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THE CHANGES OF CARDIO HEMODYNAMIC INDEXES AT CHILDREN WORKING ON COMPUTER

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Abstract- ***Introduction. Young people are exposed to a range of information technologies in different environments, including home and school, but the degree of factors influencing information technologies are poorly understood.***
Materials and methods. Current research included children of 7th from, divided into 2 groups depending on the duration of using the computer. There were investigated the following cardio hemodynamic indexes: frequency of heart contractions, systolic and diastolic blood pressure, pulse pressure, average dynamic pressure, systolic volume and cardiac minute-volume.
Results. The research results indicate that changes in cardio hemodynamic indexes were within the norm of age, but recorded statistically reliable decrease in the dynamics of the day and week in children from both studied groups. A further reduction of 10% (which shows a fatigue) on an average in the research of the dynamics of the day or week were registered in children who work more on the computer. The largest decreases of the indexes' values in the dynamic of the day were registered an the last lesson and in the dynamics of the week - Friday. The individual analyses of the children indicate an increase and a decrease of the investigated values of cardio hemodynamic indexes.
Conclusions. Cardiovascular hemodynamic indices recorded changes, show a strain of the body systems and as a result – the development of fatigue, which is recorded in children working more on the computer.

Keywords –: children, computer, cardio-hemodynamic indexes, correlation

I. INTRODUCTION

The functional and health's status of children is a reflection of the prosperity of the society and therefore the studying of the dynamic and multifactorial assessment of functional status of students in the process of studying is important for the prevention of premorbid processes [1,2,4,5]. The analysis of morbidity based on the data of periodic medical examinations, of the people working on computer, found that the most common nosologics were: myopia (28-51%), vegeto-vascular dystonia (21-63%), anemia (13-37%), osteochondrosis (7-48%), hypertonic disease (9-43%), autoimmune thyroiditis (11-33%) [6,10,13,15,20,21].

In daily life, autonomic functions in a healthy body are maintained at the stable level due to mechanisms of itself. On the action of stressogenic factors (in this case - intellectual effort, including work on computer) develops an emotional strain, characterized by a complex of somatic-vegetative changes which refers to the cardiovascular system [8,12,14,16].

The changes in the cardiovascular hemodynamic indices with low frequency heart contractions and decreased blood pressure during activities are explain ad during the action of the intellectual effort in cortex are formed outbreaks of excitation, that induce negative phase of sub cortical centers in case of vase-motor and cardio-regulatory centers. Acceleration pulse and increased blood pressure also provoke the fatigue, especially developing of stage I of the fatigue – stage of excitation. However, it should be noted that changes in hemodynamic indices also depend on the type of the nervous system [3,18,19].

The urgent adaptation of the circulatory system during working on computer summarizes in children with a complex of changes of parameters in cerebral blood circulation, forearm, and the autonomous nervous regulatory action on the heart rate [11,18,22].

Recent studies show, that in 15-16 year old children during the work on computer the body reaction is characterized by the changes in the heart rate, blood pressure, 11-hydroxy-corticosteroids content, histamine, serotonin, sodium ions (in fluid from the mouth), and the values and direction of which, depend on the initial state and presence of electromagnetic fund, without deviations from physiological norms. No changes occur during lessons without computer [9,12,17].

II. MATERIALS AND METHODS

As the subject of the study served the children from 5 schools from Chisinau, Republic of Moldova. Children were 13-14 years old (average age – 13, 8 years old). Children were divided into two groups, depending on the duration of the computer use: group I=children who work more on the computer - children who work a long period of time (over five years old), a long period of time of use (more than 5 hours), daily use of the computer, in the weekend the use of computer becomes more than 5-6 hours, group II=children using the computer for a less period of time than children from group I.

As the physiometric indicators of cardiovascular system in the present study were considered - the frequency of heart contractions, systolic and diastolic blood pressure, pulse pressure, average dynamic pressure, systolic volume and cardiac minute-volume, measured by conventional methods [7,12].

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III. RESULTS AND DISCUSSION

The studying of cardiovascular hemodynamic indices in children using the computer in the educational process allows to establish the presence or lack of emotional tension which can then induce changes in the cardiovascular system and the body as a whole.

