Paper ID: 42257
interactive

IAF/IAA SPACE LIFE SCIENCES SYMPOSIUM (A1)
Interactive Presentations - IAF/IAA SPACE LIFE SCIENCES SYMPOSIUM (IP)

Author: Mrs. Tatyana Kukoba
FSC RF-IMBP, Russian Federation

Dr. Elena Fomina
FSC RF-IMBP, Russian Federation
Mr. Valery Novikov
FSC RF-IMBP, Russian Federation

REDUCTION OF BONE AND MUSCLE LOSS IN LONG-DURATION SPACE FLIGHTS BY RESISTIVE EXERCISES WITH DIFFERENT WEIGHT

Abstract

The purpose of the study was a comparative analysis of the effectiveness of the resistive exercises depending on the "weight"" and the number of repetitions to prevent the negative effects of weightlessness on the musculoskeletal system. Analysis of the protocol of resistive trainings, carried out by cosmonauts during the space flight, made it possible to identify 3 groups of cosmonauts. In the group A (n = 12) "weight" in the leg muscles exercises was higher than the body weight (BW) and the number of repetitions was 12-16 times. In the group B (n = 9) the "weight" was about 100% of BW with the number of repetitions 30 times. Group C (n = 6) was consisted of 3 cosmonauts who did not do resistive exercises and 3 cosmonauts who did exercises for the leg muscles with minimal load, their "weight" reached 30% of BW and the number of repetitions from 8 to 12 times. Based on the results of isokinetic testing, losses of the maximum voluntary force in the group C after long space flights were the highest. They were 52% for the hip muscles, 40% for the shin and 36% for the thigh strength endurance. In group B the maximum voluntary force decreased in the in the hips on 28%, in the shin muscles on 24%, and the loss of the hip muscles strength endurance reached 4%. In group A the hips maximum voluntary force decreased by 3%, the shin one decreased by 2%, the loss of the hips strength endurance was 13%. The highest decrease of bone mineral density was found in the group C, on average of the group the loss in the proximal epiphysis -5,8%, in the lumbar spine it was 5,4%. Group B had losses in the proximal epiphysis of the hip the bone mineral density 4,9% on average, in the lumbar spine 2,9%. In the group A the loss of bone mineral density was the smallest. In the proximal epiphysis of the hip it was 3,3%, in the lumbar spine it was 2,4%. Thus, resistive training on the ARED with the "weight" more than 100% of BW, with a number of repetitions 12 to 16 times, was the most effective for saving maximum voluntary force and bone mineral density during space flight. The "weight" 100% of BW and the number of repetitions 30 times was sufficient to maintain muscle strength endurance.