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Reactivity of the hypothalamo-pituitary neurosecretory system in rats changed by aerobic exercise

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ABSTRACT

Currently, one of the main problems in sports is the formation of the protective adaptation processes that occur in the humoral control system of the human body and the evaluation of the changes that occur in them. 35 infertile male white rats weighing 130-220 grams were taken as the experimental material of the work. The result obtained. It has been proven that the adaptation reaction in the hypothalamic-pituitary-neurosecretory system to forced aerobic stress by swimming in water is fully formed from 21 days to 90 days.

When rats are subjected to aerobic stress due to a 7.5% load by chronic swimming in water, until the 21st day of stress, the amount of NSH with high functional activity in the SOYA, PVYA of the hypothalamus increases, during swimming in animals, an adaptation process is formed, and from the 21st day of stress From the beginning to the 3rd month, due to hyperhydration of SOYA, PVYA NSH nuclei, glial cell quantity, surface of the nucleus, NSM synthesis in NSH prevailed over secretion process, full adaptation and recovery process was observed in SOYA, PVYA NSH of hypothalamus and in aerobic swimming.

Keywords. Aerobic exercise, hypothalamus, pituitary gland, swimming. Suprooptic nucleus, paraventricular nucleus.

INTRODUCTION

In recent years, in professional sports, many scientific researches have been carried out on the changes that occur in the athlete's body during aerobic, mixed,

anaerobic stress and their prevention, and significant progress has been made in studying the laws of pathological changes [7, 13, 14, 15]. Depending on the level and duration of physical exertion, the central nervous system, hypothalamus-pituitary-adrenal gland, hypothalamus-pituitary-thyroid gland, pituitary-pancreas, hypothalamus-pituitary-gonadal system and other mechanisms of morphological, physiological, pathological changes in the plane of the endocrine glands [3]. In the human body, depending on the dynamics of hormones in the athlete's body, the cardiovascular system, the respiratory system, the locomotor system, the somatic nervous system and other organs, the complications of the integration of the changes, the mechanisms of the prevention of complications are highlighted and developed [4, 11, 17].

The main mechanisms of cell damage, pathways of compensatory-restorative processes, and genetic mechanisms have been highlighted in professional athletes depending on the level of stress [1, 17]. The phase and level of development of the protective adaptive reaction mechanism in the hypothalamo-pituitary and endocrine systems against such stresses have been studied [5]. The obtained data show that after high-intensity stress neurohumoral control disorders, the development of hidden or obvious endocrinopathy, changes in hormonal control at one or more stages are possible. Most often, this process is related to the control of the central nervous system, autonomic nervous system, endocrine system, synthesis, accumulation, secretion and transport of hormones, consumption by cells, storage, metabolism, inactivation, it is related to the release of hormones and the disruption of specific tissue receptors [2, 8]. The changes that occur in the endocrine system and other systems depending on the levels and duration of physical stress and their interrelation have not been fully studied until now. The analysis of the literature shows that there are few studies on the disruption of the endocrine system in aerobic, mixed, anaerobic stress and depending on the duration of the stress, mainly adenohypophysis, thyroid gland, adrenal gland, gonads, stomach studied in the plane of the pancreas. [9, 12, 21], however, changes in hypothalamic-pituitary-neurosecretory system recticity depending on the levels and duration of physical exertion were not improved.

MATERIALS AND METHODS

The experiment was conducted on 35 white adult rats weighing 160-180 g. In them, the (aerobic) physical stress caused by chronic swimming in forced water with a load of 7.5% of body weight is called using the method Karkishchenko N.N., Karkishchenko V.N. (2017). Morphofunctional reactivity in the supraoptic nucleus (SOYA) and paravertical nucleus (PVYA), hypothalamo-pituitary tract and neurohepaphysis (NG) was studied during chronic swimming in rats and 1 minute after swimming, 7, 21, 28 days and 2-3 months. In each group, vital signs: appearance, breathing, swimming activity were monitored [23]. The reactivity of the hypothalamo-pituitary neuroreactive system was assessed by: physiological, histological, morphological histochemical, cytophotometric methods. Statistical analysis was performed using the standard package of Microsoft Office programs - Excel 2000.

The level of probability of possible error (P) was determined using the demand criterion table. Differences between two compared indicators were considered reliable when R=0.05 and R<0.05.

