. Water skiing. Surfing. Swimming. Walking. Race walking.



### **Sports injury where stretch may be useful**

Calf strain. Achilles tendon strain. Achilles tendonitis. Medial tibial pain syndrome (shin splints). Posterior tibial tendonitis.

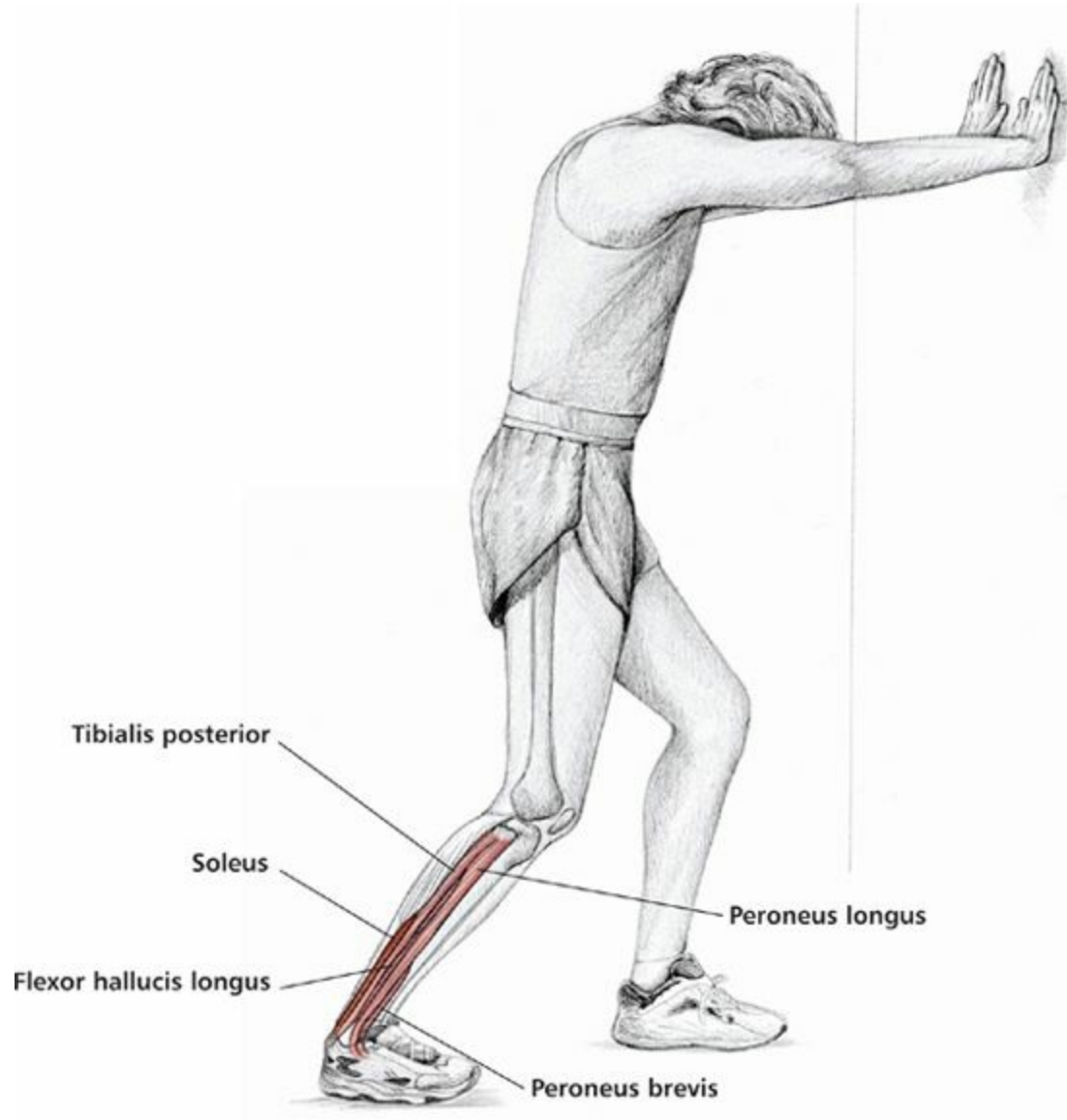
### **Common problems and more information for performing this stretch correctly**

Make sure the toes of your back leg are facing forward. Letting your toes point to one side will cause this stretch to put uneven tension on the calf muscles. Over an extended period of time, this could lead to a muscle imbalance. Regulate the intensity of this stretch by lowering your body.

### **Complementary stretch**

[K05](#).

# K04: LEANING HEEL BACK ACHILLES STRETCH





## Technique

Stand upright while leaning against a wall and place one foot behind the other. Make sure that both toes are facing forward and your heel is on the ground. Bend your back leg and lean towards the wall.

## Muscles being stretched

Primary muscle: Soleus.

Secondary muscles: Tibialis posterior. Flexor hallucis longus. Flexor digitorum longus. Peroneus longus and brevis.

## Sports that benefit from this stretch

Basketball. Netball. Boxing. Cycling. Hiking. Backpacking. Mountaineering. Orienteering. Ice hockey. Field hockey. Ice-skating. Rollerskating. Inline skating. Martial arts. Tennis. Badminton. Squash. Running. Track. Cross-country. American football (gridiron). Soccer. Rugby. Snow skiing. Water skiing. Surfing. Swimming. Walking. Race walking.

## Sports injury where stretch may be useful

Calf strain. Achilles tendon strain. Achilles tendonitis. Medial tibial pain syndrome (shin splints). Posterior tibial tendonitis.

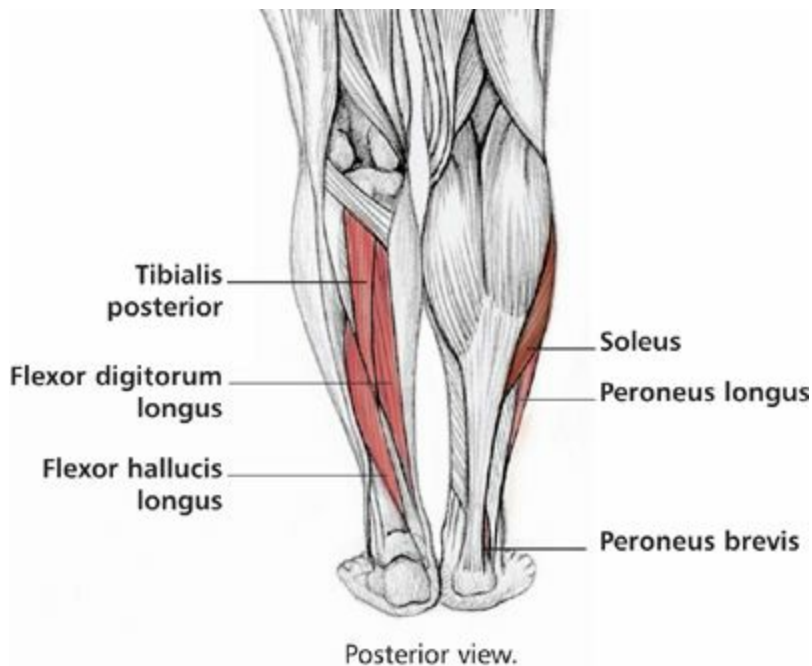
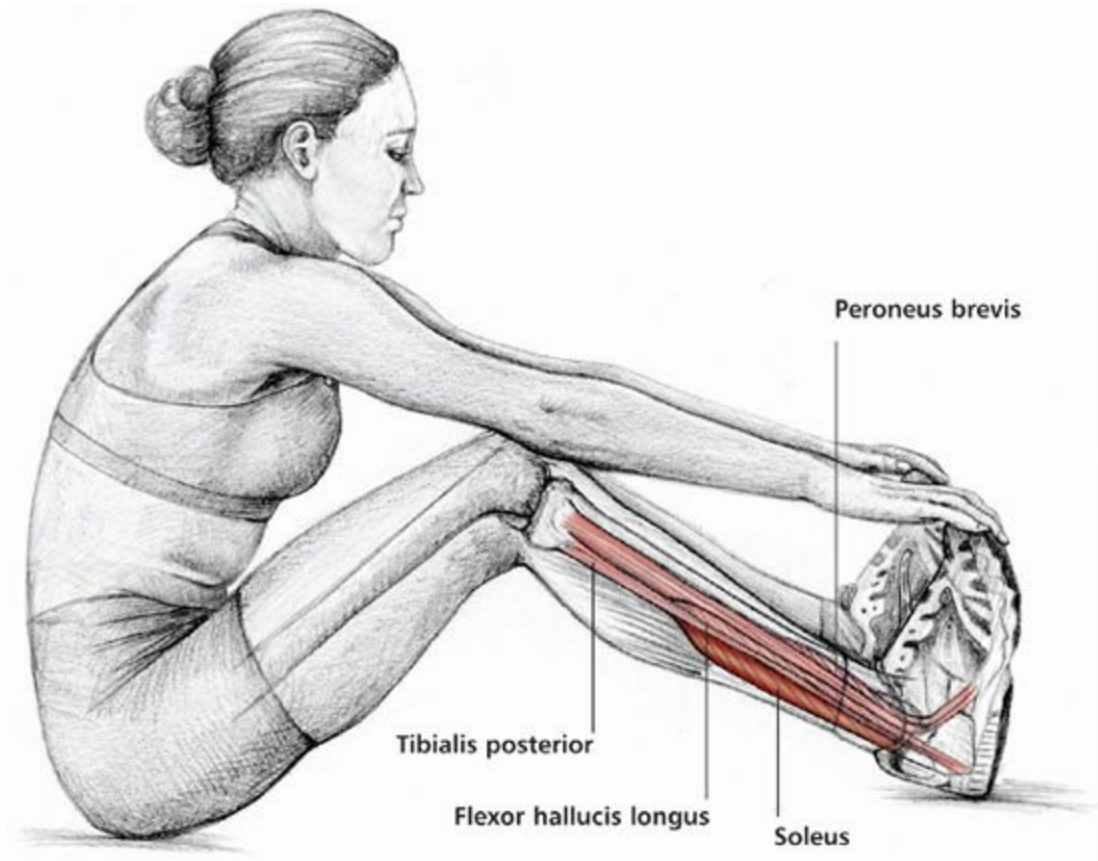
## Common problems and more information for performing this stretch correctly

Make sure the toes of your back leg are facing forward. Letting your toes point to one side will cause this stretch to put uneven tension on the calf muscles. Over an extended period of time, this could lead to a muscle imbalance. Regulate the intensity of this stretch by lowering your body.

