

## **Lactate or Performance Threshold?**

By Dario Fredrick

*[Velo News, Vol. 33/No. 13, August 16, 2004]*

In the previous installments on lactate and exercise (“Acid Trip” and “Why Are We Measuring Lactate?”), we saw that lactate neither causes fatigue nor is its concentration in the blood directly representative of fatigue. Blood lactate concentration reflects a balance between its production and its use as fuel, but its measurement — and the concept of “lactate threshold” — may not give us the best information to determine training intensities. This month, we look at an alternative to lactate measurement to establish training and performance levels.

### **Performance-based Measurement**

If lactate itself does not cause fatigue and is not a limiter to cycling performance, do we need to measure lactate to determine a performance threshold? Regardless of blood lactate concentrations, a maximal sustainable workload exists for every cyclist. This performance threshold or “maximal steady state” (MSS) can be defined as the maximal sustainable workload (and corresponding average heart rate) for approximately 30 minutes. This type of performance-based testing directly measures what the athlete is interested in: performance. It does not measure a surrogate measurement, lactate concentration, which is subject to other variables and not solely the cause of changed performance.

### **Field or Indoor Test?**

Accurate determination of MSS can be accomplished in two ways; either by performing a time trial or a ramp test. To determine MSS by riding a TT, simply record average power (if available) and heart rate for a 20k effort. A good warm up is important. Keep in mind that a field test of this length can be affected by many external variables such as wind, temperature, humidity or varying terrain. A better controlled field test would be to perform an uphill TT of 20-30 minutes in length on a moderate gradient. Average power will likely be approximately 10W higher than for a flat TT. Performing the TT on an indoor ergometer/stationary trainer can reduce variability by eliminating many of the external variables mentioned. This option requires an ergometer that allows use of your own bicycle and provides either power measurement or significant resistance to mimic road conditions.

### **Ramp it up**

A ramp test is performed on a stationary ergometer, where the cyclist begins riding at a relatively low workload, gradually increasing power in stages throughout the test until fatigue. The most important element of a ramp test is its design since power increments and stage durations can both directly affect the results. If power is increased too rapidly, heart rate has insufficient time to respond, while excessive power increments can skip over one’s MSS, either under or over estimating performance. A valid and reliable test is one which accurately and consistently predicts 20k performance (average power and HR). The advantage of a valid ramp test over a TT effort is reduced post-test recovery time and a greater range of comparative power to HR-based information at various intensities. Comparing one TT to the next may tell you how your MSS power has

changed, but it will not necessarily provide information about training induced changes at other levels of intensity.

It is unnecessary to measure lactate to accurately determine training intensities or predict cyclists' performance. We can minimize reliance on equipment-intensive, invasive methods such as blood sampling and lactate measurement while still maintaining accuracy and simplicity in performance testing. A cyclist's performance threshold can be most simply thought of as the maximal sustainable workload (power) and corresponding heart rate for a given period, as these data are directly applicable to the training tools we have available today, the power meter and HR monitor.

*Dario Fredrick, M.A. is an exercise scientist, head coach and founder of Whole Athlete™. He can be reached via [www.wholeathlete.com](http://www.wholeathlete.com).*