PERFORMANCE POINT
PHYSIOLOGY
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Incremental Blood Lactate (BLa) Testing

In sport physiology, it is common to measure an athlete's Blood Lactate (BLa) response to exercise. Small, hand-held analyzers measuring capillary blood drawn from the fingertip or earlobe are relatively affordable and easy to use, making their use in physiological testing widespread. Data from incremental exercise tests can be used to evaluate the effects of training, predict performance, and guide exercise prescription (see Figure 1). However, while lactate testing can be an easy and valuable tool, considerations must be made when interpreting results.

Terminology and Definitions

Lactate is a byproduct of anaerobic metabolism. Plotting BLa data against workload from an incremental test (increase in exercise intensity every few minutes) will produce a plotted curve indicating a transition from mostly aerobic to a sustainable mix of aerobic-anaerobic metabolism, and a second transition to mostly anaerobic metabolism. There are multiple ways to identify transitions in metabolism from a lactate curve so threshold definitions should be known before applying the results to a training program.

Fixed Thresholds

- 2.0 & 4.0 mM
- easy to identify
- influenced by factors other than fitness (see chart)

Individualized Thresholds

- break in linearity in BLa curve
- increase in BLa > 1 mM
- identification can be subjective/difficult

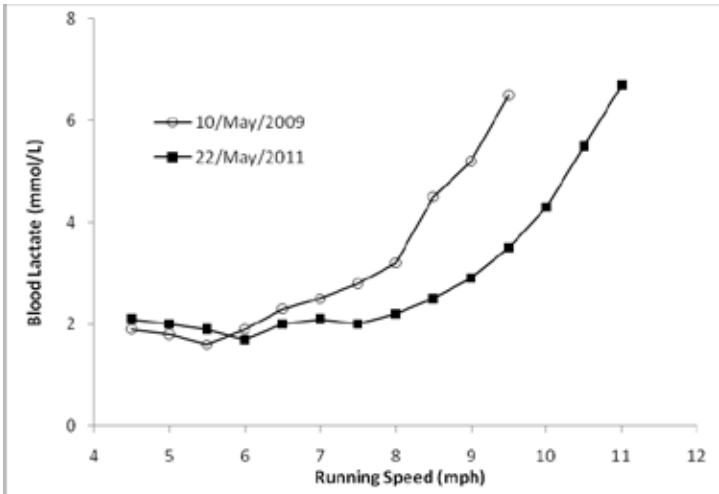

Figure 1. Blood lactate response monitored over 2 years - rightward and downward shift of curve in 2011 suggests improved aerobic fitness.

Test Protocols

BLa is measured with the assumption it reflects what is happening within exercising muscle. While this is mostly true, there is a time lag before lactate produced in the muscle appears in the blood, especially at higher intensities. Workloads less than 5-7 minutes tend to underestimate muscle lactate and overpredict threshold intensities. While repeated testing with shorter workload durations (e.g., 2 minutes) can still be useful at tracking training effects over time, caution must be used when interpreting test results for prescriptive purposes. Results can also be influenced by the amount of rest time taken to sample blood between stages (should be minimized) and type of ergometer used (should be as sport-specific as possible).

Non-Fitness Factors affecting BLa

BLa response to exercise intensity is reproducible when testing conditions are consistent. This is why standardizing pre-test preparation and collecting data the same way every time is vital for ensuring quality results, especially if fixed thresholds are used (refer to September 2006 *Performance Point* entitled, "Pre-test Preparation"). The following are some of the factors that can influence BLa levels:

- temperature
- altitude
- glycogen depletion
- bicarbonate ingestion
- caffeine
- anemia
- alcohol consumption
- hydration status

Finally, while hand-held analyzers are very simple and easy to use, your data will only be as good as your technique. Calibrate your analyzer, understand its limitations in accuracy and precision (i.e., realize that not all change is meaningful), and ensure the sampling site is clean of contaminating factors like sweat and alcohol that can affect the measured value.

TERMINOLOGY

Background, Terminology and Definitions

Energy is produced both aerobically and anaerobically, with the extent of contribution from each pathway depending largely upon the intensity of exercise.

Aerobic	**Anaerobic**
- slower, oxygen-dependent	- faster, oxygen-independent
- more sustainable	- short-lived, fatigue-inducing

With increasing exercise intensity working muscles rely on the faster Anaerobic pathway to a greater extent in order to meet the energy demands of work. But because Anaerobic metabolism is less sustainable, an endurance athlete trains the body to use Aerobic metabolism at as high an intensity as possible. While its role in metabolism is complex, lactate is used as a marker of energy system predominance because it is produced by the Anaerobic pathway (it is also used as a fuel and removed by Aerobic metabolism).