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INFLUENCE OF SHORT-TERM ISOLATION IN A HERMETICALLY CLOSED FACILITY ON THE
DYNAMICS OF METABOLIC REGULATION MARKERS AND PARAMETERS CHARACTERIZING
THE STATE OF BONE TISSUE AND BODY COMPOSITION OF VOLUNTEERS (LUNA-2015 AND
SIRIUS-17)

Abstract

It is known that space flight factors have a significant effect on water-electrolyte metabolism, in particular, on the calcium exchange, which leads to a metabolic change and mineralization of bone tissue, and also to a body composition change. The results of ground-based examinations of volunteer who took part in extra-long experiments (antiorthostatic hypokinesia (370 days) and isolation in the hermetically closed facility (520 days)) showed similar direction of changes [Morukov B., 1999; Novikov V. et al., 2016]. At this, it was demonstrated that staying in a room of limited volume leads to the development of low-severity osteopenia, but with a high initial rate of development [Oganov V. et al., 2001]. For a better understanding of the releasers and beginning of these changes, it is especially important to study the metabolic processes and bone status at the early stages of space flight or analog experiments. The main purpose of this work was a comprehensive study of the effect of short-term isolation conditions in the hermetically closed facility on the content of the hormones (thyroid, hypothalamo-hypophysial, suprarenal, and others) and bone markers (Ca⁺⁺, TRAP5b, DKK-1), reflecting the processes of bone remodeling, in the serum and plasma, and also the analysis of their relationship with bone status and body composition parameters. Study of the influence of the isolation experiment conditions on female organism is of special interest. Twelve volunteers participated in the experiments "LUNA-2015" and "SIRIUS-17": 8 women from 22 to 37 years old (one female volunteer participated twice) and 3 men from 33 to 43 years old. Study of bone status and body composition was performed according to the standard program with the use of the bone densitometer Lunar Prodigy Advance in the baseline period and on first day after exiting. The collection venous blood and urine were performed prior to the beginning of the experiment, on 5-7th and 14th days of isolation, and on 1st and 7th days after isolation. The results of the analysis showed the individual character of bone dynamics in standard zones, while a unidirectional decrease of bone mineral content in organisms of the Luna 2015 participants was observed. The obtained data on the effect of short-term isolation conditions on bone metabolism and the relationship between the dynamics of bone markers, body composition, and bone mineralization are of undoubted interest, since similar short-term studies are not carried out either on cosmonauts or patients with osteoporosis.