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THE INFLUENCE OF PHYSICAL ACTIVITY ON THE CONDITION OF THE CEREBRAL CIRCULATION IN FEMALE STUDENTS

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Abstract

Educational environment of the University influences to the development of inactivity, it also has a negative impact on the process of adaptation of students. In response to the impact factors of the educational environment of the University there is a situation of mental stress, which leads to the decrease of reactivity and to the increase of emotional stress. The necessity of the correction of these destructions determined the relevant aim of the research - to study peculiarities of cerebral hemodynamics in the dynamics of the studying year in female students with different indicators of locus of control and different levels of physical activity.

Was used the technique for the assessment of the level of subjective control. To assess the state of the vascular system of the brain is used the method of rheoencephalography. The excess of the number of the investigated rheoencephalographic indicators in girls of the control group compared to normative values indicates the occurring stress state of cerebral circulation in the dynamics of the academic year, under the influence of mental stress. Female students with higher locus of control can compensate the indicators of hemodynamic stress with the systematic fitness. The dynamics of rheoencephalographic indicators show a better blood circulation in the vessels of the carotid pool of the brain in girls of the main group as a result of sports.

Key words: students, adaptation, stress reactivity, psycho-emotional tension, cerebral hemodynamics, locus of control, physical activity, rheoencephalographic indicators, fitness.

Introduction

The learning process in the University requires students to adapt to an increased level of mental workload [18]. In many earlier investigations are confirmed data about the influence of the complex personal body parameters on the adaptation process, including its emotional stability [6, 7, 8, 9, 10, 11, 12, 20].

Describing the relationship of personal body parameters and emotional resilience to stress, it is possible to study the importance of such personality indicator as locus of control. On a scale of locus of control a group of internals perceives positive or negative events as consequences of personal actions which potentially are under their personal control, which contributes to a better adaptation to the conditions of study at the University. The internals are able to compensate stress reactive symptoms by persistent and prolonged outdoor sports. We conducted a questionnaire survey among the female students [15, 16, 19] of the pedagogical University, which allowed to highlight in the studied population two fairly stable groups: group 1 – those who are attending lessons of physical training, 2 group – girls with long term of the most popular sport among the youth - fitness. It is known that physical activity [1] and fitness [2, 3, 18, 22, 23, 26] positively affect the overall haemodynamics of the body.

In this regard, it is advisable to explore as indicators of the state of cerebral hemodynamics in students at different stages of the educational process in the University.

Aim of the study.

To investigate the peculiarities of a brain hemodynamics in the dynamic of the academic year in female students with different indicators of locus of control and different levels of a physical activity.

Methods and organization of research

To study the role of regulation of stress processes in humans we can use the psychological property as the locus of control.

We used the technique of the estimation of level of subjective control. In the research took part female students of 18-19 years in the amount of 48 people. Were formed two groups (24 persons): the control and the main.

On the basis of the obtained data on the locus of control were formed the control and main groups. In the control group were included girls with low locus of control, in the main – with averages.

Girls with high locus of control were in a small number, so they were not included in the control and main groups. Girls in the control group were engaged in physical activity, attending classes of physical training in University, girls in the main group additionally visited fitness classes.

Overall fitness can be described as physical activity, of an integrated plan, with the aim to enhance the ability of the organism to the physical stress [12, 25].

To assess the state of the vascular system of the brain was used the method of rheoencephalography [27]. In the study were performed the rheoencephalographic parameters in the studied groups of girls at the beginning of the academic year and also after the three and six months with the use of rheological analyzer "Mitsar-REO".

Results and discussion

Was established a relationship between personal characteristics, psychomotor, and hemodynamic indicators when performing emotionally significant activities [17].

Much attention is paid to the psychological characteristics of personality and stress, as well as the study of the role of regulation of stress processes of such psychological properties as the locus of control [4, 10].

Internal control is based on the perception of positive or negative events as consequences of personal actions, being potentially under a personal control.

The internals have more efficient cognitive system. The used methods allow us to assess the perception of the event personality on a continuum of external (external) and internal (internality) locus of control.

According to a scale of total internality were allocated two studied groups: a control group of female students with a low level of internality of 2.76 $\pm$ 0.64 and the main – with the average level of internality of 4.28 $\pm$ 1,56.

