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The Myth of the Fat-Burning Zone

Tony Leyland

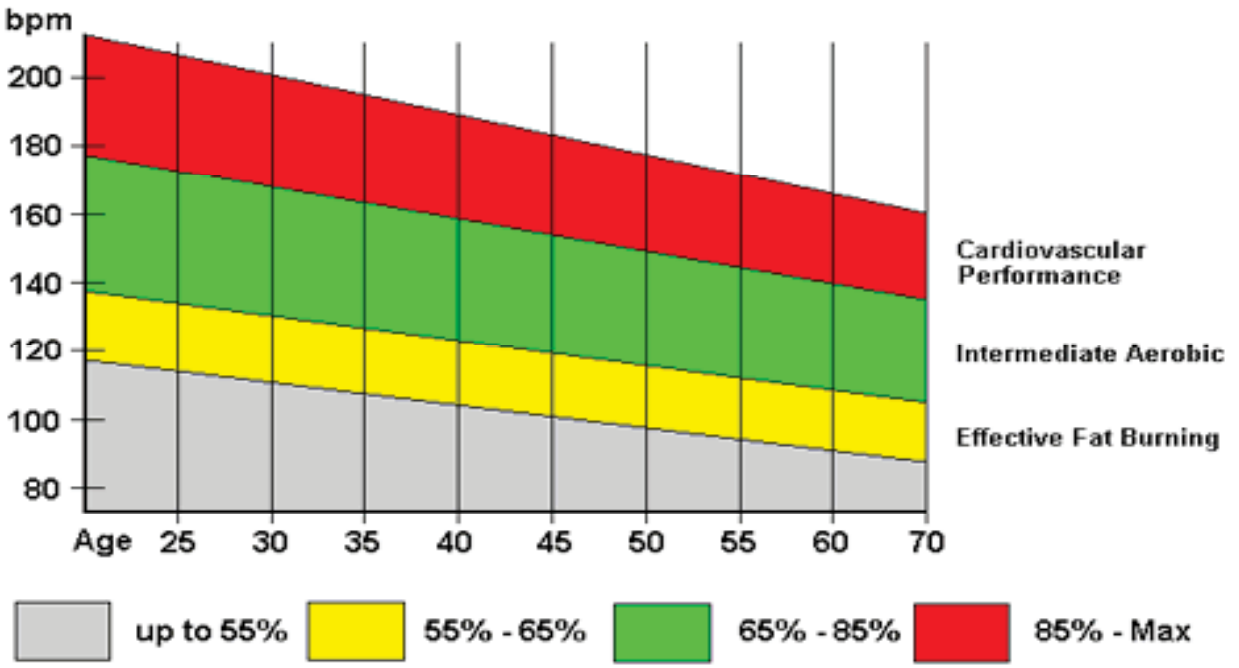

Figure 1. Mythical training zones. Misleading charts such as this promote the myth of a low-intensity fat-burning zone.

In last month's *CrossFit Journal*, I said that we must always focus on performance when assessing fitness. Specifically, I argued that body fat measurement not only is futile (from an accuracy standpoint) but, more importantly, is irrelevant to athletes focused on what they can do rather than how they look. That said, fat loss is still a major and valid concern for many trainees out there, and the fitness industry is full of schemes and strategies for burning body fat.

One of these supposedly scientific nuggets of accepted "wisdom" is the belief, espoused by many personal trainers and reflected in the preset programs on most cardio machines, that the best way to lose fat is to work at a moderate intensity. A version of the graph above appears on the walls of innumerable gyms and training studios across the United States and Canada, graphically illustrating the supposedly "right" exercise intensity (as a percentage of an individual's mathematically estimated

maximum heart rate) for maximizing fat loss. But it is not an accurate representation of the true picture.

The myth of the fat-burning zone

The correct answer to the question "does slow and steady burn more fat?" is, as with many things in health and fitness, a bit more complex than just a simple yes or no. It depends on a few things, mainly training intensity and duration of exercise. Obviously if you go for an all-day hike you are going to burn a considerable amount of stored body fat as fuel, but the bottom line is that if you don't have all day to work out, you should exercise intensely (assuming that the intensity level chosen is safe for you).

What in fact happens in low-intensity exercise is that a greater percentage of total calories expended comes from fat. For example, if you cycle along at 50 percent VO_2 max (VO_2 max = maximum aerobic capacity), fat would provide about 50 percent, on average, of the energy you needed to keep going. But if you cycle at 75 percent VO_2 max, fat would provide only 33 percent of the required calories. Thus, the slower workout sounds better in terms of fat usage. Or does it? Not if you understand the basics of percentages. One percent of Bill Gates's net worth is considerably more than 100 percent of my net worth (you can trust me on that one). So we should be careful about our use of percentages.

