Changes in the functional capabilities of the cardiovascular system of medical students during the academic year

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Abstract

Objective of the study is to analyse changes in the functional capabilities of the cardiovascular system of medical students during the academic year.

Methods and structure of the study. The study was conducted at the Department of Physical Education of Surgut State University. To assess the functional capabilities of the cardiovascular system of students, the following were used: the Kerdov vegetative index (VI), the Robinson index (RI), the endurance coefficient (EC), and the cardiovascular system adaptation potential index. First-year medical students (103 in total, including 69 women and 34 men) took part in the testing.

Results and conclusions. An analysis of changes in the functional capabilities of the cardiovascular system of medical students during the academic year revealed a positive trend in indicators. Young men showed economisation of cardiac activity, while young women showed stabilisation of regulatory processes. The results obtained reflect the formation of adaptive mechanisms in the bodies of first-year students.

Keywords: *psychophysical readiness, medical students, cardiovascular system, autonomic nervous system.*

Introduction. The modern system of higher education in the field of medicine places high demands on the level of psychophysical preparedness of future specialists. The professional activity of a doctor is associated with a high level of responsibility, as well as the need to maintain a high level of performance under conditions of mental and physical stress.

In this regard, particular importance is attached to the training of future medical workers in universities, in particular the organisation of physical education for medical students, which should be focused not only on the development of physical and mental qualities, but also on the formation of adaptive and regulatory mechanisms of the body [2].

One of the informative criteria for assessing the effectiveness of physical education and the formation of psychophysical preparedness is the state of the cardiovascular and vegetative systems, which reflect the degree of adaptation of the body to both educational and professional activities. It is well known that optimal functioning of the autonomic nervous system provides the conditions for maintaining homeostasis and contributes to increased stress resistance and improved cognitive performance, which is particularly important for students in medical fields of study.

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Results of the study and discussion. Analysing the results of the cardiovascular system indicators of students (Table 1), it should be noted that the heart rate at the beginning of the academic year, both among young men and women, is above normal (more than 80 beats per minute). At the end of the year, there

Table 1. Cardiovascular system indicators of students during the academic year (M±m)

Indicators	Young men		Young women	
	Pre-control	Post-control	Pre-control	Post-control
Heart rate (bpm)	85,14±1,54	79,23±1,50	84,56±1,28	80,95±1,06
Systolic blood pressure (SBP) (mm Hg)	128,17±2,25	124,38±1,46	116,52±1,15	111,66±1,10
Diastolic blood pressure (DBP) (mm Hg)	84,20±1,50	79,97±1,31	76,94±0,96	73,56±1,02
Pulse pressure (mm Hg)	43,97±2,22	44,41±2,11	39,57±0,93	38,10±0,87

is a positive trend towards a decrease in heart rate to the normal range (60-80 beats per minute).

The blood pressure readings of students at the beginning of the academic year were within normal limits, with no deviations towards hypertension or hypotension. By the end of the academic year, a decrease in systolic and diastolic blood pressure values was recorded. After the decrease, SBP and DBP remained within normal limits, which can be considered one of the signs of adaptation to academic stress. Pulse pressure is also within physiological normal limits, with a decrease observed by the end of the academic year, which may indicate economisation of the heart and increased efficiency of haemodynamic regulation [3-5].

Based on the obtained parameters of the cardiovascular system, Robinson's indices, endurance coefficient, Kerdov vegetative index, and cardiovascular system adaptation potential index were calculated. The results of the study are presented in Table 2, Figures 3-4.

At the beginning of the academic year, the average group VI index in young men (0.27±2.16) corresponded to a state of vegetative equilibrium. In young women, the VI was significantly higher (7.88±1.58), which may indicate the predominance of sympathetic nervous system activity. By the end of the academic year, a decrease in VI values (-2.15±2.63) was observed in young men, indicating a shift towards the predominance of parasympathetic innervation tone. Meanwhile, young women showed a slight increase to 8.30±1.56, which may be associated with emotional sensitivity and high stress levels in the educational process.

According to RI, it should be noted that by the end of the year, the results among young men and women show a clear downward trend of more than 8 units. The decrease in this indicator in both groups indicates an increase in the efficiency of cardiac activity. In particular, this may indicate economical and effective contractile activity of the myocardium, which increases the capabilities of the cardiovascular system.

