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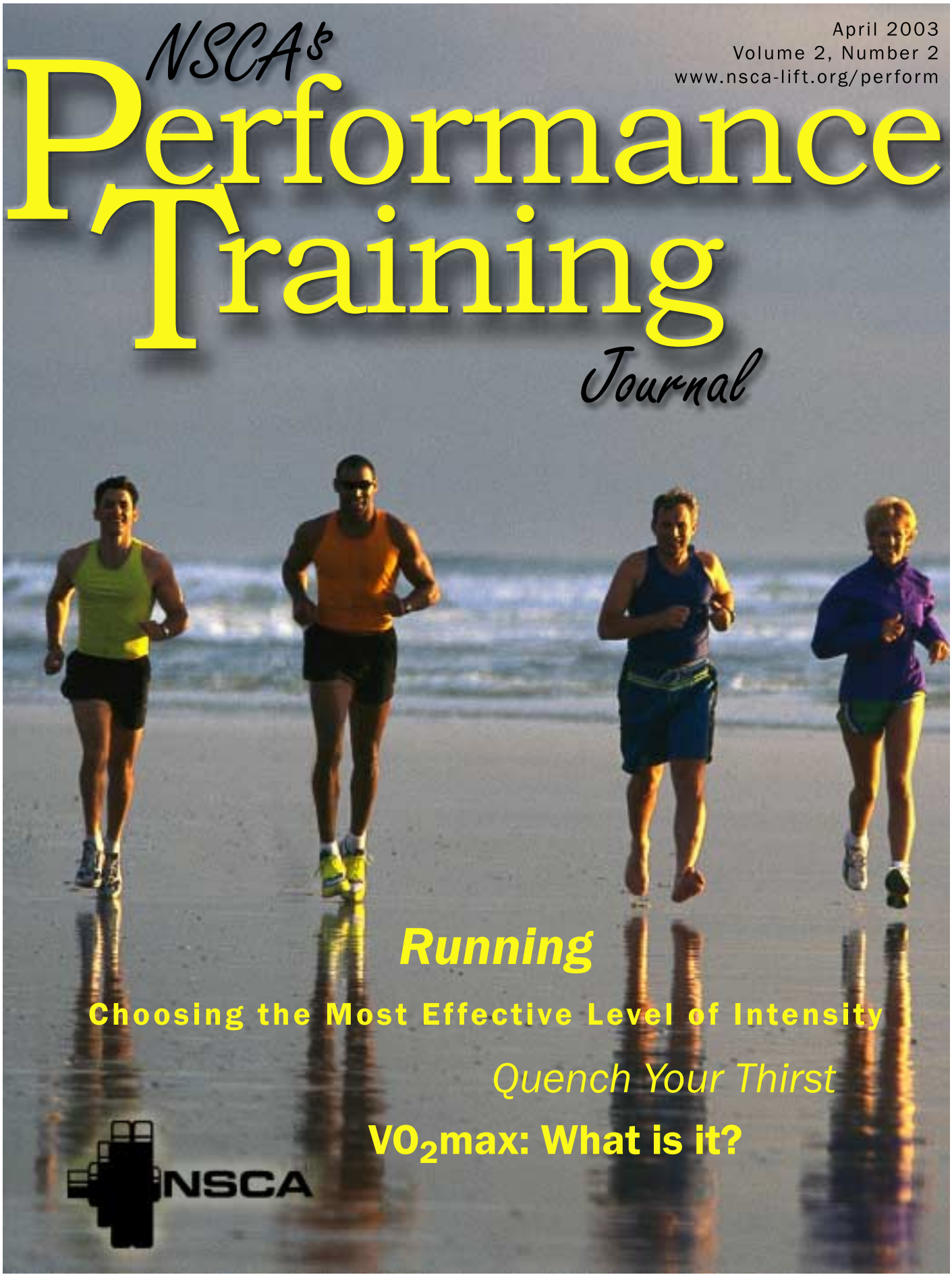

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NSCA

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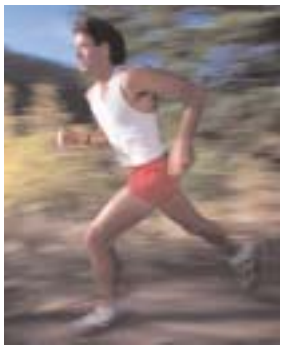

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NSCA's Performance Training Journal

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FitnessFrontlines

G. Gregory Haff, PhD, CSCS

Does Resistance Training Help Running Economy?

A recent study by Millet and colleagues, published in *Medicine and Science in Sports and Exercise*, reports that heavy resistance training improves maximal strength and running economy. Additionally, no negative effects on maximal aerobic capacity were noted in response to the training protocol. The study's 15 triathletes were assigned to two groups; group 1 performed a combination of heavy resistance training and endurance training. Group 2 performed only the endurance training protocol. The heavy resistance protocol required subjects to perform resistance training 2 days a week with between 3 – 5 repetitions performed at >90% of one repetition max. The group that performed the resistance training program showed significantly better improvements in running economy, hopping power, and overall muscular strength after the completion of the 14 weeks of combination training compared to performing just endurance training. Therefore based upon this study it appears that the inclusion of a resistance-training program, which uses heavier resistances, does not impair endurance performance and may actually result in improvements in factors that relate to endurance performance success.

