



Daily dynamics of cortisol in female students with somatoform dysfunction of the autonomic nervous system engaged in fitball-gymnastics

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Abstract

Objective of the study was to evaluate the impact of the fitball-gymnastics course on the daily dynamics of the cortisol concentration of female students with a disorder of the autonomic nervous system.

Methods and structure of the study. The scientific work was carried out at the North Caucasian Federal University, the participants were female students assigned to a special medical group with hypertonic (n=14) and hypotonic (n=16) type of vegetovascular dystonia at the age of 18-20 years. Control group - practically healthy female students (n=28). As a leveling of the processes associated with the disease, a course of fitball-gymnastics exercises was used in the system of additional education. Female students with ADHD of hypertonic type (n=15) and hypotonic type (n=17) made up correction groups. A highly sensitive competitive immunoassay was used to measure cortisol concentration in human saliva plasma. To determine daily fluctuations, hormone sampling was performed at 8:00, 12:00, 16:00 and 20:00.

Results and conclusions. As a result of the experiment, violations of the daily secretion of cortisol were revealed in girls with ADHD both in hypotonic and hypertonic types. In female students with ADHD of the hypotonic type, the cortisol concentration increased by the end of the day, in female students with ADHD of the hypertonic type, the maximum values were determined at 12 o'clock. Students with ADHD involved in fitball gymnastics showed a positive dynamics of cortisol concentration during the day - they revealed a decrease in its concentration in the evening.

Keywords: *somatoform dysfunction of the autonomic nervous system, special medical group, cortisol, fitball-gymnastics.*

Introduction. Among high school students and students of secondary and higher educational institutions, students with "vegetative dysfunction syndrome", "vegetovascular dystonia" and "neurocirculatory dystonia" have recently been increasingly sent to special medical groups for physical education. This is a vulnerable age group, in which the influence of various stresses experienced during this period joins the factors of hormonal changes in the body. Timely diagnosis and correction of the manifestations of this syndrome, including the methods of physical culture, is the key to preventing the early transformation of functional disorders into somatic ones [4, 5, 7].

There are various interpretations of these violations in the scientific literature. According to I.N. Zakharova et al. (2015), autonomic dysfunction is a complex of disorders in the autonomic regulation of internal organs, which leads to the development of functional disorders of the cardiovascular system (arrhythmia,

blockade, vascular crises, etc.) [2]. Proposed by A.M. Wayne et al. (2010), the classification of autonomic disorders classifies vegetative-vascular dystonia as a syndrome of vegetative-vascular dysfunction in organic somatic diseases, which manifest as a syndrome of autonomic-vascular-trophic disorders [1].

Some researchers, for example, O.N. Ivakhnik, I.G. Kuznetsova (2009) classify vegetative-vascular dystonia as a disease associated with disruption of the circadian organization of the activity of the autonomic nervous system [3]. Identification of a certain rhythmic organization of the functioning of the leading adaptive systems of the body is of great importance for the diagnosis of psychosomatic disorders and the selection of methods for correcting the "failure" of biorhythms [8]. A special role in these processes is assigned to the rhythms of the neuroendocrine system, which provides temporal synchronization of biochemical reactions and physiological functions [6].

In our work, we adhere to the term “somatoform dysfunction of the autonomic nervous system” (code F45.3), which includes these concepts, according to the Tenth Revision of the International Statistical Classification of Diseases and Related Health Problems (ICD-10). Objective of the study was to evaluate the impact of the fitball-gymnastics course on the daily dynamics of the cortisol concentration of female students with a disorder of the autonomic nervous system.

Methods and structure of the study. The scientific work was carried out at the North Caucasian Federal University, which involved female students classified for health reasons to a special medical group, with a disease of vegetovascular dystonia of hypertonic (n=14) and hypotonic (n=16) types at the age of 18-20 years. Practically healthy female students (n=28) took part in the study as a control group. To level the negative consequences associated with somatoform dysfunction of the autonomic nervous system (ADHD), a course of fitball-gymnastics exercises was used in the system of additional education. Female students with ADHD of hypertonic type (n=15) and hypotonic type (n=17) made up correction groups.

A highly sensitive competitive immunoassay was used to measure cortisol concentration in human saliva plasma. To determine daily fluctuations, hormone sampling was performed at 8:00, 12:00, 16:00, and 20:00. For this purpose, reagent kits of LLC “ALKOR-BIO” and a microstrip photometer for immunoassay STATFAX 303 Plus were used.

