SPACE LIFE SCIENCES SYMPOSIUM (A1)
Biology in Space (7)

Author: Dr. Irina Ogneva
IBMP, Russian Federation

Mr. Nikolay Biryukov
IBMP, Russian Federation

INFLUENCE OF SIMULATED MICROGRAVITY ON CORTICAL (SUBMEMBRANE) CYTOSKELETON'S STRUCTURE OF THE SKELETAL MUSCLE FIBERS AND CARDIOMYOCYTES OF RODENTS

Abstract

Stay under conditions of microgravity results in number of structural and functional changes in muscle and myocardium cells. Load decrease on hindlimb cause external mechanical tension reduction of skeletal muscle fibers. Volume load on cardiomyocytes increases due to fluid shift in cranial direction at early stages of gravitational unloading. Mechanical tension change may cause deformations in different compartments of cells, particularly in cortical cytoskeleton. Stiffness may play role of structural changes indicator. Cortical cytoskeleton contribution to longitudinal stiffness is negligible relatively to one of contractile apparatus. For this reason structural changes in skeletal muscle fibers and cardiomyocytes could be estimated by measuring transversal stiffness followed by cytoskeleton proteins content analysis. Transversal stiffness was measured with atomic force microscopy technique. Protein content was determined with western-blotting. Microgravity effect on skeletal muscles and cardiomyocytes was simulated with Ilyin-Novikov antiorthostatic suspension model with Morey-Holton modification of different duration. We showed the soleus muscle fibers transversal stiffness of sarcolemma with cortical cytoskeleton decreased step-by-step through hindlimb suspension period. Cardiomyocytes transversal stiffness dropped after 12 hours of suspension, came to normal level after 18 hours and continued grow till the third day of unloading. These parameters correlate with non-muscle isoform of actin content in membrane fraction, which forms cortical cytoskeleton. The stiffness was also associated with differently directed change of alpha-actinin-1 and alpha-actinin-4 content in both membrane and cytoplasmic fractions. This change allows us of suggestion that these proteins are involved in a signaling pathways, which form different response of cardiomyocytes and skeletal muscle cells on external mechanical conditions change.