Millet GP, Jaouen B, Borrani F, Candu R. (2002). Effects of concurrent endurance and strength training on running economy and VO_2 kinetics. *Medicine and Science in Sports and Exercise*, 34(8):1351 – 1359.

Running Capacity and High Carbohydrate Meals

Recently, researchers at Loughborough University in England reported that the consumption of a high carbohydrate meal three hours before exercise coupled with carbohydrate-electrolyte supplementation during exercise resulted in significantly improved endurance running capacity. Ten men performed three treadmill runs to exhaustion after consuming 1) a carbohydrate meal 3 hours before exercise and a carbohydrate-electrolyte solution during exercise, 2) a carbohydrate meal three hours before exercise and water during exercise, and 3) a liquid placebo three hours before exercise and water during exercise. The carbohydrate meal + supplementation during exercise resulted in the longest time to exhaustion (125.1 ± 5.3 min), while the placebo + water regime resulted in the shortest duration (102.9 ± 7.9 min). The carbohydrate meal coupled with water consumption during exercise resulted (111.9 ± 5.6 min) in a longer duration than the placebo + water condition and a shorter duration than the carbohydrate + supplementation regime. Based upon this research it appears that a carbohydrate meal three hours prior to endurance exercise can enhance performance, and the inclusion of carbohydrate and electrolytes during performance results in maximal improvements in endurance performance.

Chryssanthopoulos C, Williams C, Nowitz A, Kotsiopoulou C, Vleck V. (2002). The effects of a high carbohydrate meal on endurance running capacity. *International Journal of Sports Nutrition and Exercise Metabolism*, 12(2):157 – 171.

Changes in the force-velocity and force-power relationships as a result of strength training may explain increases in aerobic performance.

Maximal strength training results in significant improvements in cross country skiing economy. Nineteen male cross country skiers were divided into two groups with one group performing both cross country skiing and resistance training and the other performing only cross country skiing training. Participants in the resistance training group performed three sets of five repetitions three times a week with roughly 85% of their one repetition maximum. All resistance-training repetitions were performed with an emphasis on high movement velocities. The resistance-training group significantly increased their one-repetition maximums, time to exhaustion, and their upper body exercise economy. The researchers also determined that there were significant alterations to both the force-velocity and force-power curves. The researchers suggested that the positive performance gains associated with the resistance-training regime were directly related to the positive alterations in force-velocity and force-power curves.

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About the Author

G. Gregory Haff, PhD, CSCS is an assistant professor and the Human Performance Laboratory Director at Midwestern State University in Wichita Falls, TX. He serves as the program director for the USA Weightlifting Regional Development Center at Midwestern State University and is a member of the National Strength and Conditioning Association's Research Committee and the USA Weightlifting Sports Science and Sports Medicine Committees. Dr. Haff received the National Strength and Conditioning Association's Young Investigator Award in 2001.

MindGames

Suzie Tuffey Riewald, PhD, NSCA-CPT

Loving What You're Doing

I was struck by a conversation I recently had with a friend. Once a highly competitive athlete, he now runs just a few low-key road races a year, but trains day-in and day-out year round. One of his comments to me was, "Ugh, now I have to go do my run." There was a note of dread in his voice as he talked about having to go home so he could do his daily run.

My response back to him was, "If you don't want to run, then don't run. No one is making you do it."

"No, I need to do it," was his only response. How unfortunate that he doesn't *want* to run but, rather, feels like he *has* to run.

Have you ever felt like this—where you are not at all looking forward to your workout whether it is running, lifting, swimming, cycling, or some other fitness activity? Experiencing these feelings on an infrequent basis is fairly typical of most athletes; it is unrealistic to expect yourself to be enthused, excited, and motivated every time you lace up your running shoes to go for a run. However, if you find that you are experiencing these feelings on a consistent basis, it may be time for you to take a closer look and perhaps implement strategies to bring the joy and enjoyment back to your running (or chosen sport/exercise activity). You will eventually be worn down if you are continually fighting these feelings of "not wanting to run, but making yourself do it."

Strategies

The question lingers—what can be done to address and attempt to alter these negative feelings? I'll offer two possible strategies. One strategy relates to getting back to the roots of your running. That is, you need to get back to why you began running. Think for a minute about some of the reasons influencing your decision to be "a runner." Most athletes will list some of the following reasons as being factors influencing their decision to exercise—which of these rings true for you? What additional reasons were important for you that aren't included in this list?

I run…

- Because I enjoy the solitude of running
- To get or stay in shape
- To achieve health benefits such as decreased weight and cardiovascular fitness
- To be with friends or meet new people
- Because it enhances how I feel about myself
- To help me manage stress in my life
- To compete/achieve performance goals
- To improve my physical appearance

Your primary reasons for running need to be brought back to the forefront to remind you of the real reasons you are running. Write your reasons for running on a note card and post it somewhere where you will see it every day. Let it serve as a much needed reminder that you don't *have* to run but you choose to run to achieve specific results (i.e., to lose weight, to deal with work stress). For example, when you get up in the morning for your run, take a look at your list to remind yourself why you are getting up at 5:30am. This should help quiet the little voice telling you how good it would feel to get back in bed. Your note card containing your "reasons for running" gives meaning and joy to your athletic pursuits.