Let's look at an example for a subject who has a VO_2 max of 2.0 liters/min. This subject does two 30-minute workouts, one at 50 percent of her VO_2 max (about 65 percent of calculated max heart rate) and one at 70 percent of her VO_2 max (about 80 percent of max heart rate). The table below shows the calories and fat burned during these two exercise sessions.

The greater the energy requirements, the more our body uses glucose and glycogen as fuels because of their efficiency—that is, because more energy can be generated per unit of available oxygen when burning glucose than when burning fat. Glycogen is a bunch of glucose molecules, the form in which carbohydrate is stored in the muscle and liver. This is why our test subject working at the lower intensity (1 liter of oxygen per min) will burn a greater percentage of fat than when working at the higher intensity. The second row in the table reflects this higher fat utilization per liter of available oxygen. It is this fact that has led to the misconception of slow and steady being better for fat loss.

But what does the information in row 2 really tell us? All it says is that you will burn more fat calories for each liter of oxygen consumed if you work out more slowly. It says nothing about total oxygen used or total calories burned. When you work out more intensely, you need more energy and hence you will burn more calories and use more oxygen during the workout (rows 3 and 4 in the table). And, as in the Bill Gates analogy, you are often better off to take a lower percentage of something large than a higher percentage of something small.

As rows 4 and 5 show, both more fat and more calories are burned during higher intensity exercise over a given time period. Therefore, if you have limited time it is best to exercise as hard as safely possible in the time available. Does that sound like CrossFit?

It really is simple logic. If you have 30 to 60 minutes to exercise, does it make sense that working out at a lower intensity than you are safely capable of would cause you to lose more fat? To believe this is to believe that expending less energy is going to help you lose more fat. Not on this planet.

The table below shows values for two intensities of continuous aerobic work. What about anaerobic work like sprints and lifts though? One study looking at this topic found that a group of subjects doing bike interval work (a series of sprints) lost more body fat (estimated from changes in skinfold measurements) than another

Parameters	Exercise Intensity	
	50% VO_2 max	70% VO_2 max
Liters of oxygen per min	1.0	1.4
Fat kcal burned per liter of O_2	2.43	1.96
Kcal burned per min	4.86	6.86
Total kcal burned per 30 min	146	206
Fat kcal burned per 30 min	73	82

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group doing steady-state cycling (Trembblay et al.). The researchers controlled the work rates so that the total work done for each session for both groups was the same. More research needs to be done, but maybe one day the fitness industry will be recommending anaerobic interval training as the best way to lose body fat. Imagine that.

Fuel for exercise

The myth of the fat-burning zone is linked to the misconceptions that dietary fat makes you fat and that only by burning fat during exercise can you reduce the amount of fat stored in your body. At rest, about two-thirds of energy production comes from fatty acids and the other third from glycogen and glucose. At 95 percent of VO_2 max and above, these carbohydrate sources are used almost exclusively. Many CrossFit workouts are performed in the anaerobic energy systems well above 100 percent of VO_2 max, so how can CrossFitters lose more fat if we are burning only carbohydrate?

As I mentioned, during high-intensity exercise you burn lots of muscle and liver glycogen. Some of the longer CrossFit workouts such as "Murph" or the 20-minute timed workouts would significantly deplete glycogen stores (working that intensely for 20+ minutes might almost totally deplete glycogen stores in some muscles). When you eat carbohydrates after such a workout, these glycogen stores will be replaced. If you hadn't depleted these glycogen stores, any digested glucose in excess of general energy needs would be stored as fat. If you look again at row 5 in the table you will see that in addition to more fat being burned, a lot more carbohydrate and protein must have been burned as well (since there were 60 more total calories burned in the higher intensity exercise). Keep in mind that the body can convert glucose into fat for storage. (Alas.) So if you do the slow and steady workout, you will burn fewer calories and deplete less of your glycogen stores, and excess carbohydrate in the diet will be stored as fat. How many people say they are walking or jogging lots and can't seem to lose weight? I have heard it many times. They are simply not working hard enough. You burn fat even while at rest, but the bottom line is that you must burn lots of calories, whether by way of a 40-kilometer march with a 40-pound rucksack or, if you haven't the time for that, an intense CrossFit workout.