## Complementary stretch

[K02](#).

# K05: SITTING BENT KNEE TOE PULL ACHILLES STRETCH



## Technique

Sit with your legs out in front and bend both knees. Grab hold of your toes and pull them towards your knees.

## Muscles being stretched

Primary muscle: Soleus.

Secondary muscles: Tibialis posterior. Flexor hallucis longus. Flexor digitorum longus. Peroneus longus and brevis.

### **Sports that benefit from this stretch**

Basketball. Netball. Boxing. Cycling. Hiking. Backpacking. Mountaineering. Orienteering. Ice hockey. Field hockey. Ice-skating. Rollerskating. Inline skating. Martial arts. Tennis. Badminton. Squash. Running. Track. Cross-country. American football (gridiron). Soccer. Rugby. Snow skiing. Water skiing. Surfing. Swimming. Walking. Race walking.

### **Sports injury where stretch may be useful**

Calf strain. Achilles tendon strain. Achilles tendonitis. Medial tibial pain syndrome (shin splints). Posterior tibial tendonitis.

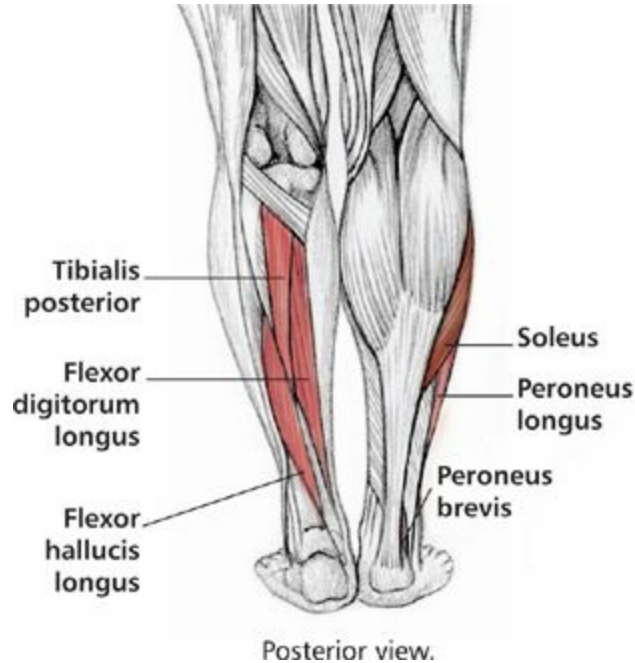
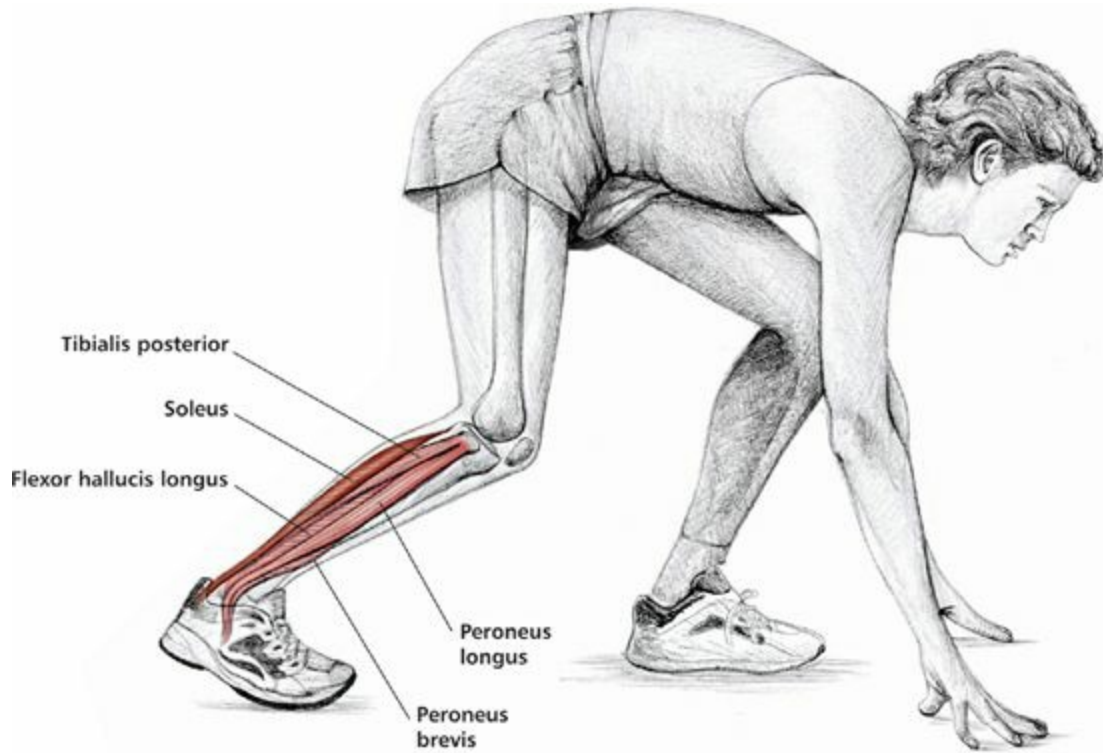
### **Additional information for performing this stretch correctly**

Regulate the intensity of this stretch by pushing your heels forward and pulling your toes back.

### **Complementary stretch**

[K01](#).

# K06: CROUCHING HEEL BACK ACHILLES STRETCH



## Technique

Stand upright and place one foot in front of the other. Bend both your front leg and your back leg and then push your back heel towards the ground. Lean forward and place your hands on the ground in front of you.

## Muscles being stretched

Primary muscle: Soleus.

Secondary muscles: Tibialis posterior. Flexor hallucis longus. Flexor digitorum longus. Peroneus longus and brevis.

### **Sports that benefit from this stretch**

Basketball. Netball. Boxing. Cycling. Hiking. Backpacking. Mountaineering. Orienteering. Ice hockey. Field hockey. Ice-skating. Rollerskating. Inline skating. Martial arts. Tennis. Badminton. Squash. Running. Track. Cross-country. American football (gridiron). Soccer. Rugby. Snow skiing. Water skiing. Surfing. Swimming. Walking. Race walking.

### **Sports injury where stretch may be useful**

Calf strain. Achilles tendon strain. Achilles tendonitis. Medial tibial pain syndrome (shin splints). Posterior tibial tendonitis.

### **Common problems and more information for performing this stretch correctly**

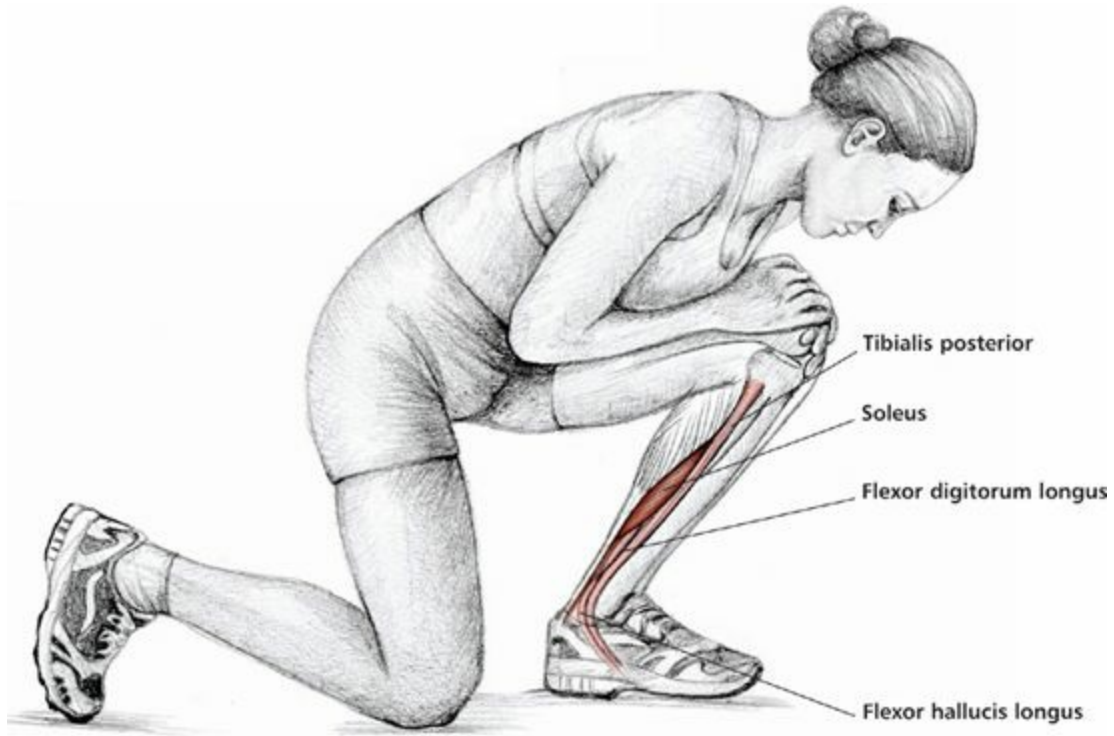
Make sure the toes of your back leg are facing forward. Letting your toes point to one side will cause this stretch to put uneven tension on the calf muscles. Over an extended period of time, this could lead to a muscle imbalance.

### **Complementary stretch**

[K04](#).



# K07: KNEELING HEEL-DOWN ACHILLES STRETCH



## Technique

Kneel on one foot and place your body weight over your knee. Keep your heel on the ground and lean forward.

## Muscles being stretched

Primary muscle: Soleus.

Secondary muscles: Tibialis posterior. Flexor hallucis longus. Flexor digitorum longus. Peroneus



longus and brevis.

### **Sports that benefit from this stretch**

Basketball. Netball. Boxing. Cycling. Hiking. Backpacking. Mountaineering. Orienteering. Ice hockey. Field hockey. Ice-skating. Rollerskating. Inline skating. Martial arts. Tennis. Badminton. Squash. Running. Track. Cross-country. American football (gridiron). Soccer. Rugby. Snow skiing. Water skiing. Surfing. Swimming. Walking. Race walking.

### **Sports injury where stretch may be useful**

Calf strain. Achilles tendon strain. Achilles tendonitis. Medial tibial pain syndrome (shin splints). Posterior tibial tendonitis.

