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THE VARIABILITY OF URINE PROTEOME AND COUPLED BIOCHEMICAL BLOOD
INDICATORS IN COSMONAUTS WITH DIFFERENT PREFLIGHT AUTONOMIC STATUS

Abstract

The adaptation strategy of the human body in microgravity conditions is largely associated with the plasticity of the processes of proteomic regulation of the cardiovascular system. The price of adaptation for cosmonauts with individual vegetative status varies. Our research group continues investigations aimed at studying the relationship between the characteristics of the autonomic regulation of the heart rate and changes in the proteome of cosmonauts. In the presented work, we reveal the relationship between the proteomic composition of urine and the variability of some biochemical blood parameters in astronauts with differences in autonomic status. We believe that the study of urine protein composition performed by proteomics methods will help to understand molecular mechanisms maintaining homeostasis and to make corrections to the existing methods of countermeasures. The objects of the study were 5-min samples of electrocardiogram (ECG) at rest and urine and venous blood samples, obtained in the same timeline from twelve male cosmonauts (age 46.5 ± 3.4 years), who performed space flights (SF) with duration 169–199 days onboard the Russian segment of the International Space Station (ISS). Two groups with different sympathetic-parasympathetic balances were identified (each consisting of 6 cosmonauts). We have revealed in groups of cosmonauts with a preflight predominance of sympathetic or parasympathetic drive the significant differences in the directionality of changes on days 1 and 7 after the SF as compared to the preflight values in three proteins (from a total amount of around 200). These sets were totally different in classified groups. In the group of cosmonauts with a predominance of the sympathetic drive

were changed unidirectionally COL6A1 with potassium, ferrum, alpha-1. MUC1 with amylase, urea, inorganic phosphate, glucose, alkaline phosphatase, ionized calcium. CDH13 with uric acid, ferrum, alpha-1, potassium. In the group of cosmonauts with a predominance of the parasympathetic tone: direct bilirubin, potassium, and total calcium with COL6A1. Direct bilirubin, potassium with MUC1 and total ferrum binding capacity, transferrin, glucose gamma, globulin transferase with CDH13. We hypothesized that the concentration of these proteins and their different relationship with some biochemical parameters reflect, as we called this process, "adaptation price" which depends on the type of autonomic regulation. This work was supported by the Basic Programs 64.1 and 65.3 of the Russian Academy of Sciences for the period from 2013 to 2023.