

DO DISTANCE RUNNERS REALLY NEED TO STRENGTH TRAIN?

Jason Karp is always a welcome contributor to these pages. His expertise as a PhD in exercise physiology and his long experience as a coach and personal trainer make him a knowledgeable, authoritative voice of clarity in running training matters.

BY JASON R. KARP, PHD

When I was in eighth grade, I broke the school record for chin-ups. I still have the certificate of achievement from the school's principal proudly displayed on my wall. I still brag about the accomplishment to others. It doesn't matter that it was so many years ago or that some tough kid has probably come along since to break my record. At the time, I had the strongest biceps and forearms in junior high. I used chin-ups to show off to the girls in class. My mother even bought a chin-up bar and attached it to my bedroom door frame so I could train at home. I did chin-ups every day. Until I became a distance runner.

At first glance, distance running doesn't seem to have much to do with lifting weights to get big, strong muscles. Indeed, the best runners in the world are quite small, with slim legs and arms that would make some Hollywood actresses drool. But as I tell the runners I coach, what your muscles look like isn't important; what they do is what matters. And if people train them properly, they can teach their muscles to do some amazing things. Just ask the Kenyan and Ethiopian runners with the skinny legs.

These days, athletes in all sports lift weights to supplement their sport-specific training. Even dis-

tance runners have jumped on the bandwagon. Indeed, much has been written about strength training for the runner—everything from lunges while holding dumbbells in your hands to calf raises on the edge of a stair to endless repetitions of abdominal crunches while balancing on a big, lime green exercise ball. Does anyone else reading these training suggestions ever wonder if they will really lead to a new 5K or marathon personal best?

My research on the training characteristics of the 2004 U.S. Olympic Marathon Trials qualifiers, published in *International Journal of Sports Physiology and Performance* in

2007, found that these marathoners did little, if any, strength training. During the entire year of training leading up to the Olympic Trials, the men averaged less than one strength workout per week and the women averaged 1.5 strength workouts per week. About half of the athletes did not do any strength training at all.

One of two conclusions can be drawn from this—either the U.S.'s elite marathoners do not believe that strength training will make them better marathoners, or they do not have the time to strength train given the time they devote to running.

WHY STRENGTH TRAINING WON'T MAKE YOUR ATHLETES FASTER

Runners have only so much energy and time for training, so they want to get the greatest return on their investment. If someone runs 30 miles per week and has a choice between staying at 30 miles and adding strength training or running 10 more miles per week, the latter strategy has a greater impact on his or her performance. Provided there are enough weeks to train to slowly and carefully increase his or her weekly mileage, running more miles is a better strategy. I, and many other coaches who have come before me, starting with Arthur Lydiard in the 1950s, believe that runners can get a lot more out of running hill sprints or bounding up a hill than by doing lunges while holding dumbbells.

Unlike most sports, which require strength, speed, and power to be successful, distance running performance is primarily limited by the delivery and use of oxygen. And

there are no studies showing that strength training improves oxygen delivery from lungs to muscles. Strength training does not improve the most important factors that enable a runner to run faster, including the following:

- Cardiac output, which determines how much blood the heart pumps per minute.
- The amount of hemoglobin in the blood, which determines how much oxygen is transported in the blood to the muscles.
- Muscles' capillary density, which determines how much oxygen is delivered to the muscles.
- Amount of mitochondria in the muscles, which determines how much oxygen the muscles use to regenerate energy (ATP) for muscle contraction.
- Ability to dissipate heat when running for a long period, which affects cardiovascular function and the ability to maintain the pace in a long race like a half-marathon or marathon.
- Muscles' ability to use fat as fuel, which occurs by making more mitochondria and by running long enough that the muscles start running out of carbohydrate.

Since strength training can't improve aerobic ability, it can't directly make someone a better distance runner. The most direct way to become a better runner is to run.