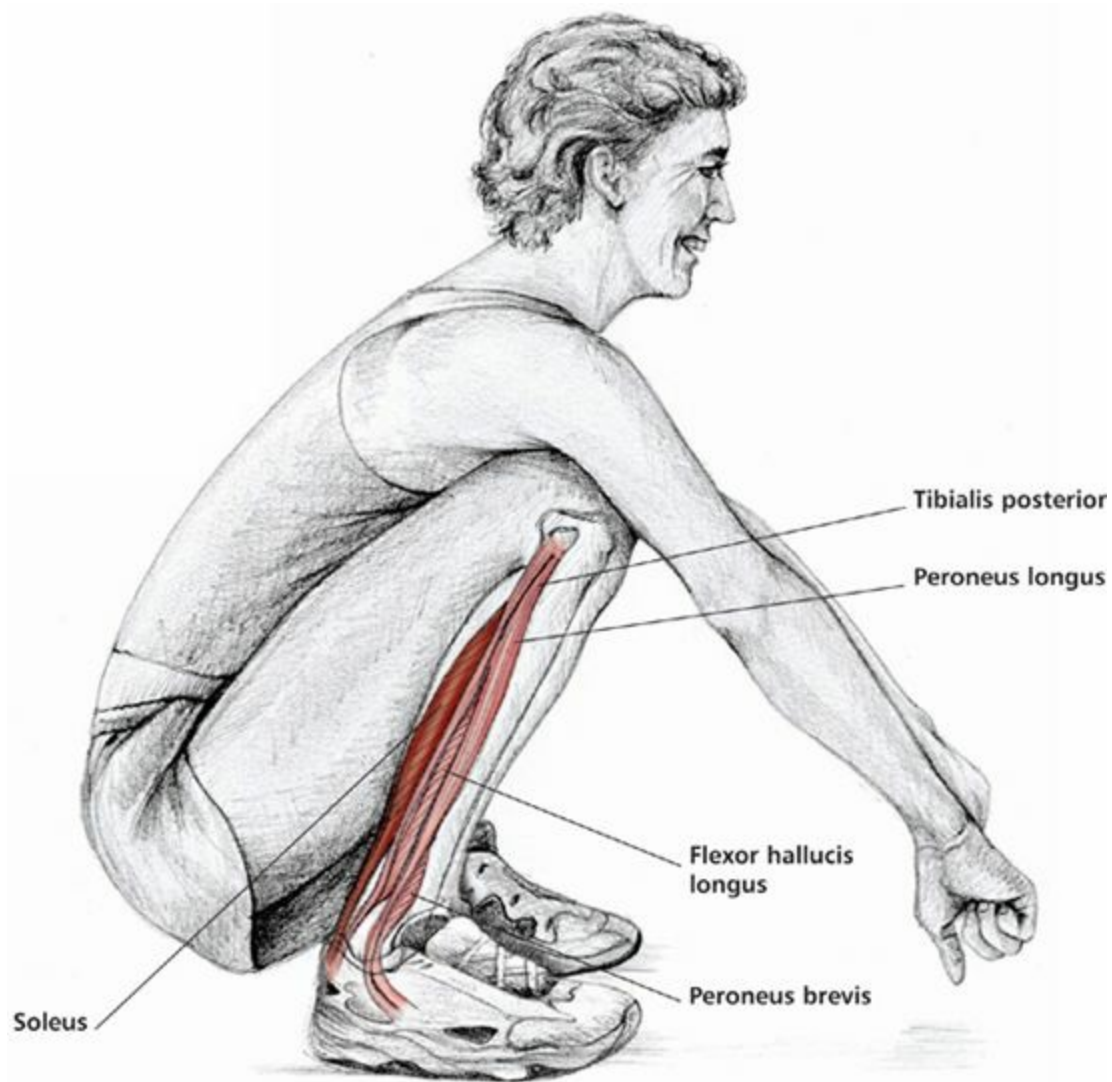
### **Common problems and more information for performing this stretch correctly**

This stretch can put a lot of pressure on the Achilles tendon. Ease into this stretch by slowly leaning forward.

### **Complementary stretch**

[K01](#).

# K08: SQUATTING ACHILLES STRETCH



Posterior view.

## **Technique**

Stand with your feet at shoulder-width apart. Bend your legs and lower to a sitting position. Place your hands out in front for balance.

## **Muscles being stretched**

Primary muscle: Soleus.

Secondary muscles: Tibialis posterior. Flexor hallucis longus. Flexor digitorum longus. Peroneus longus and brevis.

## **Sports that benefit from this stretch**

Basketball. Netball. Boxing. Cycling. Hiking. Backpacking. Mountaineering. Orienteering. Ice hockey. Field hockey. Ice-skating. Rollerskating. Inline skating. Martial arts. Tennis. Badminton. Squash. Running. Track. Cross-country. American football (gridiron). Soccer. Rugby. Snow skiing. Water skiing. Surfing. Swimming. Walking. Race walking.

## **Sports injury where stretch may be useful**

Calf strain. Achilles tendon strain. Achilles tendonitis. Medial tibial pain syndrome (shin splints). Posterior tibial tendonitis.

## **Additional information for performing this stretch correctly**

If need be, hold onto something for balance and make sure your toes are facing forward.

## **Complementary stretch**

[K07](#).



## Shins, Ankles, Feet, and Toes

The muscles of the shin originate at the top of the tibia, just below the knee joint, and extend down the front of the shin and over the ankle joint. The primary action of the shin muscles is to dorsiflex, extend, or invert the ankle joint.

The **extensor hallucis longus** and **extensor digitorum longus** are the main extensor muscles of the toes. The tendons of these muscles run over the front of the ankle, over the foot, and attach to the toes. These muscles dorsiflex the foot and work in opposition to the flexor muscles. When the calf muscles are tight, or the muscles are worked beyond their exertion level, inflammation of the tendon may occur.

**Tibialis anterior** originates from the lateral condyle of the tibia, and inserts into the medial and plantar surfaces of the medial cuneiform bone. Tibialis anterior is responsible for dorsiflexing and inverting the foot and is used frequently during running to *toe up* with each step. Pain in the front of the shin occurs when the muscle and tendon become inflamed and irritated through overuse or improper form.

One structure worth noting is a tough fibrous tissue, **plantar fascia**, also called *plantar aponeurosis*, which connects the heel to the toes. Repetitive ankle movement, especially when restricted by tight calves, can irritate this tissue at the insertion on the heel. Specific stretches later in this chapter help to alleviate this problem.

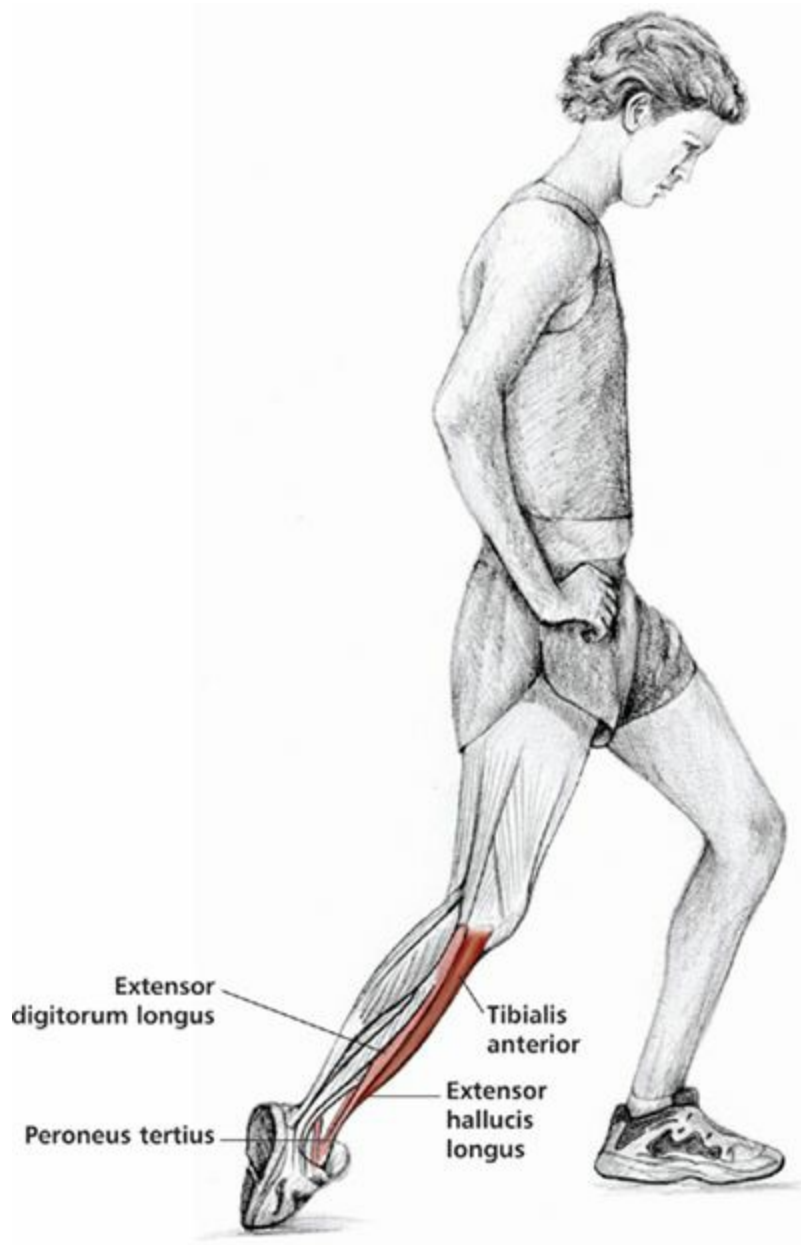
The feet and ankles are comprised of a multitude of small muscles that control the foot. The muscles around the feet and ankles, along with the structure of the joints, allow for a large range of movement of the feet and ankles, including: plantar flexion, dorsiflexion, inversion, eversion, and rotation.

There are four layers of muscle in the sole of the foot. The first layer is the most inferior (that is, the most superficial and closest to the ground in standing), comprising **abductor hallucis**, **flexor digitorum brevis**, and **abductor digiti minimi**. Abductor digiti minimi forms the lateral margin of the sole of the foot. The second layer contains the **lumbricales** and **quadratus plantae**, plus the tendons of flexor hallucis longus and flexor digitorum longus. The third layer contains **flexor hallucis brevis**,

**adductor hallucis**, and **flexor digiti minimi brevis**. The fourth layer is the deepest (most superior) layer of muscles of the sole of the foot. It consists of the four muscles of the dorsal interossei, the three muscles of the plantar interossei, and the tendons of tibialis posterior and peroneus longus. On the dorsum of the foot lies extensor digitorum brevis.

