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ASSESSMENT OF INFLUENCE OF PHYSICAL LOAD ON THE MAIN HEMODYNAMIC INDICATORS OF FIRST YEAR STUDENTS

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Abstract: An important role among the health factors is played to the indicators of the central hemodynamic on which the physical activity affects to. The data article is devoted to an actual problem of studying the functionality of the cardiovascular system of students. The purpose of the work is to study the effect of physical activity on changes of the central hemodynamic of first year students at the university. This article presents the results of experimental studies to evaluate the effect of physical load on blood pressure, heart rate, stroke and minute blood volume of students. This article is intended for teachers of physical education, as well as for scientists who studying questions of adaptation of students' organism to physical activity.

Key words: students, central hemodynamic, physical load, systolic blood volume, minute volume of blood.

ОЦЕНКА ВЛИЯНИЯ ФИЗИЧЕСКОЙ НАГРУЗКИ НА ОСНОВНЫЕ ПОКАЗАТЕЛИ ГЕМОДИНАМИКИ СТУДЕНТОВ ПЕРВОГО ГОДА ОБУЧЕНИЯ

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Аннотация: Среди факторов здоровья человека важная роль отводится показателям центральной гемодинамики, на которые оказывает влияние физическая нагрузка. Статья посвящена актуальной проблеме изучения функциональных возможностей сердечно-сосудистой системы студентов. Цель работы заключается в изучении влияния физической нагрузки на изменения показателей центральной гемодинамики у студентов первого года обучения в ВУЗе. Данная статья представляет результаты экспериментальных работ по оценке влияния физической нагрузки на показатели артериального давления, частоты сердечных сокращений, ударного и минутного объема крови у студентов. Статья предназначена для преподавателей физической культуры, а также для научных работников, изучающих вопросы адаптации организма студентов к физической активности.

Ключевые слова: студенты, центральная гемодинамика, физическая нагрузка, систолический объем крови, минутный объем крови.

The aim of the work was to investigate the influence of physical load on the indicators of the central hemodynamic of the first-year students.

Research objectives:

1. Determine the heart rate per minute and level of blood pressure of the first year students in three states: rest, load on 10 sit-ups and 20 sit-ups.
2. Calculate the value of systolic and minute volume of blood in testers.
3. To assess the effects of physical load on the hemodynamic parameters testing.

Materials and methods:

100 numbers of first-year students were involved in the pilot testing in equal numbers of male (50) and female (50). All students from the Karaganda State Medical University aged from 18 to 22 years. Registration of indicators of hemodynamic parameters was carried out in three states: rest, load on 10 sit-ups and 20 sit-ups. Blood pressure measurement was performed using dial indicators of tonometer according to the method of Korotkov [1, p. 82]. Counting of heart rate by palpation method was conducted by probing the pulse wave at the radial artery in the wrist joint. We perform calculations in systolic blood volume (SBV) and cardiac output CO [2, p. 39] for each of the samples. The dependence of the testing load parameters was evaluated with a help of the nonparametric methods of data processing. Probability ratio was calculated based on the regression coefficients with 95% confidence intervals. The relationship between the values at the state of rest and after physical activity was determined by the help of the Wilcoxon test ($p < 0,05$). To identify the differences in intersexual there was used by the method of Mann-Whitney ($p < 0,05$). Calculation of statistical characteristics was carried out by using the software package of SPSS 7.0 for Windows.

