

Reasoning of dissertation topic and competency of potential supervisor for admission onto joint LSU and TU doctoral studies in 2023

Area of research (title and code)	Natural Sciences
Field of research (title and code)	Life sciences (biology)
Topic of research	Adaptations of aerobic capacity (physiology of sports and exercise)
Institution	Lithuanian Sports University

Potential supervisor

Pedagogical and scientific degree	Name, surname	Academic position
Prof. dr.	Arvydas Stasiulis	Professor, Head of Department

Short reasoning of proposed dissertation topic

Title
Blood volume, hemoglobin mass and their effect on main components of aerobic capacity in endurance, power and spinal cord-injured athletes.
<p>Short research description (including aims and objectives) (maximum 1500 characters).</p> <p>The aim of the project is to study relationships between total blood volume, hemoglobin mass and components of aerobic capacity (aerobic power, ventilatory thresholds, efficiency and kinetics) in endurance, power spinal cord-injured athletes.</p> <p>The main objectives would be:</p> <ol style="list-style-type: none"> 1. To compare blood variables between endurance, power and spinal cord-injured athletes. 2. To evaluate the relationships among blood variables, cardiac parameters, muscle oxygenation and components of aerobic capacity (aerobic power, ventilatory thresholds, efficiency and kinetics) in endurance, power and spinal cord-injured athletes. 3. To assess the effect of short-term CO administration on aerobic capacity.
<p>Relevance of the problem, its novelty at national and international level (maximum 1500 characters).</p> <p>Total hemoglobin mass (tHb) blood volume (BV) are strongly related to maximal oxygen uptake and performance in endurance sports. Cross-sectional studies on adults show that highly trained endurance athletes have up to 40% higher levels of tHb and BV than non–endurance-trained athletes and untrained individuals (Steiner, Wehrin, 2011). Anaerobic disciplines are characterized by low values similar to those of untrained subjects (Heinicke et al., 2001; Schmidt and Prommer, 2008; Zelenkova et al., 2019). Whether the higher levels are due to endurance training or genetic predisposition is not entirely clear, and the mechanisms behind the higher levels of tHb are not yet fully understood (Convertino, 2007; Montero, Lundby, 2018).</p> <p>Fat-free mass (FFM) had the best correlation with tHb in young, active women and men as compared to other anthropometric variables (body weight, body surface area) (Falz et al., 2019). It has been recently shown that increases in tHb during puberty are mainly associated with increased fat-free mass (FFM) and independent of sex or volume of endurance training (Landgraf and Hallen, 2020). There are less data about tHb and BV in power athletes. Some of them (eg. bodybuilders) have highly developed FFM. We can expect very high amounts of tHb and BV in these athletes but the functional role of that remains unclear.</p> <p>BV and tHb are decreased in spinal cord-injured individuals, which may be related to their inactive lifestyle, because total BV increased with increased physical activity in these subjects (Houtman et al., 2000). It has been shown that in spinal cord injured athletes, tHb adapts moderately to chronic endurance exercise, although tHb in spinal cord injured athletes does not reach the level of able-bodied-trained persons (Schumacher et al., 2009). It is suggested that BV and volume loading has an effect on left ventricular diastolic function in individuals with spinal cord injury (Sharif et al., 2017). There is need of more research regarding the BV and tHb in spinal cord-injured athletes in order to understand their effect on physical abilities in such subjects.</p> <p>Furthermore quite few is known about the impact of tHb and BV on other (except for VO₂max) components of aerobic capacity (thresholds, efficiency, response kinetics) in different sports.</p>

In this doctoral project we are planning to collect more data about blood variables in power athletes and athletes with spinal cord injury using CO rebreathing technique, to compare results with those of endurance athletes and to get more insight about the role of blood variables for main components of aerobic capacity and its physiological determinants in different sports.

Research methods and possibilities for conducting these studies (maximum 1500 characters).

1. Measuring total blood volume, hemoglobin mass and other related variables using method of CO rebreathing technique (Detalo Health Performance devise).
2. Testing aerobic capacity on during constant and increasing exercise tests by pulmonary gas exchange analysis (portable Cortex gas analyser).
3. Measuring muscles oxygenation during exercise using near-infrared spectroscopy method (portable Moxy analyser).
4. Measuring cardiac parameters (stroke volume, heart rate, cardiac output) at rest and during exercise using impedance method (portable Physioflow system).

All these methods and equipment are available at the university. In addition, LSU has agreements with several sports federations including those for disabled athletes, so they will serve as participants for seeking of many goals of this doctoral project.

Please indicate the links between the proposed topic for the doctoral thesis and biomechanics / physical therapy / sports study programs.

The topic and studies proposed are closely related to sport study program.

Is the proposed topic for the doctoral thesis related to currently funded research projects? Please indicate the links between the proposed topic for the doctoral thesis and funded research projects

Is the proposed topic for the doctoral thesis related to joint research with a foreign institution? Please indicate the links between the proposed topic for the doctoral thesis and research with a foreign institution

We have tight cooperation with prof. Carsten Lundby (University of Lillehammer, Norway) who is one of the inventors of our new automated Detalo Health Performance system which allows us to measure blood volume and Hb mass applying CO rebreathing method.

Currently I am supervisor of 3 doctoral students.

Supervisor

(signature)

(Name, surname)

Date

2023-05-02