SOCCER FITNESS INC.

SOCCER FITNESS

SOCCER FIT-FACTS

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RESISTED SPRINTING METHODS—WHICH ONE IS BEST?

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Over the past 20 years, several different training methods have been used by fitness trainers and strength and conditioning coaches, to try to add resistance to running and sprinting movements. The purpose of this article is to examine the science behind different types of resisted sprinting training methods, and determine which are more or less effective in improving running speed. Before such a comparison can be made, it is important to understand that there are two fundamentally different phases of high speed running, to which resistance can be added (each of which have their own specific biomechanical properties):

1. sprint starts / acceleration
2. upright running / striding

During sprint starts, the body is trying to produce as much power as possible, from a static position. The athlete's body must be positioned so that the pelvis is tilted forwards, in a way that lowers the centre of mass, which allows for maximal power output and explosive forward movement. Forces from the legs must be directed backwards, and into the ground at a 45 degree angle, in order to propel the body forwards / upwards at a 45 degree angle.

During upright running, there is less forward lean, and the body's centre of mass is more stable and upright. Propulsive forces are maximized by powerful hip flexion (raising the knees) and hip extension (pushing into the ground). The pelvis should not be tilted forwards, as this will limit the range of motion of hip flexion and decrease stride length, also decreasing running speed.

In this article, we are examining 3 different resisted sprinting methods, each of which provide resistance to sprint starts, upright running, or both:

1. Weighted Sleds
2. Parachutes
3. Elastic Loading Devices, or Running Cords

Weighted Sleds

As mentioned previously, an athlete starting a run / sprint from a static (motionless) start, has to be able to maximize the force they produce in the forward direction. Staying "low", tilting the pelvis and trunk forwards, will allow the athlete to produce maximal amounts of horizontal, or forward, forces. For this purpose, a properly designed harness affixed to a weighted sled, or loading device, can be an effective training tool for improving explosiveness in the first 3-5 steps of a maximal sprint effort. Weighted sleds lose their effectiveness if used for distances greater than 5-8 metres, or 3-5 steps, because they require the athlete to maintain a low centre of mass, and a forward-tilted pelvis. As mentioned previously, this type of body position will limit the range of motion of hip flexion (raising the knees) thereby reducing stride length. Having athletes train and run with resistance, using improper form such as a forward-tilted pelvis, can be counterproductive, as gains in strength may be offset by detrimental changes in running mechanics.

Parachutes:

Parachutes used for resisted sprinting typically attach to the athlete's waist. While the athlete is in stride (upright running), parachutes apply a slight resistance at the waist, requiring the athlete to produce more horizontal (forward) propulsive forces. There are two inherent problems with using parachutes as resisted sprinting devices, however. Firstly, parachutes typically do not fill with air until the athlete has already reached an upright running posture. This means that they provide no resistance at the starting phase of sprinting (sprint starts). The second problem with parachutes is that, like weighted sleds or harnesses, they typically attach to the athlete's waist or torso. Once resistance from the parachute kicks in, this attachment site of the resistance means that the athlete must tilt the pelvis forwards to optimize the production of horizontal propulsive forces. As with weighted sled running, a forward-tilted pelvis is neither safe nor effective as athletes reach higher running speeds. The gains in strength caused by the slight resistance during upright running may be offset by decreases in mechanical efficiency caused by the forward-tilted pelvis.

Elastic Loading Devices, or Running Cords:

Utilizing technology originally developed in the early 1990's by John Frappier of the Frappier Acceleration Program, elastic loading devices such as Running Cords provide elastic resistance to key muscles of the running stride (hip flexors, knee extensors, and lower abdominals) during the "swing phase" or sprinting. The cords attach to both the thigh (upper leg—provides resistance to hip flexion) and calf (lower leg — provides resistance to knee extension) of both legs. This unique attachment site of resistance (to the athlete's legs) as opposed to the traditional attachments to the waist or torso with sleds and parachutes, allows for resistance to be added to the running stride without changing or affecting running mechanics. The pelvis is freely allowed to tilt forwards during sprint starts, thereby allowing the athlete to run with resistance from a static start. The resistance does not cause the pelvis to tilt forwards during upright running, allowing the athlete to maintain a high amount of hip flexion, and perform upright running with resistance at any speed. Because the load is applied mainly to the hip flexors and core muscles, running cords are the only resisted sprinting tool that effectively apply resistance to both the start, and upright, phases of sprinting. **SF**

