

② WARM-UP, COOL-DOWN AND STRETCH

Preparing the body for sports participation by warming up will help enhance maximal performance and reduce the risk of injury. “Warming up” can include light exercise, sport-specific exercises, stretching and even psychological preparation.^[1]

A cool-down is a brief period of low-intensity exercise done at the end of a sporting activity. The length of the cool-down will vary with the duration and intensity of the previous activity, but will usually range from 5 to 15 minutes and incorporate some form of low-intensity cardiovascular exercise and static stretching. Although a cool-down period after an exercise session is beneficial to players, it is often neglected.

The Aims and Benefits of Warm-Up

The warm-up aims to prepare the mind, heart, muscles and joints for physical activity. Its benefits include improved performance, greater psychological preparation, and injury prevention. It also offers a significant general health benefit: vigorous exercise started without a warm-up has been shown to place a large amount of stress on the heart and can lead to cardiovascular difficulties such as a heart attack.^[1,2]

Warming up helps to prevent a rapid increase in blood pressure and improves blood flow to the heart and working muscles.^[2] The increased activity associated with warming up increases muscle temperature and makes the muscles more pliable. A higher muscle temperature also increases the speed and efficiency of the nerve messages and biochemical reactions that cause movement.^[1,3] Conversely, a decrease in muscle temperature results in an increase in muscle stiffness and a lowered capacity for work.^[1,3] Cold, less pliable and elastic muscle works harder to accommodate a given load and will be more resistant to sudden stretch. Less pliable tissues are also more susceptible to overuse injuries caused by repetitive low-intensity stretching of inflexible tissues.^[4]

Warm-up activates and primes the appropriate energy systems, allowing for an efficient use of fuel and lower lactate levels.^[1,3] Taking time to adjust to the particular playing conditions also promotes psychological preparation as competitors have time to assess the light, wind and temperature of the environment, the playing surface and surrounding hazards. Warm-up has been shown to improve players’ ability to concentrate and visualise their performance.^[3]

The Aims and Benefits of Cool-Down and Stretch

Adding a cool-down period may reduce the incidence of injuries. Static stretching in a cool-down also promotes flexibility.

The fast burning of carbohydrates for fuel during intense exercise generates waste products such as lactic acid. Lactic acid in the muscles hinders recovery by reducing strength, slowing the rate of glucose absorption (refuelling) and contributing to muscle soreness, so its quick removal is beneficial, particularly for players who train and compete on consecutive days. Lactic acid can be removed from the muscles and blood most effectively with light aerobic exercise, which sustains the elevated blood circulation. This blood flow carries the by-products of exercise away from the muscles.

Cool-down is important for recreational exercisers as well as competitive players because it helps lower the levels of adrenaline (a hormone) produced during vigorous exercise. Adrenaline that stays in the bloodstream while a player rests can place stress on their heart.^[2] Being inactive after exercise can also cause blood to pool, especially in the legs. This slows the return of blood to the heart, which can reduce blood pressure suddenly. This drop in blood pressure often leads to light-headedness and feelings of nausea and discomfort. Continued movement, in the form of a cool-down, is particularly useful after vigorous exercise as it helps

to circulate blood and return it to the heart, reducing the risk of fainting or collapse.

Cooling down slowly also minimises the physiological stress of stopping exercise. The large amount of heat generated during intense exercise must be released if the body is to return to its normal temperature. By moving around, particularly outdoors, the body can gradually release heat into the circulating air.

Best Practice for the Warm-Up Process

The warm-up will be most effective if it follows a set procedure. Table 2 shows a suggested warm-up procedure and an example for soccer.

Performing light aerobic exercise at the beginning of the sporting activity is recommended for starting the warm-up process. Jogging is ideal for most team sports. Static stretching may also be a component of the warm-up (see “Guidelines for Stretching” for the best way to static stretch). Dynamic stretching as part of the warm-up is also a good idea when the sporting activity requires rapid dynamic movements.^[5] Dynamic stretching is when muscles are stretched in a progressive, controlled way – gradually increasing the speed of stretch to replicate the sport-specific requirement. It needs to be carefully supervised as it involves exercises that need to be performed with good technique. Sport-specific exercises are also highly recommended in the warm-up as they help to prepare the player for the specific demands of the game.^[6]

It is important to remember that adequate fluids need to be consumed during the warm-up.

Best Practice for the Cool-Down Process

Performing light aerobic exercise at the end of the sporting activity is recommended for starting the cool-down process. Jogging is ideal for most team sports as it continues the sporting activity and uses a large amount of muscle mass. Low-intensity cycling and rowing are also good options, particularly after gym training sessions. Again, it is important to keep taking fluids during the cool-down period.

Flexibility/stretching exercises are the other important component of the cool-down. These aim to elongate the soft tissues and provide benefits such as improved joint range of motion. Stretching enhances joint range of motion by increasing the extensibility of the tendons, ligaments and muscles. While not all sporting activities require extreme levels of joint mobility, stretching exercises allow for normal movement patterns and a less restricted motion.