The results of the study were subjected to variational-statistical processing using the computer program Microsoft Excel 2010 and SPSS (version 19.0 for Windows).

Results of the study and their discussion. The daily dynamics of cortisol secretion is shown in Figures 1, 2. According to the data obtained, girls with somatoform dysfunction of the autonomic nervous system of the hypotonic type in the morning are 22% lower than girls in the control group ($p < 0.01$). Further, the female students of the control group observed a gradual decrease in this indicator. In female students with somatoform dysfunction of the autonomic nervous system of the hypotonic type in both groups, by 12 o'clock, the concentration of cortisol decreases slightly. In the group of girls with ADHD according to the hypotonic type (control), the average cortisol concentrations after 12 hours begin to increase and reach maximum values at 20 hours with a difference from the control group at this time of 32% ($p < 0.01$).

The increase in cortisol concentration in the evening hours may be due to the growing stress of the adaptation system towards the end of the school day. The body, weighed down by the existing pathology, can hardly cope with the load and is not able to ad-

equately respond to the stress that has accumulated during the day. In the girls of the correctional group with a disorder of the autonomic nervous system of the hypotonic type at 16 o'clock there is a slight increase in cortisol, and by 20 o'clock the cortisol concentration decreases, as in the students of the control group.

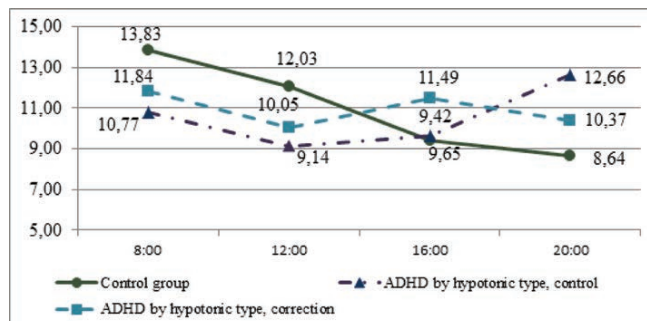


Figure 1. Daily dynamics of cortisol secretion in female students with somatoform dysfunction of the nervous system according to the hypotonic type after correction

Note: * - the significance of the average values of the cortisol concentration between ADHD according to the hypotonic type, control and ADHD according to the hypotonic type, correction; ** - reliability of mean HR values between the control group and ADHD according to the hypotonic type, control ($p < 0.01$).

In girls with somatoform dysfunction of the autonomic nervous system of the hypertensive type, there is a sharp increase in the concentration of cortisol by 12 o'clock in the afternoon (by 18%), then by 16 o'clock it decreases by 24% in relation to the daily value, and by 20 o'clock it again slightly increases, while being significantly higher than in the control and correction groups ($p < 0.01$). The girls of the correction group showed a decrease in the concentration of cortisol in the evening hours, and these values are significantly lower than in female students with ADHD of the hypertensive type who do not do additional physical exercises.

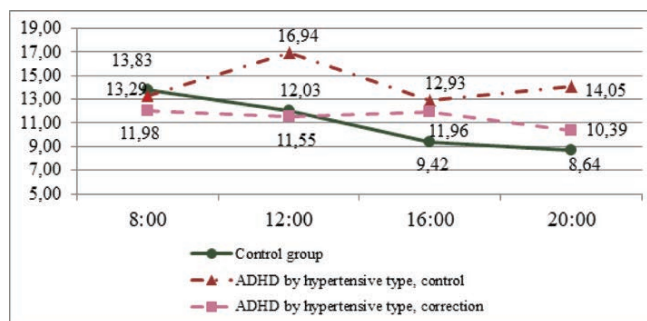


Figure 2. Daily dynamics of cortisol secretion in female students with somatoform dysfunction, disorder of the autonomic nervous system by hypertonic type after correction

Note: * - the significance of the average values of the



cortisol concentration between ADHD by hypertensive type, control and ADHD by hypertensive type, correction; ** – reliability of mean heart rate values between the control group and ADHD according to the hypertensive type, control ($p < 0.01$).

Conclusions. When comparing the indicators of cortisol concentration in female students with somatoform dysfunction of the autonomic nervous system according to hypotonic and hypertonic types with the control group, a violation of the daily dynamics of its secretion was revealed. This may be accompanied by a violation of the regulatory mechanisms of adaptation of the organism in response to the influence of the external environment of the organism of female students with dysfunction of the autonomic nervous system. Fitball-gymnastics classes affect the daily dynamics of cortisol and reduce its concentration in the evening, thereby relieving the growing stress of the working day.

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