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AN EXAMINATION OF ARTERIAL BAROREFLEX AND HEART RATE VARIABILITY FOLLOWING INDIVIDUALISED ARTIFICIAL GRAVITY TRAINING IN MALES AND FEMALES

Abstract

Research has previously shown that long-term space travel negatively affects multiple physiological systems in the body. As we prepare for going back to the Moon and in planning for deep space exploration, and long-term stay on other planetary surfaces, artificial gravity (AG) induced by human centrifugation could provide sustainable mitigation of spaceflight physiological deconditioning. In our study, performed at the European Space Agency space medicine facilities in Toulouse, France, we investigated the effect of individualised AG training on heart rate variability, and overall changes in the arterial baroreflex in healthy males and females. In a randomised study, 14 participants (6 females; 8 males) underwent cardiovascular assessment during an AG tolerance test and then a 45-minute individualised AG training using a protocol previously developed by our team. Briefly, presyncope levels were determined using centrifugation-induced AG prior to the AG training session. Each participant performed 45 minutes of AG training to a maximum AG level of 0.1 g at the heart lower than their presyncopal AG level. Wavelet coherence transform was used to assess the coupling between systolic blood pressure (SBP), and heart periods (RR intervals) in two frequency bands: LF = [0.04 0.15], and HF = [0.15 0.5], while convergent cross mapping was used to study the bidirectional link between RR intervals and SBP. Heart rate increased (p¡0.01) during the final 5 minutes of AG in the presyncope test (presyncope period) compared to baseline and decreased during recovery (p¡0.01) in both males and females. Diastolic blood pressure increased (p=0.03) during the presyncope period compared to baseline in males, while it did not change in females. However, female participants had a higher cardiac baroreflex active gain in the HF (p=0.059) and LF (p=0.01) bands during the presyncope period compared to males. In addition, during the subsequent individualised AG training, overall cardiac baroreflex active gain in the HF band was higher (p=0.02) for female compared with male participants. The presyncope test revealed different cardiovascular strategies between the biological sexes. Males exhibited greater vascular reflex (elevated diastolic BP) whereas females relied on cardiac reflex (higher baroreflex active gain). This elevated baroreflex active gain in females persisted throughout the subsequent AG training period, suggesting a protective conditioning response.