Let`s discuss the characteristics of indicators of rheographic index. Values of rheographic index in girls of the main and control groups in a background study (at the beginning of the academic year) were within the lower limit of normal.

After three and six months from the beginning of the academic year in girls of the main group the rheographic index increased respectively by 10.1% ($p<0.05$); by 19,4% ($p<0.01$) compared to the background values.

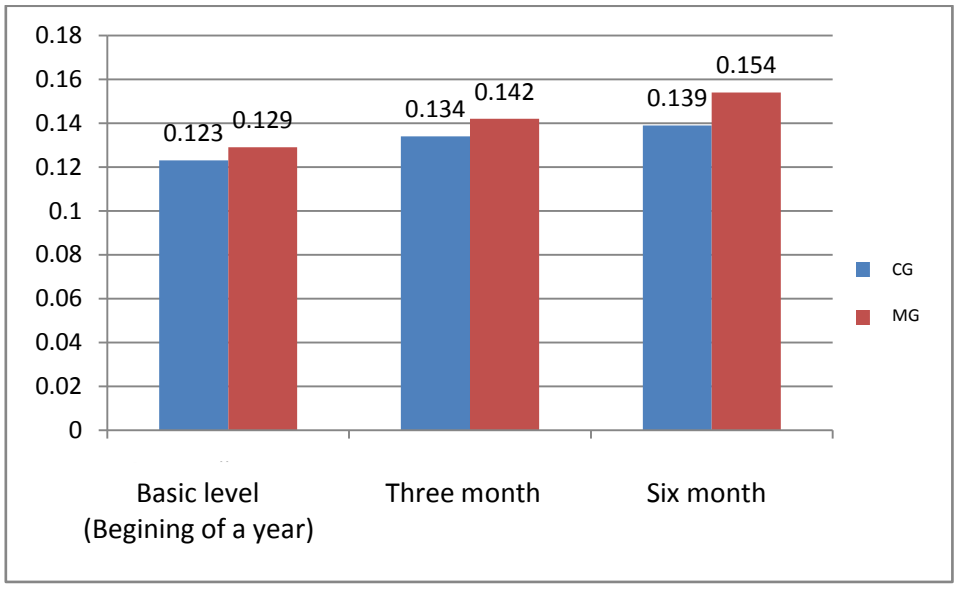

Figure 1. Rheographic index (RI, Om).

Described dynamics of rheographic values of the index indicates a change in the blood vessels of the carotid region [24]: within six months of the sports there was a gradual improvement of blood flow and pulse blood in the vessels of the carotid pool of the brain in girls of the main group.

Similar, but less significant dynamics of rheographic index was observed in girls in the control group.

After three and six months from the beginning of the academic year, in girls of the control group the rheographic index increased respectively by 8.9% ($p<0.05$); by 13,0% ($p<0.05$) compared to background values (Fig.1).

Figure 1 shows that within six months of the study, girls in the control group showed a more significant hypovolemia of the blood vessels of the carotid pool of the brain compared with a group of girls of a similar age involved in sports. In particular, after three and six months from the beginning of the academic year indicators of rheographic index in girls of the main group exceeded the data of the control group respectively by 5.9% ($p<0.05$) and by 10.8% ($p<0.05$), being within the boundaries of the reference ranges throughout the study periods.

The above mentioned dynamics of indicators of rheographic index indicates a better blood circulation in the vessels of the carotid pool of the brain [5] in girls of the main group during the academic year as a result of sports.

The state of the vascular wall elasticity can be characterized by using the indicator of the modulus of elasticity.

After three and six months of sports in girls of the main group a coefficient of elasticity of the vascular wall (modulus of elasticity) unreliable increased compared to the background values. In girls of the control group during these periods the values of the modulus of elasticity exceeded the background level, respectively, by 8.0% ($p<0.05$) and 16.0% ($p<0.05$), indicating a decrease of elasticity of vessels of the carotid pool of the brain. This is confirmed by the decreases of modulus of elasticity of the blood vessels of the brain in girls of the main group compared to a control after three and six months from the beginning of the academic year, respectively by 4.6% and by 12.2% ($p<0.05$) (Fig.2).

