Why are we Measuring Lactate?

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Last month we examined the myth that lactate causes fatigue. Despite how common the misconception may be among coaches and athletes, we have known for years that lactate is not the root of all evil but an important fuel. If lactate does not cause nor is directly representative of fatigue, why are we measuring lactate and what is lactate threshold?

Blood Lactate Values

Within the muscle cell, the initial breakdown of glucose results in the production of lactate. Lactate is then either shuttled into the muscle's mitochondria (aerobic "furnaces") to be used as fuel, or released into the blood to be used as fuel in other muscle, the heart and the brain, and as an essential component to making glucose in the liver.

The measurable value of lactate represents the combined effects of its rates of appearance and removal from the blood. Picture a bathtub with the faucet on and the drain open. The difference between the rates of appearance (water entering from the faucet) and removal (exiting the drain) determine the volume of water in the tub.

The amount of lactate released by muscle into the blood (appearance) is dependent on both the production of lactate by glycolysis (anaerobic glucose metabolism) in the muscle, and the use of lactate as fuel within the muscle. As exercise workloads increase, there is an increase in anaerobic metabolism, resulting in increased lactate production. However, the use of lactate as a fuel within the muscle can reduce the amount of lactate that is released into the blood.

Disappearance rates (removal) from the blood are determined by lactate's use as fuel in other muscle, the heart, the brain or to make glucose in the liver.

Lactate is Fuel

The ability to use lactate as fuel can be enhanced with training. The protein transporters that shuttle lactate into muscle mitochondria can be increased as can the density of mitochondria. If after a period of training you see comparatively lower blood lactate values for the same workload, it is possible that lactate metabolism has improved, and that there is a greater contribution of aerobic metabolism at that workload. Therefore, rather than a direct mechanism of reduced fatigue, an improvement in lactate metabolism by working muscle (reflected by a reduced appearance in the blood), reduces fatigue indirectly by sparing glycogen. Keep in mind that reduced blood lactate does not suggest "improved lactic acid buffering," despite what many nutritional supplement manufacturers claim.

Lactate Threshold

What then is lactate threshold? There are numerous definitions of lactate threshold and little agreement in the field of exercise science as to where this "threshold" occurs. Some use a fixed lactate value such as 4mM. But given the ability to alter lactate appearance with training, and that lactate values vary significantly from person to person, a fixed

value is not a valid measure of performance. Other methods have been used, such as graphing lactate values from increasing exercise intensity and identifying a “break point” in the curve.

While there have been correlations in the past between identified lactate thresholds and time trial performance, there is now sufficient evidence that lactate values are not necessarily representative of performance, often underestimating time trial intensity.

The concept of lactate threshold was developed from the false notion that an accumulation of lactate caused fatigue, which is clearly a gross oversimplification. Measuring lactate provides us with insight into metabolic processes occurring in the body, and the effect of training on those processes, but it may not give us the best information to determine training intensities. Next month we will examine alternatives to lactate measurement in determining training and performance levels.

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