The endurance coefficient was determined using the Kvas formula. As the studies showed, by the end of the year, a pronounced decrease in the average group indicator was observed only among young men (19.08±0.91), while among young women, the indicators remained practically at the same level (21.94±0.55). The decrease in EC in young men may be associated with an increase in functional reserves and improved resistance to physical and psycho-emotional stress, which can be considered a sign of adaptive restructuring of the cardiovascular system.

Table 2. Indicators of the Kerdo vegetative index, Robinson index, endurance coefficient and adaptive potential of students during the academic year (M±m)

Indicators	Young men		Young women	
	Pre-control	Post-control	Pre-control	Post-control
Kerdo vegetative index (VI)	0,27±2,16	-2,15±2,63	7,88±1,58	8,30±1,56
Robinson index (RI)	109,27±3,08	98,74±8,65	98,71±1,93	90,66±1,68
Endurance coefficient (EC)	22,10±2,16	19,08±0,91	22,19±0,63	21,94±0,55
Cardiovascular system adaptation potential index	2,46±0,05	2,31±0,05	2,21±0,24	2,09±0,03

According to scientists, health can be viewed as the degree of severity of adaptive reactions caused by the development of the body's functional reserves. The indicators of the adaptive potential of the cardiovascular system obtained using the method developed by R.M. Baevsky at the beginning of the academic year were within the range of 'satisfactory adaptation' (up to 2.59). At the end of the year, the values decreased slightly to 2.21±0.24 in young men and 2.09±0.03 in young women. This dynamic indicates an increase in the degree of adaptation of students and an improvement in the circulatory system. By the end of the year, the results in both groups had improved, which may indicate a balanced physiological response and no signs of overstrain of regulatory mechanisms [1].

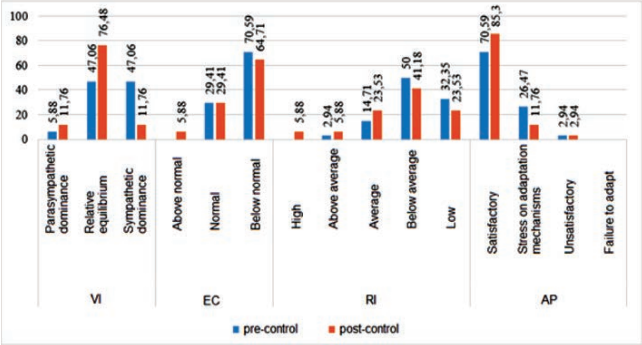

Figure 1. Changes in the functional state of the cardiovascular and autonomic nervous systems of young men during the academic year

Figure 1 shows changes in the functional state of the cardiovascular and autonomic nervous systems in young men, revealing a trend towards normalisation and increased adaptive capacity of the body. At the end of the academic year, there is a noticeable increase in the relative balance of autonomic regulation, improvement in the functional state of the cardiovascular system, and a decrease in the tension of compensatory mechanisms.

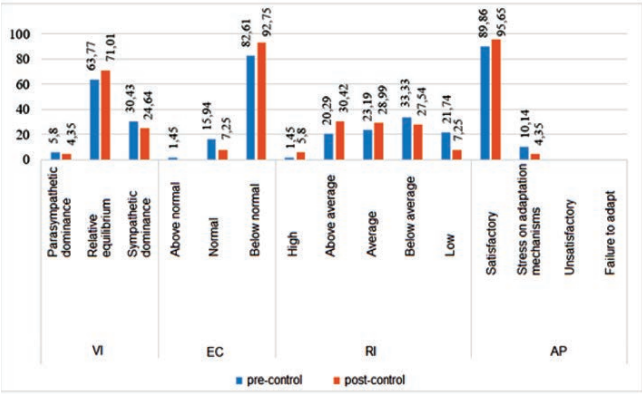

Figure 2. Changes in the functional state of the cardiovascular and autonomic nervous systems of young women during the academic year

The changes in the indicators for female students show positive dynamics, reflecting an improvement in vegetative regulation and an increase in the adaptive capabilities of the female students' bodies. At the end of the academic year, a predominance of female students with a relative balance between the divisions of the vegetative nervous system and a satisfactory level of adaptation was identified.

Conclusions. An assessment of changes in the functional capabilities of the cardiovascular system of medical students during the academic year shows an improvement. Young men show a tendency towards economisation of cardiac activity and increased endurance, while young women show a tendency towards stabilisation of regulatory processes and moderate sympathetic predominance. The results obtained indicate the formation of adaptive mechanisms and an adequate response of the body to prolonged academic stress.

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