SPACE LIFE SCIENCES SYMPOSIUM (A1)
Medical Care for Humans in Space (3)

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DISTINCTIVE CHARACTERISTIC OF LOCOMOTOR TRAINING FOR PREVENTION OF NEGATIVE CONSEQUENCES OF WEIGHTLESSNESS

Abstract

Microgravity, as one of the factors of spaceflight, is known to cause a decrease in general and physical performance that is triggered mainly by changes of the skeletal muscles system of cosmonauts. Skeletal muscles under microgravity are subject to physiological and morphological alteration. Withdrawal of body weight and hence decreased proprioceptive information from the gravity-dependent "support receptors" seem to be negative factors of spaceflight. The system of measures counteracting unfavorable effects of weightlessness was developed in Russia. The key of this system is composed by locomotor exercises. Numerous studies, performed under conditions of spaceflight, as well as in ground experiments, have demonstrated that the locomotor exercises on treadmills are the most efficient to activate the support afferentation system. There is a great variability in performance of physical exercises by cosmonauts. to onboard documentation. Some cosmonauts follow to recommendations of onboard documentation; the others prefer to train using mostly active and aerobic kinds of locomotor exercise. The purpose of the study was to compare the efficacy of different regimens of locomotor training to counteract the negative effects of weightlessness. The effectiveness of training regimes of in-flight locomotor exercises was assessed by the results of the locomotor MO-3 test that consists of 5 velocity steps that include: 3 min of walking, 2 min of slow running, 2 min of middle-velocity running, 1 min of running with maximal speed and 3 min of concluding walking. Heart rate was recorded during locomotion, including 3 minutes before and 3 minutes after the test accomplishment. The passive mode of the treadmill was used during the test. The velocity of locomotion on the steps was selected by subject herself. The efficacies or the regimens used by cosmonauts in flights was assessed after the flight by the parameters of the walk performance on the floor with the rate of 90 steps/min. EMGs of legs m. tibialis anterior, m. gastrocnemius medialis and m.soleus were recorded during this test execution and analyzed. The data on the ratio of heart rate to the velocity of running at MO-3 test during the flight and electromyographyc response of locomotion after flights have given strong evidences of higher effectiveness of interval locomotor training with a number of switches from walking to intensive running. As well as, it was found that locomotor training is effective only in case that passive mode training constituted not less than 30