Sports that benefit from these shin, ankles, and feet stretches include: basketball and netball; boxing; cycling; hiking, backpacking, mountaineering, and orienteering; ice hockey and field hockey; ice-skating, roller-skating, and inline skating; martial arts; racquet sports like tennis, badminton, and squash; running, track, and cross-country; running sports like soccer, American football (gridiron), and rugby; snow skiing and water skiing; surfing; swimming; walking and race walking.

# L01: FOOT-BEHIND SHIN STRETCH



## Technique

Stand upright and place the top of your toes on the ground behind you. Push your ankle to the ground.

## Muscles being stretched

Primary muscle: Tibialis anterior.

Secondary muscles: Extensor hallucis longus. Extensor digitorum longus. Peroneus tertius.

## Sports that benefit from this stretch

Basketball. Netball. Boxing. Hiking. Backpacking. Mountaineering. Orienteering. Martial arts. Tennis. Badminton. Squash. Running. Track. Cross-country. American football (gridiron). Soccer. Rugby. Walking. Race walking.

### **Sports injury where stretch may be useful**

Anterior compartment syndrome. Medial tibial pain syndrome (shin splints). Ankle sprain. Peroneal tendon subluxation. Peroneal tendonitis.

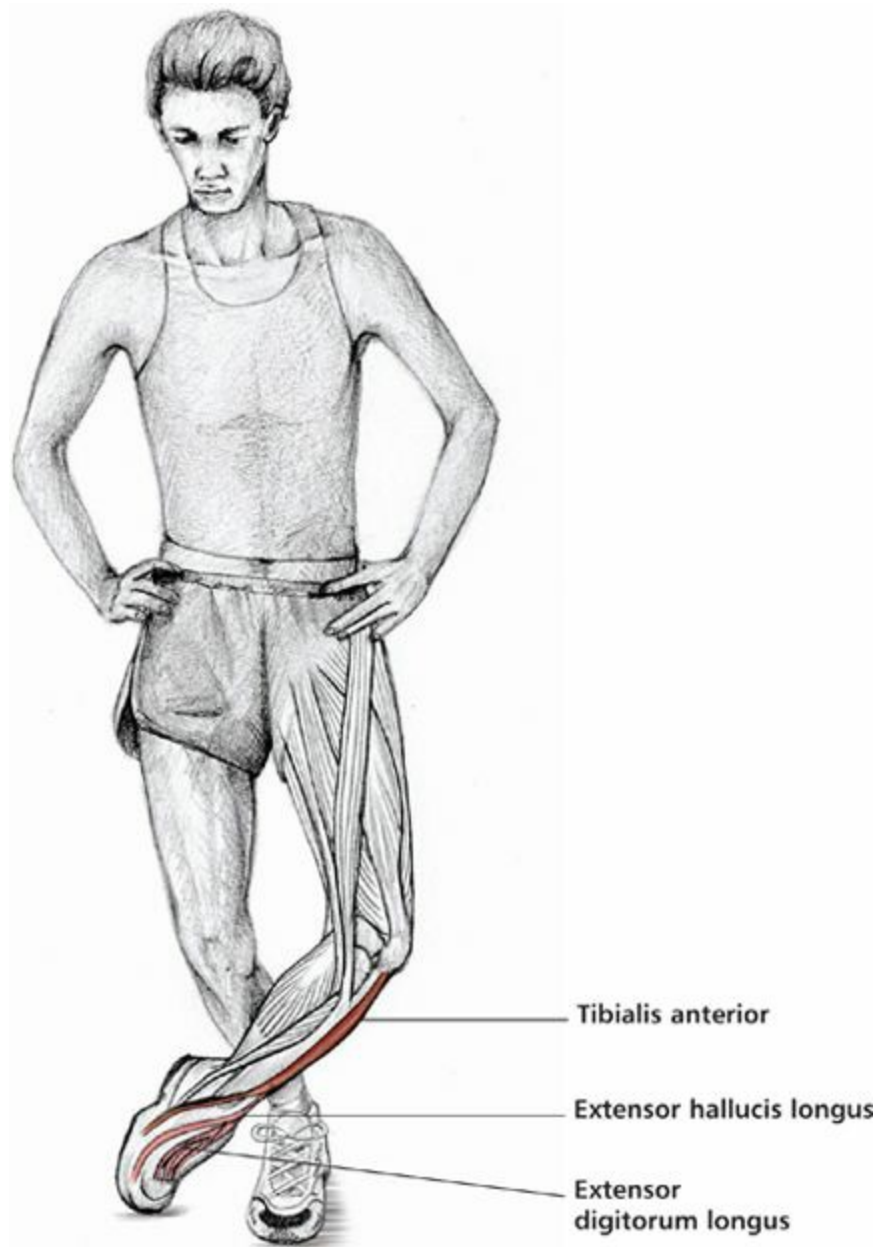
### **Additional information for performing this stretch correctly**

Regulate the intensity of this stretch by lowering your body and pushing your ankle to the ground. If need be, hold onto something for balance.

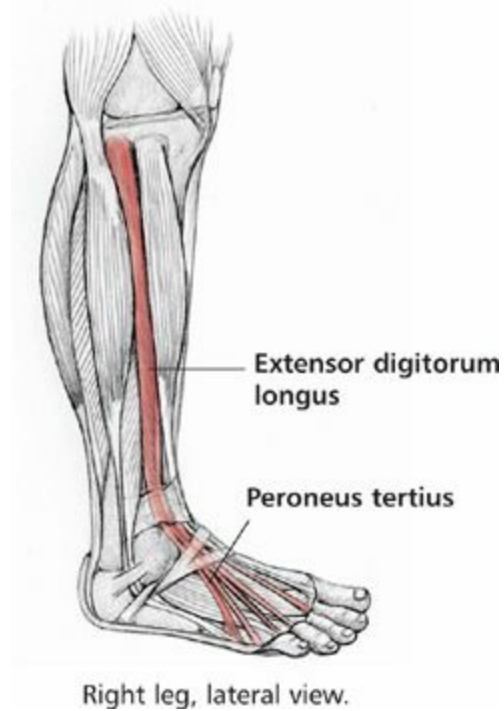
### **Complementary stretch**

[L02](#).

## L02: FRONT CROSS-OVER SHIN STRETCH







### **Technique**

Stand upright and place the top of your toes on the ground in front of your other foot. Slowly bend your other leg to force your ankle to the ground.

### **Muscles being stretched**

Primary muscle: Tibialis anterior.

Secondary muscles: Extensor hallucis longus. Extensor digitorum longus. Peroneus tertius.

### **Sports that benefit from this stretch**

Basketball. Netball. Boxing. Hiking. Backpacking. Mountaineering. Orienteering. Martial arts. Tennis. Badminton. Squash. Running. Track. Cross-country. American football (gridiron). Soccer. Rugby. Walking. Race walking.

### **Sports injury where stretch may be useful**

Anterior compartment syndrome. Medial tibial pain syndrome (shin splints). Ankle sprain. Peroneal tendon subluxation. Peroneal tendonitis.

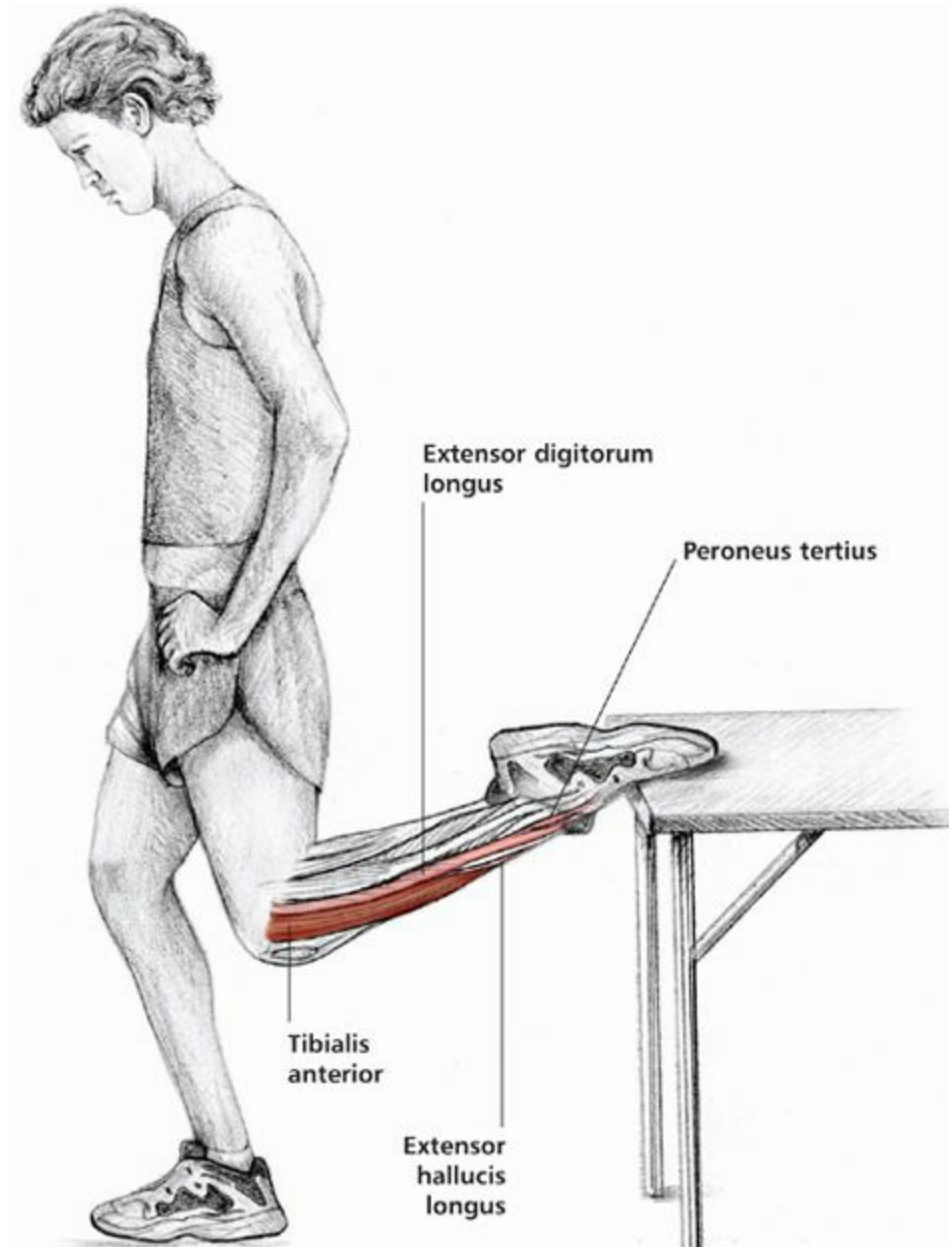
### **Additional information for performing this stretch correctly**

Regulate the intensity of this stretch by lowering your body.

