

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

<b>Area of research (title and code)</b>	Natural sciences, Biology (N 010)
<b>Field of research (title and code)</b>	Exercise physiology
<b>Topic of research</b>	Physical activity to prevent mental fatigue during the mentally demanding working day in pre-retirement years
<b>Institution</b>	Lithuanian Sports University, Institute of Sports Science & Innovations, Kaunas, Lithuania

### Potential supervisor

<b>Pedagogical and scientific degree</b>	<b>Name, surname</b>	<b>Academic position</b>
Professor, PhD	Marius Brazaitis	Chief researcher

### Short reasoning of proposed dissertation topic

<b>Title</b>
Enhancing Cognitive Efficiency and Mental Fatigue Resistance during Pre-Retirement Years: A Study of Physical Interventions in Lithuania
<b>Short research description (including aims and objectives) (maximum 1500 characters).</b> <p>The retirement age in Lithuania was set to increase gradually starting from 2012 until it reaches 65 years for both men and women in 2026. Despite cognitive and physical decline associated with aging, older adults are still expected to perform the same job-related tasks as their younger peers. Workplace sitting is a major contributor to sedentary behavior (Clemes et al., 2014). Data from various countries suggests that adults spend between 6.2 and 9.6 h per day engaging in sedentary behaviors, with a significant portion of this time spent sitting at work (Tudor-Locke et al., 2011). Engaging in continuous cognitively demanding tasks for at least 60 min (Wascher et al., 2014) or prolonged sitting for 2–7 h (Triglav et al., 2019) can lead to subjective mental fatigue (Wennberg et al., 2016) and a deterioration in cognitive function, including impacts on visual searching, problem-solving ability, and attention (Triglav et al., 2019). The full-time workday in an office setting has also been linked to decreases in arousal level and motivation, as well as negative consequences on cognitive information processing, working memory, and the ability to focus (Zhao et al., 2012). Therefore, in the present PhD project we aim to explore options for reducing fatigue during sedentary work in individuals who are in pre-retirement period (55–65 years) that requires the use of cognitive resources. We hypothesize that exercise influences blood circulation in periphery and the brain by altering improved glucose and oxygen delivery to the brain during demanding mental work, and therefore, the first aim of the present project will be to investigate whether aerobic cycling exercise before and right after the mentally demanding working day influences glucose concentration along with modulation in cognitive efficiency and mental fatigue resistance. The second aim will be to investigate whether changing body position by shifting from therapeutic ball to standing position and vice versa would influence glucose concentration, cognitive efficiency, and mental fatigue resistance during mental work. The third aim will be to compare young individuals (18–40 years) with individuals who are in pre-retirement period (55–65 years).</p>

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

As we age, the brain undergoes structural and functional changes, leading to a decline in cognitive performance. In individuals over 55 years of age, the prefrontal cortex and hippocampus volume decreases by 1-2% annually (**Raz et al., 2005**). These changes in brain volume, particularly in the prefrontal regions and the hippocampus, have been suggested as the reason behind the age-related

cognitive decline that often occurs in memory and executive function tasks (**Reuter-Lorenz et al., 2010**). In the modern world, skilled work is in high demand, and it is important to help workers reduce mental fatigue to improve their welfare and productivity both during and after working hours (**Albulescu et al., 2022**). Mental fatigue can lead to chronic stress and ultimately burnout, which can have negative physical and mental consequences on workers' well-being and health, such as insomnia, depression, hypercholesterolemia, type 2 diabetes, coronary heart disease, hospitalization due to cardiovascular disorders, musculoskeletal pain, changes in pain experiences, prolonged fatigue, headaches, and gastrointestinal issues (**Salvagioni et al., 2017**). Taking breaks during work, such as lunch breaks, scheduled breaks, or micro-breaks, has the potential to improve individual well-being and performance (**Sonnentag et al., 2022**). However, research in this area has been limited, and the effects of recovery during these shorter intervals are not yet fully understood (**Sonnentag et al., 2022**). Recently, we have concluded that Lithuanian hygiene standards involving regular short breaks with low physical activity during the working day do not protect against exhaustion caused by mental work in young healthy men participants. Even with short breaks, the sensation of fatigue develops and the worker's ability to focus attention and to activate neural resources became compromised during the 7 h of mental tasks. As a result, cognitive functions such as attention, executive control, visual tracking, learning, and visual recognition (which seem to be the most susceptible to fatigue) are affected (**Brazaitis and Satas, 2023**). These cognitive functions do not seem to recover fully to the baseline level after a 4.5-h rest. Recent research, however, has demonstrated the potential benefits of shorter but more frequent microbreaks in improving energy levels and reducing fatigue without negatively impacting productivity (**Albulescu et al., 2022**). Incorporating aerobic physical activity during these breaks can also enhance the restorative effects (**Blasche et al., 2018**). Therefore, by investigating the effectiveness of differently structured physical activity on cognitive efficiency and mental fatigue resistance during a simulated mental working day we would be able to provide essential results for discussing prevention of exhaustion caused by mental work in individuals who are in pre-retirement period (55–65 years).