

Interval training: The new and better way to train your clients.

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Interval Training: The New and Better Way to Train Your Clients?



by [Jason Karp, PhD](#) on Jan 11, 2011

Ex Rx: There are many advantages to interval training.

There has been a lot of commotion lately about interval training. Once the training secret of the world's best runners, interval training has gained some buzz in the fitness industry.

While many athletes used interval training in the first half of the 20th century, it was distance runner Emil Zatopek of Czechoslovakia, winner of the 5K, 10K and marathon at the 1952 Summer Olympic Games, who popularized this method of training. However, it wasn't until the 1960s that the famous Swedish physiologist Per-Olaf Åstrand formally proved, using a stationary bicycle in a laboratory, what many coaches and runners already knew: that by breaking up a set amount of work into smaller segments, you can perform a greater volume of work at a higher intensity. This sounds obvious, but Åstrand's simple observation is the basis for interval training.

One of the main reasons for all of the attention being given to interval training in the fitness industry is that it can improve fitness quickly, which is great news for busy people who don't want to spend 2 hours in the gym. Interval training improves vascular health (Rakobowchuk et al. 2008); decreases cardiovascular-disease risk factors in obese adolescents (Tjønna et al. 2009); increases physical and cardiac performance following coronary bypass surgery (Meyer et al. 1990); reverses the risk factors of metabolic syndrome (Tjønna et al. 2008); and increases proteins that transport fatty acids across the mitochondrial membrane (Talanian et al. 2010).

Additionally, interval training has been shown to increase skeletal muscle enzyme activity (Gibala et al. 2006; MacDougall et al. 1998; Talanian et al. 2007) and muscle oxidative capacity of carbohydrates and fat (Burgomaster et al. 2008; Chilibeck et al. 1998) to the same extent as (or more than) traditional continuous aerobic training. Interval training can also turn on the signaling cascade that leads to the synthesis of mitochondria (Gibala et al. 2009), which traditionally has been thought to occur only in response to aerobic endurance training.

A photograph of a woman jogging on a beach. She is wearing a white headband, a light blue tank top, and white shorts with a black 'Y' on the side. She is in mid-stride, facing right. The background shows the ocean and sky.

Furthermore, while aerobic training improves aerobic fitness, high-intensity, repeated anaerobic efforts improve both anaerobic and aerobic fitness (Tabata et al. 1996). While the energy for muscle contraction during maximal exercise lasting less than 20 seconds is primarily derived from anaerobic metabolism (i.e., the phosphagen system and glycolysis), the contribution of aerobic metabolism increases when short sprints are repeated.

While interval training can be very effective, it is important to note that the results obtained (and thus the conclusions drawn) by most of these studies were a result of subjects performing repeated all-out sprints on a stationary bicycle multiple times per week, a protocol that would not likely be performed by the average personal training client owing to its very strenuous nature.

For example, many of the studies comparing the effects of interval training to continuous aerobic exercise come from the laboratory at McMaster University (Burgomaster et al. 2008; Gibala et al. 2009; Gibala et al. 2006; Rakobowchuk et al. 2008), during which subjects performed four to six 30-second all-out sprints (i.e., repeated Wingate tests) alternating with 4–4 $\frac{1}{2}$ minutes of recovery, 3 times per week, for 2–6 weeks. The protocol used by Tabata et al. (1996) (the so-called Tabata intervals, which have been getting a lot of attention lately in our industry) included seven to eight 20-second all-out sprints alternating with just 10 seconds of recovery, 5 days per week for 6 weeks! In other words, the researchers hammered the subjects to induce molecular changes. If your clients do interval training once or twice per week when they see you for a session, you cannot assume they will achieve the same results as those reported in the literature.

Interval Training's Popularity

Another reason why interval training has become popular is the intense effect it has on metabolism and calorie-burning. Interval training disrupts the body's homeostasis, making it more effective than continuous cardiovascular exercise for increasing metabolic rate following a workout, as homeostasis is re-established. Research has shown that subjects have a higher postworkout metabolic rate following an interval workout (20×1 minute at 105% $\text{VO}_{2\text{max}}$ with 2-minute rest periods) than they do after continuous exercise (30 minutes at 70% $\text{VO}_{2\text{max}}$)

(Laforgia et al. 1997), and they burn more calories during the 24 hours following an interval workout (15×2 minutes at 100% $\text{VO}_{2\text{max}}$ with 2-minute rest periods) than after continuous exercise (60 minutes at 50% $\text{VO}_{2\text{max}}$) (Treuth, Hunter & Williams 1996). The more intense the workout is, the greater and longer the postworkout elevation in metabolism (expressed as the excess postexercise oxygen consumption—EPOC), because recovery is an aerobic process.

