

BODY COMPOSITION CHARACTERISTICS AS THE MODERATORS OF PAIN THRESHOLDS CHANGES IN DIFFERENT THERMO-CLIMATIC CONDITIONS

Lukasz Kryst¹, Magdalena Zeglen¹, Julia Badzinska^{2,3,4}, Weronika Bogusz¹, Agnieszka Witkowska¹, Adrianna Dzidek⁵ and Joanna Kryst⁶

¹University of Physical Culture, Faculty of Physical Education and Sport, Department of Anthropology, Krakow, Poland; ²Jagiellonian University, Doctoral School in the Social Sciences, Krakow, Poland;

³Jagiellonian University, Institute of Psychology, Pain Research Group, Krakow, Poland; ⁴University of the National Education Commission, Institute of Psychology, Krakow, Poland; ⁵University of Physical Culture, Department of Chemistry and Biochemistry, Krakow, Poland; ⁶University of Physical Culture, Faculty of Rehabilitation, Department of Chemistry and Biochemistry, Krakow, Poland

Background: Pain perception (PP) is a complex human trait shaped by biological characteristics and environmental conditions. From an anthropological perspective, variability in pain sensitivity reflects interactions between body build, physiological regulation and external stressors (e.g. hypoxia, thermal extremes). Body composition influences thermoregulation and metabolic processes and may therefore contribute to individual differences in sensory thresholds, pain thresholds and pain tolerance.

Objective: The aim was to assess whether body composition is associated in differences in PP under various environmental conditions.

Subjects and methods: The study included 45 individuals (62% men, mean age 27.96). Participants completed controlled laboratory sessions in a thermoclimatic chamber under baseline conditions, simulated altitude (4200 m asl), heat (+42 °C) and cold (-10 °C). Sensory thresholds, pain thresholds and tolerance were assessed using electrical stimuli. Body composition was assessed using bioimpedance. Analysis of covariance was used to examine the effects of environmental conditions and body characteristics on pain-related outcomes.

Results: Body build and composition characteristics associated with individual sensory, pain and tolerance thresholds. In hypoxic conditions, sensory thresholds were significantly associated with sex ($p<0.01$), body mass ($p<0.05$), and muscle mass ($p<0.05$). During cold exposure (-10°C), total body water percentage significantly related with sensory thresholds ($p<0.05$). Under elevated ambient temperature (+42°C), muscle mass ($p<0.05$) and BMI ($p<0.05$) were significant predictors of pain tolerance.

Conclusions: Body build and composition are associated with differences in PP under specific environmental conditions. Sensory thresholds were related with somatic characteristics in hypoxia and cold, while pain tolerance in heat was related to muscle mass and BMI. These findings highlight the importance of considering environmental context and body composition when examining human variability in pain responses.

Keywords: Body composition; Pain perception; Environmental conditions.

Acknowledgement / Funding Source: The study was approved by the Bioethics Committee of Regional Medical Association in Kraków (98/KBL/OIL/24, 16 October 2024).