Vilniaus universitetas
Medicinos fakultetas

STUDENTŲ MOKSLINĖS VEIKLOS TINKLO *LXXVI* KONFERENCIJA

Vilnius, 2024 m. gegužės 13–17 d.

PRANEŠIMŲ TEZĖS

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VILNIAUS
UNIVERSITETO
LEIDYKLA

2024

ISSN 2783-7831 (skaitmeninis PDF)

EXPLORING NEUROPHYSIOLOGICAL AND CARDIOVASCULAR RESPONSES TO INTENSE PHYSICAL ACTIVITY: THE ROLE OF BRAIN–DERIVED NEUROTROPHIC FACTOR

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Background and Aim. This study aims to investigate the interconnections between Brain–Derived Neurotrophic Factor (BDNF) levels and the perceived intensity of high–intensity exercise, as well as the immediate effect on heart rate. BDNF, a neurotrophin crucial for neuronal growth and synaptic plasticity, may demonstrate dynamic changes in response to varying exercise intensities. Understanding the relationship between BDNF levels, exercise intensity, and heart rate provides valuable insights into the neurobiological and cardiovascular adaptations induced by exercise. By exploring these connections, the study seeks to enhance comprehension of how exercise intensity influences BDNF secretion and its potential implications for cognitive and cardiovascular health.

Materials and Methods. Fifteen participants, consisting of eight women and seven men, were enrolled in this study, with all procedures conducted following ethical guidelines and informed consent obtained from each participant. Pre-exercise and post–exercise blood samples were collected from participants who refrained from any exercise activity for at least 48 hours prior to testing. These blood samples were analyzed for BDNF levels using enzyme–linked immunosorbent assay (ELISA) detection kits. Additionally, subjective ratings of high-intensity exercise intensity were recorded using standardized scales, along with immediate measurement of heart rate post–exercise.

Results. Analysis of the data obtained from the fifteen participants (n=15) revealed significant findings regarding the relationship between perceived intensity of high–intensity exercise and BDNF levels after exercise, as well as heart rate. Results indicated that following high–intensity exercise, BDNF levels were measured at a mean concentration of 15.554 ng/ml, and the mean heart rate immediately after exercise was recorded at 142.8 bpm. Participants reported a mean perceived exercise intensity of 7.867 out of 10. A Wilcoxon signed–rank exact test indicated significant associations between exercise intensity and post–exercise BDNF levels ($V = 0$, p–value = 0.00006104), as well as heart rate, suggesting a correlation between exercise intensity and both physiological responses.

Conclusions. This study provides valuable insights into the connection between BDNF levels, exercise intensity, and heart rate following high–intensity exercise. The observed increase in BDNF levels suggests its potential role in mediating exercise–induced neurobiological adaptations, while the immediate elevation in heart rate reflects the acute cardiovascular response to intense physical activity. These findings underscore the importance of exercise intensity in modulating neurobiological and cardiovascular responses, highlighting the multifaceted benefits of high–intensity exercise for cognitive and cardiovascular health. However, the study is limited by its relatively small sample size. Therefore, further research with larger sample sizes is warranted to validate these findings and explore their implications for cognitive and cardiovascular outcomes.

Keywords. BDNF; Exercise Intensity; Heart Rate; Cognitive Health; Cardiovascular Health.