### **Complementary stretch**

[L04](#).

## L03: RAISED FOOT SHIN STRETCH



### Technique

Stand upright and place the top of your toes on a raised object behind you. Push your ankle downwards.

### Muscles being stretched

Primary muscle: Tibialis anterior.

Secondary muscles: Extensor hallucis longus. Extensor digitorum longus. Peroneus tertius.

### Sports that benefit from this stretch

Basketball. Netball. Boxing. Hiking. Backpacking. Mountaineering. Orienteering. Martial arts. Tennis. Badminton. Squash. Running. Track. Cross-country. American football (gridiron). Soccer.

Rugby. Walking. Race walking.

**Sports injury where stretch may be useful**

Anterior compartment syndrome. Medial tibial pain syndrome (shin splints). Ankle sprain. Peroneal tendon subluxation. Peroneal tendonitis.

**Additional information for performing this stretch correctly**

If need be, hold onto something for balance.

**Complementary stretch**

[L01](#).

## L04: DOUBLE KNEELING SHIN STRETCH



### Technique

Sit with your knees and feet flat on the ground. Sit back on your ankles and keep your heels and knees together. Place your hands next to your knees and slowly lean backwards. Slowly raise your knees off the ground.

### Muscles being stretched

Primary muscle: Tibialis anterior.

Secondary muscles: Extensor hallucis longus. Extensor digitorum longus. Peroneus tertius.

### Sports that benefit from this stretch

Basketball. Netball. Boxing. Hiking. Backpacking. Mountaineering. Orienteering. Martial arts

Tennis. Badminton. Squash. Running. Track. Cross-country. American football (gridiron). Soccer. Rugby. Walking. Race walking.

### **Sports injury where stretch may be useful**

Anterior compartment syndrome. Medial tibial pain syndrome (shin splints). Ankle sprain. Peroneal tendon subluxation. Peroneal tendonitis.

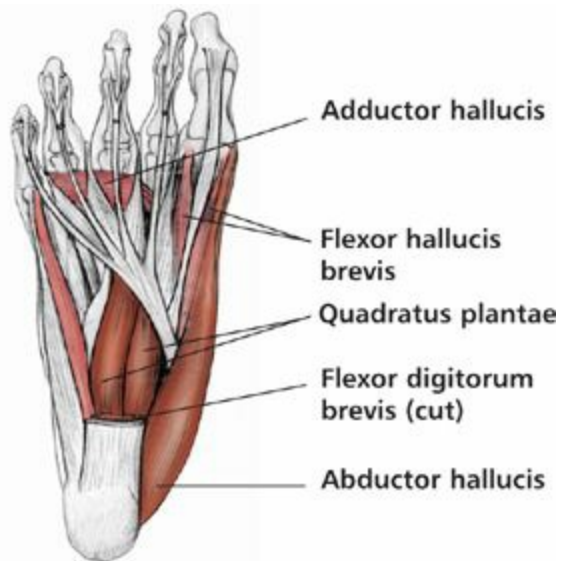
### **Common problems and more information for performing this stretch correctly**

This stretch can put a lot of pressure on your knees and ankles. Do not attempt this stretch if you suffer from knee or ankle pain.

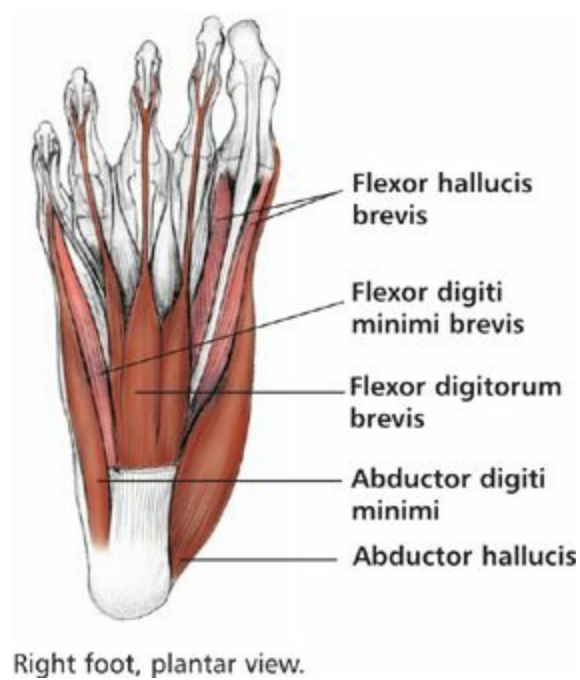
### **Complementary stretch**

[L03](#).

# L05: SQUATTING TOE STRETCH



Right foot, plantar view.



## Technique

Kneel on one foot with your hands on the ground. Place your body weight over your knee and slowly move your knee forward. Keep your toes on the ground and arch your foot.

## Muscles being stretched

Primary muscles: Flexor digitorum brevis. Abductor hallucis. Abductor digiti minimi. Quadratus plantae.

Secondary muscles: Flexor hallucis brevis. Adductor hallucis. Flexor digiti minimi brevis.

## Sports that benefit from this stretch

Basketball. Netball. Boxing. Cycling. Hiking. Backpacking. Mountaineering. Orienteering. Martial arts. Tennis. Badminton. Squash. Running. Track. Cross-country. American football (gridiron). Soccer. Rugby. Surfing. Walking. Race walking.

## Sports injury where stretch may be useful

Posterior tibial tendonitis. Peroneal tendon subluxation. Peroneal tendonitis. Flexor tendonitis. Sesamoiditis. Plantar fasciitis.

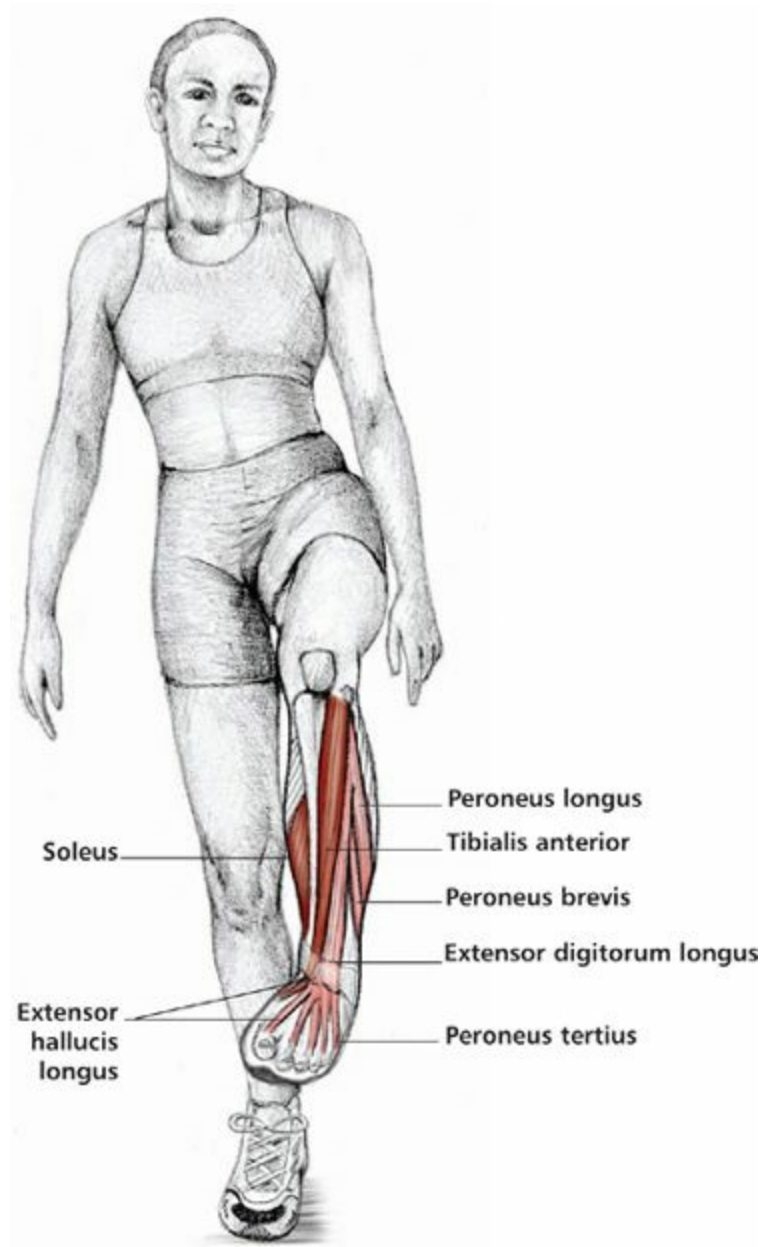
## Common problems and additional information for performing this stretch correctly

The muscles and tendons underneath the foot can be very tight; do not apply too much force too quickly when doing this stretch.

## Complementary stretch

[K07](#).

# L06: ANKLE ROTATION STRETCH







### **Technique**

Raise one foot off the ground and slowly rotate your foot and ankle in all directions.

### **Muscles being stretched**

Primary muscles: Soleus. Tibialis anterior.

Secondary muscles: Extensor hallucis longus. Extensor digitorum longus. Peroneus longus, brevis and tertius. Tibialis posterior. Flexor hallucis longus. Flexor digitorum longus.

### **Sports that benefit from this stretch**

Basketball. Netball. Boxing. Hiking. Backpacking. Mountaineering. Orienteering. Martial arts. Tennis. Badminton. Squash. Running. Track. Cross-country. American football (gridiron). Soccer. Rugby. Walking. Race walking.

### **Sports that benefit from this stretch**

Anterior compartment syndrome. Medial tibial pain syndrome (shin splints). Ankle sprain. Posterior tibial tendonitis. Peroneal tendon subluxation. Peroneal tendonitis.

### **Additional information for performing this stretch correctly**

If need be, hold onto something for balance.

### **Complementary stretches**

[L02](#), [K02](#).

