IAF/IAA SPACE LIFE SCIENCES SYMPOSIUM (A1)
Medicine in Space and Extreme Environments (4)

Author: Dr. Martina Anna Maggioni
Charité Universitätsmedizin Berlin, Germany, martina.maggioni@charite.de

Dr. Paolo Castiglioni
IRCCS Don Gnocchi Foundation, Italy, pcastiglioni@dongnocchi.it
Prof. Giampiero Merati
Universita degli Studi di Milano, Italy, giampiero.merati@unimi.it
Mr. Stefan Mendt
Charité Universitätsmedizin Berlin, Germany, stefan.mendt@charite.de
Ms. Katharina Brauns
Charité Universitätsmedizin Berlin, Germany, katharina.brauns@charite.de
Mrs. Anika Werner
Charité Universitätsmedizin Berlin, Germany, anika.werner@charite.de
Dr. Mathias Steinach
Charité Universitätsmedizin Berlin, Germany, mathias.steinach@charite.de
Prof. Hanns-Christian Gunga
Charité Universitätsmedizin Berlin, Germany, hanns-christian.gunga@charite.de
Dr. Alexander Christoph Stahn
University of Pennsylvania, Germany, astahn@pennmedicine.upenn.edu

REDUCED PARASYMPATHETIC OUTFLOW DURING OVERWINTERING IN ANTARCTICA

Abstract

Antarctic expeditions have been associated with various stressors including, but not limited to social isolation, sensory deprivation, absence of privacy, separation from friends and family, altered photoperiods and sleep disruptions. Heart rate variability (HRV) is a non-invasive measure of the autonomic nervous system that has been shown to be a reliable marker of stress in various settings. Previous research, using HRV recordings, showed that Antarctic expeditions are characterized by changes in vagal balance. However, these studies are limited to short missions. For future exploratory space missions, long-duration studies in these environments are critically needed to understand and predict the dynamics of HRV. The aim of the present study was therefore to investigate the effects of a 14-month winter-over at the German Neumayer III station in Antarctica on HRV. HRV was recorded for 10-min at rest in the morning in supine position before, after and 10 times during the expedition. The experiment was conducted for three winter-overs with a total of N=25 healthy volunteers (15 men, 38 +/- 6 yrs; 10 women, 32 +/- 6 yrs, mean +/- SD). HRV was analyzed in the frequency domain using spectral analyses. Data during the expedition were clustered in trimesters (T1: February to April, T2: May to July, and T3: July to October) and analyzed by mixed models with subject as a random factor, trimester and sex as fixed factors, and baseline data as a covariate. High frequency (HF) power, index of parasympathetic modulations, decreased significantly at T2 with respect to T1, without further changes at T3. The low to high frequency power ratio (LF/HF), index of cardiac sympathovagal balance, did not change at T2, but significantly increased at T3. Women showed a larger interindividual variability and a trend to higher level of stress (i.e. higher sympathovagal balance) compared to men. These data suggest a reduced parasympathetic outflow during long-duration over-wintering in Antarctica. Remarkably, these findings contrast data from shorter Antarctic missions,

confirming the need for long-duration studies. It is currently unclear, whether these effects may be attributed to changes in sleep, altered photoperiods, psychosocial stressors or a combination thereof. Therefore, further studies are critically warranted to (i) elucidate the mechanisms and their interactions, (ii) and if, and to what extent the depression of cardio-vagal tone affects physical and mental performance.