IAF/IAA SPACE LIFE SCIENCES SYMPOSIUM (A1)
Human Physiology in Space (2)

Author: Dr. Jessica Koschate
German Sports University Cologne, Germany

Dr. Uwe Drescher
German Sports University Cologne, Germany
Mr. Lutz Thieschäfer
German Sports University Cologne, Germany
Dr. Uwe Hoffmann
German Sports University Cologne, Germany

CARDIORESPIRATORY REGULATION IN RESPONSE TO EXERCISE – FIRST RESULTS FROM HERA C4

Abstract

Purpose: Muscular oxygen uptake ($V'O_{2musc}$) kinetics were slowed in astronauts, returning from six months missions onboard the International Space Station (ISS; Hoffmann et al., Eur J Appl Physiol 116:503-511, 2016). Therefore, the effects of 45 d of isolation inside the Human Exploration Research Analog (HERA) facility, including phases of sleep deprivation and restricted physical training on $V'O_{2musc}$ kinetics and cardiovascular regulation during exercise were investigated to identify possible mechanisms for slowed $V'O_{2musc}$ kinetics. **Methods:** To date six healthy individuals (40±8 y, 25±4 kgm^{-2}) were tested 8 d before the mission (M-8), on mission day 22 (M22), mission day 42 (M42) and 4 d after (M+4) a simulated mission to an asteroid. At all test days a cycle exercise test with changing work rates (WR) of 30 and 80 W was completed. On M-8 and M+4 a step protocol to assess peak oxygen uptake ($V'O_{2peak}$) was added. Heart rate (HR) and mean arterial blood pressure (MAP) were measured beat-to-beat and pulmonary oxygen uptake ($V'O_{2pulm}$) breath-by-breath. $V'O_{2musc}$ was estimated from HR and $V'O_{2pulm}$. Kinetics responses were calculated using time series analysis. Higher maxima of the cross correlation function (CCF_{max}) between WR and the respective parameter indicate faster kinetics. During the mission, exercise training sessions were restricted to every other day with a HR below 85%of the age-related maximum. Sleep was restricted to 5 h per weekday and 8 h at the weekends. Statistical analyses on the kinetics parameters (HR, $V'O_{2musc}$, $V'O_{2pulm}$) were performed by means of repeated measures ANOVA (M-8, M22, M42, M+4) and the Friedman-test (MAP). $V'O_{2peak}$ was compared using a t-test. **Results:** HR kinetics did not change significantly throughout the mission (M-8 vs. M22 vs. M42 vs. M+4; mean ± standard deviation [a.u.]: 0.28±0.07 vs. 0.37±0.18 vs. 0.36±0.13 vs. 0.28±0.06; P=0.111) similar to $V'O_{2pulm}$ (0.33±0.09 vs. 0.29±0.08 vs. 0.33±0.10 vs. 0.28±0.05; P=0.363) and MAP (0.34±0.09 vs. 0.37±0.03 vs. 0.37±0.05 vs. 0.36±0.08; P=0.154). $V'O_{2musc}$ kinetics were slowed by trend (0.33±0.06 vs. 0.31±0.08 vs. 0.35±0.06 vs. 0.28±0.03; P=0.063) at MD+4. $V'O_{2peak}$ differed not significantly between M-8 (35.4±7.1 ml min^{-1} kg^{-1}) and M+4 (36.6± 6.1 ml min^{-1} kg^{-1}). **Conclusions:** Preliminary results of this small sample indicate no significant effects of the simulated HERA-mission on HR and $V'O_{2pulm}$ kinetics. Though, a small trend towards slowed $V'O_{2musc}$ kinetics after the mission signifies decreased tolerance to moderate aerobic metabolic demands as observed similarly after ISS missions.