

## SPACE LIFE SCIENCES SYMPOSIUM (A1)

## Human Physiology in Space (2)

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COMPARATIVE STUDY OF THE EFFICACY OF DIFFERENT KINDS OF MUSCLE TRAINING IN  
EXPERIMENT SIMULATING INTERPLANETARY SPACE FLIGHT. RESULTS OF THE STUDY  
WITH 105-DAYS ISOLATION

**Abstract**

A question of the efficacy of countermeasure means and regimens still remains under the discussion. The long term space flights provided the possibilities to test the number of ways to improve the efficacy of countermeasures. One of promising approaches that may allow to decline the time and efforts spent for active physical training of cosmonauts seems to be electromyostimulation (EMS). The purpose of the study was to compare the efficacy of two kinds of EMS which is used on ISS, namely low- and high-frequency ones, and resistive training under conditions of 105-d isolation studies. According to experimental protocol 6 subjects were divided into 3 groups by 2 subjects each, and the whole experimental term was divided by 3 terms of 35 days duration. Every group was obliged to exercise for 35 days using one of the training means: one month – the low-frequency EMS (3 hours per day), the other one – the high-frequency EMS (40 minutes per day) and the third one – a force training using the Russian-Austrian device “MDS”. The difference in order of regimens’ usage by different groups allowed to avoid the effects of staging on the results of experiment. Additionally every day all the subjects performed 30 minutes of veloergometry. Efficacy of countermeasure means was evaluated by the results of submaximal veloergometry test with gas analysis, interval treadmill step test and strength testing performed on 31-34, 66-70 and 102-105 days of isolation. Cardio-vascular system’s state assessment was provided by heart rate monitoring during test performance. The results of oxygen consumption’s level analysis showed that all types of training have increased aerobic capacities of human body. The anaerobic threshold also shifted to higher level of load’s power independent of training’s type. A tendency to increase the capabilities of cardio-respiratory system’s functions was revealed by heart rate analysis. According to the subjective evaluation by Borg scale the tolerance to high velocity running after EMS sessions tended to be higher after resistive exercise training. The results of this study should be accepted as preliminary ones due to a small number of subjects in the groups and violations of recommended regimens of training by some of them. The studies will be continued during the next “Mars” experiment with 520-days isolation. The study was provided by the group of scientists including A.V. Suvorov, A.V. Shpakov, D.R. Khusnutdinova, Yu.A. Koryak, D.R. Babich, H. Tschan, T. Angeli, N. Bachl.