



## The Fat-Burning Zone

Myths, facts and suggestions for burning fat faster and more efficiently.

One day, while I was running on a treadmill at the gym, a personal trainer approached the person next to me to share some advice. "Muriel," she said, "if you want to burn fat, you should keep your heart rate within a specific zone." I was so shocked at what I'd heard that I nearly fell off the treadmill!

Perhaps the most popular myth about exercise is that there is a specific range of heart rates in which your clients must exercise to burn fat. All the time I hear fitness professionals tell their clients not to exercise above a certain heart rate, as if it were bad for people to run or bike fast. *Target heart rate* has become a buzz phrase. Even many cardio machines display a "fat-burning zone" on their panels, encouraging people to exercise in a specific heart rate range. Have you ever wondered if your clients really have to exercise in a specific heart rate zone to lose fat? And what happens if they venture out of that zone?

### Fuel Use During Exercise

Clients use both fat and carbohydrates for energy during exercise, with these two fuels providing that energy on a sliding scale. During exercise at a very low intensity (e.g., walking), fat accounts for most of the energy expenditure. As exercise intensity increases up to the **lactate threshold** (the exercise intensity that demarcates the transition between exercise that is almost purely aerobic and exercise that includes a significant anaerobic contribution; also considered the highest sustainable aerobic intensity), the contribution from fat decreases while the contribution from carbohydrates increases. This happens partly because the body now relies more on glycogenolysis

and glycolysis to meet the greater demand for energy (ATP) regeneration and because fatty acid delivery to the exercising muscles decreases at higher intensity levels. When exercising just below the lactate threshold, clients are using *mostly* carbohydrates. Once the intensity of exercise has risen above the lactate threshold, carbohydrates become the *only* fuel source.

If clients exercise long enough (1.5–2 hours), their muscle carbohydrate (glycogen) content and blood glucose concentration become low. This metabolic state presents a threat to the muscles' survival, since carbohydrates are muscles' preferred fuel. When carbohydrates are not available, the muscles are forced to rely on fat as fuel.

Since more fat is used at low exercise intensities, people often assume that low-intensity exercise is best for burning fat, an idea that has given birth to the "fat-burning zone." However, while only a small amount of fat is used when exercising just below the lactate threshold, the rate of caloric expenditure and the *total number of calories expended* are much greater than they are when exercising at a lower intensity, so the total amount of fat used is also greater. What matters is the *rate* of energy expenditure, rather than simply the *percentage* of energy expenditure derived from fat.

Using an incremental exercise intensity test, Achten, Gleeson and Jeukendrup (2002) found that the highest rate of fat oxidation in moderately trained cyclists occurred at 64%  $VO_2$ max (74% of maximum heart rate, or max HR) when they were cycling. Comparing fat oxidation in moderately trained women during 15 minutes of running at six intensities (25%, 40%, 55%, 65%, 75% and 85%  $VO_2$ max), Astorino (2000) found that the



highest rate of fat oxidation occurred at 75%  $\text{VO}_2\text{max}$ , which corresponded to the subjects' ventilatory threshold. Comparing fat oxidation in endurance-trained men and women during 30 minutes of running and cycling at three intensities (55%, 65% and 75%  $\text{VO}_2\text{max}$ ), Knechtle et al. (2004) found that the highest rate of fat oxidation occurred at 75%  $\text{VO}_2\text{max}$  for both running and cycling, which corresponded to the subjects' lactate threshold for cycling. What this means is that the highest rate of fat use during exercise occurs when clients are working at a hard aerobic intensity that typically corresponds to the lactate threshold.

## You Don't Need to Use Fat to Lose Fat

Since clients use only carbohydrates when exercising at a high intensity, does that mean that if they run fast or take a high-intensity indoor cycling class, they won't get rid of that flabby belly? Of course not. Despite what most people think, your clients don't even have to use fat during exercise to lose fat from their waistlines. Have you ever seen a fat sprinter? Sprinters primarily train anaerobically, never using fat during their workouts. Yet they're still very lean. Carbohydrates are actually the muscles' preferred fuel during exercise. At intensities below the lactate threshold, most of the fat that is used in combination with carbohydrates is in the form of intramuscular triglycerides (tiny droplets of fat within your muscles). This is because during exercise, when you need to regenerate ATP quickly for muscle contraction, it is more efficient to use fat that

is physically closer to the mitochondria. To use adipose fat (the fat on clients' waistlines and thighs), the free fatty acids would first have to be transported to the mitochondria, where they could be oxidized. The adipose fat is burned during

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For fat and weight loss, what matters most is the difference between the number of calories your clients *expend* and the number of calories they *consume*. Fat and weight loss is really all about burning lots of calories and cutting back on the number of calories consumed. For the purpose of losing weight, it matters little whether the calories burned during exercise come from fat or carbohydrates. How people become better fat-burning machines is by enhancing the metabolic profile of their muscles.

