SPACE LIFE SCIENCES SYMPOSIUM (A1)
Human Health : Countermeasures (2)

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EFFECTS OF LOW AND HIGH FREQUENCY ELECTROMYOSTIMULATION ON THE STRENGTH-VELOCITY PROPERTIES OF MUSCULUS TRICEPS SURAE DURING 7–DAY DRY IMMERSION

Abstract

One of the most consistent effects of microgravity exposure on humans is a dramatic decline of skeletal muscles' contractility. First it affects antigravity (tonic) and then – locomotor (phasic) muscles. According to the data of earlier electromyostimulation studies, adequate activation of slow (tonic) muscular fibers is achieved by low-frequency stimulation (LF EMS), whereas fast (phase) fibers are responsive to high frequencies (HF EMS). On this basis we thought it important to perform differentiation evaluation of the preventive effectiveness of LF and HF EMS in a microgravity simulating experiment. Seven-day dry immersion (DI) was used as a ground-based model of microgravity. The experiment involved 27 volunteers who were distributed into the control (n=16), LF EMS (n=6) and HF EMS (n=5) groups. Object of the investigation was m.triceps surae (MTS) consisting of muscles with different fiber composition, i.e. antigravity (tonic) m.soleus and locomotor (combined) m.gastrocnemius. It is noteworthy that input of these muscles in the total ankle torque varies with a knee joint angle. At the angle of 90^{o} muscular work is done by m.soleus predominantly. Larger knee joint angles mobilize m.gastrocnemius. Therefore, it is possible to make a selective analysis of strength-velocity properties of muscles with different composition. Preventive effectiveness of LF EMS and HF EMS was evaluated using isokinetic dynamometry within the angular velocity range from 0 to 150 deg./s at two knee joint angles - 90^{o} (m.soleus works predominantly) and 160^{o} (work is done by MTS). DI of the control group led to a pronounced decline of the m.soleus strength-velocity properties (15-20Four members of the LF EMS group reduced the m.soleus strength-velocity properties insignificantly (2 to 5Application of HF EMS either preserved or increased the strength-velocity properties of whole TM (7As was expected, was shown that LF EMS is an adequate countermeasure for maintenance of strength-velocity properties in antigravity muscles, while HF EMS has a favorable effect on locomotor muscles.