

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)	Natural Sciences N 000
Field of research (title and code)	Biology 01B
Topic of research	Thermal acclimation and health
Institution	Lithuanian sports university

Potential supervisor

Pedagogical and scientific degree	Name, surname	Academic position
Assoc. prof. PhD	Rima Solianik	Senior researcher

Short reasoning of proposed dissertation topic

Title
Time course of adaptive responses in humans during a 16-day hot and cold acclimation programme, and its effect on health-related indicators
Short research description (including aims and objectives) (maximum 1500 characters).
<p>Adaptation to a thermal stressor (heat or cold) is usually studied in isolation, yet these stressors can be used in combination for different health-related purposes. Thus, primary aim of this project is to determine whether interventions consisting of whole body immersion in hot and cold baths over 16 days develop heat and/or cold adaptation by remodeling thermoregulatory (rectal, skin and muscle temperature), metabolic (oxygen consumption (VO₂) and carbon dioxide production (VCO₂), metabolic heat production), cardiovascular (blood pressure (BP), heart rate (HR) and HR variability) and physiological responses (saliva and blood markers for stress and thermal tolerance), and the secondary aim is to determine if current cold-hot acclimation has any effects on physical and mental health-related markers (body weight and composition, subjective psychoemotional state, sex hormones, complete blood count, cytokines hormones, tryptophan and kynurenine metabolites, glucose tolerance and insulin resistance; BP, HR and HR variability). Thus, the project involves two objectives: i) to determine time course of the adaptive responses of 16 sessions of brief (5-min) whole-body immersions in hot and cold baths, and ii) to determine response in health-related markers.</p>
Relevance of the problem, its novelty at national and international level (maximum 1500 characters).
<p>It is well established that thermal acclimation can be used to adjust organism to a temperature change (Sawka et al., 2002; Brazaitis & Skurvydas, 2010; Brazaitis et al., 2014), and is a commonly used strategy to prepare athletes for competition in hot/cold environments (Casadio et al. 2016; Jones et al., 2017). Moreover, thermal therapies can be used to improve health. Heat therapy can reduce depressive symptoms (Naumann et al., 2017) and improve cardiovascular function, quality of life and well-being (Brunt & Minson, 2021), whereas cold therapy can be used as a potential tool to combat obesity and associated metabolic complications by increase in energy expenditure, whole body glucose and fatty acid utilization, insulin sensitivity, and decrease in fasting glucose and insulin levels (Lichtenbelt et al 2015; Hanssen et al., 2016; Ivanova Blondin 2021). Furthermore, there is evidence that repeated cold exposure alter immune responses, however consequences and therapeutic relevance of these changes remain to be determined (Brazaitis et al., 2014; Lans et al., 2015). Noteworthy, that adaptation to a thermal stressor is usually studied in isolation (only heat or only cold), yet these stressors can be used in combination for different purposes. But to date, we are not aware of any previous study of the effects of such combination of whole-body immersions in hot and cold baths on adaptive responses and health-related indicators.</p>

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

Participants:

Young healthy adults (aged 18 to 35 years).

Acclimation protocol:

16 sessions: 8 whole-body cold-water immersion (CWI; 14°C for 5 min) and 8 whole-body hot water immersions (HWI; 45°C for 5 min).

Provocative protocols before and after acclimation:

Prolonged CWI (14°C for 2 h or until Tre reach 35°C)

Prolonged HWI (43-44°C for 2 h or until Tre reach 39°C)

Methods:

- Anthropometry and body composition evaluation (Tanita);
- Spirometry (Metalyzer 3B, Cortex) and HR (Polar) evaluation;
- BP assessment (Microlife)
- EMG-based measurement of pectoralis major muscle activation (Biometrics);
- Body temperature (core, skin and muscle) evaluation (Ellab);
- Psychoemotional state evaluation (HAD; PANAS), and subjective ratings for thermal and shivering sensations;
- Blood and saliva sample analysis (stress markers (cortisol, epinephrine and norepinephrine), immune response related markers (neutrophils, leucocytes, lymphocytes, monocytes, IL-6, IL-1 β , TNF- α), thermal tolerance (HSP72), sex hormones (testosterone, FSH, LH, 17-beta estradiol, progesterone (ELISA, Tecan Multimode microplate reader), depression related markers (tryptophan and kynurenine metabolites));
- 75-g oral glucose tolerance test (analysis of glucose (Glucocard X-mini plus meter; Arkray) and insulin (ELISA, Tecan Multimode microplate reader) responses).

All equipment is available at LSU and all procedures can be performed at LSU, except for tryptophan and kynurenine metabolites analysis.

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

Thermal therapies (heating and cooling) are widely used in sports medicine, athletic training and rehabilitation settings.

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

No

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

Institution: Karolinska institute

Roles: Sophie Erhardt will take part in triptophan and kynurenine metabolites analysis.

Currently I am supervisor of 2 doctoral students.

Supervisor


(signature)

Rima Solianik

(Name, surname)

Date 2022/04/26