Table 1

Basic statistical characteristics of the studied parameters of hemodynamic students

Indicators	Boys			Girls			P-degree
	median	25% - quartile	75% - quartile	median	25% - quartile	75% - quartile	
HR	69	68	80	74	65	77	0,745
SD	120	120	125	110	100	119	0,027
DD	90	80	90	70	60	70	0,008
PP	40	32	40	40	30	40	0,770
SBV(ml)	55,60	51,20	62,80	69,20	62,20	73,60	0,010
CO (l)	5,48	5,21	5,84	4,78	4,33	5,33	0,029
HR 10	80	78	98	79	73	98	0,745
SD 10	125	120	130	110	110	120	0,034
DD 10	90	90	90	71	60	80	0,003
PP 10	40	35	40	40	37	50	0,474
SBV (ml) 10	56,20	53,70	58,80	62,80	59,50	78,20	0,019
CO (l) 10	5,81	5,70	6,15	5,45	4,64	6,65	0,380
HR 20	104	90	110	87	84	100	0,205
SD 20	130	129	140	120	120	130	0,032
DD 20	90	87	90	76	70	85	0,019
PP 20	45	42	50	42	40	50	0,474
SBV(ml) 20	59,00	57,80	61,80	67,60	61,40	71,60	0,135
CO (l) 20	6,77	6,01	6,80	6,17	4,92	7,15	0,454

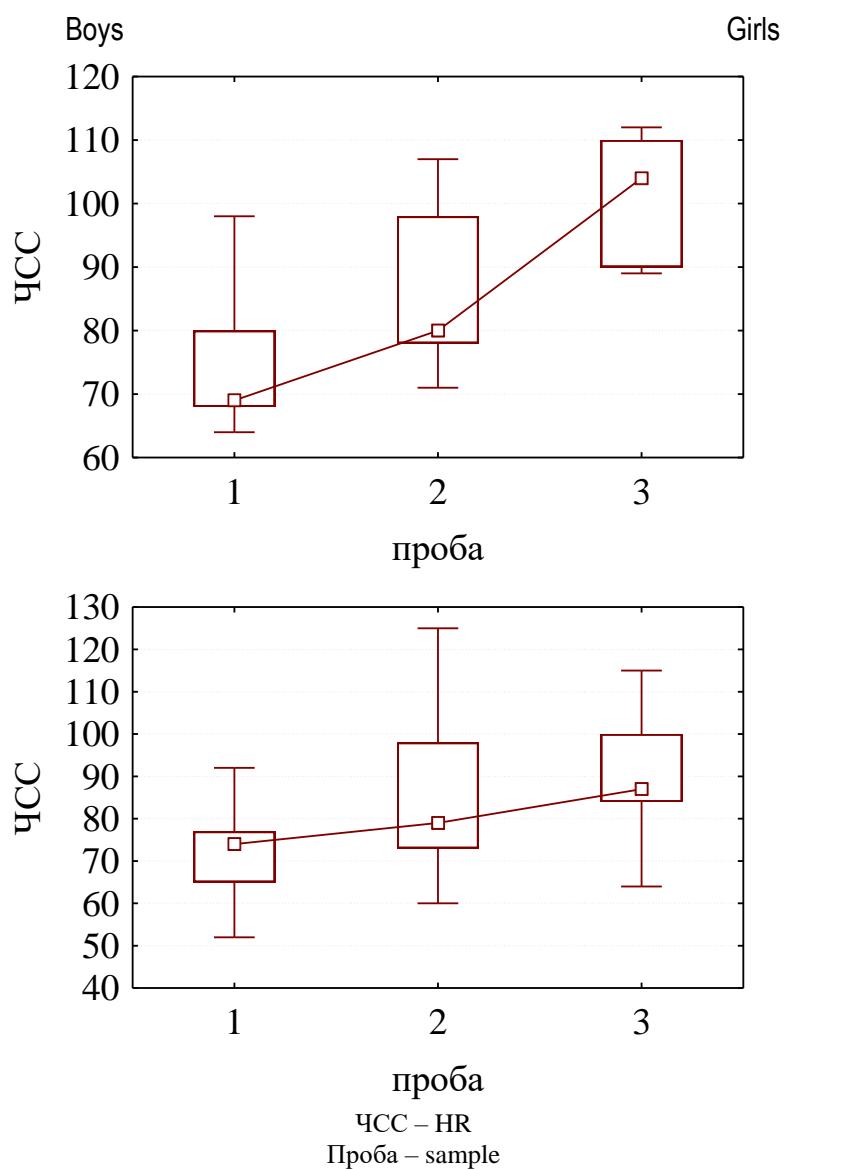
Results and discussion: While comparing the studied parameters of testers there were identified their significant differences according to gender. It was confirmed by the available literature data about gender differences of hemodynamic parameters [3, p. 742]. On the basis of this the sample was divided by gender, and the further assessment of parameters of the central hemodynamic depending on the load carried in the group of girls and boys separately.

