

Reasoning of dissertation topic and competency of potential supervisor for admission into LSU biology doctoral studies with a participation of Tartu university 2024

Area of research (title and code)	Natural Sciences
Field of research (title and code)	Biology (N 010)
Topic of research	IMPLICATIONS FOR HAMSTRING INJURY PREVENTION: HIGH-VELOCITY AND COMBINED HIGH-VELOCITY AND ECCENTRIC EXERCISE STRATEGIES IN YOUNG ATHLETES
Institution	Lithuanian sports university

Potential supervisor

Pedagogical and scientific degree	Name, surname	Academic position
Assoc Prof. PhD.	Mantas Mickevičius	Senior researcher

Short reasoning of proposed dissertation topic

Title
IMPLICATIONS FOR HAMSTRING INJURY PREVENTION: HIGH-VELOCITY AND COMBINED HIGH-VELOCITY AND ECCENTRIC EXERCISE STRATEGIES IN YOUNG ATHLETES
Short research description (including aims and objectives) (maximum 1500 characters).
<p>The project aim is to investigate the interactions between high velocity elastic-band and NHE as a strategy to reduce hamstring injury risk in young athletes.</p> <p>Objectives:</p> <ol style="list-style-type: none"> 1. To investigate the acute effects of high velocity elastic-band exercises on knee flexors and extensors muscle properties and performance in relation to the load volume and magnitude, and participants' age and sex. 2. To examine the impact of different lengths of high velocity elastic-band and combined high velocity elastic-band with Nordic hamstring training programs on knee flexors and extensors muscle properties and performance in young athletes. 3. To determine the effects of high velocity elastic-band and combined high velocity elastic-band with Nordic hamstring training program on reducing hamstring injuries in young athletes. <p>We hypothesize that implementing a high-velocity elastic band training strategy will induce neural and peripheral adaptations (Kamandulis et al., 2020), beneficial for young athletes who demands rapid changes in direction, jumps, and sprints. Through the systematic manipulation of exercise volume and intensity, the incorporation of both velocity and eccentric strength-based exercises, and a comprehensive investigation conducted in real athletic settings, we expect to enhance our understanding of the relationships between different type exercises and they potential for injury prevention.</p>

During the study we will measure in detail the skeletal muscle function (torque, range of motion, movement frequency), morphological (thickness and fibers pennation angle) and mechanical (stiffness) properties, which all are reflecting neuromuscular adaptation in general. Additionally, muscle electromyography will be employed to evaluate the possible modifications in muscle recruitment patterns indicative of neural adaptation. Participants demographics, including age, stature, body mass, leg dominance, sport and medical history, playing position, level of competition, number of training sessions attended, and matches played in the current season, will be also recorded. These data will be associated with hamstring injury occurrences. We will enroll young athletes participating in team sports such as football, basketball, volleyball, and handball as they are known to have an increased susceptibility to hamstring injuries (Ekstrand et al., 2016; Maniar et al.2023). The focus will be on post-pubertal athletes to mitigate maturity-related issues.

Relevance of the problem, its novelty at national and international level (maximum 1500 characters).

Hamstring injuries are among the most common non-contact injuries in sports (Ekstrand et al., 2022). Research findings strongly associate hamstring injuries with high-intensity and short-term actions, especially accelerations and decelerations during high-speed running (Askling et al., 2012). Exercise is a key strategy to reduce the hamstring injury incidence with primary focus on improving hamstring strength, body asymmetry, proprioception and mobility (Shalaj et al., 2020; Rudisill et al., 2023). However, current prevention strategies often prioritize slow-type exercises, neglecting the fact that most injuries occur during high-speed activities. Training to increase strength at high movement velocities has gained little (although growing) attention in the current literature.

Recently, we have proposed a new approach to injury prevention by applying exercise at high-velocity with low-resistance (Janusevicius et al., 2017; Kamandulis et al., 2020). This strategy has been shown to induce alterations in hamstring muscle recruitment during flexion–extension cycles and muscle strength at high movement speed (Kamandulis et al., 2020). It was linked with a reduction of roughly 30% in the hamstring injury risk among professional and semi-professional football players, implying that this exercise type may have some potential protective value in the football settings (Kamandulis et al., 2023). However, optimal volume and intensity for this methodology to influence athletes' muscle properties and performances, and its potential dependence on athletes' demographic characteristics such as age and sex, have not yet been investigated. Therefore, further studies in elucidating this issue are warranted. It should be considered that slow-type exercises such as NHE has been also shown very effective in reducing hamstring injury rates in football players (Al Attar et al., 2017), probably due to the eccentric nature of exercise with unique potential to increase both the eccentric strength and fascicle length of the muscles. Further research to determine the optimal high-velocity hamstring muscle training volume and frequency, and to establish the effects in different age and gender populations, separately and in combination with other hamstring strengthening methods such NHE training, may provide valuable insights for the effectiveness of this method as hamstring injury prevention strategy.