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EFFECTS OF THE LONG SPACE FLIGHTS ON THE HINDLIMB SKELETAL MUSCLES.

Abstract

Mechanical unloading of the skeletal muscle leads to a rapid loss of the muscle mass and the strength, which worsens with increasing duration of unloading. This condition is relevant to a plethora of scenarios from prolonged bed rest due to stroke, chronic diseases and bone fractures as well as spaceflights by the astronauts. Hind-limb unloaded (HU) mouse is a well-recognized model of muscle atrophy; however, the molecular changes in the skeletal muscle during unloading are poorly characterized. We have used Raman spectroscopy to evaluate the structure and behavior of signature molecules involved in regulating muscle structural and functional health. The Raman spectroscopic analysis of gastrocnemius muscles was compared between 16-18 weeks old HU c57Bl/ 6J mice and ground-based controls. The spectra showed that the signals for asparagine and glutamine were reduced in HU mice, possibly indicating increased catabolism. The peaks for hydroxyproline and proline were split, pointing towards molecular breakdown and reduced tendon repair. We also report a consistently increased intensity in¿ 1300 cm-1 range in the Raman spectra along with a shift towards higher frequencies in the HU mice, indicating activation of sarcoplasmic reticulum (SR) stress during HU.