

## **The Validity of a Novel Staged Exercise Test for Measuring Lactate Metabolism and Performance in Cyclists**

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### **ABSTRACT**

Several types of lactate threshold ( $T_{lac}$ ) protocols have been developed over the years to maximize accuracy and reliability while maintaining ease of measurement and application to training and performance. **PURPOSE:** The purpose of this study was to determine the validity of a novel staged maximal lactate steady state exercise test (sMLSS) in predicting the MLSS using the Lactate Plus® (Nova Biomedical, Waltham, MA) analyzer. **METHODS:** Blood lactate concentration (BLC) was measured in duplicate for all tests. Seven trained cyclists (20 miles per week) performed a  $VO_{2max}$  test starting at 100W and increasing by 30W every three minutes until volitional fatigue. Lactate threshold was defined as the previous workload to a  $2 \text{ mmol}\cdot\text{L}^{-1}$  increase in BLC. Next, the sMLSS test was performed starting at the  $T_{lac}$  workload, determined previously, then increasing 10W every 15 minutes for a total of three stages. BLC was measured every 3 minutes. MLSS was predicted by visual inspection and defined as  $< 1.0 \text{ mmol}\cdot\text{L}^{-1}$  increase in the final 6 minutes of the stage. Finally, cyclists then performed two to six MLSS exercise tests, adjusting by 5W depending on lactate response, to validate the sMLSS. MLSS was determined at the maximal workload with  $< 1 \text{ mmol}\cdot\text{L}^{-1}$  increase in BLC in the final 20 minutes. Dependent T-test and Pearson correlation coefficient was used to determine reliability between lactate trials. Bland-Altman plots, One-way ANOVA, and regression analyses were used to analyze differences between the types of exercise tests. **RESULTS:** There were no significant differences for duplicate BLC trials for all tests ( $p= 0.21$ ;  $r=0.982$ ). The sMLSS was significantly correlated with the MLSS workload and percentage of max workload ( $r = 0.997$ ;  $p=0.001$ ,  $r = 0.978$ ,  $p=0.01$ ), respectively. There was no bias noted between sMLSS and MLSS protocols for predicting lactate accumulation. **CONCLUSION:** This novel protocol was determined to be a valid and efficient means determining lactate performance in recreationally trained cyclists. The sMLSS was effective at reducing testing time from 12 days to 3 days.

