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EVALUATION OF THE EFFECT OF 21-DAY HEAD-DOWN BED REST ON THE
CARDIOVASCULAR SYSTEM BY BLOOD PROTEIN COMPOSITION, INCLUDING MARKERS
SST2, NT-PROBNP AND D-DIMER

Abstract

Head-down bed rest (HDBR) is not only one of the models of the physiological effects of weightlessness, but also physical inactivity, which is becoming more common in modern society. It is known that the impact of HDBR is accompanied by the development of compensatory-adaptive reactions affecting the cardiovascular, endocrine, central and peripheral nervous systems. Currently, the reactions of the cardiovascular system to the conditions of HDBR are being actively studied. An increase in the stiffness of the aorta has already been shown, the parameters of which were not fully restored even 1 month after the end of the experiment. Remodeling of the vascular wall, leading to an increase in its rigidity, is an integral indicator of the risk of developing cardiovascular diseases. The study of the composition of blood proteins functionally associated with the cardiovascular system by proteomic methods can contribute to understanding the mechanisms underlying cardiovascular changes under the influence of hypokinesia. In this work, in order to clarify the molecular mechanisms of changes occurring during 21-day HDBR, using chromatography-mass spectrometry, the protein composition of the blood plasma of volunteers was studied, and the target determination of the levels of myocardial stress markers sST2, NT-proBNP, and one of the markers risk of thrombosis, D-dimer, was performed. It was found that by the end of HDBR, the level of proteins of the complement system and the coagulation cascade, platelet degranulation, fibrinolysis, and acute phase proteins increases, while the level of proteins involved in amino acid biosynthesis, glycolysis, oxygen transport, heme catabolism, and other processes decreases. An increase in the content of retinol-binding protein 4, apolipoprotein B and protein S100A8, which negatively affect the functional state of blood vessels, was noted. The rapid recovery of sST2, NT-proBNP levels immediately after the end of the experiment, after a significant decrease on the 21st day of the experiment, reflected the absence of myocardial stress. On the contrary, a decrease in the levels of sST2, NT-proBNP on the 21st day of the experiment indicated a decrease in the load on the myocardium and a decrease in the extensibility of myocytes. The unchanged level of D-dimer in the blood during 21 days of bed rest and after testified to the absence of the risk of thrombosis in the conditions of this study and 14 days after the end of the experiment. This research was funded by the Russian Science Foundation grant No. 22-74-00069, <https://rscf.ru/project/22-74-00069/>.