Reasoning of dissertation topic and competency of potential supervisor for admission onto joint LSU and TU doctoral studies in 2022

Area of research (title and code)	
Field of research (title and code)	
Topic of research	
Institution	Lithuanian Sports University (LSU)

Potential supervisor

Pedagogical and scientific degree	**Name, surname**	**Academic position**
Dr.	Sigitas Kamandulis	Head researcher, professor

Short reasoning of proposed dissertation topic

Title

MONITORING AND MANAGING FATIGUE BY TENSIOMYOGRAPHY-DERIVED MARKERS IN HIGHLY TRAINED ATHLETES

Short research description (including aims and objectives)
Relevance of the problem, its novelty at national and international level

In any sport, athletes are exposed to periods of high physical loads, during which it is particularly important to manage stress and balance recovery in order to avoid performance decline, overtraining and injuries. Magnitude of stress may be dependent on several different aspects such as the athlete's physical fitness, skills, and personality, as well as training and competition environment. Fatigue is observed to not only develop acutely but also build in a cumulative manner inducing non-functional overreaching and the overtraining syndrome (Russell et al., 2019, Grandou et al., 2020). A range of methods of fatigue monitoring was suggested including self-assessment of training loads, self-scored questionnaires, and blood markers for indicating under-recovery (Robson-Ansley et al., 2009). However, these methods are subjective or invasive, which makes their use not very comfortable in the elite athletic environment. We are searching for easy-to-perform non-invasive monitoring technique for fatigue monitoring and therefore will focus on tensiomyography (TMG) which measures radial deformation of skeletal muscle in response to an external electrical stimulus (Loturco et al., 2016, Pereira et al., 2019). The TMG have been shown to be sensitive to detect muscle fatigue (Tous-Fajardo et al., 2010, Garcia-Manso et al., 2012) and able to discriminate athletes with distinct physical qualities and training background (Loturco et al., 2015) but it remains seldom incorporated in athletes' monitoring routine. The main aim of this study was therefore to analyze the associations between markers of TMG and training load volume as well as intensities in elite athletes within their normal training.

The study will include measurements of sleep quality, mood, heart rate, heart rate variability, samples of blood and saliva, as well as nutrition monitoring to better understand their relationship with performance. Sailors, swimmers and long distance runners will participate as subjects. Despite a substantial literature on the influence of fatigue on human performance, the interest in monitoring athletes' readiness to perform through non-invasive methods remains high priority for translating science knowledge into practice. Handling individual training-induced responses is particularly relevant for top competitors.

References:

Loturco I, Pereira LA, Kobal R, Kitamura K, Ramirez-Campillo R, Zanetti V, Abad CC, Nakamura FY. Muscle Contraction Velocity: A Suitable Approach to Analyze the Functional Adaptations in Elite Soccer Players. J Sports Sci Med. 2016;15:483-91.

Loturco I, Gil S, Laurino CF, Roschel H, Kobal R, Cal Abad CC, Nakamura FY. Differences in muscle mechanical properties between elite power and endurance athletes: a comparative study. J Strength Cond Res. 2015;29:1723-8.

Simunic B, Degens H, Rittweger J, Narici M, Mekjavic IB, Pisot R. Noninvasive estimation of myosin heavy chain composition in human skeletal muscle. Med Sci Sports Exerc. 2011;43:1619-25.

Grandou C., · Wallace L. · Impellizzeri FM · Allen NG · Aaron J. Coutts AJ Overtraining in Resistance Exercise: An Exploratory Systematic Review and Methodological Appraisal of the Literature. Sports Med, 2020 Apr;50(4):815-828.

Pereira LA, Ramirez-Campillo R, Martín-Rodríguez S, Kobal R, Abad CCC, Arruda AFS, Guerriero A, Loturco I. Is Tensiomyography-Derived Velocity of Contraction a Sensitive Marker to Detect Acute Performance Changes in Elite Team-Sport Athletes? Int J Sports Physiol Perform. 2019 Nov 18:1-7. doi: 10.1123/ijspp.2018-0959.

Robson-Ansley P.J., Gleeson M & Ansley L. (2009) Fatigue management in the preparation of Olympic athletes, Journal of Sports Sciences, 27:13, 1409-1420.

Russell S, Jenkins D, Rynne S, Halson SL, Kelly V. What is mental fatigue in elite sport? Perceptions from athletes and staff. Eur J Sport Sci. 2019 Nov;19(10):1367-1376. doi: 10.1080/17461391.2019.1618397. Epub 2019 May 28.

Tous-Fajardo J, Moras G, Rodriguez-Jimenez S, Usach R, Doutres DM, Maffiuletti NA. Inter-rater reliability of muscle contractile property measurements using noninvasive tensiomyography. J Electromyogr Kinesiol. 2010;20:761-6.

Garcia-Manso JM, Rodriguez-Matoso D, Sarmiento S, de Saa Y, Vaamonde D, Rodriguez-Ruiz D, Da Silva-Grigoletto ME. Effect of high-load and high-volume resistance exercise on the tensiomyographic twitch response of biceps brachii. J Electromyogr Kinesiol. 2012;22:612-9.

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

This study will include tests for the evaluation of velocity of contraction assessed via tensiomyography, assessment of force parameters by Biodex dynamometer, VO2max measurements by oxygen analyses, functional recovery (heart rate, heart rate variability, samples of blood and saliva), neuromuscular properties (EMG, rate of force development) and biomechanical analyses of performance technique. LSU has the necessary equipment. Part of experiments will be held at Gdansk because they have large cohort of sailors to assist as subjects.

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

This study will provide knowledge about the adaptation of athletes to different interventions, therefore the outcomes can be shared with students involved in Sports Coaching 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

Proposed topic is not related to any currently funded research project.

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

Dr. Tomasz Chamera is head researcher at Gdansk University of Physical Education and Sport (tel. +48 58 5547195, https://www.awf.gda.pl) and will be directly involved in this project. His participation is necessary since part of studies are planned to perform with sailors at the Gdansk University of Physical Education and Sport. He is also vice-president of World Sailing federation, which allows us to believe his assistance in recruiting sailors not only in Poland but also in other countries.

Currently I am supervisor of 3 doctoral students.

Supervisor  Sigitas Kamandulis

(signature) (Name, surname)

Date 2022 05 09