



Running Economy

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In many sports speed is an important attribute and ways to improve speed are sought after. In a simplistic view, to improve speed you need to increase stride length and/or stride rate. Many athletes and coaches initially concentrate on improving stride length only to find that both stride rate and speed decrease. It is perhaps more effective to work on stride rate because this increases the power in the leg muscles which in turn naturally increase stride length.

In a number of sports (e.g. football, basketball, netball, hockey) the athlete is required to conduct short bursts of effort and is then able to recover by getting oxygen back into the system. There are sports (e.g. running) where there is a long sustained burst of effort and oxygen consumption (breathing rhythm) needs to be effective and efficient.

Running economy can also be improved by improving your **VO2max**.

Stride Length and Rate

Exercise physiologists Jack Daniels, PhD monitored the stride rate, stride lengths of the athletes in the 1984 Olympic track and field competitions. It was found that competitors in the shorter distances had longer stride lengths. Female stride lengths varied from 4 feet 10 inches in the marathon to 6 feet 8 inches for the 800 metres. Male stride length was 6 feet 2 inches during the 10 kilometre race to just over 7 feet 9 inches in the 800 metres.

In contrast, the stride rate did not vary significantly. Stride rates for all events, for both men and women, fell between 185 and 200 steps per minute.

Reference: Hoffman, K (1971). Stature, leg length and stride frequency. *Track Technique*, 46: 1463-69.

Reference: Rompottie, K (1972). A study of stride length in running. *International Track and Field*. (pp.249-56)

Stride length - 100m sprinter

Work conducted by Hoffman on male 100 metre sprinters (10.4 to 11.0 seconds) indicated that the average stride length was 1.14 times the athlete's height. Similar work conducted by Rompotti on the best twelve 100m sprinters (11.0 to 12.4 seconds) at Stanford University concluded that the normal stride length was 1.17 times the athletes height. Despite the differences in abilities of the athletes in each group the results are fairly similar.

Further work conducted by Atwater on twenty three 100m sprinters (9.9 to 10.4 seconds) concluded that the average stride length was 1.35 times the athlete's height.

The possible reason for the differences in the results is that the work by Hoffman and Rompotti was conducted on cinder tracks; where as the work by Atwater was conducted on synthetic surfaces. Using Atwater's results, the six foot athlete (1.8 metres) has an average stride length of 2.5 metres.

How to improve Stride Rate

The easiest way to determine your strike rate is to count the number of times your right foot lands during one minute of running. Repeat the one minute runs at different speeds from an easy jog to interval speed. If you are like an elite athlete you will find that your stride rate is 90 or more per minute (180 steps) and is similar for various speeds. If your stride rate is less than 90 then make a conscious effort to increase the stride rate. To do this, concentrate on quicker, lighter, relaxed steps, but do not change the way your feet strike the ground. I have found that Aqua running often helps athletes with a slow strike rate.

Cross country runners need to maintain strike rate when **running up hills** by adjusting the stride length. If you let strike rate slow down you will find that fatigue sets in and it is harder to get back to the desired strike rate once you are over the crest of the hill.

Exercises to improve Stride Length and Frequency

Perform the following three exercises in the order in which they are presented.

The high-bench step-up : develops the hamstrings, with complimentary development of the gluteals (the 'buttock' muscles) and the quadriceps.

- Begin from a standing position on top of a high bench (approximately knee height), with your body weight on your left foot and your weight shifted toward the left heel
 - The right foot should be free and held slightly behind the body
- Lower the body in a controlled manner until the toes of the right foot touch the ground, but maintain all of your weight on the left foot
- Return to the starting position by driving downward with the left heel and straightening the left leg
- Repeat for the prescribed number of repetitions, and then switch over to the right leg
- Maintain absolutely upright posture with the trunk throughout the entire movement, with your hands held at your sides (with or without dumbbells)
- Frequency: 2 to 3 times a week - 2 to 3 sets of 15 to 20 repetitions - 2 to 3 minutes recovery

One-leg squat : develops the quadriceps and gluteals, with a complimentary boost to the hamstrings.

- Stand with the left foot forward and the right foot back, with the feet about one shin-length apart (your feet should be hip-width apart from side to side)
- Place the toes of the right foot on a block or step that is six to eight inches high. As in the step-up exercise, most of the weight should be directed through the heel of the left foot
 - Bend the left leg and lower the body until the left knee reaches an angle of 90 degrees between the thigh and lower leg
- Return to the starting position, maintaining upright posture with the trunk and holding your hands at your sides
- Complete the prescribed number of repetitions with the left leg before switching to the right leg
- Frequency: 2 to 3 times a week - 2 to 3 sets of 15 to 20 repetitions - 2 to 3 minutes recovery

One-leg hops in place : builds strength and coordination in the entire lower extremity, including the foot, ankle, shin, calf, thigh, and hip.

- Start from the same position you used for the one-leg squat, with the toes of the right foot supported by a six to eight inch block
- Hop rapidly on the left foot at a cadence of 2.5 to 3 hops per second (25 to 30 foot contacts per 10 seconds) for the prescribed time period
- The left knee should rise about four to six inches, while the right leg and foot should remain stationary
- The left foot should strike the ground in the area of the mid-foot and spring upwards rapidly - as though it were contacting a very hot plate on a cooker
- The hips should remain level and virtually motionless throughout the exercise, with very little vertical displacement.
- After hopping for the indicated time on the left leg, switch to the right leg and repeat the exercise
- Frequency: 2 to 3 times a week - 1 to 2 sets of 10 to 20 seconds - 2 to 3 minutes recovery