RECENT RESEARCH INVOLVING AN ELASTIC LOADING DEVICE

In a 1997 study conducted through the Department of Exercise Science at the University of Massachusets in Amhurst, MA, Swanson et. al. used an elastic loading device to add resistance to hip flexion and knee extension during the "recovery" or "swing" phase of sprinting. Seven (7) male track and field athletes performed five trials in three (3) different locomotion conditions: 1. level running; 2. incline running at 30% grade and 4.5 metres/second; and 3. incline running at 30% grade, 4.0 metres/second and using the elastic loading device. Muscular loading was measured at the thigh and leg during all three conditions. The results indicated that the general patterns of muscle loading were the same for all three conditions. When comparing incline running (condition 2) against incline running with an elastic loading device (condition 3), the elastic loading device produced substantially greater muscular loading during the "recovery" (swing) phase during hip flexion (raising the knees).

Athletes using Running Cords at the Soccer Fitness Training Centre

Implications for Soccer Players

In soccer, as in many other "ground-based" sports, running speed, as well as the ability to recover between high intensity running (speed endurance), are both important aspects of physical performance. Because hip flexor strength can be a limiting factor in overall running speed, training methods that can increase hip flexor strength and power will have a positive effect on running speed and speed endurance, will also have a positive effect on improving physical performance in soccer. Training with elastic loading devices on an inclined treadmill has been shown to increase the muscular load to the hip flexors while running, while maintaining the same general pattern of muscular loading as is seen with level running.

This type of training, therefore, will allow soccer players to increase the strength and explosiveness of the hip flexors, and thereby improve running speed and speed endurance, while maintaining proper running mechanics. There is simply no other way to achieve this training effect than with elastic loading devices. **SF**

EXERCISE SPOTLIGHT— PUSH-UP "PLUS"

In this feature of Soccer Fit-Facts, we will highlight an important exercise that can—and should—be incorporated into the training program of young soccer players. In this issue, we feature push-ups "plus" an exercise which builds strength in the chest and shoulders, while simultaneously helping to stabilize the entire shoulder girdle, improving flexibility and stability, and preventing shoulder injuries. The exercise basically consists of performing a push-up, while adding a second series of movements—scapular protraction and retraction—that activate the smaller rotator cuff muscles of the shoulder. The word "plus" in this exercise refers to scapular protraction and retraction. Here we show two variations of Push-Up "Plus":

1. Stability Ball Wall Push-Up "Plus"
2. Stability Ball Floor Push-Up "Plus"

Stability Ball Wall Push-Up "Plus"

Stand facing a wall, about 1 metre away from the wall, and hold a stability ball against the wall at shoulder height, palms facing the wall. Slowly bring the body towards the wall/ball, by bending at the elbow and keeping the shoulder blades pulled downwards and inwards. Stop when the elbows are at a 90 degree angle, and hold this position for 2 seconds (Figure 1). Push into the ball, straightening arms, and when they are completely extended, protract the shoulder blades by pushing them outwards (Figure 2). Hold this position for 2 seconds, then repeat

Stability Ball Floor Push-Up "Plus"

Start by placing feet on the stability ball, and hands on the floor, and walk out on your hands until they are completely under the chest, shoulder-width apart. Slowly lower whole body towards the floor by bending the elbows, keeping the shoulder blades pulled downwards and inwards, and the back and pelvis in a straight and neutral position. Stop lowering when the nose is about 1 inch off the floor, and hold this position for 2 seconds (Figure 3). Raise the body upwards by pushing into the floor and straightening the arms. When the arms have completely straightened, slowly move the shoulder blades downwards and outwards to the sides. Hold the position with straight arms and protracted shoulder blades for 2 seconds, then repeat (Figure 4).

