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Behaviour, Performance and Psychosocial Issues in Space (1)

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EXERCISE CAN MAINTAIN BRAIN FUNCTION MEASURED BY fNIRS IN ISS-SIMULATING  
CONFINED ENVIRONMENT

**Abstract**

Over the past few years, the number of Japanese astronauts recruited for a long-term stay at the International Space Station (ISS) has increased. Spending extended time periods on the mission with the same people, in the same room, might be a psychosocial stressor for the astronauts in the confined environment. Efficient methods to measure the stress triggered under such conditions have yet to be established. Thus, we plan to evaluate some stress-related index measurements under confined environment stress. fNIRS (functional Near Infrared Radioscopy, portable 22ch type, LIGHTNIRS by Shimazu Corporation) was used to measure an index of the frontal brain function during a Verbal Fluency Test (VFT) in the long-term confinement environment facilities of the JAXA (Japan Aerospace Exploration Agency). fNIRS is used to distinguish the type of psychiatric diseases in Japan. Research participants (all adult males) were installed in "the confinement environment adaptation training facilities" of the JAXA Tsukuba Space Center for 14 days in 2016. During the confinement experiments, we tried to simulate the conditions experienced by astronauts during selection-examination and stay in the ISS, and compare the effect of exercise between intervention and control groups. Intervention group members (N=8) had regular 15-minute exercise by aero bike every day, while any exercise was prohibited for the control group members (N=7). fNIRS measurements showed a significant difference between intervention and control groups. This result indicates that the exercise had a positive effect towards maintaining good frontal brain function, statistically analyzed by a generalized linear mixed model. Previous studies showed significant positive effect of aero bike exercise on frontal brain function measured by fNIRS using STROOP test in daily life. Our result verifies the same effectiveness in the confined environment. Frontal brain functions

have very important role of cognitive and executive functions in general. Psychosocial stress has negative effects on the frontal brain function. It could be hypothesized that this type of exercise would be useful to astronauts in the ISS for maintaining good frontal brain function. Ethical issues were reviewed and approved both from the University of Tsukuba Medical Ethics Committee (No.1022) and the JAXA Ethical Review Board. We declare no conflict of interest. This study was supported by the JSPS Grant in Aid for scientific research (15H05935).