The histogram distribution of the studied traits was analyzed: heart rate (HR), systolic degree (SD), diastolic degree (DD) and pulse pressure (PP), systolic volume (SBV) and cardiac output (CO) at rest and during physical load. It was found that the distribution of frequencies of occurrence in a group of girls and as well as in a group of boys differed from the normal law. For the curves there was not characteristic of bell-shaped form, histogram was reflecting asymmetrical with respect to the average value of the characteristic distribution

("skew") and the presence of distracting from the overall picture of values. The asymmetry coefficient is different from zero and kurtosis coefficient have negative values (pointed tip of the curve). Thus, the basic statistical characteristics which reflecting the hemodynamic parameters in the study samples were determined median and inter quartile range.

The analysis of medians of evaluated traits there were revealed that their values in the groups separated by sex were differed significantly, but did not exceed the standard norms, both at the state of rest and during increasing load (10 and 20 sit-ups) (tab.1).

While analyzing the reaction of changes in heart rate there was revealed significant increase of the median values with increasing load (fig. 1).



□ Median, □ 25%-75% quartile, ⊞ diapason (sweep) without emissions;
1 – the original state of rest, 2 – after 10 sit-ups, 3 – after 20 sit-ups.

Fig.1. Dynamics of changes in heart rate among the students while load

In all three cases the coefficient of variation was close to one hundred percent, this indicates that there are values to be very different from the average volume. However p-level that characterizes the probability of erroneous while rejection of the null hypothesis of less than 0.05 (tab. 2), which means that the load was significantly influenced to the testing group on the heart rate.

Table 2

The significance of differences in heart rate at the state of rest and during physical load

Sample	p-degree					
	HR		SBV		CO	
	boys	girls	boys	girls	boys	girls
Rest- 10 sit-ups	0,021165	0,000517	0,465209	0,727538	0,024917	0,002356
Rest - 20 sit-ups	0,043115	0,000114	0,345232	0,121933	0,043115	0,000367
10 sit-ups - 20 sit-ups	0,035678	0,000060	0,465209	0,647471	0,049617	0,001471

While analyzing the values of SBV in pairs at the state of rest and after physical load (tab. 2) there was revealed a significance level above the specified data. This suggests that the difference may well be random and therefore we cannot reject the null hypothesis. That means in this case the physical load does not affect to SBV in the study group. The same conclusion can be done by analyzing the level of significance of pair comparisons of SBV after 10 and 20 sit-ups. A more significant meaning is a difference of SBV at the state of rest and SBV after 20 sit-ups. In this case, the significance level is below the rest (0,345 in men and 0,122 in women), but also does not support the influence of load on cardiac output. Indeed, at higher demand of oxygen during the physical action provides ergonomic working heart ejection greater blood volume. In the study groups, on the other hand, the cardiac output after the load is not changed, but the increasing demand on oxygen is necessary to ensure the body. This is achieved due to significant changes in heart rate after the two loads.

Analysis of changes in cardiac output (CO) has shown that the data figure is dependent on the load increases (fig. 2).