The frequency of heart contractions at the end of the lesson was included in the range of 76.8±0.29 beat/min. – 68.8±0.32 beat/min. to children who work more on the computer and 80.9±0.21 beat/min. – 73.8±0.32 beat/min. to children who work less on the computer. The average values of the frequency of the heart contractions, during the lesson decrease by 8.0% in children who work more on the computer and 4.8% in children who work less on the computer.

The values of the systolic blood pressure decrease at the end of the lesson, in the dynamics of the day or week, with several units' then dynamic blood pressure, which leads to lowering of blood pulsating. The systolic blood pressure was 103.9±0.48 to 91.9±0.43 mm Hg in children work more on the computer and 109.9±0.32 to 100.1±0.33 mm Hg in children who work less on the computer (the values in the end of the lesson). The values of diastolic blood pressure vary between 69.9±0.34 and 57.5±0.34 mm Hg, the pulse and the blood pressure were included in the range of 41.3±0.24 to 33.8±0.17 mm Hg to children who work more on the computer. In children who work less on the computer the limits of variation values of diastolic blood pressure and pulsating blood were higher. At end the lesson, on an average, the systolic blood pressure decreased by 7.5%, the diastolic blood pressure by 10% and pulsating pressure – by 5.1% at children who work more on the computer, while in the children who work less on the computer the blood pressure drops on an average approximately half less (systolic blood pressure decreased by 4.3%, diastolic blood pressure – by 7.7% and TP – 2.5%).

The average dynamic pressure recorded values, approximately medium between systolic and diastolic blood pressure, with variations between 80.4±0.32 to 74.3±0.25 mm Hg for the children who work more on the computer and 84.4±0.22 to 79.5±0.18 mm Hg in children who work less on the computer, and decreased by 10.0% from children who work more on the computer and 5.7% - of children who work less on the computer of the end of the lesson. The variations in systolic volume were included in the limits from 62.2±0.22 to 51.6±0.22 ml from children who work more on the computer and 62.8±0.15 to 58.8±0.12 ml in the children who work less on the computer. The average values of the systolic volume have decreased by 8.6% in children from children who work more on the computer and 7.4% from children who work less on the computer.

The cardiac minute-volume varies between 4.79±0.04 and 4.37±0.03 l in children who work more on the computer and between 5.16±0.02 and 5.05±0.01 l in children who work less on the computer. The cardiac minute-volume reduction by 11.5% of the end of the lesson in the children who work more on the computer and by 5.0% in children who work less on the computer was determined by a decrease of frequency of cardiac contractions and by the reduction of systolic volume.

By individual analyses of children it was established, that in some children the values of cardio-hemodynamic indexes decreases, and in another part-increases, and in some children – it does not change.

In most of the children were registered increased cardiovascular hemodynamic indices in both studied groups, while of children who work more on the computer were recorded a number of children, about twice as high as the where the values of studied indexes decrease. The number of children in which did not change the value of indexes prevail in children who work less on the computer.

In children from grow children who work more on the computer up I the increase of the values of cardiovascular hemodynamic indices at the end of the lesson takes place in a lower range, while reduction of indices is in a greater number of children, changes which speak about the prevalence of parasympathetic regulation of nervous system and thus about the advanced degree of fatigue in children of children who work more on the computer than those in children who work less on the computer. Increased blood pressure and cardiac minute-volume were recorded in the higher number of children and with higher values in children who work less on the computer, indicating an expressed mobilization of adaptation of cardio-hemodynamic indices, in comparison with children who work more on the computer.

There was a share of 34.7% of children who work more on the computer in which the frequency of heart contractions after Informatics discipline fell from 3.2 to 9.4 beat/min, in the children who work less on the computer just in half of the children (17.7%) recorded a decrease which varied in the limits of 2.4 to 6.7 beat/min. Systolic blood pressure decreased in 35.3% of children who work more on the computer, and with 3.7 to 10.8 mm Hg. and with 2.6 times fewer children (13.8%) in children who work less on the computer recorded a decrease from 3.0 to 7.8 mm Hg. Diastolic blood pressure decreased in 36.7% of children who work more on the computer with 3.0 to 4.8 mm Hg., while in children who work less on the computer diastolic blood pressure was recorded with 1,9 times in a smaller number of children (19.3%) with values between 1.8 to 3.5 mm Hg. In the children who work more on the computer (35.6%) the pulse pressure decreases from 1.8 to 4.6 mm Hg. and a decrease of 1.7 to 3.5 mm Hg. record 2.2 times fewer children who work less on the computer (16.5%).