A second strategy (that may seem somewhat counter to the first recommended strategy) relates to "letting go" of goals and just having some fun on a run or workout activity. While having a purpose or goal to daily workouts is beneficial and productive, there are times when it is equally beneficial to "just run." Don't worry about how far, how fast, or how long you are running. Just go out for a run and allow yourself to enjoy it without the pressure of having to do a certain workout or maintain a set pace. Some specific ideas as to how this can be achieved and how you can enjoy what you're doing include:

Take off your watch

A novel concept for runners as they are typically tied to their watch—this will take out of the equation the measure of "how fast" you are running. Go at whatever pace you want; don't worrying about how your time compares to the last time you did this loop or how long you ran.

Variety is the spice of life

Avoid your "typical" running loops or paths by running somewhere you have never run before. Blaze new running trails or find different streets to run on and be sure to enjoy the new scenery. You can also add variety and enjoyment by creating a new workout.

Make it social

Once a week, plan to run with a friend or a running group to make it a social run. Focus on sharing with others rather than focusing on where, how fast, and how far you are running.

Cross train

If you don't feel like running, don't run and instead go for a bike ride, swim, lift weights, play tennis, or hike. Many similar physical, mental and health benefits can be realized through cross-training. Additionally, it can give you a needed mental break from running and a break from pounding the pavement.

Make a game out of it

Use your creativity and make a mental or physical game out of your run. A teammate of mine created a running game she used when running on a golf course in the early morning. Running in no particular direction or order, she would do "pick ups" between every hole and tee and try to guess the length of the hole (what a great workout as well). Another friend would play the license plate game when running on city streets. Creating such games gives new energy to runs.

Take time-out

Interpret running as a break from the stresses and hassles of the day. Instead of running posing an additional stress of something you *have* to do, approach it as a healthful strategy to help you manage stress from work, school, responsibilities, etc. Let running serve as a much needed break or time-out from the real stresses of life.

Conclusion

Exercise, physical fitness, and, for many of you, athletic performance are undoubtedly important. You have made a commitment to your physical pursuits, but it is not always easy. There are times when running is perceived as a burden—an additional stress. With some work, you can modify these feelings of dread and lack of enjoyment regarding running by implementing some of the strategies identified in this article. Make a commitment to bring back some of the joy to your running.

About the Author

Suzie Tuffey Riewald received her Master's and PhD in Sport Psychology/Exercise Science from the University of North Carolina-Greensboro. She has worked for USA Swimming as the Sport Psychology and Sport Science Director, and now is Associate Director of Coaching with the USOC where she works with various sport national governing bodies (NGBs) to develop and enhance coaching education and training. Additionally, Suzie is an NSCA-Certified Personal Trainer.

TrainingTable

Debra Wein, MS, RD, LDN

Quench Your Thirst

Long and tough running workouts can be exhausting and also dangerous, if you neglect to "quench your thirst." Replacing the fluids lost from your body when you exercise in the heat is essential to sustain performance, prevent dehydration, and ultimately, to avoid injury. What to drink and when to drink is commanded by how long and how hard you exercise, environmental conditions, and whether or not you have acclimated to the heat. For training and running events less than one hour in duration, good old water is sufficient for optimal rehydration. On the other hand, workouts that last more than an hour increase fluid losses (1 – 2 quarts/hour) and drain the muscle's energy stores, making sports drinks the optimum replacement.

Sports drinks contain three main ingredients: water, carbohydrate (6 – 10%), and sodium, and are precisely formulated for utilization during exercise. The benefits of these drinks include the offset of fluid losses, the replacement of energy (50 – 80 calories per cup), the boosting of fluid absorption into the blood, and of course the sweeter taste (lemon-lime, etc.). However, if you dislike the taste of these drinks you may want to try diluting fruit juice, which is about 12 – 15% carbohydrate, with an equal amount of water. The drawbacks of sports drinks include the cost and also the excess calories, particularly if you are trying to lose weight rather than win a competition. So taste-test the different brands, but make sure it is while you are exercising, because your taste buds do change, and different drinks will have different effects during exercise. The bottom line is, choose one that you enjoy; the more you like it the more you'll drink it!

Lastly, keep in mind that these beverages are not complete foods; they lack protein, fat, fiber, and some of the essential vitamins and minerals. Therefore, it is still necessary to eat a well balanced diet—including fruits, vegetables, lean proteins, beans, and whole grains—to provide your body with the nutrients that you need to run and perform your best.

More fluid facts and guidelines for the succesful runner:

- Thirst is not always a good indicator of fluid loss. Drink before you are thirsty!
- Avoid caffeine and alcohol, as they increase the rate of fluid loss.
- Drink fluids at a cool temperature.
- Unless you are an ultra-endurance athlete participating in events lasting over eight hours, electrolyte (sodium, potassium, and chloride) losses from exercise are easily overcome by typical intakes from the regular diet. Therefore, salt tablets are not recommended.

Healthy Hydration

For an active person, adequate hydration can mean a difference between moderate dehydration and optimal performance. Follow these sport nutrition guidelines:

Hyper-hydrate

One to two hours before a run, drink a sports drink or 2 1/2 cups (20 oz.) of water.