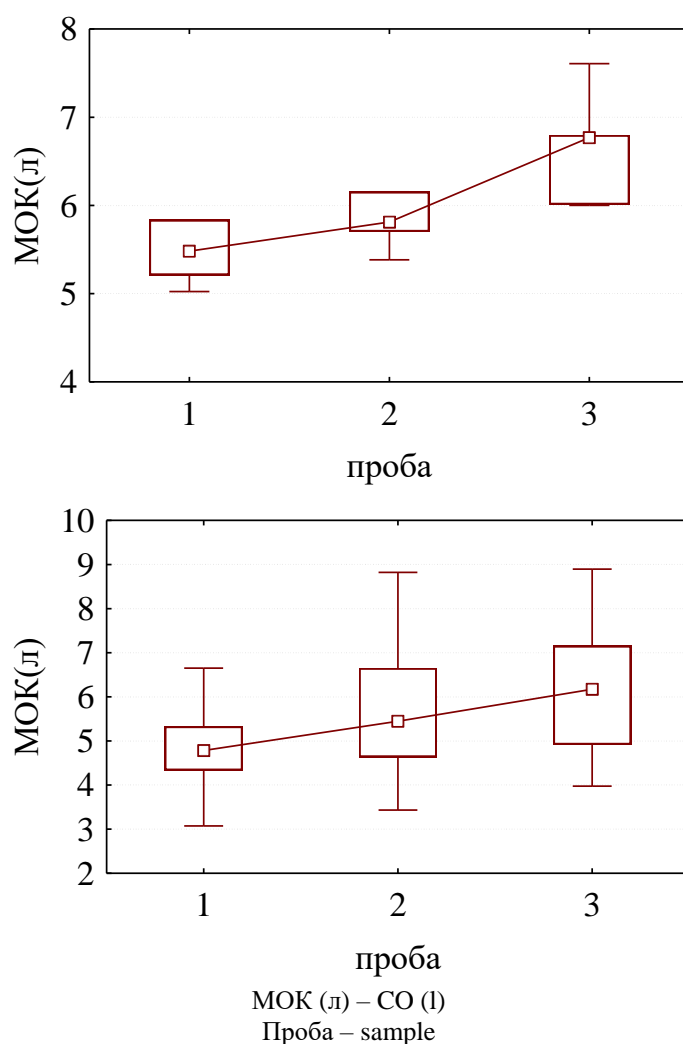


Fig. 2. Dynamics of changes in CO of students during the physical load

The level of significance during the pair comparison of CO values in the state of rest and CO after 10 sit-ups was equal to 0,025 in male and 0,002 in female, which is less than a predetermined p- value (tab. 2). In the other two pair comparisons (CO in the state of rest and after 20 sit-ups, CO after 10 sit-ups and 20 after sit-ups) there were also confirmed the connection of physical activity with a change of data parameter. Thus, the increase in cardiac output of the surveyed students during physical activity is not due to an increase in cardiac output, but according to the quickening of the heart rate, which is not ergonomic for the heart.

Conclusions:

1. In conclusion of this project we can make several consecrations regarding to the effect of physical exercises on the main hemodynamic parameters of the human body (heart rate, blood pressure, SBV, CO). In the course of the increasing of experiment the load was increasing. The general summation in this study is students of the first year of KSMU and the sample was consisted from 27 people, who were healthy by a result of the medical examination and did not have any disease in the time of research. The experiment was conducted in relatively equal conditions for all participants of the testing.

2. The practical significance of this investigation is concluded to improve the health status of the students and their way of life. From the results of such experiments there are stereotypical normal systolic pressure reaches after physical activities like 20 sit-ups. It speaks of the fact that physical activity has beneficial effects on the tone of the blood vessels and in general on the human body. In order to preserve the health of students it would be appropriate to increase the number of hours dedicated to general physical fitness classes. Visitations of physical exercises 2-3 times a week will provide students with the normal state of work of the cardiovascular system and thus it improves its performance.

3. These results allow teachers of physical training in high schools and coaches to more effectively select the type and intensity of physical activities taking into account the initial capacity to respond to the load. This will greatly improve the functional state of students, their resistance to physical stress and endurance that can become an integral part of disease prevention among young people.

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