Energy expenditure throughout the day

But there is more to this topic than just looking at the energy expended during workouts. An added benefit of higher-intensity work is that you work at much higher metabolic rates and your metabolism stays higher for longer after the work out. Intense exercise (e.g., weight training, high-intensity interval training, plyometrics, sprints, etc.) can increase metabolic rate for hours after the vigorous workout (from 3 to 14 hours after, depending on intensity and individual variability). On the other hand, slow aerobic exercise doesn't raise metabolism that high and hence has little effect on metabolism after your workout. You can be back at resting metabolism within an hour after a slow steady jog.

Weight training and other high-intensity exercise (especially CrossFit-type workouts that target all muscle groups) will also increase muscle mass, and muscle is a more metabolically active tissue than adipose tissue (fat storage tissue). However, the standard belief that muscle burns many more calories than adipose tissue is in fact erroneous. As best we can tell, muscle tissue burns only 5 to 7 calories per pound per day. Robert Wolfe, Chief of Metabolism and Professor of Biochemistry at the University of Texas Medical Branch, states that "every 10-kilogram difference in lean mass translates to a difference in energy expenditure of 100 calories per day, assuming a constant rate of protein turnover." That's 10 calories per kilogram of muscle, or slightly less than 5 calories per pound. Adipose tissue is marginally metabolically active burning approximately 2 calories per pound per day.

So why does everyone think muscle is so much more metabolically active? It's simple: in numerous studies we see that those who are exercising and gaining muscle mass increase their daily metabolic rate considerably. In an 18-week study of 26 sedentary men, subjects gained roughly 2.8 pounds of lean mass during the first eight weeks (Van Etten). During this time their average daily metabolic rate increased by 263 calories per day. So, dividing the increase in resting metabolic rate (263 calories) by the increase in lean mass (2.8 pounds) gives a figure of 94 calories per pound. However, we can't assume that this figure represents the metabolic rate of muscle, as the daily metabolic rate includes the energy cost of physical activity. Moreover, as we saw last month, body composition assessments, even in well conducted studies, are necessarily going to be approximations.

What appears to be more significant than the metabolic activity of muscle at rest is that having more muscle mass and training across all metabolic pathways increases your feeling of "having energy" and your ability to perform any required activity. This means you will probably find that CrossFit athletes (and others who do intense exercise) are more active throughout the day. How many of you play other sports, play actively with your kids, and generally feel energized throughout the day? How many of you wait for elevators to take you up one or two flights of stairs? How many sedentary people wait for elevators?

To recap: Performing high-intensity exercises burns more calories, kicks your metabolism into high gear for the duration of the exercise and for hours afterward, has a slight effect in increasing resting metabolism, and allows you to perform more activity throughout the day. No wonder studies have shown that exercise programs that include weight training and/or high-intensity interval work improve body composition better than aerobic exercise only.

Starting a fitness regimen

Of course, everyone is warned not to jump into CrossFit workouts too quickly in the beginning. You need to build intensity slowing by doing more gentle variations of the workouts and focusing on learning correct techniques and movement patterns and gradually increasing the intensity as your body adapts to the stimulus. In one research study, three groups walked and ran for 15, 30, and 45 minutes respectively for a 20-week training period. In the end, of course, the 45-minute training group lost more body fat. For previously sedentary and/or obese individuals, who do not tolerate high-intensity exercise well, it is best to start off at low to moderate intensities, so increasing the duration of exercise may be the only way to manipulate total calories expended.

But you *need* to get to a point where you can do higher intensity anaerobic work as well as aerobic exercise, as the research is clear that a combination of weight training, anaerobic intervals, plyometrics, and aerobic activity results in faster fitness gain and fat loss than either weight training or aerobic activity alone. In fact, CrossFit is probably the best type of training there is to improve body composition. But keep in mind that this is just a byproduct of the main goal, which is excellent performance across all components of fitness.

The links below are to some graphs that show the benefits of what I have discussed above. These studies show that aerobic exercise and weight training increases muscle mass and decrease body fat significantly better than diet only or aerobic exercise only. No studies have been done specifically on CrossFit in this area (yet!), but I'd wager that CrossFit would prove to be even more effective at generating a positive change in body composition.

http://www.exrx.net/FatLoss/WTCalLBWStudy.html
http://www.exrx.net/FatLoss/DietExStudy.html
http://www.exrx.net/FatLoss/HIITvsET.html
http://www.exrx.net/FatLoss/WT%26End.html

Studies cited in this article:

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