RESULTS AND DISCUSSION

When studying the process of physical adaptation during swimming in animals with chronic aerobic stress, as well as the reactivity of the hypothalamic-pituitary-neurosecretory system, the following morphofunctional changes were observed in the reactivity of the hypothalamic-pituitary system. On the first day of physical exertion, rats' swimming in water was active, splashing, and at the same time short in duration, the amount of neurosecretory cells with high functional activity (NSH) in SOYA, PVYA increased by 1.2 times, and the amount of neurosecretory substances in NSH by 1.04 times, and 1.1 times in NG, and blood excretion was found.

By the seventh day of stress, the swimming of the rats was orderly, fast, but the duration was significantly higher, the fullness of blood vessels in SOYA, PVYA nuclei was increased by 1.14 times, the amount of NSH with high functional activity by 1.3 times, the size of the NSH nucleus by 1, 1 times, and the cytoplasm volume increased by 1.07 times, in neurosecretory cells (NSH) the ratio of the nuclear volume to the cytoplasm was 1.04 times, and the amount of NSM was 1.07 times, and the amount of NSH with low functional activity was 1.34 times, OD 1.11 times in NG and 1.13 times in NG, it was found to be released into the blood. On the seventh day of chronic stress, there was a decrease in the ratio of the nuclear volume to the cytoplasm in NSHs, and a decrease in the synthesis of neuropeptides in NSHs was observed .

By the fourteenth day of the stress, it was observed that the swimming of rats was regular, fast, and its duration increased, the arterial fullness in SOYA, PVYA increased by 1.19 times, the amount of high functional activity NSH by 2.7 times, the size of the nucleus to the cytoplasm in NSH was observed. 1.3 times the ratio indicator, 1.21 times and 2.43 times the amount of NSH with medium and low functional activity, 1.2 times the reduction of the ratio of NSH to the amount of GLIAL cells, and 1.19 times the increase of the surface of the nucleus, it was observed that the amount of neurosecretory substances (NSM) decreased by 1.23 times in neurosecretory cells (NSH), 1.08 times in hepatothalamo-hippophysial tract, and 1.1 times in OD, GGT. By the 14th day, nuclear hyperhydration has occurred in NSHs and increased productive activity in cells - increased synthesis of neuropeptides .

By the 21st day of chronic stress, the swimming of rats was formed at a higher level than in free, orderly duration, and the activity was high, and the amount of high functional activity NSH in the nuclei of SOYA, PVYA increased to the maximum, i.e. 3.6 times, in NSHs, the size of the nucleus was reduced to the cytoplasm. increase the ratio index by 1.13 times and the surface of the cell nucleus by 1.3 times, it was determined that the amount of NSH with medium functional activity is 1.4 times and the amount of NSH with low functional activity is 4.7 times, the ratio of NSH to the amount of GLIAL cells is 1.2 times decrease,

it was observed that the amount of NSM decreased by 1.5 times in NSH, 1.24 times in OD, and 1.22 times in NG.

By the 21st day of chronic aerobic stress, it was found that the hypothalamo-pituitary-neurosecretory system formed an adaptation reaction based on the hyperhydratation of the nucleus of SOYA, PVYA NSH, the increase in the number and surface of GLIAL cells, the maximum release of neurosecretory substances into the blood. By 21 days of stress, an increase in the number of GLIAL cells and the surface of the nucleus compared to NSH indicates that NSX increases its functional activity and provides protection-trophic processes [16, 18, 22].

Thus, by 21 days of aerobic stress provided by chronically swimming in water with a load of 7.5%, it was found that the adaptation process of the hypothalamo-pituitary neurosecretory system was ensured in the SOYA, PVYA, in relation to swimming in the body of rats.

By the 28th day of physical stress, the swimming ability of rats was formed at a high level, and the duration of free swimming activity increased. In the nuclei of the hypothalamic-pituitary-neurosecretory system SOYA, PVYA, NSH with high functional activity decreased by 1.11 times compared to the 21st day of pre-aerobic stress, the amount of NSH with low functional activity decreased by 5.3 times compared to the intact group, the amount of destructive cells decreased by 1.3 increased by 1.2 times, the ratio of NSHs to the amount of GLIAL cells decreased by 1.2 times, and it was observed that the indicator of the previous group was maintained, and based on the increase of the surface of the GLIAL cell nucleus, the size of the nucleus of NSH, the volume of the cell cytoplasm, the ratio of NSHs to the volume of cell cytoplasm increased up to 1.3 times, the amount of NSM in NSHs compared to the previous group, it increased by 1.05 times, up to 1.06 times in the middle height, and up to 1.07 times in the neurohypophysis and shifted towards recovery.