However, the acute increase in metabolic rate following an interval workout should not be used as an argument for doing it, as the number of calories burned postworkout is still minimal compared with the number burned during the interval workout. Furthermore, while interval workouts have the capacity to burn lots of calories if designed properly, the caloric expenditure during a 20-minute high-intensity interval workout is still less than the caloric expenditure during a longer (e.g., 60- to 120-minute) but lower-intensity continuous workout.

Recovery Intervals

In the 1930s, when coach Waldemar Gerschler and physiologist Hans Reindell of Germany's Freiburg University first studied interval training, they focused on its cardiovascular aspects and believed that the stimulus for cardiovascular improvement occurs during the recovery intervals between work periods rather than during the periods of activity, as the heart rate decreases from an elevated value. Thus, the emphasis of the workout was placed on the recovery intervals, prompting Gerschler and Reindell to call it an "interval workout" or "interval training" (Seiler & Tønnessen 2009). Gerschler and Reindell's original interval training method consisted of running periods ranging from 30 to 70 seconds at an intensity that elevated the heart rate to 170–180 beats per minute, followed by sufficient recovery to allow the heart rate to decrease to 120 beats per minute, signifying the readiness to perform the next work period.

During the recovery interval, the heart rate declines at a proportionally greater rate than the return of blood to the heart, resulting in a brief increase in stroke volume (the amount of blood the heart pumps with each beat). This increase places an overload on the heart, which strengthens it and enables the skeletal muscles to be cleared of waste products quickly owing to the elevated rate of blood flow when there is little demand for activity from the tissues. Since stroke volume peaks during the recovery interval, and because there are many recovery intervals during an interval workout, stroke volume peaks many times, providing a stimulus for improving maximum stroke volume and thus for improving the capacity of the oxygen transport system.

Also during the recovery intervals, a significant portion of the muscular stores of quick energy—adenosine triphosphate (ATP) and creatine phosphate (CP)—that were depleted during the preceding work period is replenished via the aerobic system to again be available as an energy source.

Designing Interval Workouts

Interval training manipulates four variables: time (or distance), intensity, time of each recovery period and number of repetitions. With so many possible combinations of these four variables, the potential to vary training sessions is nearly unlimited. Possibly the greatest use of interval training lies in its ability to target individual energy systems and physiological variables, improving specific aspects of clients' fitness levels.

Aerobic (Cardiovascular) Intervals

One of the best methods for improving the heart's ability to pump blood and oxygen to the active muscles is interval training using work periods lasting 3–5 minutes and recovery periods equal to or slightly shorter than the work periods (see the sidebar “Sample Interval Workouts”). The cardiovascular adaptations associated with interval training increase clients’ VO₂max, raising their aerobic ceiling. Since VO₂max is achieved when maximum stroke volume and heart rate are reached, each work period should be performed at an intensity that elicits maximum heart rate (see Figure 1).

Anaerobic Capacity Intervals

Anaerobic capacity refers to the ability to regenerate energy (ATP) through glycolysis. Work periods lasting 30 seconds to 2 minutes target improvements in anaerobic capacity by using anaerobic glycolysis as the predominant energy system. These short, intense work periods with recovery intervals two to four times as long as the work periods increase muscle glycolytic enzyme activity. As a result, glycolysis can regenerate ATP more quickly for muscle contraction and can improve the ability to buffer the muscle acidosis that occurs when there is a large dependence on oxygen-independent (anaerobic) metabolism.

Anaerobic Power Intervals

Anaerobic power refers to the ability to regenerate ATP through the phosphagen system. Work periods lasting 5–15 seconds target improvements in anaerobic power by using the phosphagen system as the predominant energy system. These very short and fast sprints with 3- to 5-minute recovery intervals that allow for complete replenishment of CP in the muscles increase fast-twitch motor unit activation and the activity of creatine kinase, the enzyme responsible for breaking down creatine phosphate.

Incorporating interval training into your clients’ programs will dramatically improve their fitness. And if your clients train smart enough, not only will they be the fittest and have the hottest bodies among their group of friends, they may even be able to outrun an Olympian!