An alterative method is to drink 1 1/2 cups (12 oz.) of water 15 – 30 minutes before exercise. (Do both in very hot conditions, for a total of 4 cups or 32 oz.)

Hydrate

Drink 1 cup (8 oz.) of water or a sports drink every 15 – 20 minutes during a workout.

Rehydrate

Weigh yourself before and after a workout. For each pound of body weight lost drink 20 ounces of water. If you don't have access to a scale, drink until your urine is clear. Clear urine is a good indication of adequate hydration.

Suggested Reading

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Casa DJ, Armstrong LE, Hillman SK, Montain SJ, Reiff RV, Rich BSE, Roberts WO, Stone JA. (2000). National Athletic Trainers' Association Position Statement: Fluid Replacement for Athletes. *J. Athl. Train.* 35:212 – 224.

About the Author

Debra Wein, MS, RD, LDN, is an adjunct faculty member at the University of Massachusetts, Simmons College and The Boston Conservatory, and chairs the Women's Subcommittee of the Massachusetts' Governor's Committee on Physical Fitness and Sports. She is the President of The Sensible Nutrition Connection, Inc.

VO_2 Max: What Is It? How Do You Develop It?

Warren E. Jones, JD, CSCS

What Is $V0_2$ Max?

VO_2 Max or aerobic capacity, is the upper limit of one's ability to produce energy through oxidative pathways. It is a measure of one's capacity to get oxygen from the air to the muscles, where the oxygen is used to produce aerobic energy. Simply put, VO_2 max is a measure of how fit your cardiovascular system is.

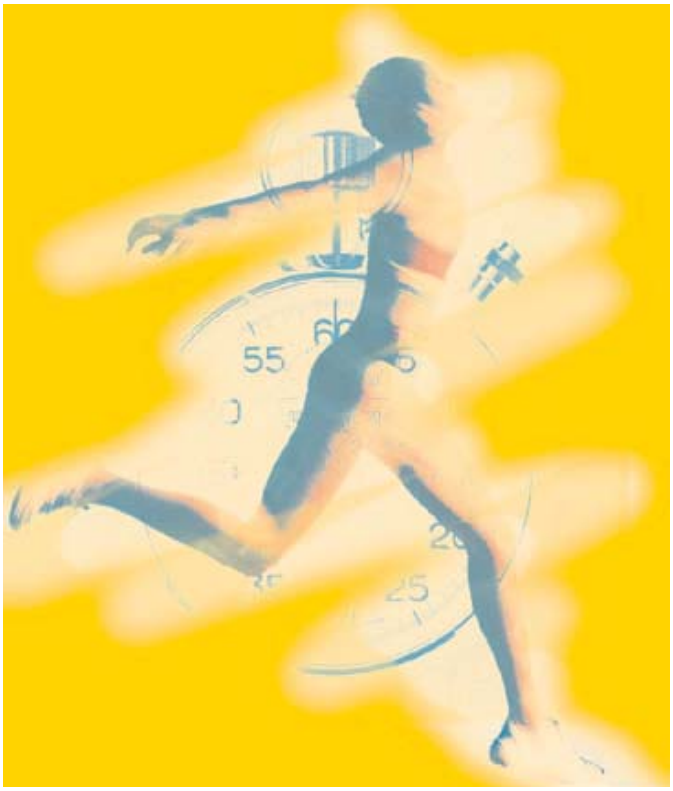
Estimating Your VO_2 Max From Your Races

Your VO_2 Max can be estimated based on your current race times. For example, if you're able to run one mile in five minutes and 45 seconds, your VO_2 Max can be estimated with the following formula: 133.61 – (13.89 x time in minutes). So, your VO_2 Max estimate from the formula would reflect a VO_2 Max of 53.74 ml/kg/min. The two mile, six mile, and 10 K. formulae are, respectively, as follows 128.81 – (5.95 x time in minutes); 120.62 – (1.59 x time in minutes); and 120.9 – (1.54 x time in minutes). For more particulars on this topic, see Costill[3].

Low VO_2 Max?

In a recent study, individuals with baseline VO_2 Max numbers below 40 ml/kg/min exhibited significant improvements in VO_2 Max after training, even when exercise intensities were as low as 28 – 32 percent of heart rate reserve. However individuals with VO_2 Max values above 40 ml/kg/min failed to improve maximum aerobic capacity when they trained at intensities below 46 percent of heart rate reserve[4].

Heart rate reserve is an individual's maximum heart rate minus their resting heart rate. For example, a maximum heart rate of 160, minus a resting pulse of 60 equals 100. Exercising at 28% of heart rate reserve would put the target heart rate at 88 beats per minute (28% of 100, plus the resting heart rate of 60).



For someone who has trained long and hard, but still has a VO_2 Max below 40ml/kg/min, fairly high intensities of exercise are probably required to increase aerobic capacity. But for someone with a low VO_2 Max, who is just beginning an exercise program, minimum intensities will probably produce results[1].

How Does One Enhance an Already Solid VO_2 Max?