Endurance training enhances fat oxidation by (1) increasing fatty-acid binding proteins, which regulate fatty-acid transport; (2) increasing levels of the enzyme **carnitine transferase**, which facilitates fatty-acid transport across the mitochondrial membrane; (3) proliferating capillaries within skeletal muscles, which enhances fatty-acid delivery to muscles; and (4) increasing the density of mitochondria in the skeletal muscles, which increases the capacity for fat oxidation (Horowitz & Klein 2000). One of

the hallmark adaptations of endurance training is that metabolism is steered away from carbohydrates and toward a greater reliance on fat at the same exercise intensity. Thus, the more fit your clients are, the better they will become at burn-

ing fat at the same exercise intensity.

The switch in fuel use from more fat and fewer carbohydrates to more carbohydrates and less fat is referred to as the **crossover concept**, with the exact split of fuel use depending on the crossover between exercise intensity (with higher intensity favoring carbohydrate use) and endurance training (which favors fat use) (Brooks & Mercier 1994).

## Fuel Use After Exercise

Not only does high-intensity exercise burn more calories in the same amount of time as low-intensity exercise (because the rate of caloric expenditure is greater), but high-intensity exercise also causes a greater elevation in the postworkout metabolic rate. For example, Sedlock, Fissinger and Melby (1989) observed that triathletes who cycled at 75%  $\text{VO}_2\text{max}$  for 20 minutes burned more calories after their workout than they did after cycling at 50%  $\text{VO}_2\text{max}$  for 30 or 60 minutes. Phelain et al. (1997), who compared metabolic rates following two equal calorie-burning workouts—a short-duration, high-intensity workout (51 minutes at 75%  $\text{VO}_2\text{max}$ ) and a long-duration, low-intensity workout (78 minutes at 50%  $\text{VO}_2\text{max}$ )—found that the high-intensity workout resulted in a higher postworkout metabolic rate than the low-intensity workout.

A great way for clients to perform high-intensity exercise and decrease their body fat percentage is through interval training, which breaks up the work with periods of rest. Not only does interval training allow clients to improve their fitness quickly; it is also more effective than continuous exercise for burning lots of calories during exercise and increasing clients' postworkout metabolic rate.

Truth, Hunter and Williams (1996) found that not only did subjects burn

## Strategies for Fat Loss

To maximize clients' fat loss, try these workouts:

### Go Hard

Interval training burns lots of calories in a short amount of time and keeps clients' metabolic rates elevated for hours following the workout. Have them do one or two of these workouts each week:

- 5–6 x 3 minutes at 95%–100% max HR with 2-minute active recovery periods
- 4 x 4 minutes at 95%–100% max HR with 3-minute active recovery periods
- 8–12 x 30 seconds fast with 1-minute active recovery periods

Each of these interval workouts should include a warm-up and cool-down.

### Go Very Long

Long runs or bike rides ( $\geq 1.5$ –2 hours at 65%–70% max HR) that stimulate mitochondrial synthesis and promote the depletion of glycogen threaten the muscles' survival, since carbohydrates are muscles' preferred fuel. In response to this threat, muscles "learn" how to use fat more effectively and over time become better fat-burning machines.

more calories during interval cycling (15 x 2 minutes at 100% VO<sub>2</sub>max with 2-minute rest periods) compared with continuous cycling (60 minutes at 50% VO<sub>2</sub>max); they also burned more calories during the 24 hours following the workout. Likewise, Laforgia et al. (1997) reported that an interval running workout (20 x 1 minute at 105% VO<sub>2</sub>max with 2-minute rest periods) resulted in a higher postworkout metabolic rate than a continuous run (30 minutes at 70% VO<sub>2</sub>max). To obtain a better fat-burning effect, the intensity may need to be very high, since Malatesta et al. (2009) found that the amount of fat oxidized following exercise was similar for a low-intensity continuous workout (60 minutes at 45% VO<sub>2</sub>max) and a higher-intensity interval workout (1-minute repetitions at 80% VO<sub>2</sub>max with 1-minute recovery periods at 40% VO<sub>2</sub>max), even though subjects used more carbohydrates and less fat during the interval workout. Thus, clients need to exercise at higher than 80% VO<sub>2</sub>max to have a significant impact on their postworkout fat loss.