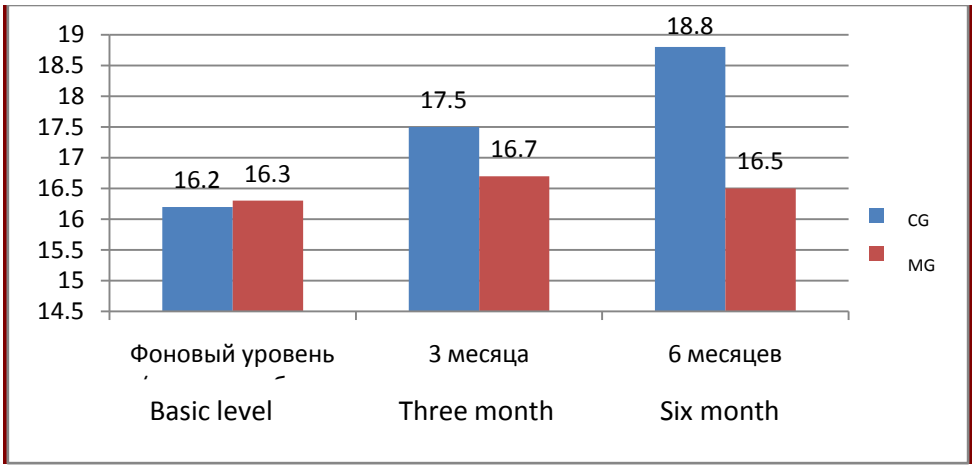

Figure 2. The modulus of elasticity (ME, %).

According to the figure 2 it is seen that coefficient values of elasticity of a vessel wall (elastic modulus) in girls of a control group in six month from the beginning of the academic year did not exceeded the normative indexes by 4,4% ($p<0,05$), indicating a hypertension of brain vessels.

Thus, in girls of the control group within six months from the beginning of the academic year there was an increased tone of cerebral vessels, which indicates a high level of stress compared to girls involved in sports. Hypovolemia of the brain vessels in girls of the control group during these periods, in our opinion was the compensatory reaction of the cerebral circulation in response to emotional stress caused by the educational process in the University.

Dicrotic index characterizes the state of the vascular tone of the brain. After three and six months of training in University in girls of the main group a dicrotic index of cerebral vessels was higher than the background values, respectively by 4.9%; and 6.9% ($p<0.05$). In girls of the control group the values of this indicator were higher than the background in these periods, respectively by 9.7% ($p<0.05$) and by 23.5% ($p<0.01$), indicating an increased tone and resistance of vessels of the microvasculature of the brain in the dynamics of the academic year. After six months of study the dicrotic index value of cerebral vessels in girls of the main group was by 12.5% ($p<0.05$) lower that the values in the control group, which indicates a decrease of the tonus of the vessel wall of the microvasculature of the carotid pool of the brain under the influence of sports (Fig. 3).

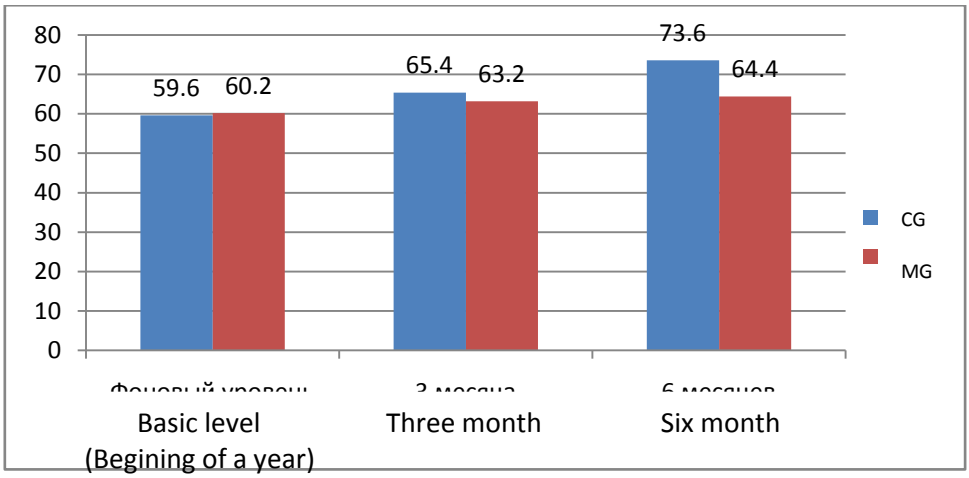

Figure 3. Dicrotic index (DI, %).