# Resources

- Alter, M.J.: 2004. *Science of Flexibility*. Human Kinetics. IL, USA.
- Anderson, R. A.: 2010. *Stretching*. Shelter Publications. CA, USA.
- Armiger, P.: 2010. *Stretching for Functional Flexibility*. Lippincott, Williams & Wilkins. MD, USA.
- Bahr, R. & Maehlum, S.: 2004. *Clinical Guide to Sports Injuries*. Human Kinetics. IL, USA.
- Beachle, T. & Earle, R.: 2008. *Essentials of Strength Training and Conditioning*. Human Kinetics. IL, USA.
- Biel, A.: 2010. *Trail Guide to the Body*. Books of Discovery. CO, USA.
- Chek, P.: 2009. *An Integrated Approach to Stretching*. C.H.E.K. Institute. CA, USA.
- Delavier, F.: 2010. *Strength Training Anatomy*. Human Kinetics. IL, USA.
- Goldspink, G.: 1968. Sarcomere length during post-natal growth and mammalian muscle fibers. *Journal of Cell Science*, 3(4): 539–548.
- Gummerson, T.: 1990. *Mobility Training for the Martial Arts*. A & C Black. London, UK.
- Jarmey, C.: 2008. *The Concise Book of Muscles*. Lotus Publishing. Chichester, UK.
- Jarmey, C.: 2006. *The Concise Book of the Moving Body*. Lotus Publishing. Chichester, UK.
- Kurz, T.: 2003. *Stretching Scientifically*. Stadion Publishing Company. VT, USA.
- Martini, F., Timmons, M. & Tallitsch, R.: 2009. *Human Anatomy*. Pearson Benjamin Cummings. CA, USA.
- Mattes, A.: 2000. *Active Isolated Stretching: The Mattes Method*. Self Published. FL, USA.
- McAtee, R. & Charland, J.: 2007. *Facilitated Stretching*. Human Kinetics. IL, USA.
- Norris, C.M.: 1998. *Sports Injuries: Diagnosis and Management*. Butterworth-Heinemann. Oxford, UK.
- Tortora, G.J. & Derrickson, B.: 2009. *Principles of Anatomy and Physiology*. John Wiley & Sons, Inc. NJ, USA.
- Walker, B.: 2007. *The Stretching Handbook*. The Stretching Institute. NY, USA.
- Walker, B.: 2007. *The Anatomy of Sports Injuries*. Lotus Publishing. Chichester, UK.
- Weldon, S.M.: 2003. The efficacy of stretching for prevention of exercise-related injury: a systematic review of the literature. *Manual Therapy*, 8(3): 141.
- Wharton, J & P.: 1996. *The Whartons' Stretch Book*. Three Rivers Press. NY, USA.
- Williams, P.E. & Goldspink, G.: 1971. Longitudinal growth of striated muscle fibers. *Journal of Cell Science*, 9(3): 751–767.

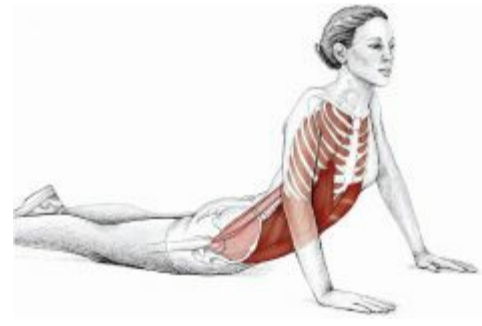
Wilmore, J.H. & Costill, D.L.: 1994. *Physiology of Sport and Exercise*. Human Kinetics. IL, USA.

Ylinen, J.: 2008. *Stretching Therapy*. Elsevier. PA, USA.

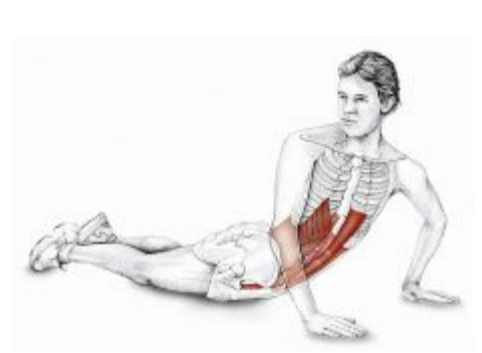
# Top Five Stretches for Each Sports Injury

The stretches below are a short list of suggested stretches to help with a number of common sports injuries. The following stretches are beneficial for the prevention and long-term rehabilitation of the injuries listed below; however, they are not to be used in the initial stages of injury rehabilitation. Stretching during this early stage of the rehabilitation process will only cause more damage to the injured tissues. Avoid all stretching during the first seventy-two hours after any soft tissue injury, and remember to follow *The Rules for Safe Stretching*.

# Abdominal muscle strain



C02



C03



C05



D14



D21

# Achilles tendon strain and tendonitis



K01



K02



K04



K05



K07



# Ankle sprain



J03



J06



K04



L02



L06

# Anterior compartment syndrome



F02



L02



L03



L04



L06

# Anterior cruciate ligament sprain (ACL)



F01



F02



F03



G03



J03

# Back ligament sprain



D01



D05



D09



D14



D21



# Back muscle bruise, and strain



D05



D08



D13



D18



D22

# Biceps bruise, strain, rupture, and tendonitis



A17



B02



B06



B07



B11

# Calf strain



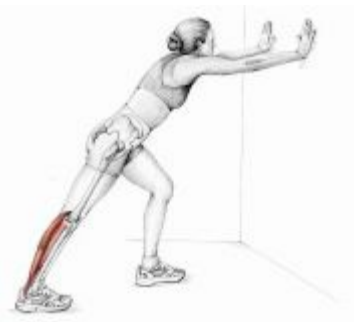
G03



G13



J03

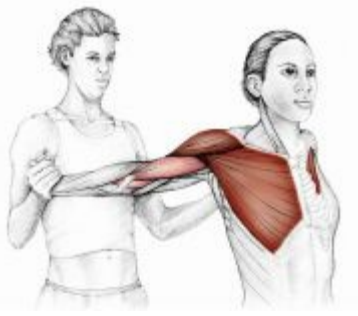


J06



K02

# Carpal tunnel and ulnar tunnel syndrome



B02



B11



B13



B16



B17



# Chest strain



A14



A17



B04



B05



B07

# Elbow sprain



A08



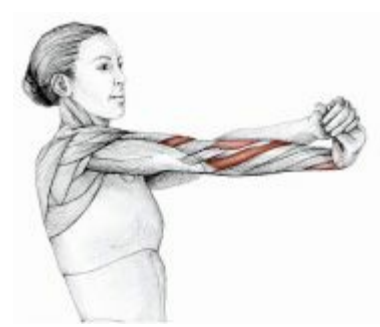
A16



B10



B11



B17

# Finger sprain and tendonitis



B11



B12



B13



B14



B17

# Frozen shoulder (adhesive capsulitis)



A08



A14



A16



B06



B07



# Groin strain and tendonitis



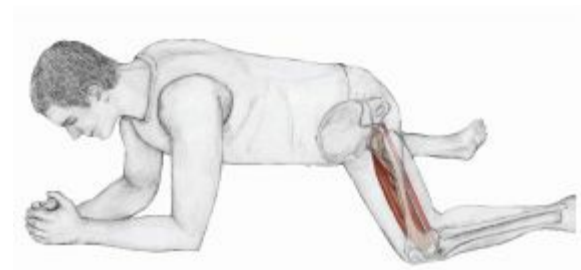
H01



H02



H04



H06



H08

# Hamstring strain



G01



G05



G08



G11



J03

# Hip flexor strain and iliopsoas tendonitis



C03



F01



F02



F03



F05

# Iliotibial band syndrome



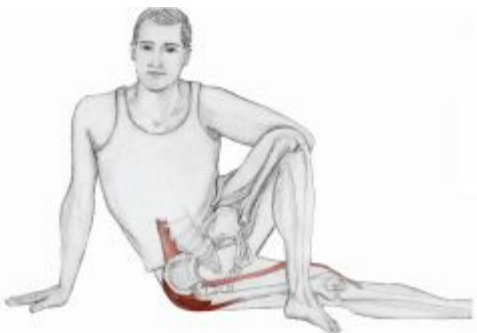
D22



I02



I03



I05



I07



# Impingement syndrome



A16



B01



B06



B07



B10

# Medial collateral ligament sprain (MCL)



F03



F05



H02



H04



H07

# Medial tibial pain syndrome (shin splints)



J06



K02



K04



K07



L02

# Osgood-schlatter syndrome



C03



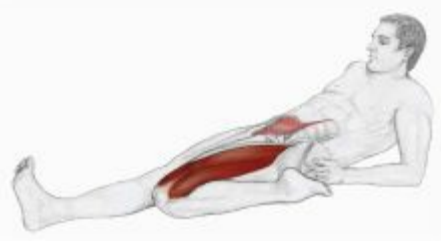
F02



F03



F04



F06



# Osteitis pubis



G04



G13



H02



H05



H07

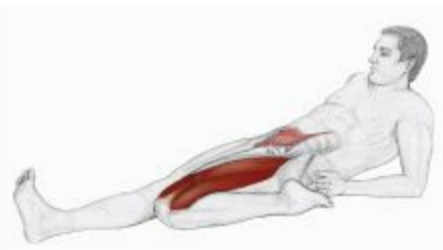
# Patellar tendonitis (jumper's knee)