Velocity VO_2 Max is the pace (in minutes per mile) or miles per hour that causes VO_2 Max to be attained. To determine your velocity VO_2 Max, run as far as you can in six minutes (be sure to perform this from a rested state). Divide six by your distance, expressed as a percentage of a mile. For example, if you cover 0.9 of a mile in six minutes, six divided by 0.9 is 6.67, or 6:40 pace. If you cover 1.1 miles, six divided by 1.1 is 5.45, or 5:27 pace[2]. To improve your endurance performance, run intervals at that velocity for at least three minutes.

Researchers from the University of Queensland, Australia, have also found that optimizing VO_2 Max occurs by running at velocity of VO_2 Max for 60 percent of one's TMax (the duration one can sustain velocity of VO_2 Max). Recovery should be for the same duration or time as the velocity VO_2 Max effort. For example, if your velocity VO_2 Max interval (the running portion) is two minutes and forty five seconds, your recovery (a slow jog) should be 2:45[2]. For a substantial portion of the recovery time, your heart rate will stay very high. Given the recovery time, you should be able to repeat the interval a number of times. Do as many as you can, maintaining the pace. Initially, your repeats will be a small number, but stay with it.

Will Just Keeping Up My Miles Be Enough?

Although the volume of running during training is the most important determinant for developing aerobic endurance, racing success depends to a large degree on the quality, or speed of training. Long slow distance running is considerably slower than race pace. Such training fails to develop the neurological patterns of muscle fiber recruitment that will be needed during races. Training for races requires a faster pace because which muscle fibers are used will differ according to running speed. Runners who only train at speeds slower than race pace will not train all of the muscle fibers for efficiency needed for competition[3].

Incidentally, beyond certain limits, adding on more miles produces no benefits, and can cause harm. For runners, this limit appears to be around 70 miles per week. If running for fitness is your goal, then 20 – 25 miles per week may be plenty. But those who want to compete in a five kilometer or ten kilometer race might be better off with 35 – 40 miles per week, and those willing to endure a marathon would best prepare with mileages of 60 – 90 miles per week[3].

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1. Anderson O. (2002). On the threshold of something big: How intensely must you train to obtain benefit? *Running Research News*, 18, 3: 1-4.
2. Anderson O. (2002). The true effects of various workouts-and how to answer that key question-what do I do on Monday? *Running Research News*, 18, 5; 1-8.
3. Costill D, Trappe S. (2002). *Running—The Athlete Within*, Traverse City, MI: Cooper Publishing Group.
4. Swain D, Franklin, B. (2002). VO2 Reserve and the minimal intensity for improving cardiorespiratory fitness, *Medicine and Science in Sports and Exercise*, 34: 152-157.

About the Author

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Choosing the Most Effective Level of Intensity for Cardiovascular Exercise

Jurgen Giessing, PhD, EdD

If done correctly, cardiovascular exercise—such as running, cycling, or inline-skating—offers an abundance of health benefits such as increased metabolism, reduced body fat percentage, increased immune function, increased alertness, and improved general well-being. Moreover, it should be considered that cardiovascular disease is the number one killer in the developed world today. By exercising aerobically, the risk of cardiovascular disease can be reduced significantly. Furthermore, aerobic training helps to reduce the chance of several medical conditions including diabetes, stroke, and osteoporosis. However, this only applies if it is done correctly. It is not sufficient to simply run for a few minutes and wait for all those positive and healthy adaptations to take place. If done incorrectly, exercising might even put one's health at risk. So the question is not whether you should exercise aerobically or not, but rather how you should do it. Each person should individually evaluate his or her own circumstances and develop a training program based on the knowledge of current science. Based on the findings of sports science research we know that there are four main factors directly influencing the way a training program should be designed. Those factors are:

1. Goals: Do you exercise in order to maximally improve your physical fitness or do you rather put the emphasis on burning as much fat as possible?
2. Age: Maximum heart rate decreases with age. As maximum heart rate is one of the factors used to calculate training intensity, a person's age must always be taken into account.

3. Level of conditioning: If you already are in a decent or even advanced state of aerobic conditioning, you can and you should apply higher amounts of intensity than somebody who is just getting started.
4. Time: Another aspect that has to be considered is the amount of time you are going to be able to devote to your training program. It does make a difference how long and how often you exercise.

Putting all that together:

Intensity

It is generally recommended that one should run at 60 – 85% of maximum heart rate in order to maximally improve cardiovascular fitness. On the other hand, it has been stated many times that running at 40 – 55% of maximum heart rate is more effective for fat burning. However, the statement "More fat is burned at lower levels of intensity" is absolutely false. It is true that a higher percentage of fat is burned when low or medium levels of intensity are applied. The absolute amount of fat burned during exercise, however, is definitively higher when intensity is increased[1]. The following sample calculation makes this pretty obvious:

Two people of comparable body mass and level of physical fitness are running for the same amount of time. One person runs at 40% of maximum heart rate and burns 400 Calories, 70% of which are fat and 30% of which are carbohydrates. The other person runs at 80% of maximum heart rate, runs for a much longer distance in the same amount of time, and burns 700 Calories (50% fat and 50% carbohydrates). The person who ran at an intensity of 40% burned 31 grams of fat (70% of 400 kcal, divided by 9 kcal per gram, the amount of energy in 1 gram of fat). The other person who ran at an intensity of 80% burned 39 grams of fat (50% of 700 kcal, divided by 9 kcal per gram)[4,5]. Whereas the first person exercising at 40% burned a higher percentage of fat, the second person who ran with a pulse rate twice as high burned significantly more fat. The bottom line is: If you run at 60 to 80% of your maximum heart rate, you will improve your cardiovascular fitness and burn more fat than you would at lower levels of intensity. In addition to that, you burn more fat after exercising at a higher level of intensity[6], even when you are resting. An intensity of 60 to 80% of maximum heart rate is therefore called "target heart rate zone" because this is the level of intensity at which one should train aerobically. It does not imply, however, that an even higher level of intensity would be even better. Generally speaking, 75 to 80% of maximum heart rate should not be exceeded. If intensity is 85% or more, fat burning hardly takes place at all because this kind of training intensity can only be realized anaerobically, with the consequence that glycogen (carbohydrates that are stored in the human body, most of it is stored in the muscles and in the liver) is burned instead of fat.

Rule no. 1: Low intensity is out, the ideal level of intensity is in. Read on to find out how to calculate your individual Target Heart Rate (THR) and always exercise within 90 to 110% of your THR.

Age

Everybody who is older than 35, or has not exercised for more than a year, should see a physician and get a health check-up before starting any training program. This is absolutely necessary in order to make sure you do not suffer from any illnesses or diseases you are not aware of. There are a few conditions in which aerobic exercise is potentially dangerous and only your doctor can find that out.

In order to find your target heart rate, i.e. the heart rate at which you should run, your age is an important factor. In general, maximum heart rate decreases with age, so does one's target heart rate because it is based on maximum heart rate. You can predict your maximum heart rate by subtracting your age from 220. For a 30-year old person maximum heart rate is 190.

Rule no.2: Subtract your age from 220 to predict your maximum heart rate (MHR).

Level of Conditioning

When you are just starting a running program or any other kind of cardiovascular training, or have not exercised for several months, you should start with an intensity of 60% of MHR. This is important, as your body has to gradually adapt to the new kind of stress that it is exposed to. And make no mistake, training means stress to your body. However, if done correctly, it is a positive kind of stress, called "eustress" in the scientific literature (the Ancient Greek syllable "eu" means "good"). You also have to keep in mind that it is not only your heart that has to adapt to the training program, but your whole body. That means that the whole cardiovascular system (heart, lungs, blood vessels etc.) and the muscular system have to adapt as well as all your bones and tendons.

Although starting a cardio training program might seem very simple, it is important to watch these points. If you feel good exercising regularly, that's fine. You may even feel like doing more, i.e. exercising at higher levels of intensity. You may gradually increase intensity by 5% every other month you exercise regularly. That means that if you started at an intensity of 60%, you may increase intensity gradually until you reach 75%. Do not increase intensity in months in which you have not exercised at least twice a week.

Take your resting pulse (RP) every day. An ideal moment to do that is immediately after waking up when you are still in bed, because at that time of the day there have not yet have been factors such as food, drink, or work which might elevate your resting pulse. If you keep up your training as suggested, you should see a steady decrease in RP after the first few months of training.

Rule no.3: Beginners start at 60% of MHR and gradually increase intensity by five percent for every eight weeks of regular training.

Time

In order to find out how long your cardiovascular training sessions should be, you have to take into consideration how many times per week you have time to exercise. A rule of thumb for beginners is that you should train for at least one hour a

week. If you cannot spend that much time training, you will hardly see any progress. One hour a week could mean half an hour twice a week, or twenty minutes every other day. Intermediate or advanced trainers need to do more than that. However, 90 minutes per session should not be exceeded unless you are already in outstanding shape.

If your training sessions are rather long (lasting one hour or more to complete) it might be beneficial to train every second day to provide your body with sufficient rest between training sessions. If you also work out with weights you can alternate weight training and cardio days. On a training schedule that includes both anaerobic (weight training) and aerobic (cardio) training, it may be necessary to include at least one day per week when you do not train at all. Combined with healthy nutrition, this allows you to fill up the glycogen stores in your body. Skipping the off day does not only increase the risk of overtraining, but also prevents you from restoring enough glycogen to effectively work out with weights. It has been shown in many studies that training intensity and efficiency suffer if muscular stores of glycogen are too low[2]. In the worst case, the athlete working out at low glycogen stores is unable to achieve the necessary training intensity to induce gains in strength and muscle mass and burns off even more glycogen in a workout. This does not do anything to improve his present level of fitness.

If fat burning is your priority you should do at least four cardio sessions per week as this has been shown[3] to be beneficial for effectively losing subcutaneous fat (fat which is stored under the skin). For maximum fat burning you could alternate weight training and cardio sessions. In addition to training aerobically every second day, one should add another 30 minutes after each weight training session. This approach is ideal for fat burning as weight training workouts burn a lot of glycogen. If cardio sessions are then done after most of the glycogen has already been burned, the body has to rely on fatty acids to fuel the cardio training.

Rule no. 4: Beginners should try to train at least an hour a week, not exceeding 90 minutes per session.

Your individual target heart rate (THR)

Experienced athletes as well as beginners should always stay within 90 – 110 percent of THR.

