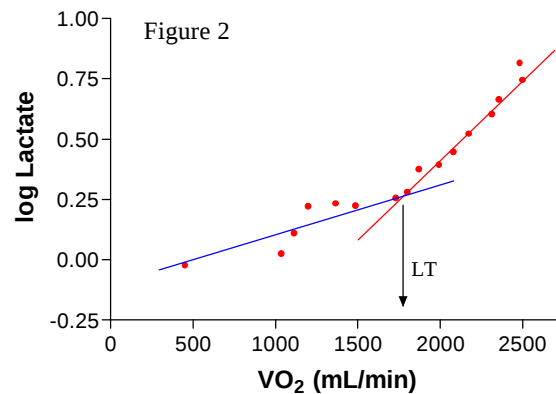
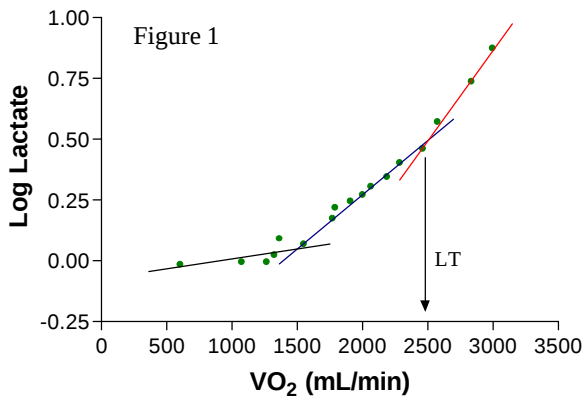


Determination Of Lactate Threshold Using Three Different VO₂max Protocols

Robert A. Robergs, Farzaneh Ghiasvand, Steve Burns, Todd A. Astorino, and Derek W. Marks. Center for Exercise and Applied Human Physiology, The University of New Mexico, Albuquerque NM 87131-1258.

Introduction: There is limited research that has evaluated the effect of different exercise protocols on the accuracy of the detection of the lactate threshold (LT). Consequently, the LT has been detected in research that has used intermittent, ramp, step, and even multiple steady state bouts spread over multiple days (1-3). Uncertainty also exists over the accuracy and change in the LT during acute hypoxia (4). **Purpose:** The purpose of this study was to determine the LT in response to two different VO₂max protocols, as well as during acute hypoxia ($F_{I}O_2=0.15$, $P_B = 635$ Torr). It was hypothesized that a 75W step protocol would result in a lower relative LT in comparison to a ramp protocol, and hypoxia would result in the lowest relative LT. **Methods:** Eight subjects (7 men, 1 woman, mean age, height, weight and VO₂max = 27.75 ± 5.07 yr, 185.50 ± 1.64 cm, 76.00 ± 10.60 kg, and 3468.75 ± 422.35 mL/min, respectively) performed three VO₂max tests on a cycle ergometer using 3 different protocols (25 W/min ramp-R, 75 W/3 min step- S, and 25 W/min ramp with acute hypoxia- H) conditions. Trials were separated by at least 2 days, w were randomly assigned, and subjects had no knowledge of the specific protocol to be completed on a particular day. Blood samples for determination of blood lactate concentration were obtained from the antecubital vein every minute during the first 5 min of the test, every 30 s from minute 5-10, and every minute thereafter until test termination. Enzymatic spectrophotometric assay was used for determination of blood lactate concentration. The LT was determined by plotting log lactate vs. VO₂ (5). Three experienced researchers agreed upon the fitting of a linear function to blood lactate concentration above and below the breakpoint in blood lactate. **Statistics:** A repeated measures ANOVA was used to examine differences in the LT (mL/min and %VO₂max) from the different protocols. **Results:** Mean data $\pm$ SD are presented in Table 1. Raw data from one subject is presented in Figures 1 (R) and 2 (H). The absolute and relative LT were not significantly different among the three protocols.



Protocol	LT (mL/min)	LT (%VO ₂ max)
R	2245 $\pm$ 455	64% $\pm$ 0.1
S	2214 $\pm$ 508	65% $\pm$ 0.1
H	1996 $\pm$ 495	70% $\pm$ 0.1

* P<0.05 from H

Discussion: The LT is similar when detected from ramp or longer duration step protocols. However, it should be noted that during hypoxia, a trend was demonstrated for a higher relative LT. For N = 8 and a mean difference of 620 ml/min, power = 0.8 (unpaired t-test). Further research is warranted to better clarify the change in lactate accumulation with acute hypoxia, and guidelines should be established for procedures to most accurately detect the LT.

References: 1) Ribeiro JP et al. *Braz J Med Biol Res* 19(1):109-117, 1986. 2) Chwalbinska-Moneta J et al. *J Appl Physiol* 66(6):2710-2716, 1989. 3) Davis JE et al. *J Appl Physiol* 41(4):544-550, 1976. 4) Koistinen P et al. *Int J Sports Med* 26:78-81, 1995. 5) Beaver W. L. et al. *J. Appl Physiol* 59: 1936-1940, 1985.