F02



F03



F06



H04



I02

# Patellofemoral pain syndrome



F01



F02



F05



H05



I04

# Pectoral muscle insertion inflammation



A14



B01



B04



B05



B07



# Peroneal tendonitis



J04



K02



K04



L02



L06

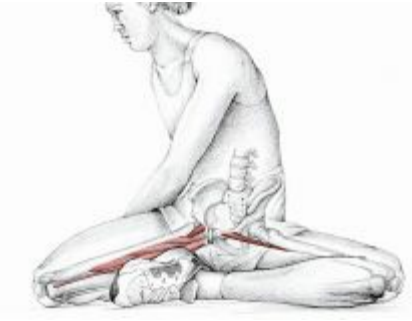
# Piriformis syndrome



E01



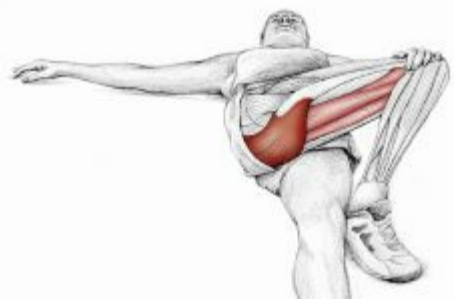
E03



E05



E09



E11

# Plantar fasciitis



J03



J06



K04



K07



L05

# Posterior tibial tendonitis



H08



J02



K01



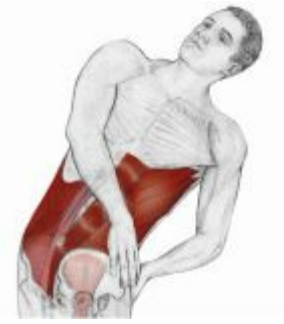
K04



K07



# Quadriceps bruise, strain, and tendonitis



C05



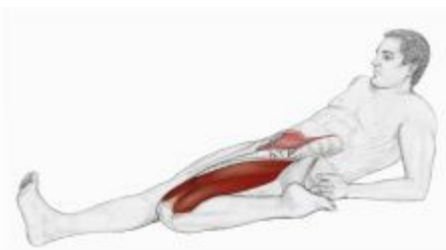
F01



F02



F05





# Rotator cuff tendonitis



A09



A12



A13



A14



A15

# Tennis, golfer's, and thrower's elbow



A12



A14



A16



B01



B10

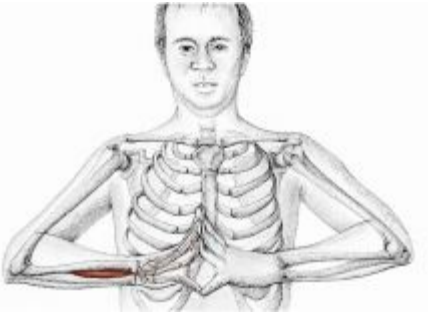
# Thumb sprain



B12



B13



B14



B15



B17



# Triceps tendon rupture



A09



B01



B06



B09



B10

# Whiplash and wryneck



A01



A02



A04



A07





# Wrist sprain and tendonitis



B04



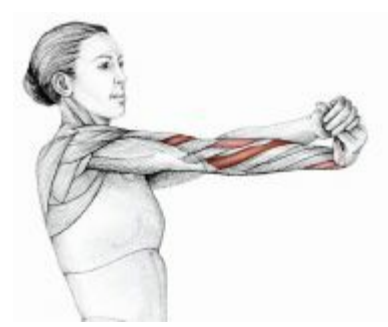
B11



B12



B16



B17

# Top Five Stretches for Each Sport

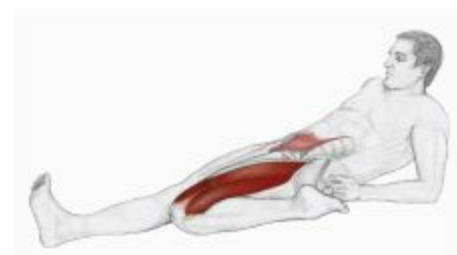
## American football (gridiron)



D13



E10



F06



G13



H02



# Archery



A16



B12



C02



D06



D14

# Basketball



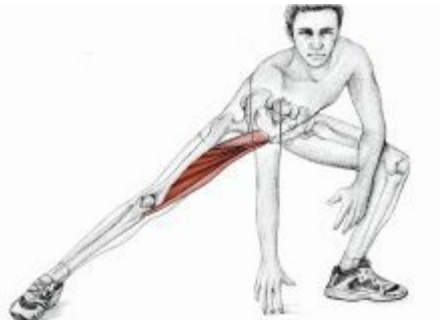
A05



B13



F03



H05

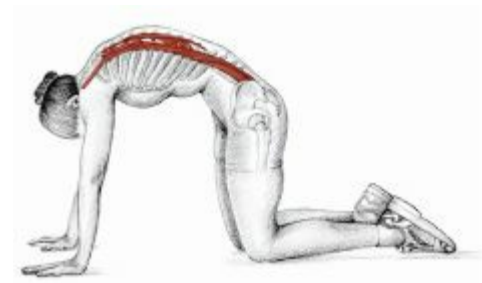


K07

# Backpacking



C02



D11



E07



G03



K07

# Batting sports (cricket, baseball, softball, etc.)



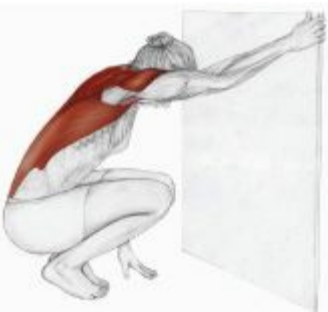
A09



B16



C03



D02



D18



# Boxing



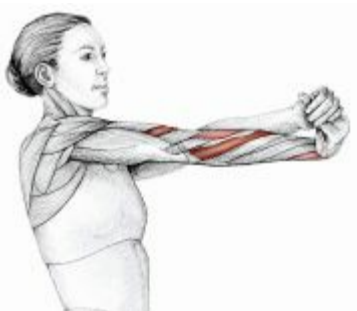
A01



A07



B08



B17





# Canoeing



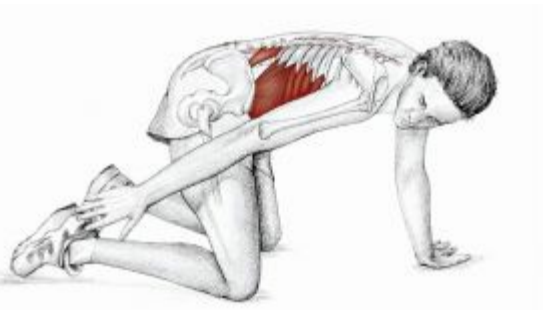
A13



A16



B06



D20



E04

# Contact sports (soccer, American football (gridiron), rugby, etc.)



A02



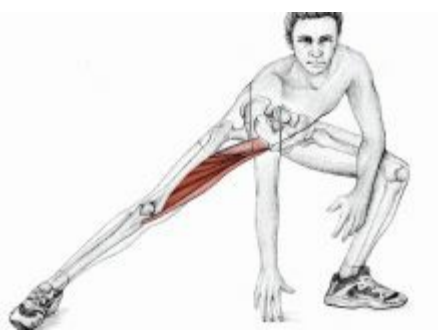
A07



E08



F01



H05

# Cross-country



C05



F03



I04



K07



L01



# Cycling



B06



D08



E05



F05



J03

# Field hockey



D22



E07



F02



H04

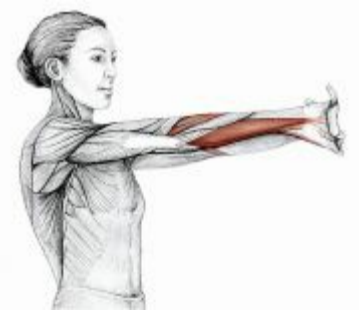


J02

# Golf



A17



B12



D06



D18



I04

# Hiking



C03



D11



E03



G01



J03

# Ice hockey



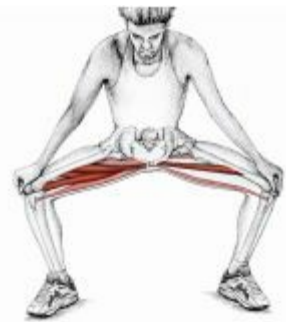
D23



E08



F01



H02





K07

# Ice-skating



D07



E03



E12



F01



H01

# Inline skating



D09



E04



E10



F03



H04

# Kayaking



A13



A17



B07



D18

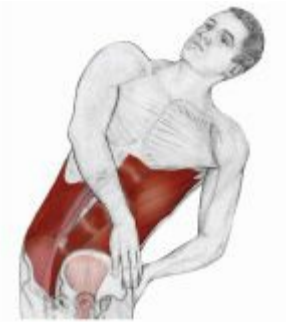


E03

# Martial arts



B17



C05



D13



G05





H06

# Mountaineering



C02



D09



E01



G03

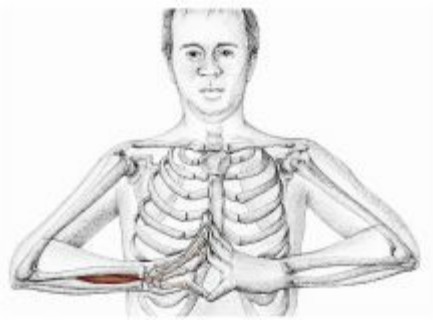


L02

# Netball



A02



B14



F03



H05



K04

# Orienteering



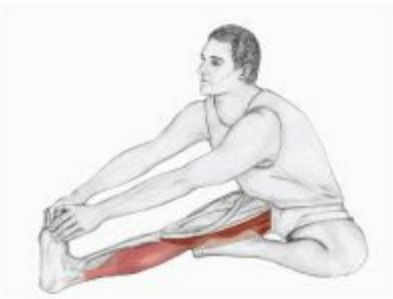
C03



D13



E04



G06



K02

# Race walking



D17



E05



F03



J02





K04

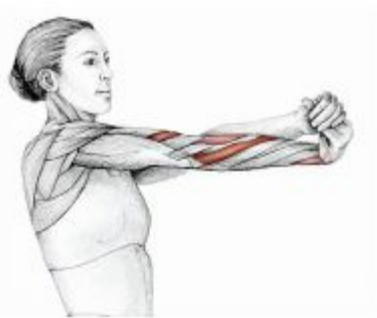
# Racquet sports (tennis, badminton, squash, etc.)