Three stretching techniques are frequently used: static, dynamic, and proprioceptive neuromuscular facilitation (PNF). Static stretching is the most common and is performed by placing the muscle in its most lengthened position and holding it there at least 30 seconds and up to 60 seconds.^[7] Under this imposed stretch the muscle and surrounding connective tissues slowly increase in length. Static stretching is the safest type of stretching and the most appropriate for a cool-down (see “Guidelines for Stretching”). PNF stretching uses combinations of alternating contraction and relaxation of the muscle groups. It has been shown to be an effective way to increase muscle length in minimal time and is commonly used by physiotherapists for treating muscle strains.^[8] Ballistic stretching, incorporating rapid movements and bouncing, is discouraged for most sports as during these types of movements the muscles have a greater stiffness and resistance to stretch, which does not help in lengthening the tissues.

The safest and most effective time to stretch if trying to increase the length of the muscles and improve joint range of motion is just after exercise.^[9] This is because the soft tissues are more elastic and pliable after exercise and are consequently able to be lengthened more safely. For this reason stretches at the end of exercise should be held for a longer time than during the warm-up.

Guidelines for Stretching

Despite the fact that no studies have been able to prove that stretching reduces the rate of injuries,^[10, 11] the scientific literature does support the physiological basis for the performance enhancement and injury prevention that result from stretching.^[8]

2. WARM-UP, COOL-DOWN AND STRETCH cont.

Correct body position is of paramount importance when performing stretching exercises. Proper instruction is required. The following simple guidelines for static stretching should be followed:^[8,10]

- Stretch slowly until a comfortable tightening within the muscle is felt (the point of gentle discomfort)
- Hold each muscle in a state of near maximal stretch for a minimum of 30 seconds
- Relax and breathe out as you move into the stretch – avoid holding your breath
- Avoid bouncing
- The correct posture and stretch position should always be maintained and kept within the limits of comfort
- Stretch both sides of the body.

Concentrate on the major muscles, especially those that will have a large demand placed on them and those that have been identified in the pre-season screening process as lacking in flexibility. Stretches may need to be individualised to account for previous injuries^[12] and environmental conditions. Contra-indications such as joint instability or ligament damage need to be identified and considered before prescribing stretching exercises.

Practical guidelines on warm-up/cool-down and stretch can be found in the “Warm-Up, Cool-Down and Stretch” section of the *ACC SportSmart Coaches’ Kit*.

References

1. Best, T.M. and Garret, W.E. Warming up and cooling down. In: Renstrom, P.A.F.H. (Ed.) *Sports Injuries. Basic Principles of Prevention and Care*. Blackwell Scientific Publications: Oxford, 1993.
2. Stamford, B. How to warm-up and cool-down your workout. *Physician and Sports Medicine*, 1995, 23(9): 97-98.
3. Tancred, B. and Tancred, G. An examination of the benefits of warm-up: a review. *New Studies in Athletics*, 1995, 10(4): 35-41.
4. Micheli, L. *The Sports Medicine Bible*. Harper Collins: New York, 1995.
5. Faccioni, A. Warming-up routine for dynamic sports. *Strength and Conditioning Coach*, 1995, 3(1): 7-9.
6. Rutledge, R. and Faccioni, A. Dynamic warm ups. *Sports Coach*, 2001, 24(1): 20-22.
7. Shrier, I. Stretching before exercise does not reduce the risk of local muscle injury: a critical review of the clinical and basic science literature. *Clinical Journal of Sport Medicine*, 1999, 9(4): 221-227.
8. McCullough, C. Stretching for injury prevention. *Patient Management*, August, 1990: 61-67.
9. Allerheiligen, W.B. Stretching and warm-up. In: Baechle, T.R. (Ed.) *Essentials of Strength Training and Conditioning*. Human Kinetics: Champaign, Illinois, 1994.
10. Shrier, I. and Gossal, K. Myths and truths of stretching. *The Physician and Sportsmedicine*, 2000, 28(8): 57-63.
11. Pope, R., Herbert, R., Kirwan, J. and Graham, B. A randomized trial of pre-exercise stretching for prevention of lower-limb injury. *Medicine and Science in Sports and Exercise*, 2000, 32(2): 271-277.
12. Ninos, J. Guidelines for proper stretching. *Strength and Conditioning*, 1995, 17(1): 44-46.

COMPONENT	PURPOSE	EXAMPLE FOR SOCCER
Aerobic Exercise	<ul style="list-style-type: none"> • Raises the body's temperature and activates body systems. 	<ul style="list-style-type: none"> • 5-10 minutes of light jogging (enough to cause a light sweat).
Stretching	<ul style="list-style-type: none"> • Increases the elasticity of the tissues and increases joint range of motion. 	<ul style="list-style-type: none"> • Static stretches for the hamstrings, quadriceps, calves and groin held at least 30 seconds. • Dynamic stretches for the leg muscles (e.g. leg swings).
Sport-Specific Exercises	<ul style="list-style-type: none"> • Prepares the player for the types of activities to be expected in the game. • Allows physical and mental adjustment to the conditions. 	<ul style="list-style-type: none"> • Short sprints, fast changes of direction, jumps and hops. • Passes and shooting drills involving other players and the ball.

table 2: COMPONENTS OF THE WARM-UP