Abstract

Title: Analysis of Heart Rate Variability (HRV) During Simulated Operational Stress in Military Personnel.

Goal: To analyze the effect of a three-day simulated operational stress on Heart Rate Variability (HRV) in individuals without the presence of sleep deprivation and caloric deficit.

Methods: This bachelor's thesis combines empirical and theoretical approaches. The research sample included four students from the Military Department at the Faculty of Physical Education and Sport, Charles University (FTVS UK) in Prague, divided into control and experimental groups (two students in each group). All participants were physically fit and healthy individuals with an average age of 22.5 ± 1.91 years, an average height of 185.75 ± 4.19 cm, and an average weight of 89.5 ± 7.59 kg. Before the actual measurement, participants filled out the Pittsburgh Sleep Quality Index (PSQI), the Perceived Stress Scale (PSS10), and the Connor-Davidson Resilience Scale (CD RISC), and their baseline HRV values were measured. Then they underwent a three-day stress protocol of simulated military operational stress (SMOS), designed to simulate conditions that soldiers may encounter during combat deployment. This protocol included the "Tactical Mobility Test" (TMT) battery, consisting of seven tests: reaction speed, shooting, jump height, dragging an injured person, shuttle run without load, shuttle run with load, and load carrying. The test battery was completed three times in one day, with the control group resting for 40 minutes between each TMT, while the experimental group performed a 40-minute march with a 31 kg load at 4 km/h instead of resting. HRV was measured again before and after each test day, and participants responded to a current perceived pain scale. Using these indicators, we monitored the impact of the load on individual participants and compared the results between the experimental and control groups.

Results: Analysis of heart rate variability (HRV) indicators showed that the load did not have a uniform impact on all participants. For the RMSSD parameter, deterioration was observed only in two participants when comparing the initial baseline measurement with the final measurement. The most significant deterioration was observed in participant 2

(by 57.4%), while participant 4 improved by 50% in the final measurement. The LF/HF indicator showed similar results, with deterioration again observed only in two participants. The most significant deterioration was seen in participant 4 (by 33.8%), while participant 2 improved by 67.3% compared to baseline. The final evaluated indicator was pNN50, where only two participants showed deterioration again. The most significant deterioration was observed in participant 2 (by 72%), while participant 4 achieved the most significant improvement (by 271%). When comparing data between groups, it was found that the load had a more significant impact on the control group participants, even though they did not have to complete the loaded march. The differing results between the groups cannot be considered entirely conclusive due to the small sample size.

Conclusion: Due to the small sample size, this work primarily has the character of a pilot project, and its results can be used as a basis for further studies in this area. Based on the obtained data, the following conclusions were drawn:

- The SMOS protocol impacts the internal environment of the individual, but this impact was not significant enough to prevent both the experimental and control group participants from completing the protocol.
- Some participants did not experience sufficient load, which led to their final values not being significantly worse compared to the initial values.
- For further research, I would recommend including additional stressors, such as sleep deprivation and caloric deficit, to better assess the impact of simulated operational stress on heart rate variability.

Keywords: military, continuous operational stress, heart rate variability, load