Paper ID: 89578
oral

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

Author: Prof. Martina Anna Maggioni
Charité Universitätsmedizin Berlin, Germany

Dr. Stefan Mendt
Charité Universitätsmedizin Berlin, Germany
Dr. Mathias Steinach
Charité Universitätsmedizin Berlin, Germany
Dr. Anika Friedl-Werner
Charité Universitätsmedizin Berlin, Germany
Dr. Katharina Brauns
Charité Universitätsmedizin Berlin, Germany
Dr. Oliver Opatz
Center for Space Medicine Berlin (ZWMB), Germany
Prof. Alexander Christoph Stahn
Charité Universitätsmedizin Berlin, Germany
Prof. Hanns-Christian Gunga
Charité Universitätsmedizin Berlin, Germany

CIRCADIAN RHYTHM CHANGES OF CORE BODY TEMPERATURE DURING LONG-DURATION SPACEFLIGHT (CIRCADIAN RHYTHM PROJECT)

Abstract

Previous experiments conducted on the Mir station and during short-term space shuttle missions indicated that the circadian rhythm of core body temperature (CBT) changes during spaceflight due to the absence of 24 h light/dark cycles, as well as to operational shifts in work/rest cycles. However, so far, no systemic studies on the circadian rhythm of CBT were performed during missions on the International Space Station (ISS). Moreover, despite the high amount dedicated by astronauts to physical training (2.5 h per day), the role of exercise during spaceflight on the ISS, has not been studied with reference to the possible circadian misalignment in astronauts. To address this gap, in the frame of the ESA/DLR sponsored study "Circadian Rhythm" recently concluded, we analyzed the circadian rhythm of CBT and physical activity logs a of 10 astronauts before, during and after a 6-month mission aboard the ISS. Measurements were done employing the heat-flux approach with the double sensor (TcoreTM Dräger) and data were collected continuously for 36-hour in each measurement's session. We found: i) that rhythm phase gradually delayed within the first month and then remained relative stable at about 45 min later compared to preflight, and ii) that the rhythm MESOR (i.e., Midline Estimating Statistics of Rhythm, a rhythm-adjusted mean) was significantly increased inflight in all astronauts by more than 1 C (p¡0.0001). Although the amplitude seemed to be higher in space, these changes were statistically not significant, and no statistical differences were found between conditions for rhythm phase either. About three weeks after spaceflight the MESOR returned to baseline values (p¡0.332). Since aerobic or resistive exercises were not performed exclusively in the morning or in the late afternoon, according to the available physical activity logs, exercise seems unlikely to induce phase shifts. Given that even small increases in CBT or small phase shifts can impair physical and cognitive performance, both findings have significant implications for astronauts' health and well-being in light of future long-duration spaceflights and deserve

further investigations.

Funding: DLR Project number 50WB1330, 50WB1730, 50WB2330