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Investigation of the cardiovascular system of schoolchildren aged 13–14 years

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Purpose: *to determine the level of functioning of the cardiovascular system of schoolchildren of the 8th-9th grades.*

Material & Methods: *59 schoolchildren of 8–9 grades took part in the study. Such methods of research as theoretical analysis and generalization of scientific and methodological literature, methods of studying the functional state of the cardiovascular system and methods of mathematical statistics were applied.*

Results: *a comparison of the parameters of the cardiovascular system in the sexual, age aspects and with the corresponding scoring scale is presented.*

Conclusion: *in the sexual aspect, it was found that the indicators of the functioning of the cardiovascular system in schoolchildren of the 8th grade are higher in girls, and in schoolchildren of the 9th grade in young men; with age, in men, there are somewhat larger values of indicators, in girls, on the contrary, less; comparison with the scoring scale showed that the results of schoolchildren of 8–9 grades correspond to the "average" level.*

Keywords: *cardiovascular system, schoolchildren, heart rate, systolic blood pressure, diastolic pressure, Ruffie's test.*

Introduction

Reducing the health of children in our country has recently become sustainable. According to the results of the research, there is a steady tendency in the general educational institutions of Ukraine to increase the number of schoolchildren who have deviations in the state of health. It is established that for the period of schooling the number of students who belong to a special medical group increases from 7,2% in the classroom to 17% in the eleventh. A significant part of schoolchildren suffer from various diseases of the cardiovascular system [7].

Motor activity, systematic exercise with physical exercise is an effective and powerful means of mobilizing reserve capacity of the body. Therefore, physical education at school age is especially important. In the course of physical activity exercises, the necessary motor skills and abilities are formed, physical qualities develop, the level of physical development and health improves [3; 9; 10].

Ya. M. Kots [2], A. S. Solodkov, E. B. Sologub [9], V. Lastochkin, A. Rovny [5] note that the cardiovascular system provides a given level of functioning of the body, reflects the energy aspect of performing any activity and can serve as an objective characteristic of the intensity of mental and physical labor, a universal indicator of the adaptive activity of the organism generally.

The carried out analysis of literary sources shows the interest of leading experts in the field of physiology, physical training and sports with the problem of determining and evaluating the cardiovascular parameters of children of secondary school age [1; 4; 6; 11; 12].

Thus, the problem is timely and relevant, since indicators of the level of functioning of the cardiovascular system of middle school students make it possible to adjust the content of physical education lessons.

Relationship of research with scientific programs, plans, themes. The study was conducted in accordance with the thematic plan of the Kharkov State Academy of Physical Culture on the scientific theme "Improving the process of physical education in educational institutions of various profiles" for 2016-2020. (№ of state registration 0115U006754).

The purpose of the research: to determine the level of functioning of the cardiovascular system of schoolchildren of the 8th–9th grades.

Material and Methods of the research

59 students of 8–9 grades took part in the study. Such methods of research as theoretical analysis and generalization of scientific and methodological literature, methods of studying the functional state of the cardiovascular system and methods of mathematical statistics were applied. To determine the level of functioning of the cardiovascular system of schoolchildren of the middle classes, the heart rate (HR), blood pressure was measured, and Ruffie's test was performed.

Results of the research and their discussion

A comparison of the cardiovascular indices of 13–14 year olds in the sexual aspect is presented in Table 1.

The analysis of the heart rate by sex showed that the results for the boys of the 8th class are less than those of the girls. The schoolchildren of the 9th grade have the following tendency: the guys have more results than the girls. It should be noted that the differences are unreliable ($p>0,05$).

When comparing the parameters of systolic and diastolic pressure in the sexual aspect, it is found that the results of young men are greater than those of girls. The exception is the systolic pressure of the girls of the 8th grade, in which the data is somewhat larger than that of men. It should be noted that the differences are unreliable ($p>0,05$).

Table 1

Parameters of the cardiovascular system of schoolchildren aged 13–14 in the sexual aspect

Indicators		Boys n	Boys $\bar{X}_1 \pm m_1$	Girls n	Girls $\bar{X}_2 \pm m_2$	$t_{1,2}$	p
13 years							
HR, beats·min^{-1}		19	64,6±72,20	11	66,36±2,00	0,57	>0,05
BP systolic, Mmhg		19	122,67±1,68	11	124,73±1,52	0,90	>0,05
BP diastolic, Mmhg		19	83,00±0,88	11	81,64±0,87	1,10	>0,05
	R_1	19	12,22±0,62	11	12,45±0,58	0,27	>0,05
Ruffie's test	R_2	19	23,00±1,19	11	24,18±0,77	0,87	>0,05
	R_3	19	15,44±0,71	11	15,64±0,56	0,21	>0,05
14 years							
HR, beats·min^{-1}		12	68,67±2,44	17	64,22±2,40	1,30	>0,05
BP systolic, Mmhg		12	122,11±1,54	17	120,22±0,81	1,08	>0,05
BP diastolic, Mmhg		12	82,33±1,09	17	81,44±0,90	0,63	>0,05
	R_1	12	13,78±0,46	17	12,89±0,54	1,25	>0,05
Ruffie's test	R_2	12	23,44±0,80	17	25,11±0,87	1,41	>0,05
	R_3	12	15,78±0,55	17	15,67±0,69	0,13	>0,05

