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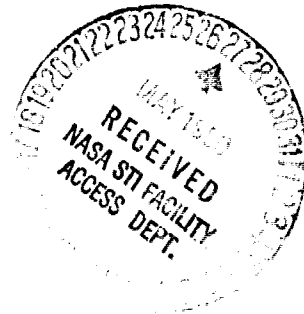
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FREE AMINO ACIDS OF THE BLOOD AND
SOME ORGANS IN HYPOKINESIA

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Translation of "Svobodnyye aminokisloty krovi i nekotorykh
organov pri gipokinezii", Zdravookhraneniye 18 (4), 1975, pp 26-27

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16. Abstract The problem of hypokinesia is acquiring very important value in the age of the intensive development of technology, mechanization and automation of production since the latter result in a considerable reduction in the muscular activity in the process of labor. In addition, a study of the functional changes induced by hypokinesia is also of clinical importance in those cases where the treatment of patients is linked to a lengthy bed confinement. Finally, this problem is of especial importance for space medicine.		
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FREE AMINO ACIDS OF THE BLOOD AND SOME ORGANS
IN HYPOKINESIA

by

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The problem of hypokinesia is acquiring very important value in the age of the intensive development of technology, mechanization and automation of production since the latter result in a considerable reduction in the muscular activity in the process of labor. In addition, a study of the functional changes induced by hypokinesia is also of clinical importance in those cases where the treatment of patients is linked to a lengthy bed confinement. Finally, this problem is of especial importance for space medicine. /26*

The aforementioned determines the urgency of the problem and the interest of the researchers in it. Since in the literature there is insufficient coverage of the questions of the change in the metabolic fund of amino acids in hypokinesia, and the content of these compounds in the tissues predetermines the possibility of tissue protein synthesis, in this study we set the task of studying the metabolic fund of amino acids of the blood and tissues of certain organs of rats under conditions that sharply limit their motor activity.

The experiment used 20 male rats weighing 186.2 ± 2.0 g who were in a state of hypokinesia for 10 days. Hypokinesia was created by maintaining

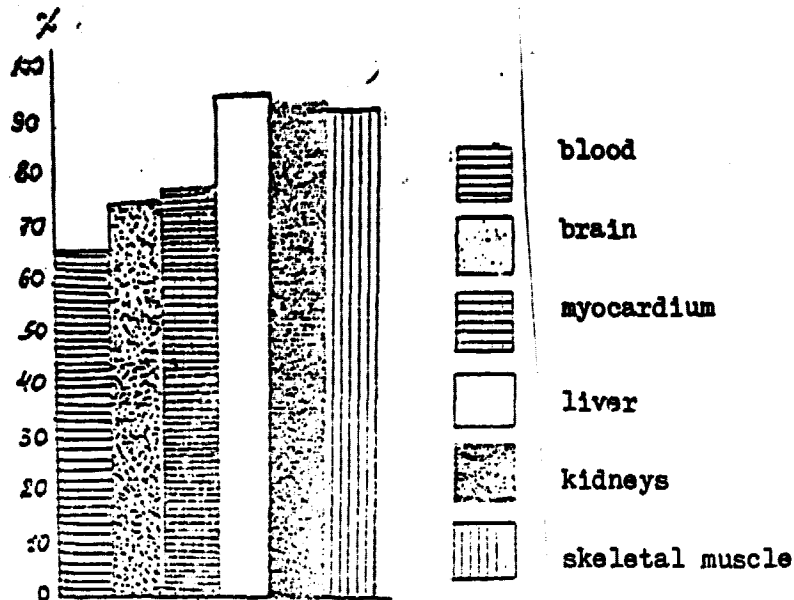
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the animals in special cages. The control was data obtained on 20 rats maintained in normal cages with a free motor pattern. Both animal groups received standard food rations. Before the start of the experiment and at its completion the rats were weighed and their body temperature was taken. In the established periods the animals were decapitated, blood was immediately taken and tissues were taken from the liver, kidneys, brain, skeletal and cardiac muscles to determine the content of free amino acids in them. The latter were analyzed according to the method of Awapara (1949) perfected by Z. I. Levedeva (1964). The method of statistical processing of the experimental material was taken from I. A. Oyvin (1960).

Limited mobility of the animals led to a significant ($D < 0.001$) reduction in the body weight (by 19.5%) and insignificant reduction in temperature ($D > 0.2$).

Study of the total content of free amino acids in the blood and tissues of the experimental animals (see figure) demonstrated that on the average it was 19% lower than in the controls. The most pronounced decrease in the sum of free amino acids was noted in the tissue of the brain (72.5%), myocardium (75%) and blood (64.1%). The results of the investigation of the quantity of individual compounds indicate that the level of certain of them was considerably reduced, and of the others, on the contrary, increased as compared to the control. Thus, the content of cystine, alanine and glycine was low ($D < 0.001$) in the blood and all the studied tissues, while the concentration of phenylalanine in the same objects of study was high ($D < 0.001$). Attention is drawn to the unequal content of individual amino acids in different tissues. Thus, the quantity of tryptophan was increased in the brain, kidneys, skeletal muscle and myocardium, while in the liver it was significantly diminished as compared to the control index. The concentration of leucine reliably ($D < 0.001$) rose in the tissue of the brain and myocardium, in the other tissues its increase was not statistically significant. In the tissues of the majority of the organs there was a reliable decrease in the content of glycine, aspartic acid with serine and glutamic acid with threonine. The decrease in the level of the indicated amino acids can be governed by their use as an energy source. In addition,

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Total Content of Free Amino Acids in Tissues of Certain Organs of Rats during Hypokinesia (in % of control)

glycine and other compounds can be expended to render harmless toxic products formed in the organism during hypokinesia. The developing pronounced imbalance in the content of amino acids undoubtedly can promote the decrease in intensity of tissue protein synthesis.

The hypothesis on the decrease during hypokinesia in the rate of protein synthesis in the muscle tissues corresponds to the ideas on the dependence of protein synthesis on the level of the physiological cellular function (F. Z. Meyerson, 1967). The results of the research of G. A. Makarov (1974) on the inclusion of glycine $l-C^{14}$ in the subcellular fractions of certain tissues of animals during their prolonged hypodynamia also indicate the inhibition of the synthetic processes. In addition to this it was shown that during hypokinesia in animals and in people a negative nitrous balance develops (P. O. Vyazitskiy et al., 1972, and others), which can emerge as a result not only in the decrease of the rate of tissue protein synthesis, but also intensification of their breakdown. The increase we observed in

the quantity of a number of irreplaceable free amino acids should be appraised evidently, as a result of the intensification also of the catabolic processes.

Thus, our studies make it possible to consider that during hypokinesia a disruption occurs in the plastic metabolism. This indicates the possibility of searching for preventive and therapeutic resources for affecting the organism that is under conditions sharply limiting its motor activity.

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