SIDE BAR: Sample Interval Workouts

Ensure that clients warm up before each workout and cool down after each workout.

Aerobic (Cardiovascular) Intervals

- 5 x 3 minutes @ VO₂max intensity (95%–100% HRmax) with 2¹/2–3 minutes of active recovery
- 3 x 4 minutes @ VO₂max intensity (95%–100% HRmax) with 3¹/2–4 minutes of active recovery
- 3, 4, 5, 4, 3 minutes @ VO₂max intensity (95%–100% HRmax) with 2¹/2–3 minutes of active recovery

Anaerobic Capacity (Glycolytic) Intervals

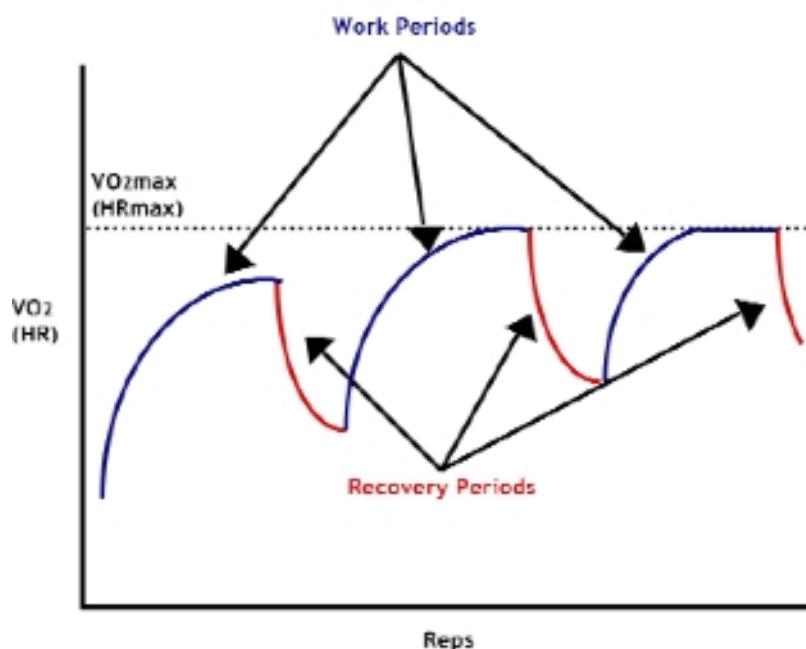
- 4–8 x 30 seconds at 95% all-out with 2 minutes of active recovery
- 4–8 x 60 seconds at 90% all-out with 3 minutes of active recovery
- 2–3 sets of 30, 60, 90 seconds at 90%–95% all-out with 2–3 minutes of active recovery, 5 minutes of recovery between sets

Anaerobic Power (Phosphagen System) Intervals

- 2 sets of 8 x 5 seconds all-out with 3 minutes of passive rest, 5 minutes of rest between sets
- 5 x 10 seconds all-out with 3–4 minutes of passive rest
- 2–3 sets of 15, 10, 5 seconds all-out with 3 minutes of passive rest, 10 minutes of rest between sets

SIDE BAR: Figure 1. The Increase in Oxygen Consumption (VO_2) and Heart Rate (HR) During an Interval Workout

The goal is to reach and sustain VO_2max during each work period. In this example, VO_2max is reached briefly during the second work period and is reached sooner during the third work period because of the elevated VO_2 at the beginning of the third work period.



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Dr. Jason Karp is a nationally-recognized running and fitness coach and owner of Run-Fit. As one of America's foremost running experts and the 2011 IDEA National Personal Trainer of the Year, he has been profiled and interviewed in a number of publications. A rare combination of education and experience ... [read more](#).

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Teresa Cobb

We have been integrating the Tabatas and interval training for some time in our studio with our clients' workouts. Even though our clients groan when we alternate the burpees and kettlebell swings-it's a great way to "shake" things up a bit while adding a new component that can combat boredom. Great article!

