28th ECSS Anniversary Congress, Paris/France, 4-7 July 2023

Estimation of lactate thresholds for muscle oxygenation in healthy, non-training individuals and high-trained speed skaters

Rebis, K.1, Klusiewicz, A.1, Dlugolecka, B.2, Rozanski, P.2, Kowieski, K.2

1Institute of Sport - National Research Institute in Warsaw, 2Jozef Pilsudski University of Physical Education in Warsaw, Faculty of Physical Education and Health, Biala Podlaska, Poland

INTRODUCTION:

In the last few years, the introduction of mobile oximeters to measure the oxygenation level of myoglobin in the muscle cytoplasm and hemoglobin in the blood vessels of the muscle microcirculation (muscle oxygen saturation, SmO2) has been particularly relevant to training practice [1]. SmO2 measurements provide valuable information about oxygen transport and utilization in muscles [2]. The main objective of the study was to determine lactated thresholds (aerobic and anaerobic) for near-infrared spectroscopy (NIRS) measurements in healthy, non-training individuals and highly trained athletes. It was important to answer the question to what extent muscle oxygenation at the anaerobic threshold level and after maximal exercise is dependent on the level of physical capacity.

METHODS:

The study involved 29 untrained students (Female students n=13, 23.1 \pm 1.0yrs, body mass index (BMI) 22.3 \pm 3.7, Male students n=16, 23.8 \pm 1.1yrs, BMI 25.6 \pm 3.4) and 27 leading Polish speed skaters, members of the National Team of juniors and seniors, men and women (Female speed skaters n=13, 18.5 \pm 2.0yrs, BMI 21.3 \pm 1.0, Male speed skaters n=14, 17.9 \pm 2.2yrs, BMI 22.3 \pm 1.2). A graded-intensity exercise test on a bicycle ergometer was performed. The test consisted of 3-minute stages with graded load performed continuously. Based on blood lactate concentrations, the aerobic and 3 anaerobic thresholds (AT4 mmol, Dmax modf. and LT) were determined. During GXT test, a NIRS device (Moxy monitors; Fortiori Design LLC, Hutchinson, MN, USA) was placed on the vastus lateralis (VL) muscle that is active during cycling. The normal distribution of variables was examined using the Shapiro-Wilk test. The significance of differences was assessed using the Student test and Mann-Whitney U-test for variables with a distribution different from the normal distribution. The power of relationships between the variables was determined based on Pearson's correlation coefficients (r). The coefficient intervals for correlations were also presented. The level of statistical significance was set at p 0.05. RESULTS:

Power values determined for all thresholds were significantly higher in female and male speed skaters compared to male and female college students. Muscle oxygenation (SmO2) at anaerobic thresholds was significantly lower in female speed skaters than in female students. In male speed skaters, the differences discussed were not statistically significant. Both female and male skaters additionally showed greater decreases in SmO2 after the maximal test compared to students. The dependence of SmO2 on exercise load for all groups combined was polynomial. Although the time to achieve 50% SmO2 during recovery did not differentiate between the male and female groups studied, a higher rate of muscle reoxygenation (% / s) was found in female speed skaters compared to female students. This was also confirmed by a significant correlation in women between the rate of muscle reoxygenation and Peak Power. In speed skaters, although the mentioned rate of muscle reoxygenation was not significantly higher compared to students it showed a significant positive correlation with VO2max. CONCLUSION:

High diagnostic value characterized the assessment of differences in muscle oxygenation relative to resting value (SmO2) both at anaerobic threshold (in females) and after maximal exercise (in females and males), with greater decreases in SmO2 observed in subjects with higher physical capacity. There was also a significant positive correlation between the rate of muscle reoxygenation after the maximal test and the level of physical capacity.

1. Perrey & Ferrari (2018) 2. McCully & Hamaoka (2000)

Topic: Physiology

Presentation E-poster

European Database of Sport Science (EDSS)

Supported by SporTools GmbH