How to calculate your THR

Beginners

(220-age-RP) x 0.6 + RP = THR

Example: A 35-year old beginner with an RP of 80 beats per minute, has a THR of 143.

(220-35-80) x 0.6 + 80 = 143

This means he should exercise at a pulse of 129 to 157 beats per minute.

Intermediate and advanced trainers

You are considered an intermediate if you have been training for at least six months doing at least two cardio sessions per week.

(220-age-RP) x 0.75 + RP = THR

Example: A 46 year old athlete with an RP of 60 has a THR of 146 and should exercise at a pulse of 131 to 161.

(220-46-60) x 0.75 + 60 = 146

These formulas take your resting pulse (RP) into consideration which makes the calculation much more exact: As your body adapts to the cardio training program, your RP may decrease due to your improved level of cardiovascular fitness. Always calculate your THR based on your current RP.

The Program

If you have never done any kind of cardio before, you may follow the following program:

1st week

Start by walking 10 – 15 minutes each day. Be sure to stretch the muscles of your legs after a thorough warm-up. By the end of the week, you should have increased walking to 30 minutes each day. After walking, stretch again.

2nd week

At the beginning of each training session walk for 10 or 15 minutes, then start to run slowly. Whenever your pulse exceeds your optimum THR by more than ten beats per minute, slow down and walk again. Walk/run for 30 minutes but no more than 45 minutes a day. Rest one day after each training day if you feel sore or exhausted. If you feel fine, daily training sessions are okay.

3rd week

Walk for 10 minutes and then start running. Always watch your pulse. If it rises to more than ten beats above your THR, slow down and walk for a minute or two. Try to run for at least five minutes at a stretch.

4th week

Start your training sessions by running slowly; try to stay below your THR for the first five to ten minutes. You should have built up enough stamina by now so there will be no need to walk at the beginning of your running sessions.

5th week

Run at least three or four times per week for 30 – 40 minutes each session. Stretch before and after running.

6th week

Do the same as in week 5. If you are able to run at your THR for more than 45 minutes you may reduce training frequency to three days a week. If you find it hard to run for more than 30 minutes, make sure to include at least three training sessions a week.

During your running program always keep the following rules in mind:

- Choose whatever time of the day for your training that suits your personal situation best.
- It is essential to stay within 90 – 110 per cent of your THR to make sure you improve your cardiovascular fitness and burn fat instead of carbohydrates. If you go too fast, you end up burning carbohydrates, possibly resulting in a condition called hypoglycemia (condition of feeling extremely exhausted and sometimes dizzy because all glycogen available has been burned). This can easily be avoided by not exceeding 110 per cent of THR.
- Take your RP every morning right after waking up. You only need to take your pulse for 15 seconds and then multiply the number of heartbeats by four. An increase of RP is okay during the first few days after starting your training but should decline the following days. If it continues to increase, take one or two additional rest days.
- Always drink after exercising in order to replenish the liquid you lose by sweating.

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About the Author

Jurgen Giessing, PhD, EdD is a certified physical education teacher. He received his doctor's degree in sports science from the University of Tuebingen, Germany and a doctor's degree in pedagogic from the University of Marburg. After working as a sports therapist in a hospital he taught physical education as the head of the physical education department of a secondary school in Germany. Dr. Giessing currently teaches at the University of Marburg.

Running Economy

Jim Pankratz, PT, CSCS

You've seen them before—the graceful runner who seems to effortlessly glide across the pavement, and usually across the finish line first. Ever wonder what makes these runners look so good? The answer is running economy, or simply, efficient running form. To attain this requires a harmonious balance between your body's arms, trunk, core muscles, and legs. Each muscle group must do its job at the proper level or compensation, wasted energy and potential breakdown, or injury, will occur. While genetics plays a large role in how your body is structured, anyone can improve what they have with a little technical training and sport-specific strengthening. In this article we'll discuss efficient running form, common form faults, what they mean, and how to correct them with specific strengthening exercises. The end result will be improved running economy, which leads to improved performance and the prevention of injuries.

Perfect Running Form

For the sake of this article, we won't debate what perfect running form is, but rather we'll focus on how to make your form more efficient. Your individual running form is literally a blueprint of how your body is structured and how well it works together. In this regard no two people will look exactly alike when running. However, efficient forms will have the same basic characteristics of symmetry and strength. While both of these characteristics are closely tied together, the one that will have the greatest impact on your running form is strength. Therefore your perfect running form is simply having enough strength to control your body as efficiently as you can.

Common Form Faults

Arm Swing

Arm swing is often thought of as the easiest part of one's running form to improve. But this can only occur when you have adequate strength. An asymmetrical and inefficient arm swing can be simply the result of poor technique. However, too often it is a sign of compensation to help keep your balance for inadequate hip strength (see Figure 1a). Proper arm swing (see Figure 1b&c) occurs with the elbows bent at a 90 degree angle and your arms kept close to your sides. Hands and shoulders should be relaxed with the forward swing of your arms bringing your hands to the midline of your body at sternum height. The back end of your arm swing should bring the elbows just slightly past the gluteals. As simple as this sounds, it is actually one of the most common faults of running form. To see if arm swing is a problem with your form, try the test below.