Strength training may actually hinder a runner, especially if he or she does it at the expense of more run-specific training. The physiological

changes that result from strength and endurance training are contradictory. For example, when strength training with heavy weights, muscles are stimulated to get larger. Larger muscles increase body weight, which reduces running economy because more oxygen is needed to transport a heavier weight. In contrast, endurance training decreases body weight, optimizing the use of oxygen.

SINCE STRENGTH TRAINING CAN'T IMPROVE AEROBIC ABILITY, IT CAN'T DIRECTLY MAKE SOMEONE A BETTER DISTANCE RUNNER

Larger muscles also have a smaller density of capillaries and mitochondria, which is detrimental to endurance. Runners want as many capillaries and mitochondria per area of muscle as possible to facilitate the delivery and use of oxygen. Endurance training causes muscles to respond in an opposite way, increasing the number of capillaries and mitochondria in the muscles. Runners don't want bigger muscles to run, especially a long race.

Despite the different physiological adaptations between strength and endurance training, many runners still lift weights, typically with light to moderate loads and a high number of repetitions, programs that are geared toward increasing muscular endurance (the ability to sustain or repeat a submaximal force) rather than strength (the maximal amount of force muscles can produce). But is performing a few sets of 10 to 20 repetitions going to increase muscular endurance over and above

what your athletes already achieve from their weekly running or what they would achieve by running more miles?

Think about how many repetitions they perform while running just five miles. Surely a mere 20 to 60 reps extra in the gym is not going to make them faster. While some studies have found that this type of strength training may help inexperienced runners who have a low fitness level improve their performance, other studies have shown it to be ineffective. A 20-minute 5K runner is better served by improving the cardiovascular and metabolic parameters associated with endurance than by strength training.

WHY STRENGTH TRAINING MAY MAKE YOUR ATHLETES FASTER

Although strength training can't improve the most important factors that enable someone to run faster, it can play a supportive role in increasing muscle strength and power and reducing the risk of certain types of injuries that are related to muscle weakness, especially in new runners. Beginners are more likely to get injured because they haven't yet run enough to strengthen their anatomy to withstand the stress of running. (To a certain extent, running itself has a prophylactic effect on injury because it toughens the structures vulnerable to injury. That's why Lydiard had his athletes do bounding drills up hills—to strengthen the Achilles tendons and lower leg muscles prior to his athletes transitioning to the faster workouts on the track.) While I strongly believe that strength training should never be done at the expense of run training when the goal is to become a better runner, there are some cases

in which a runner can benefit from strength training:

- Run training has already been maximized by increasing both mileage and intensity. For an advanced runner who is already running more than 70+ miles per week and is including lactate threshold runs and interval workouts, and he can't do any more or higher quality running, he may want to give strength training a try if he still has more time and energy to train.
- The physical stress of running more miles can't be handled and the runner would get injured if he/she ran more. If someone is running as much as his/her body can handle without getting injured and still wants to do something else to potentially become a better runner, try strength training.
- A new runner is training for his first marathon. If training for a first marathon only 5 or 6 months away, the person probably isn't going to be able to increase his running mileage above 30 to 35 miles per week without drastically increasing the risk of injury. In this case, he may benefit from strength training because it can increase overall fitness without the physical stress of more running.
- The genetic limit for adaptation to run training has been reached. Not everyone can keep running more and more miles and keep adapting. Some runners, like Olympians, may continue to adapt with 100+ miles per week, while others may stop adapting at 30 miles per week. Our DNA controls how

responsive to training we are. If someone has tried running more and it hasn't worked for him, strength training can be another option to improve performance.

THERE ARE SOME CASES IN WHICH A RUNNER CAN BENEFIT FROM STRENGTH TRAINING

Although many runners claim that strength training does everything from reducing injuries to improving posture in a race, perhaps its most beneficial effect is the increase in muscular power, which is the product of force (strength) and speed. Athletic performance is ultimately limited by the amount of force and power that can be produced and sustained. Force and power are influenced by a number of physiological traits, including neuromuscular coordination, skeletal muscle mechanics and energetics, efficiency of converting metabolic power into mechanical power, and the skeletal muscles' aerobic and anaerobic metabolic capacities.

