Strength Training for Women

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Raphael Brandon explains why strength training is vital for women, but the program depends on their event, not their gender.

A survey of US schoolchildren in 1985 comprising various motor tests showed that the average 18-year-old girl could perform only one pull-up. It also showed that the sit up in one-minute score peaked for girls at 14 years, with abdominal strength endurance declining from then on.

The standing long jump test also indicated that on average girls peak at 14 years. In comparison, the average boy scored significantly higher on the test and improved until 18 years old.

These statistics merely illustrate that women naturally develop less strength than men. The differences can be explained by the fact that at puberty boys have increased testosterone levels, which promotes muscle development and bone growth over the next few years. At puberty girls have increased estrogen, which promotes quite fast pelvic bone growth and fat storage around the hips and thighs.

After puberty, boys' relative fat mass decreases from 16 to 13%, while girls' relative fat mass increases from 18 to 26%. Indeed, research has shown that most of the differences in strength between men and women can be explained in terms of differences in lean body mass and muscle and fat distribution.

Women have smaller arm girth and greater arm skin fold thickness than men, similar leg girth but greater leg skin fold thickness than men. This different distribution of extra fat and smaller muscle mass accounts for much of the disparity in strength between the sexes, women being about 66 to 75% as strong in the legs and 50 to 60% as strong in the arms.

Nevertheless, research has shown that normalizing for lean body mass, which takes out the overall differences in muscle and fat, muscle pound to muscle pound women are similar in strength to men.

Can women respond to strength training?

In the past, it was believed that strength training was unsuitable for women because they were "incapable" of improving their strength. But more recent research has put paid to this theory.

Professor Jack Wilmore from the University of Texas showed that after a 10 week training program women showed a 29% improvement on the bench press and 30% improvement on the leg press, compared to a 17% and 26% improvement from men.

However, while the men showed hypertrophy (enlargement) in the leg and arm muscles, the women did not. Wilmore hypothesized that the reason for the increased strength in women must be due to an increased ability to recruit muscle fibers and coordinate the movements.

Later research has shown that women can increase muscle mass significantly. The tentative conclusion must be that in general most women find it more difficult to gain muscle mass.

Recently the Women's Committee of the National Strength and Conditioning Association presented an official summary of all the research regarding strength training for women in the US.

They reported that:

1. Women improve fitness, athletic performance and reduce injuries through strength training, just as men do
2. Physiological responses of males and females to the use of weight training and resistance exercise are similar
3. Women should train for strength using the same exercises and techniques as men
4. There is no significant difference between the sexes in the ability to generate force per unit of cross-sectional muscle. Men display greater absolute strength than women largely because they have a greater body size and higher lean body mass to fat ratio
5. Women do experience muscle hypertrophy in response to resistance exercise, but the absolute degree is smaller than in men. The conclusion to be drawn is that women are equally as strength trainable as men.

If female athletes want to achieve elite performances they must ensure that comprehensive strength training is fully covered in their training schedules.

Competitions, unlike laboratory research, do not compensate for lean body mass. It is the fastest athlete who wins, and that is the end of it. If you want to be that winner, you have to optimize your strength. In my opinion, that is a training priority.

What sort of training?

That being said, the next question is, what is the best form of strength training for women? The answer is not a matter of gender but more a matter of the particular requirements of the athlete's event, being the same for both men and women.

Looked at from this point of view, any athlete must improve her (or his) strength if their profile is less than the strength demands of their event.

To devise the best strength program based on the event's requirements, we have to analyze the event in terms of muscle use, the type of contractions each muscle uses, the biomechanics of the movement and whether maximum strength or strength endurance is the goal.

This kind of "needs analysis" should govern the design of any strength program. As an illustration of such an analysis, let us look at running the 10K

In the 10K event, the major leg muscles all work dynamically, such as the quadriceps, the hamstrings, gluteus maximus, hip flexors, calf and dorsi flexors. All these muscles are active at some point during the gait cycle and so it makes sense to strengthen them. However, they must all be strengthened in the right way to maximize 10K performance and injury prevention.

Metabolism is all of the processes or chemical changes in an organism or a single cell by which food is built up (anabolism) into living protoplasm and by which protoplasm is broken down (catabolism) into simpler compounds with the exchange of energy.

In 10K running 97% of the energy for muscle contractions comes from aerobic metabolism. Thus the predominant muscle fiber units recruited at 10K pace will be the aerobic Type 1 and 2a units. For more information on Type 1, 2a, and 2b units, refer to **Muscle Fiber Types**.

The more anaerobic Type 2a and 2b units may only be recruited towards the end of the race as the muscles tire and glycogen is depleted. (Type 2a fiber units can utilize both aerobic and anaerobic metabolism.)

For this reason, the 10K strength program must have a strength endurance emphasis, which targets mainly the Type 1 and Type 2a fiber units. It has been shown that strength athletes who perform a few sets of a few repetitions of very heavy weights e.g. four sets of five reps, have selective hypertrophy in the Type 2b fibers, which would not necessarily benefit the 10k runner.