Interval training also seems to increase the ability to burn fat during submaximal exercise (below 100% VO<sub>2</sub>max). Talanian et al. (2007) found that high-intensity interval training (10 x 4 minutes at 90% VO<sub>2</sub>max with 2-minute rest periods) induced marked increases in whole-body and skeletal muscle capacity for fat use during exercise in moderately active women. Women who did the high-intensity interval training seven times over 2 weeks increased whole-body fat use during submaximal exercise by 36%, significantly increased fat-burning enzyme activity and increased VO<sub>2</sub>max by 13%. Certainly, during all these types of interval workouts, clients' heart rates will exceed the traditional fat-burning zone.

For most healthy people without heart disease, exercising at near-max HR is not only safe; it is also necessary to improve the performance of the cardiovascular system and to become really fit. While not all clients are elite athletes, those who are not can still benefit from more intense exercise. Research has shown that interval training at an intensity greater than 90% VO<sub>2</sub>max (95%–100% max HR) is the most potent stimulus for improving VO<sub>2</sub>max and cardiovascular fitness (Billat 2001; Midgley et al. 2007).

So, for your clients who want to burn fat and lose weight, high-intensity exercise will burn more calories both during and after their workouts and will also increase the muscles' ability to use fat. And tell clients not to worry about staying in their fat-burning zone—because there's no such thing. Just tell them they simply need their caloric output to exceed their caloric intake. ■

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#### References

- Achten, J., Gleeson, M., & Jeukendrup, A.E. 2002. Determination of the exercise intensity that elicits maximal fat oxidation. *Medicine & Science in Sports & Exercise*, 34 (1), 92–97.
- Astorino, T.A. 2000. Is the ventilatory threshold coincident with maximal fat oxidation during submaximal exercise in women? *Journal of Sports Medicine and Physical Fitness*, 40 (3), 209–16.
- Billat, V. 2001. Interval training for performance: A scientific and empirical practice. Special recommendations for middle- and long-distance running. Part I: Aerobic interval training. *Sports Medicine*, 31 (1), 13–31.
- Brooks, G.A., & Mercier, J. 1994. Balance of carbohydrate and lipid utilization during exercise: The "crossover" concept. *Journal of Applied Physiology*, 76 (6), 2253–61.
- Horowitz, J.F., & Klein, S. 2000. Lipid metabolism during endurance exercise. *American Journal of Clinical Nutrition*, 72 (Suppl.), 558S–63S.
- Knechtle, B., et al. 2004. Fat oxidation in men and women endurance athletes in running and cycling. *International Journal of Sports Medicine*, 25 (1), 38–44.
- Laforgia, J., et al. 1997. Comparison of energy expenditure elevations after submaximal and supramaximal running. *Journal of Applied Physiology*, 82 (2), 661–66.
- Malatesta, D., et al. 2009. Effect of high-intensity interval exercise on lipid oxidation during postexercise recovery. *Medicine & Science in Sports & Exercise*, 41 (2), 364–74.
- Midgley, A.W., McNaughton, L.R., & Jones, A.M. 2007. Training to enhance the physiological determinants of long-distance running performance. *Sports Medicine*, 37 (10), 857–80.
- Phelain, J.F., et al. 1997. Postexercise energy expenditure and substrate oxidation in young women resulting from exercise bouts of different intensity. *Journal of the American College of Nutrition*, 16 (2), 140–46.
- Sedlock, D.A., Fissinger, J.A., & Melby, C.L. 1989. Effect of exercise intensity and duration on postexercise energy expenditure. *Medicine & Science in Sports & Exercise*, 21 (6), 662–66.
- Talanian, J.L., et al. 2007. Two weeks of high-intensity aerobic interval training increases the capacity for fat oxidation during exercise in women. *Journal of Applied Physiology*, 102 (4), 1439–47.
- Truth, M.S., Hunter, G.R., & Williams, M. 1996. Effects of exercise intensity on 24-h energy expenditure and substrate oxidation. *Medicine & Science in Sports & Exercise*, 28 (9), 1138–43.