Most movements in sports occur too quickly for muscles to produce maximal force; it is far more important to increase the rate at which force is produced. When racing, your athletes' feet are in contact with the ground for only a fraction of a second, not nearly enough time to generate maximal force. Thus, the best way to strength train to become a better runner is ironically similar to what football players do—train with heavy weights and explosive movements to improve muscle power. Power is the product of muscle strength and speed. For muscles to be powerful, they must

be strong and they must be fast.

Research suggests that power training—either lifting near maximal weights a few reps per set to focus on the strength component of power or plyometrics and sprints to focus on the speed component of power—can improve running economy, which is the amount of oxygen used to run at a given submaximal speed and is one of the three major players affecting distance running performance (the other two are $VO_2\text{max}$ and lactate threshold).

While the studies on training power with heavy weights or plyometrics found improvements in running economy, they didn't find changes in other cardiorespiratory measures important to distance running, such as $VO_2\text{max}$ or lactate threshold. This is an important finding because it suggests that the improvements in running economy do not result from cardiovascular or metabolic changes, but rather from some other (neural) mechanism.

When lifting maximal weights (strength component), or when performing quick, plyometric movements (speed component), your athletes recruit a lot of muscle fibers, which trains the central nervous system. As a result, muscles increase their rate of force development, getting stronger, quicker, and more powerful, without the negative side effect of increasing muscle size. The more effective muscle force production translates into better running economy.

To add strength training to your athletes' programs, start with a muscular endurance base, with lighter weights and more reps to accustom the person to strength

training before progressing to heavy weights and plyometrics. Don't jump right into heavy weight lifting, which can make your athletes sore and negatively affect their run training.

Periodize their annual training plan to circumvent the incompatibility between strength and endurance training. Use specific periods of the year during which they focus on aerobic endurance and strength/speed/power. Have them do the bulk of their strength training during their speed phase of training rather than during their aerobic endurance phase, since speed, strength, and power are more closely related physiological traits than are strength and endurance. Likewise, have them do their strength/power workouts on their speedwork days rather than on their recovery run or long run days so that the recovery days are truly recovery days.

If your athletes train smart enough, not only will they get faster, they may even be able to break my middle school chin-up record (it stands at 24).

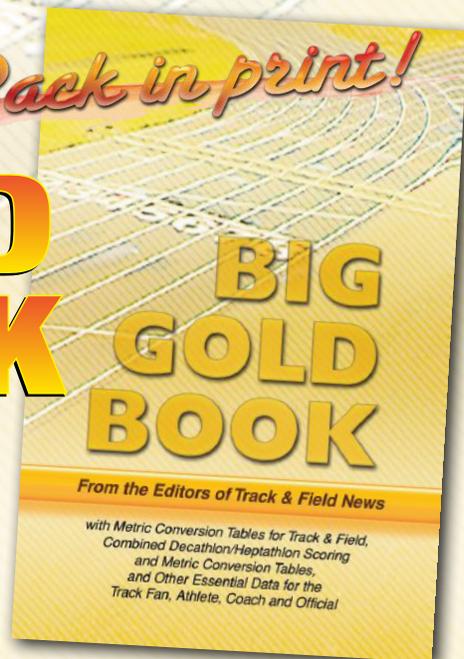
Jason Karp, PhD, is the 2011 IDEA Personal Trainer of the Year, founder and coach of REVO₂LUTION RUNNING ELITE, and creator of the REVO₂LUTION RUNNING™ certification for coaches and fitness professionals. He has more than 400 published articles in international running, coaching, and fitness magazines, is the author of eight books, including *The Inner Runner*, *Run Your Fat Off*, and *101 Developmental Concepts & Workouts for Cross Country Runners*, and speaks at fitness conferences and coaching clinics around the world.

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