Figure 1a. Rear view of asymmetrical arm swing

Figure 1b. Rear view of normal arm swing

Figure 1c. Side view of normal arm swing

Figure 2. Hip drop

Figure 3. Normal hip position

Try to maintain correct arm swing while running at a moderately fast pace over a straight line. If you are having a hard time keeping your balance or notice that you are zigzagging instead of going straight, then you may have this fault. To correct this, focus on strengthening your hips two to three times weekly until you can maintain correct arm swing while running.

Core Strength

This important area of the body involves your abdominal, back, and hip muscles, and is the source of almost all running efficiency problems. Your core is literally the base of support off of which your legs and upper body move. Strength deficiencies in this vital area can lead to multiple forms of compensation and wasted energy. When your core is working properly it keeps your trunk "quiet" or stable, which allows your arms and legs to move efficiently. What makes this challenging for the core is that it must do so when your entire body is balancing on one foot. To understand this better, let's look at one of the many possible form faults of the core - hip drop.

Hip drop occurs as a result of hip abductor muscle weakness. This muscle group's job is to keep your trunk upright while transitioning forward during the single leg stance phase of running. Insufficient strength on the stance leg will cause the opposite hip to drop (see Figure 2). This extra motion causes your legs and trunk to compensate in multiple ways, wasting even more energy in the process. Sufficient hip abductor muscles show no visible hip drop and do not waste extra energy (see Figure 3). To test this muscle's strength, squat on a single leg while reaching with the opposite leg sideways away from you (see figure 4a&b). If you are unable to maintain upright posture of your trunk then your core will need some work.

Strengthening

Strengthening key running specific muscles will improve your running economy. Perform 1 – 3 sets of 10 – 20 repetitions of these exercises 1 – 3 times per week. To prevent overtraining adjust how often you do them according to how much you run. Strengthen 1 – 2 times weekly when running 4 or more times and over 20 miles total. When running less than this, strengthen 2 – 3 times weekly.

Core Torture

The key to this exercise is keeping your body straight and pulling your belly button in. Maintain this position up to one minute and repeat 3 – 5 times. As you get stronger, alternate raising one of your legs a few inches off the ground (see Figure 5).

Standing Hip Abduction

Use elastic tubing or a machine cable attachment for resistance. Bring your leg out sideways while maintaining an upright posture and holding your belly button in (see Figure 6).

Figure 4a. Single leg squat with sideways reach (side view)

Figure 4b. Single leg squat with sideways reach (front view)

Figure 5. Core torture

Figure 6. Standing Hip Abduction

Squat Reach

Try to reach with your leg as far as you can sideways while squatting down. Maintain an upright posture by keeping your shoulder, hip, knee, and foot all in alignment. Keep your weight on the stance leg throughout the entire motion. Return to standing and repeat on the other side (see Figure 4).

Tubing Walk

Stretch elastic tubing around your ankles while walking sideways in a wide stance. Don't let your feet come together or drag on the ground. Try to walk in both directions 30 – 60 seconds 5 – 10 times (see Figure 7).

Hip Hike

Stand on a step with one leg hanging off the side. Lower the leg and hike it back up while maintaining an upright posture. Keep both knees straight throughout the motion. You should feel your hip muscles working in the leg on the step (See Figure 8).

Figure 7a. Tubing walk

Figure 7b. Tubing walk

Figure 8a. Hip hike down position

Figure 8b. Hip hike up position

Important Stretches

Don't forget to stretch after each workout. Hold each stretch for 30 seconds and repeat 1 – 3 times.

IT Band

Lie on your back and pull one leg up across your body at a right angle. Push down on your knee with your opposite hand. Make sure to keep your shoulders down. The stretch should be felt in the outer hip (see Figure 9).

Hip external rotators

Sit with your left leg straight out and your right leg upright and crossed over the left thigh. Use your left arm to pull your right knee towards your left shoulder. Switch legs and repeat (see Figure 10).

Hip internal rotators

Lie on your back with left leg bent and your right leg crossed over your left knee. Use both hands to pull your left thigh towards your chest. Switch legs and repeat (see Figure 11).

Figure 9. IT band stretch

Figure 10. External rotators stretch

Figure 11. Internal rotators stretch

Video Assessment

The best way to make sure your running form is efficient is by video analysis. Your form can be evaluated frame by frame at slow speeds. This method is far superior to any other because you are able to see asymmetry and faults that are often missed at normal speed to the naked eye. It also is a tool that gives you objective information and can help you track progress after a correction has been made. Contact a trained CSCS, physical therapist, athletic trainer, or coach who has experience in this area to help you improve your running economy today.

Conclusion

In conclusion, there are many possible running form faults that can cause you to be an inefficient runner. This leads to early fatigue, compensation, decreased performance, and possible injury. Video analysis is a valuable tool for evaluating your running form. Running specific strengthening can help you correct your faults and improve your running economy. Using these two strategies, you'll soon be crossing the finish line with ease and efficiency.

About the Author

Jim Pankratz has been working as a physical therapist for 10 years in orthopedics and sports medicine. Pankratz is a Certified Strength and Conditioning Specialist (CSCS). He teaches a variety of fitness and wellness classes to the Madison community. Jim uses video analysis to help train and rehab running athletes of all levels.

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