Bodybuilders who perform higher volumes of lighter weights e.g. six sets of 12 reps, show hypertrophy in the whole range of muscle fibers.

Although 10K athletes do not want to start bodybuilding, it could be argued that for the leg muscles a strength endurance training program of high repetitions and lighter weights would be the most suitable for a 10K athlete since the Type 1 and 2a fibers will be targeted effectively.

To improve strength endurance, 3 to 5 sets of 12 to 20 repetitions with 45-second rest periods are recommended.

The choice of leg exercises must reflect the biomechanics involved in the running movement. For example, since most thigh muscle activity occurs when one foot is in contact with the ground, single legged exercises with the foot in contact with the ground or equipment will be most relevant.

Single legged leg press, lunges or one-legged squats are all exercises of this nature, which target the muscles in the thigh and bum areas. The range of movement of the joints is also relevant.

For example, as the foot strikes the ground, the knee joint is slightly bent (about 20°). Then the knee flexes to absorb the impact (to around 40°) and then extends again before toe off. The quadriceps muscles act to control the shock absorbing knee flexion movement.

Certain strength exercises should be chosen to focus on this range of movement e.g. limited range leg press, especially to help prevent the anterior knee pain which women are prone to because of a greater femur Q angle causing more inward rotation of the knee.

Do not overlook the trunk and hips

The other major body part that requires strength training for running is the trunk and hip area. Here the major muscles involved during running are the erector spinae (back), abdominals (stomach), obliques (side) and abductors (top of the bum).

These muscles are not so obviously involved with running as the leg muscles, yet nonetheless serve a very important role in pelvis and trunk stabilization and posture control. Biomechanical research has shown that for the legs to work effectively in propelling the body, the pelvis and trunk area must be rigid and supported by its muscles, otherwise the drive from the legs will be wasted.

The hip and trunk muscles must also be trained for strength endurance, for similar reasons. However, since they do not work as dynamically as

the leg muscles, the exercises chosen should reflect their more static, supporting role. These muscles are best trained with a combination of isometric or static exercises and slow, controlled dynamic exercises of small, specific range.

For example, lying on one's front over the end of a bench and extending the arms out into a Superman position and maintaining it is an isometric exercise for the back muscles. Three sets of 10 x 10 seconds holding a straight line from the back to the hands will help maintain an upright posture as the muscles must hold the back and shoulder girdle in a rigid extended position.

An example of a slow and controlled exercise, which targets a small range, is the reverse curl or reverse crunch exercise for the stomach. This involves lying on one's back with legs fully bent.

Then, raise the hips an inch off the floor by pulling with the lower abdominals and lower again, keeping the legs completely still. Here the abdominal muscles have to work continually to raise the pelvis and then lower it again, even though it is a small range of movement.

This kind of exercise is more relevant to posture control than the more conventional sit up. After all, when we run we keep our upper bodies still, so being very strong at flexing the trunk forwards is not necessarily related to efficient running.

In general, the hip and trunk muscles must be trained for strength endurance (low resistance and high volume) using static exercises and exercises with specific ranges of movement for posture control.

The choice of exercises must reflect the need to maintain a rigid back with a level pelvis to be able to push off with the legs. Balanced strength in this area also helps prevent lower back and hamstring injuries. In my opinion, the trunk and hip area is very important for 10K strength training programs.

Strong legs will only do so much if the trunk is not a well-supported, rigid structure. Would a motor racing team put a Formula engine in a car with a Formula 3 chassis?

Training the upper body

To complete the strength analysis, we must consider the upper body. This area is less important for 10K running, but for an all body, balanced strength program some upper body exercises should be included.

Upper body strength will also help with posture and an effective, easy arm action. Once again, I would recommend a strength endurance emphasis.

A practical way to train the upper body without devoting too much time to it would be to cover most of the major upper body muscles in two or three exercises e.g. seated row together with bench press, or pull-ups together with dips, would target most of the chest, shoulder, upper back and arm muscles.

To summarize the strength training program for the 10K, all the major muscles involved in running need to be trained with a strength endurance emphasis. The exercises chosen also need to be biomechanically relevant in terms of movement, single legged and foot fixed, and any important joint ranges of movement.

This will improve the power and efficiency of running action and help reduce knee injury risks. Training the trunk muscles for endurance, using static and postural specific exercises will increase efficiency by improving the rigidity and support of the trunk. It will also help reduce low back and hamstring injury risks.

Exercises covering the upper body muscles will complete a balanced strength program that is specifically targeted to the athlete's event.

This kind of analysis can be done for any event or sport. First, the correct muscles and movements have to be pinpointed and the role they play in the sport determined. From this the relevant strength training exercise protocols can be designed for the muscles involved.

Women athletes should definitely use this method as the starting point for their essential strength training requirements.

References

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Article Reference

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