WHAT WE'RE READING...

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NOTE: Some sentiments contained within "What We're Reading" articles may not strictly conform with Simple Again's nutritional outlook. We read articles containing opposing information all the time and derive our nutritional philosophies from the latest science, the opinions of experts worldwide and our anecdotal experiences in the field. We keep an open mind and a strong affinity for fact-based evidence to help make the world of nutrition "Simple Again" for you.

Lactate Threshold and V02 Max Explained

My athletes, both experienced veterans and novice alike, often express concern that their triathlete friends have recently undergone exercise testing to determine their V02 max orlactate threshold (LT). They ask me whether or not they should be tested too. I usually answer by asking another question; "Do you know what V02 max and LT actually measure?" Usually, they don't.

V02 max and LT tests can be valuable tools used to train athletes to reach their maximum potential. But they have to be used correctly and responsibly. Adding these measures to your training regimen can be expensive with the cost of each test ranging from $100 to $300 per assessment. In order to make a responsible choice, it is important to have all the information. So let's start with a basic definition of each test.

V02 max

V02 max is defined as the maximal volume of oxygen that the body can deliver to the working muscles per minute.

This is an excellent measure of physical fitness because it provides a metric of efficiency. So if we think about the body as a machine, the muscles collectively are the engine. Just like a car engine, the muscles require a constant delivery of fuel (carbs and fats) and oxygen (to aid in "burning" the fuel). One of the functions of blood is to transport the fuel and oxygen to the muscles. The heart acts as a fuel pump, sending oxygen and nutrient rich blood out to the tissues via arteries and bringing back CO2 and metabolic wastes via veins. So you can see that there are several components involved in the operation of the system. This is reflected in the equation for calculating V02 max.

V02max = HRmax x SVmax x (AOxy-VOxy)

This looks much worse than it really is. HRmax is the maximal heart rate at peak exertion. It is measured as beats/minute. SVmax is the volume of blood pumped by the heart out to the muscles after each beat and is measured as liters/beat. If we multiply HRmax and SVmax we get maximal cardiac output (Qmax), measured as liters/minute of blood pumped out to the muscles. The last part of the equation is AOxy-VOxy. This is called the A/V oxygen difference and it is a measure of how much oxygen is taken out of the blood as it travels through the exercising muscles. The final unit for V02 max is liters of oxygen per minute.

Aerobic exercise improves V02 max significantly. Interestingly, much of this improvement results from an increase in the size of the heart. So clearly, V02 max is a great measure of physical fitness. But it is a poor predictor of athletic performance. If you measured the V02 max of eight world-class cyclists before a race, you would be hard pressed to predict which of them would win if you only had their respective V02 max values. This is where the LT comes into the picture.

Lactate Threshold

Lactate threshold is defined as the intensity of exercise at which lactate begins to accumulate in the blood at a faster rate than it can be removed. This is problematic because as a result, unbuffered acid is added to the blood, a condition that makes you feel like you have to vomit and stop right away.

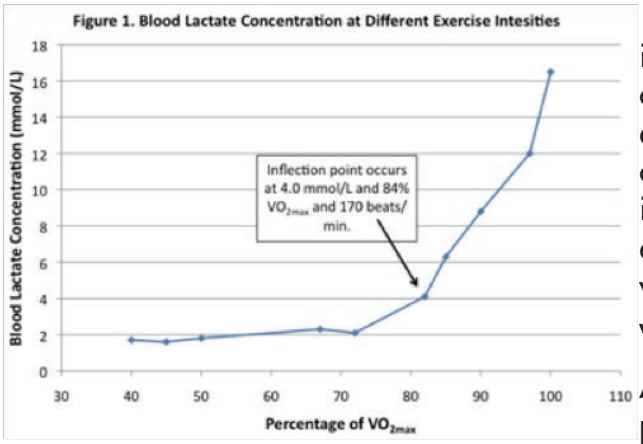
So why does this happen during high intensity exercise? In order to answer this question, we need a basic description of why lactate is formed during metabolism.

Lactate has gotten a bad rap for the past several decades. Many refer to it as a metabolic waste product (not really) and blame it for the muscle soreness that can plague us several days after a hard workout (not so, actually inflammation).

Let's start by describing how we convert our carbs to energy. Our cells produce a molecule called ATP. The breakdown of ATP provides the energy needed to contract exercising muscles. We make ATP in a three-step process: Glycolysis, Krebs Cycle, and Electron Transport Chain (ETC). The products of Glycolysis feed into Krebs, which subsequently feeds its products into ETC. When one glucose molecule is broken down completely, a small amount of ATP is made during both Glycolysis and Krebs, but most of the ATP is generated at the end of ETC. The drawback is that ETC is much slower than Glycolysis. ETC is very effective at making enough ATP to sustain low to moderate intensity exercise.

When we crank up the intensity, we need more ATP than ETC can produce at its maximal output. The only way to make up the difference is to rev up Glycolysis. In doing so, our cells make lots of lactate that spills into the blood. When the concentration of lactate in the blood starts to climb, our brain senses this and we start to feel nauseous. Within a few minutes we are forced to drop the intensity, ATP demand reduces, Glycolysis is slowed, lactate is cleared from the blood, and all is back to normal.

The advantage of having a high LT is that you can work at a higher intensity for a longer time before lactate levels become intolerable. Lactate threshold is measured by having someone either run on a treadmill or ride a stationary bike while increasing the intensity of exercise every three to five minutes until exhaustion. During this test, a blood sample is taken from either the fingertip or the ear lobe at the end of each stage and run through a lactate analyzer.



A plot of lactate concentration vs. percentage of V02 max is produced and the lactate threshold is identified as the point of inflection, as demonstrated in the graph. Highly trained endurance athletes will reach their LT at around 80 to 85 percent of their V02 max. It is important to note that a true LT test involves taking a series of blood samples. If you only have your exhaled air analyzed, than this is a ventilatory threshold test, which is related, but certainly different from an LT test.

Why should people get tested?

Although V02 max is a clear measure of physical fitness, it provides little useful information for training by itself. The LT, however, provides a definitive anchor point for training. If the test is done correctly, you will be given a heart rate range at which your LT occurred. You can use these values to train at, or just above your LT. There is no guesswork involved, and that is a great benefit to you as an athlete.

Why do I suggest that some athletes not get tested?

Both of these measures are variable and obviously they will improve with training. Being tested just once might be a waste of money because it is only a single snapshot in time. If you use your LT value from pre-season as your benchmark for training the entire season, you won't get much faster. Also, LT varies with environmental conditions and stress. Alterations in hydration, nutrition, hormones, sleep, and the time of day that testing occurs can all dramatically affect the final results.

If you choose to be tested, make sure to be assessed at least three times during the course of the season, i.e. beginning, middle, and end, and under the same conditions. Most reputable testing facilities will sell package deals that include a series of tests at an affordable price. Finally, make sure that the person testing you understands what these tests mean. If they can't describe how to interpret the results any better than what you have read, find another place to spend your hard-earned money.

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