By the 28th day of chronic aerobic stress, hyperhydration of the NSH nucleus, increase in the amount of GLIAL cells, increase in the surface of the nucleus, increase in the amount of NSM in the NSH, OD, and NG indicate that the hypothalamo-pituitary-neurosecretory system has formed a process of adaptation to chronic aerobic stress and it was observed that it moved towards recovery.

By 2 months of chronic stress, rats' swimming in water was formed at a normal high level, their activity was free, swimming duration was high, and high functional activity of NSH in the SOYA, PVYA nuclei of the hypothalamo-pituitary-neurosecretory system was higher than that of animals with chronic stress on the 21st day. decrease up to 1.4 times compared to the indicator, increase NSH with medium functional activity up to 1.2 times and increase NSH with low functional activity up to 2.0 times, as well as have destructive karyolysis compared to the intact group, as well as hyperchromic pyknotic It is observed that the amount of NSH increases up to 1.4 times, the ratio of NSHs to the amount of GLIAL cells decreases by 1.4 times, the surface of the nucleus of GLIAL cells, the volume of NSH nuclei, the ratio of the volume of cell cytoplasm increases up to 1.3 times, it is observed that it has chronic tension compared to the indicator on the 21st day of animals, it was observed that the amount of NSM increased by 1.1 times in SOYA,

PVYA, NSH, at medium height, and by 1.2 times in NG.

On the other hand, it should be said that by 2 months of chronic aerobic stress, adaptation was formed in water swimming of rats, and it was found that the formation of the adaptation process in SOYA, PVYA of the hypothalamo-pituitary neurosecretory system is increasing.

It was observed that by 3 months of aerobic exercise by chronic water swimming, the water swimming of rats was formed at a high level, the duration of free swimming activity was high, and the water swimming of rats was kept at a normal high level. When studying the reactivity of the SOYA and PVYA nuclei of the hypothalamo-pituitary-neurosecretory system of animals in this group, it was found that the amount of NSH with high functional activity decreased by 1.9 times compared to the indicator on 21 days in animals with chronic stress, and the amount of NSX with medium functional activity It was observed that the amount of NSH with low functional activity increased by 1.3 times to 2.6 times. In both nuclei, the amount of destructive cells increased by 1.4 times compared to the intact group, the ratio of NSHs to the amount of GLIAL cells decreased by 1.4 times, the surface of the nucleus of GLIAL cells, the size of the nucleus of NSX, and the ratio of the volume of the cell cytoplasm increased by 1.3 times., compared to the index on the 21st day of chronically stressed animals, it was observed that the amount of NSM increased by 1.3 times in SOYA, PVYA NSHs, by 1.17 times in medium height, and by 1.2 times in NG compared to the intact group. It was found that the amount of NSM in NSHs was 1.2 times, in PVYA NSHs, the amount of NSM was 1.1 times at medium height, and 1.1 times at low level in NG.

On the other hand, it should be said that by the 3rd month of aerobic exercise by chronic water swimming, the water swimming of rats was formed at a high level, the duration of free swimming activity was high, and the water swimming of rats was kept at a normal high level. adaptation to the level of aerobic stress due to the predominance of the amount of high and medium functional NSH in the pituitary neurosecretory system of SOYA, PVYA and hyperhydration of the nucleus, as well as the increase in the amount of destructive cells, the amount of GLIAL cells, the surface of the nucleus due to the maintenance of NSM synthesis at a high level it was observed that it was provided.

CONCLUSION

Thus, when rats are chronically subjected to aerobic stress due to 7.5% load by swimming in water, until the 21st day of stress, the amount of NSH with high functional activity in SOYA, PVYA of the hypothalamus increases, during swimming in animals, an adaptation process is formed and From the 21st day of pregnancy to the 3rd month, due to hyperhydration of SOYA, PVYA NSH nuclei, GLIAL cell quantity and surface, NSM synthesis in NSHs prevailed over the secretion process, a complete adaptation and recovery process was observed in SOYA, PVYA NSHs of the hypothalamus and during swimming.

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