A14



B07



B17



C03



D16

# Roller-skating



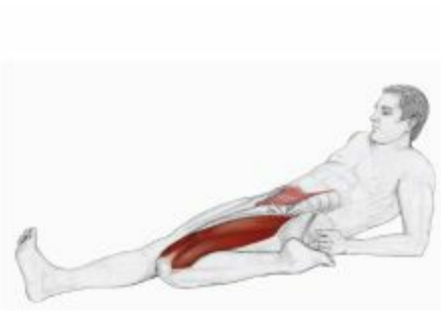
D08



E04



E13



F06



H03

# Rowing



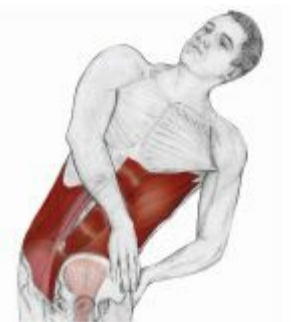
A15



A16



B06



C05



E01

# Running



C03



F01



G04



I02





K04

# Rugby



D17



E04



F01



G04



H05

# Snow boarding



D13



E01



E13



F01



I04

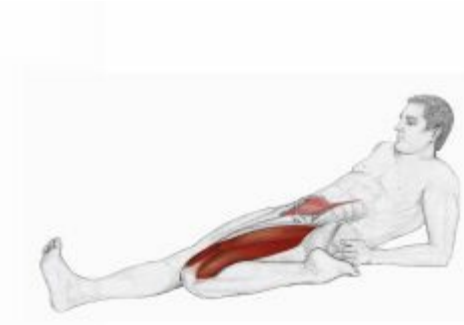
# Snow skiing



D06



D22



F06



I03



K07

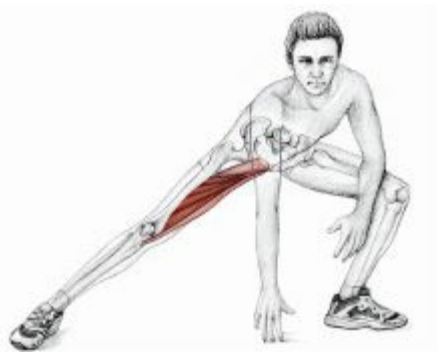
# Soccer



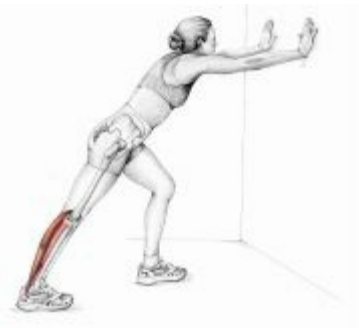
F01



G05



H05



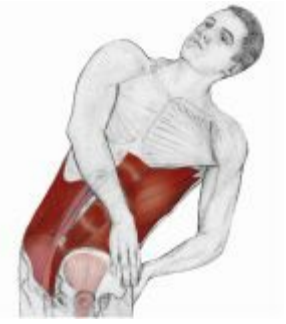
J06





L02

# Surfing



C05



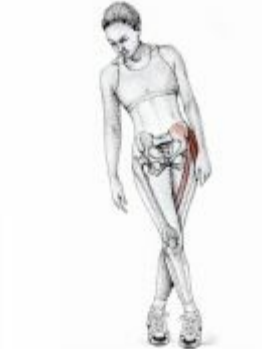
D16



E07



F05



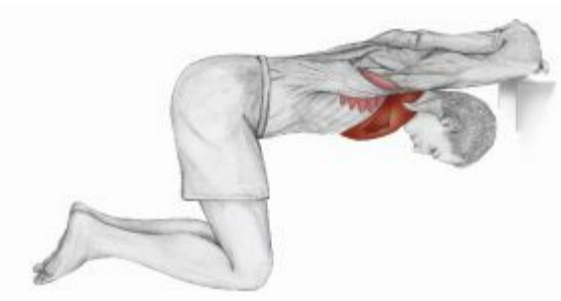
# Swimming



A12



A14



B08



D04



J03

# Throwing sports (cricket, baseball, field events, etc.)



A13



A17



B14



B17



D18

# Volleyball



A12



D22



E10



H02





K07

# Walking



D21



E08



F05



J03



K01

# Water skiing



B01



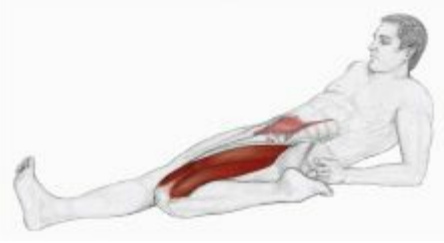
C03



D10



E09



F06

# Wrestling



D15



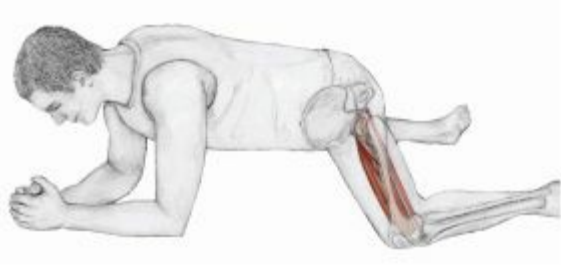
D22



E06



G01



H06

# Glossary

**Achilles tendonitis** Inflammation of the Achilles tendon.

**Adhesive capsulitis** Adhesive inflammation between the joint capsule and the peripheral articular cartilage of the shoulder. Causes pain, stiffness, and limitation of movement. Also known as frozen shoulder.

**Ankylosing spondylitis** Form of degenerative joint disease that affects the spine. Systemic illness, producing pain and stiffness as a result of inflammation of the sacroiliac, intervertebral, and costovertebral joints.

**Anterior tibial compartment syndrome** Rapid swelling, increased tension, and pain of the anterior tibial compartment of the leg. Usually a history of excessive exertion.

**Arthropathy** Any joint disease.

**Articular dysfunction** Disturbance, impairment, or abnormality of a joint.

**Avulsion fracture** Indirect fracture caused by compressive forces from direct trauma or excessive tensile forces.

**Bursa** Fibrous sac membrane containing synovial fluid, typically found between tendons and bones. It acts to reduce friction during movement.

**Bursitis** Inflammation of the bursa, e.g., subdeltoid bursa.

**Calcific tendonitis** Inflammation and calcification of the subacromial or subdeltoid bursa. This results in pain, and limitation of movement of the shoulder.

**Capsulitis** Inflammation of a capsule, e.g., joint.

**Carpal tunnel syndrome** Compression of the median nerve as it passes through the carpal tunnel, leading to pain and tingling in the hand.

**Cervical nerve stretch syndrome** Condition caused by irritation or compression of the cervical nerve roots by a protruding disc.

**Coccydynia** Pain in the coccyx and neighbouring region. Also known as coccygodynia.

**Compartment syndrome** Condition in which increased intramuscular pressure impedes blood flow and function of tissues within that compartment.

**Discogenic pain** Pain caused by derangement of an intervertebral disc.

**Dislocation** The displacement of any part, especially of a bone.

**Epicondylitis** Inflammation and microrupturing of the soft tissues on the epicondyles of the distal humerus.

**Fasciitis** Inflammation of the fascia surrounding portions of a muscle.

**Frozen shoulder syndrome** see adhesive capsulitis.

**Golfer's elbow** Inflammation of the medial epicondyle of the humerus caused by activities (e.g., golf) that involve gripping and twisting, especially when there is a forceful grip.



**Heel spur** Bony spur from the calcaneum.

**Iliotibial band syndrome** Pain/inflammation of the iliotibial band (ITB), a non-elastic collagen cord stretching from the pelvis to below the knee. There are various biomechanical causes.

**Impingement syndrome** Chronic condition caused by a repetitive overhead activity that damages the glenoid labrum, long head of the biceps brachii, and subacromial bursa.

**Inflammation** A localized protective response caused by injury to tissues. Characterized by pain, heat, redness, swelling, and loss of function.

**Lordosis** Excessive convex curve in the lumbar region of the spine.

**Medial tibial pain syndrome** Rapid swelling, increased tension, and pain of the medial tibial compartment of the leg. Usually a history of excessive exertion. Also known as shin splints.

**Neuritis** Inflammation of a nerve, with pain and tenderness.

**Osteitis** Inflammation of a bone, causing enlargement of the bone, tenderness, and a dull, aching pain.

**Osteitis pubis** A symptom-producing inflammatory condition of the pubic bones in the region of the symphysis. May be caused by a variety of conditions including degenerative changes.

**Osteoarthritis** Non-inflammatory degenerative joint disease, characterized by degeneration of the articular cartilage, hypertrophy of bone at the margins, and changes in the synovial membrane. Seen particularly in older persons.

**Patellofemoral pain syndrome** Excessive pain pertaining to the patella and femur.

**Piriformis syndrome** Condition resulting from the muscle being inflamed, shortened, or in spasm, causing impingement on the sciatic nerve. Causes pain and tingling in the posterior thigh and buttock. Occurs more frequently in women than men (ratio 6:1).

**Repetitive strain injury (RSI)** Refers to any overuse condition, such as strain, or tendonitis in any part of the body.

**Rheumatoid arthritis** Autoimmune disease, in which the immune system attacks the body's own tissues. Causes inflammation of many parts of the body.

**Rotator cuff** Helps hold the head of the humerus in contact with the glenoid cavity (fossa, socket) of the scapula during movements of the shoulder, thus helping to prevent dislocation of the joint. Comprises of: supraspinatus, infraspinatus, teres minor, and subscapularis.

**Rupture** Forcible tearing or disruption of tissue.

**Sacroiliitis** Inflammation (arthritis) in the sacroiliac joint.

**Scapulocostal syndrome** Pain in the superior or posterior aspect of the shoulder girdle, as a result of long-standing alteration of the relationship of the scapula and the posterior thoracic wall.

**Scoliosis** Lateral rotational spinal curvature.

**Sesamoid bone** Small nodular bones embedded in a tendon or joint.

**Sesamoiditis** Inflammation of the sesamoid bones and surrounding structures.

**Shin splints** see medial tibial pain syndrome/anterior tibial compartment syndrome.

**Snapping hip syndrome** Possibly caused by tight ligaments and tendons passing over bony prominences. Internal snapping mainly caused by the suction phenomenon, occurring during exercises such as sit-ups. External snapping usually as a result of the gluteus maximus clicking over the greater trochanter. Common in dancers and young athletes. Also known as clicking hip syndrome.

**Sprain** Joint injury in which some of the fibres of a supporting ligament are ruptured.

**Strain** An overstretching or overexertion of some part of the musculature.

**Subluxation** An incomplete or partial dislocation.

**Tendonitis** Inflammation of a tendon. Also known as tendinitis.

**Tennis elbow** Tendonitis of the muscles of the back of the forearm at their insertion. Caused by excessive hammering or sawing type movements, or a tense, awkward grip on a tennis racquet.

**Tenosynovitis** Inflammation of a tendon sheath.

**Thrower's elbow** Repetitive stress to the medial collateral ligament.

**Torticollis** Contracted state of the cervical muscles, producing twisting of the neck.

**Trochanteric bursitis** Trochanteric bursa lies between gluteus maximus and the posterolateral surface of the greater trochanter. Bursitis may occur if flexibility of the iliotibial band (ITB) is reduced.

**Ulnar tunnel syndrome** The ulnar nerve runs down the inside of the forearm to the heel of the hand. Excessive pressure on this nerve can cause numbness and tingling that is confined to the little finger and the outside of the ring finger. Usually not caused by repetitive motions.

**Whiplash** Nonspecific term applied to injury to the spine and spinal cord at C4/C5, occurring as the result of rapid acceleration/deceleration of the body.

**Wry neck** see torticollis.