The average dynamic pressure decreases from 2.4 to 9.7 mm Hg. at 36.7% of children who work more on the computer, while in children who work less on the computer by 2.4 times fewer children (15.4%) show a decrease of 3.2 to 7.6 mm Hg. Systolic volume decreased in 38.2% of children who work more on the computer with 2.6 to 12.1 ml in comparison with a rate of 1.7 less (22.4%) in children who work less on the computer, in which the decrease of systolic volume was from 3.1 to 9.2 ml. A decrease of minute-systolic volume was set in 34.9% of children with 0.41 to 0.52 l to children who work more on the computer and in children who work less on the computer – at a share of students – with 1.9 times lower (18.5%) and the decrease was from 0.33 to 0.48 l.

Between the indices of cardiovascular system and the studied factors in informatics classrooms there is a medium or low correlation established, and statistically significant. The average heartbeat frequency have inverse average correlation (r=-0.5) statistically significant (p<0.001) only CO_2 concentration, which implies that with increasing of CO_2 concentrations decreases the frequency of heart contractions. The changes in CO_2 concentration explain 27.0% of the variability in cardiac contraction frequency. The systolic blood pressure correlates poorly directly with the temperature (r=0.1, p<0.05) and with a very small effect (1.2%). The diastolic blood pressure correlates poorly with the temperature (r=0.05, p<0.05), practically not being affected (r^2=0.2%), while it correlates strongly (r=0.8, p<0.001) with the duration of activities at the computer and is influenced at a share of 66.7% in the simple correlation model. During the study of multiple correlation the action of both factors determine 85.2% (p<0.01) of the variability of diastolic blood pressure.

The pulse pressure correlates in medium with the temperature (r=-0.5, p<0.001), relative humidity of the air (r=0.3, p<0.05) and duration of the activities at the computer (r=0.6, p<0.05) and it correlates strongly with the noise level (r=-0.9, p<0.001). The largest share of influence on the pulse pressure, on the simple correlation, has noise level (r^2=82.0) and the lowest relative humidity (r^2=9.3%). Studying the action in the complex of all the three factors on the pulse pressure, we set a coefficient of determination of 94.9%, statistically significant (p<0.01). A strong correlation, statistically significant, was established between the average dynamic pressure with the noise level (r=0.7, p<0.05) and the duration of activities at the computer (r=0.9, p<0.001), and the average correlation with a relative humidity (r=0.4, p<0.01). The coefficient of determination (r^2) constitutes 85.1% for the basic duration of activities at the computer, 53.1% for noise and 15.7% for relative air humidity, if only these factors would act independently. When studying the action of these three factors in complex with multiple correlation, we established an influence of 92.3%, statistically significant according to ANOVA test (p<0.01).

The systolic volume and cardiac minute-volume correlate statistically and significantly with the three of the investigated factors. Thus, systolic volume correlates strongly with duration of activities at the computer (r=0.9, p<0.01) and the noise level (r=0.7, p<0.05) and the medium with the concentration of carbon dioxide (r=0.3, p<0.05). The duration of computer activities could lead to 73.3%, of noise level – 50.5% and carbon dioxide concentration – 8.9% of the variability in systolic volume, if only these factors would act separately. In their complex action they have an influence up to 67.3%, but according to ANOVA, correlation is not statistically significant (p>0.05). Cardiac minute-volume recorded a strong correlation it with noise level of (r=0.8, p<0.01) and an average correlation with duration of activities at the computer (r=0.7, p<0.05) and dioxide carbon concentration (r=0.3, p<0.05). The simple correlation model, cardiac minute-volume is influenced of 69.9% by the noise level, 48.1% - by the duration of activities at the computer and 10.8% - by the concentration of carbon dioxide, in the study of multiple correlation the result is statistically insignificant (p>0.05).

IV CONCLUSIONS

Cardiovascular hemodynamic indices recorded changes, show a strain of the body systems and as a result – the development of fatigue, which is recorded in children working more on the computer. Quantitative and qualitative changes in heart rate manifest less by the state of myocardium and more marked by the general reaction of the body, by the particularities of links between systems, realized in the dynamics of physiological concrete processes. At the same time, literature data indicate that the decrease of integral characteristics in heart rate and hemodynamic indices represent a manifestation of the restructuring and consolidation of forces, conditioned by the emotional strain that to a greater extent, in the current research is a characteristic of children who work for a long period of time on the computer.

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