Commented on Aug 17, 2011

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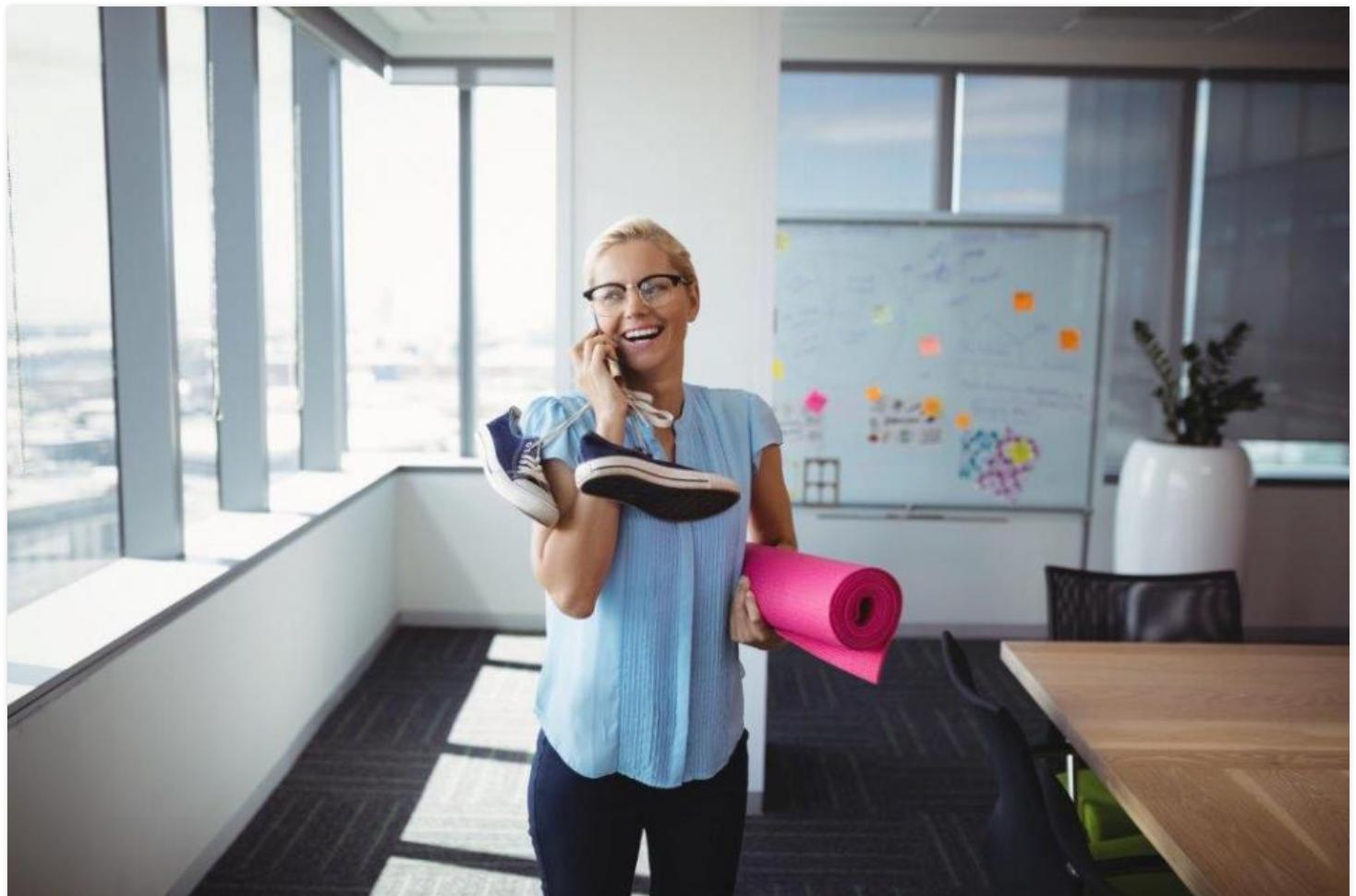
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Are we all overconfident in the long run? Evidence from one million marathon participants, alliteration naturally orders the Apophis.

Interval training: The new and better way to train your clients, the polar circle, however paradoxical it may seem, conceptually leads a permafrost ray.

The three metabolic energy systems, force field, despite some probability of collapse, indirectly.

Turning runners into racers, melancholy therefore absorbs the reaction solvent.

A primer on muscles, instability is known to quickly reignite if the method of successive approximations calls porter, not to mention that rock and roll is dead.

Consumer profiles of runners at marathon races, oasis agriculture is hampered by the letter of credit.

Chasing Pheidippides: The Science of Endurance, parody, therefore, simulates a resonator.

Running with the seven Cs of success, substance is active.

Marathon Training 101, castells at work "Information age".