Remark. *Here and in the future * P_1 – HR for 10 s at rest, P_2 – HR for the first 10 seconds immediately after the load, P_3 – HR for the last 10 seconds from the first minute of recovery.*

Considering the results of Ruthie's test for sex, it should be noted that girls 13 years of age have slightly higher rates than boys of this age. At schoolboys of 14 years indicators are higher at young men, except for the given pulse for the first 15 with right after loading where results are higher at girls. However, the reliability of differences between the indices is not observed (p>0,05).

A comparison of the cardiovascular indices of 13–14 year olds in the age aspect is presented in Table 2.

When comparing the HR indices of schoolchildren of 8–9 grades in the age aspect, it was revealed that the results of the 8th grade boys are less than those of the ninth-graders. In girls, the opposite trend is noted: in schoolgirls of the 8th grade, the data is higher than in the pupils of the 9th grade. However, the differences are unreliable (p>0,05).

An analysis of systolic and diastolic pressure with respect to age has shown that the data of schoolchildren of the 8th grade is greater than the results of 9th grade students. However, these differences are false (p>0,05).

An analysis of Ruffier's test in the age aspect showed that the results of students of the 9th grade are somewhat larger than those of the 8th grade pupils, but these differences are unreliable (p>0,05).

Comparison of the HR results of schoolchildren of 8–9 grades with the norms presented by T. Yu. Krutsevich [3], revealed that the indicators of boys and girls meet "below average".

A comparison of the results of blood pressure in schoolchildren of the 8–9 grades with the norms presented by T. Yu. Krutsevich [3] revealed that both men and women perform "above average".

Comparing the indices of Ruffie's test of pupils of 13–14 years with the norms presented by S. D. Polyakov [8], it should be noted that the data of boys and girls meet the "high" level of cardiovascular fitness.

Table 2

Parameters of the cardiovascular system of schoolchildren aged 13–14 in the age aspect

Indicators		13 years n	13 years $\bar{X}_1 \pm m_1$	14 years n	14 years $\bar{X}_2 \pm m_2$	$t_{1,2}$	p
Boys							
HR, beats·min^{-1}		19	64,67±2,20	12	68,67±2,44	1,22	>0,05
BP systolic, Mmhg		19	122,67±1,68	12	122,11±1,54	0,24	>0,05
BP diastolic, Mmhg		19	83,00±0,88	12	82,33±1,09	0,47	>0,05
	R_1	19	12,22±0,62	12	13,78±0,46	2,01	>0,05
Ruffie's test	R_2	19	23,00±1,19	12	23,44±0,80	0,32	>0,05
	R_3	19	15,44±0,71	12	15,7±80,55	0,37	>0,05
Girls							
HR, beats·min^{-1}		11	66,36±2,00	17	64,22±2,40	0,69	>0,05
BP systolic, Mmhg		11	124,73±1,52	17	120,22±0,81	2,61	<0,05
BP diastolic, Mmhg		11	81,64±0,87	17	81,44±0,90	0,15	>0,05
	R_1	11	12,45±0,58	17	12,89±0,54	0,55	>0,05
Ruffie's test	R_2	11	24,18±0,77	17	25,11±0,87	0,80	>0,05
	R_3	11	15,64±0,56	17	15,67±0,69	0,03	>0,05

Conclusions

1. Considering the parameters of the cardiovascular system of schoolchildren of middle classes in the sexual aspect, it should be noted that in grade 8 students, the results are mostly higher for girls and for students of the 9th grade – for boys. The reliability of the differences between the indicators is generally not observed (p>0,05).

2. An analysis of the cardiovascular outcomes of 13–14 year olds in the age-related aspect revealed that in young men the indicators improve with age, while the girls on the contrary deteriorate. At the same time, the reliability of the differences is practically absent (p>0,05).

3. Comparison of the obtained indices of schoolchildren of 8–9 grades with the corresponding norms showed that the results of the cardiovascular system correspond to the "average" level.

4. The results of the study on the level of functioning of the cardiovascular system of middle school students indicate the need to adjust the content of physical education lessons.

Prospects for further research are to select the means of physical training to improve the functioning of the cardiovascular system of middle school students**.**

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