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Human Physiology in Space (2)

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PREDICTING OF THE SUCCESS OF EXTRAVEHICULAR ACTIVITIES ON THE SURFACE OF
THE MOON OR MARS

Abstract

Orbital flights of different durations allow us to assess the ability to perform tasks that simulate on-planet activity, depending on the duration of the mission. In this regard, the aim of the present study was a comparative assessment of the degree of changes in physiological functions according to the results of tests and tasks simulating extravehicular activity (EVA) after flights of different durations. Countermeasure program to reduce negative effects of weightlessness did not include physical training in short flight. During the long flight, physical training was used in compliance with the system of countermeasure of negative effects of weightlessness provided for cosmonauts. A cosmonaut trained daily on a treadmill, bicycle ergometer and resistive device, supplemented with passive prophylactic means according to his state of health. Leg muscle strength testing on a Cibex isokinetic dynamometer was performed before and after a short and long space flight. Assessment of the physical performance level was performed on the basis of determining the cardiovascular system response and operational EVA tasks completion during simulating weightlessness in a spacesuit and without a spacesuit under normal Earth gravity conditions. The results of comparative analysis of strength index losses indicate the greatest strength losses after a short flight for the hip flexor muscles during isometric contraction with the value of 29. There were no strength losses in the lower leg muscles (the most gravity-dependent ones) after the short flight. All model surgeries under both weightless and Earth gravity conditions were successfully performed. Execution of model operations without a spacesuit showed an excess of maximum heart rate values by 10 beats. Overestimation of subject weight was observed. Evaluation of the cardiovascular system response to performing operations simulating EVA on the surface in a spacesuit showed no increase in the physiological load value after a short space flight. Thus, in a short space flight the level of physical performance was sufficient for performing work operations. One can expect that some decrease in the maximum capabilities of the neuromuscular system will not be a limiting factor for performing EVA on the third day after return from weightlessness. The research was supported by RAS 63.1. and Roskosmos.