Figure 3 shows that the value of the dicrotic index in girls of the control group after six months from the beginning of the academic year exceeded the normative indices by 5.1%.

The magnitude of the diastolic index of girls in both groups during all study periods were within the reference ranges. The condition of the venous outflow was assessed by indices of diastolic index of the brain vessels.

After three and six months of training in girls of the main group the diastolic index of the brain vessels was not significantly different from background values, in girls of the control group it exceeded respectively by 2.6% and 4.7%. (Fig.4). The latter circumstance indicates on a slight obstruction of the venous outflow in the vascular pool of the carotid arteries of the brain in girls in the control group that were not engaged in active sports. After six months of training in girls of the main group the diastolic index of cerebral vessels was on 5.1% lower than in the control group.

Rheoencephalographic indicators (front-mastoidal (FM) lead) of girls of the studied groups in the dynamics of the academic year (M±m) are shown in figures 1-4. In all figures CG - control group (n=24); MG - the main group (n=15); duration of the study in the dynamics of the academic year (Background level (beginning of the academic year; 3 months; 6 months); rheoencephalographic (REG) indicators reflect the total blood flow in carotid pool in girls of the study groups; reliability of differences of indicators of the MG and CG from the background levels that were calculated using the Mann - Whitney test: * p<0,05; **- p<0.01; * * * p<0,001.

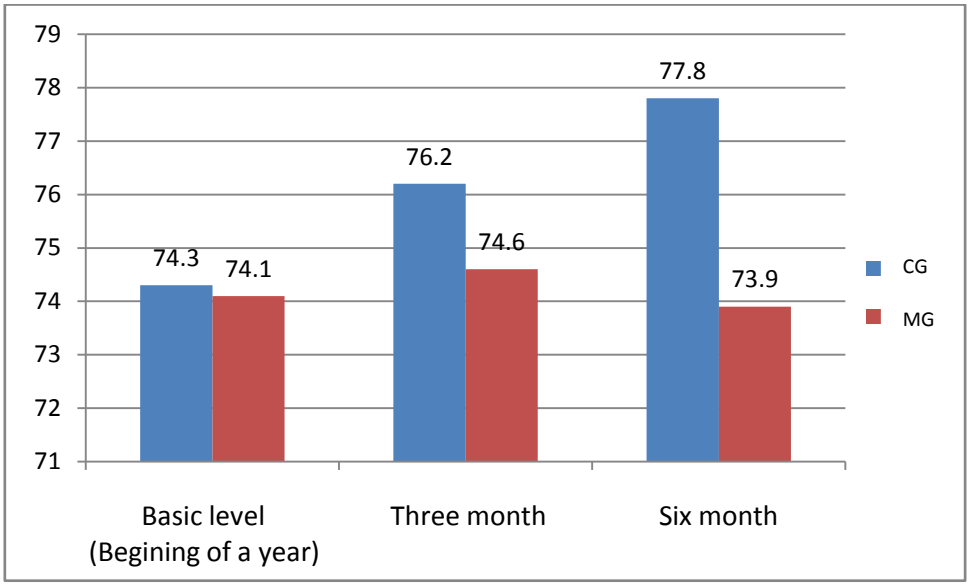

Figure 4. Diastolic index (Dai, %).

The analysis of the studied indicators of rheoencephalography research in a front-mastoidal lead that are presented in figures 1-4 evidence on the increased vascular tone in the carotid basin of the brain in girls in the control group in the dynamics of the academic year compared to girls, which body is experiencing systematic physical activity.

Conclusion.

Female students with higher control of locus (the main group) regularly attend additional fitness classes. Systematic and moderate exercises in the afternoon exceeding the amount of physical activity planned for the academic year at the University, contribute to the improvement of cerebral circulation, to the decrease of cerebral vessels tone; they are improving the elasticity of vessels, the venous outflow.

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