Perform 2-3 sets of 5-10 repetitions of Push-Up "Plus" for optimal results. Start with the wall push-ups, which are easier, before progressing to the floor push-ups. **SF**

Figures 1 and 2: Stability Ball Wall Push-Up "Plus"

Figures 3 and 4: Stability Ball Floor Push-Up "Plus"

HOW TO PREVENT — AND REHAB — A GROIN STRAIN

Groin strains are a frequent occurrence in soccer players of all ages and levels of ability. In fact, a recent article in the British Journal of Sports Medicine stated that injury rates as high as 10 to 18 groin injuries per 100 players have been reported in Britain, and 62 % of these have been diagnosed as groin strains.

A groin strain is a tear or rupture to any one of the adductor muscles. As we see in Figure 1 (right), there are five adductor muscles: the pectinius, adductor brevis and adductor longus (called "short adductors", which go from the pelvis to the thigh bone) and the gracilis and adductor magnus ("long adductors", which go from the pelvis to the knee). The main function of the adductors is to pull the legs back towards the midline, a movement called adduction. These muscles also help to control and limit movements of the thigh away from the body's centre. Thus, the adductor muscles stabilize the hip and leg during all sporting activities which involve running. During normal walking they are used in pulling the swinging lower limb towards the middle to maintain balance. They are also used extensively in high speed running / sprinting, or other sports such as soccer, which require fast changes in direction.

The two most common causes of groin strains in soccer are overuse, and lack of a sufficient warm-up which precedes high intensity movements like running, jumping and kicking, all of which can cause the muscles to tear. In soccer, overuse injuries to the groin are especially common, because of the amount of forces going through the pelvis and hip during the different twisting, kicking, and deceleration movements in the sport. Furthermore, the dominant kicking leg in soccer is at a greater risk for groin injury as it is typically used far more often than the non-dominant leg. It is not uncommon for the pelvis to actually be tilted towards the side of the non-dominant leg, which affects strength and stability of the groin and also the surrounding muscles of the dominant leg, including the hip flexors (psoas major, iliacus).

A soccer-specific prevention and rehabilitation / strengthening program for groin strains should focus on the following areas of concern:

- strengthen and target the groin muscles using a soccer-specific movement, such as kicking
- strengthen the hip flexors, which will prevent the groin muscles from being overused in hip flexion
- strengthen the muscles that externally rotate the hip, which will keep the hip in a more "neutral" position during high speed movements
- strengthen the core muscles, which will help to keep the pelvis from tilting

Below is a soccer-specific groin strain prevention and rehabilitation program. Performing these exercises 2-3 times per week, allowing for at least 48 hours of recovery between workouts, will help to alleviate pain from existing groin strains, hasten the recovery process, and prevent any future injuries to the area. **SF**

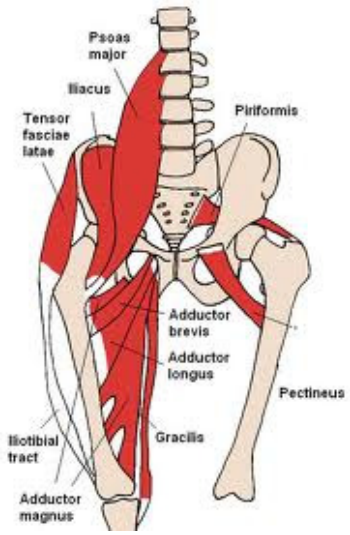


Figure 1: Anatomy of the groin and surrounding muscles

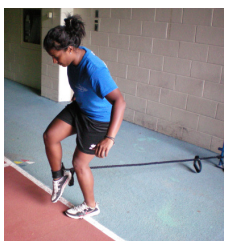
"The two most common causes of groin injuries in soccer are overuse, and lack of a sufficient warm-up which precedes high-intensity movements... "

GROIN PREVENTION / REHAB EXERCISES:

1. Thera-Band Passing / Shooting

(This exercise targets the adductor and hip flexor muscles, using soccer-specific movements)

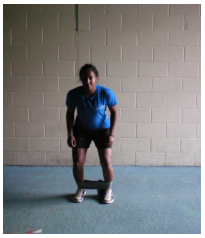
- strap a Thera-Band around the ankle, and fix the other end to a pole or table leg
- perform a passing / shooting movement, moving at 70-80% speed on the kick/ follow through
- move very slowly to get back to the starting position. Perform 2 sets of 10 repetitions for each leg for both passing and kicking movements



2. Thera-Band Side Steps

(This exercise targets the hip external rotators, which keep the hip in a "neutral" position)

- wrap a Thera-Band around both ankles and tie it up
- stand with feet shoulder width apart, and step to one side, landing on the ball of the foot
- slowly bring the opposite leg to the side
- perform 2 sets of 12 side-steps in each direction



3. Glute Bridge Kicks

(This exercise targets both the hamstrings and core muscles, which will keep the pelvis stable)

- lay supine on a mat, with knees bent, and arms extended pointed upwards, with a Thera-Band around both legs, just above the knees
- contract the abdominal muscles, and raise the hips off the ground until they are in line with the knees
- slowly extend one leg, keeping the abdominals contracted and pelvis tight. Repeat using the other leg, and perform 2 sets of 10 kicks with each leg

We are on the Web!
www.soccerfitness.ca

SOCCER FITNESS INC.

SOCCER FITNESS TRAINNG CENTRE

2ND FLOOR, TRIO SPORTSPLEX

601 CITYVIEW BOULEVARD

VAUGHAN, ONTARIO, L4H 0T1

Phone: 647-829-4360

E-mail: richard@soccerfitness.ca

Conference Venue: Nagoya University, Nagoya, Japan

Inside/Outside View of the Toyota Auditorium, Nagoya University, Nagoya, Japan

BREAKING NEWS
SOCCER FITNESS IS GOING TO JAPAN!

Over the past 3 years, Paolo Pacione, Head Strength and Conditioning Coach for the Ontario Soccer Association and Fitness Coach for various Canadian National teams, Richard Bucciarelli, President of Soccer Fitness, and Robert Rupf, Researcher at the Canadian Sport Centre Ontario, have collected data on Canadian female Provincial and National team players, for a comprehensive study comparing fitness test scores between these players as they progressed through higher ages and levels of play in Canada. Our abstract, titled *A Longitudinal Analysis of Speed Characteristics for Talented Youth Female Soccer Players in Canada,* was written and submitted in November, 2010, for presentation at the Seventh World Congress on Science and Football, being held May 26-30, 2011, at Nagoya University in Nagoya, Japan. We have recently received confirmation that our abstract has been accepted, and as a result, Paolo and Richard will be heading to Japan in May to present the study at the Conference.

An internationally recognized event, highlighting the latest in soccer-specific scientific research, the World Congress of Science and Football is aimed at academics, sport scientists, teachers, students, and administrators with an interest in the scientific study and/or the practical performance of football codes, including soccer, from grass roots to the professional levels. Held every four years, in the year after the FIFA World Cup, this Congress is regarded as the best soccer-specific sports science conference in the world. Topics covered in both oral and poster presentations will include: Sports Biomechanics & Engineering, Game & Skill analysis, Exercise Physiology & Training Science, Sports Medicine & Rehabilitation, Social Science & Management, Psychology, and Other / Interdisciplinary Approaches to Football.

"It is a huge honour for me to be able to attend and co-present research at such a prestigious event," commented Richard. "I specifically would like to thank Paolo Pacione, Robert Rupf, the Canadian Soccer Association, the Ontario Soccer Association, and the Canadian Sport Centre Ontario, for setting up this project. Without them, this study would never have happened and I look forward to a continued relationship with the CSA, OSA, and CSCO in the future". Stay on the look-out for future issues of Soccer Fit-Facts, for an in-depth review of our presentation, as well as highlights from the Seventh World Congress on Science and Football!

SF