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**FEATURES OF THE DYNAMICS OF INDICATORS OF THE  
MORPHOFUNCTIONAL STATE OF FEMALE STUDENTS OF SURGUT  
WITH DIFFERENT LEVELS OF MOTOR ACTIVITY**

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**Annotation.** A longitudinal study of indicators of the morphofunctional state of female students of Surgut with different levels of motor activity was carried out. A total of 75 girls were examined, aged 18 to 21 years. The results of the study showed that main morphofunctional indicators of girls with low level of physical activity did not have any statistically profound differences from female athlete students, with back strength being an exception. In girls with additional physical loads, the indicators of dynamometry and back strength were significantly increased by the third year of study in comparison with girls who did not do sports. Regular physical loads had a positive effect on health and adaptation processes of female students of the northern city, which was manifested through the tendency of the HR decrease, increase in body mass due to the development of the muscular system.

**Introduction.** The vital activity in the Khanty-Mansiysk Autonomous Okrug – Ugra proceeds under the influence of complex of unfavorable climate and geographical factors. Climate and geographical factors of the North influence the human state of health, determine the distress of regulatory mechanisms and contribute to the depletion of functional reserves of the human body, forming a set of factors of increased health risk, which is why those factors are considered as additional functional loads [1, 7]. Process of forming of morphofunctional state of a person during their long-term residence in the North of the West Siberia is characterized by some features, because the multifactorial nature of climate, social, economic and ecological effects of human body in this region has a emergency nature [2].

Health of the northerners is a resulting derivative of complex, multifunctional and hierachal interaction of adaptation abilities of human populations with external

(natural, social) phenomena and factors. The most important part of the issue of preserving the human capital in Ugra is the health protection of the growing generation [2, 3]. The body of students, who live in harsh conditions of Ugra, is subject to the effect of climate and geographical conditions of the North, which influence not only on its physiological development and on health at the current moment, but also on the process of its further development. It is known, that currently the basis of Ugra's residents includes descendants of those, who participated in the industrial exploration of the North and moved to the Khanty-Mansiysk Autonomous Okrug – Ugra from various regions of Russia and CIS states [2].

The student age coincides with the youth period of ontogenesis, when stages of the development of internal organs and a number of body systems, the formation of potential body abilities and the determination of preconditions for further physical development of the body, are ended. One of the factors, influencing the morphofunctional state, is a motor activity [5, 6].

The purpose of the research: to study features of dynamics of indicators of the morphofunctional state of female students of Surgut's universities with different levels of motor activity.

**Methods and organization.** The study was longitudinal. We examined change of the morphofunctional state of female students throughout 3 years. 25 girls, who did sports, endure everyday physical loads during university classes and during individual training activities, and 50 girls, who did not do sports and did not have an athletic title, participated in the study. The age of examined girls is 18-21 years. All examined female students were in the first or second medical group of health state, were born in Surgut, were not in the dispensary. Physical loads for female students with high level of motor activity can be explained by the character of their sports specialization, they are mainly directed at endurance development.

In order to determine the morphofunctional state of female students of Surgut, we measures such indicators as body length, body mass, strength of the left and right wrist muscles, strength of back extensor muscles, vital capacity (VC), heart rate (HR). Statistical processing of the received data was conducted using standard software package Statistica v.6.1. and Microsoft Office Excel 2010. Quantitative indicators were accessed according to the coherence of normal distribution using the Kolgomorov-Smirnov criteria. All examined features were normally distributed, and because of that methods of parameter-oriented statistics with the determination of mean value ( $M$ ), mean error ( $m$ ), confidence limit (95% of CL) and statistical significance of differences (according to Student) were used. Significant differences were considered as those with  $P < 0,05$ .

Change dynamics of morphofunctional indicators among girls, born and living in conditions of the northern region throughout three years, were of positive nature. The discovered tendency cooperates fully with popular general biological regularities of the development of a young person during ontogenesis (Table 1).

Table 1

Morphofunctional indicators of female students of Surgut with different levels of motor activity ( $M \pm m$ )

Group	1st year 18-19 years	3rd year 20-21 years	P
Girls, who did not do sports			
Body length, cm	163,02±1,13	165,38±1,19	p>0,05
Body mass, kg	56,89±1,33	55,34±1,37	p>0,05
Strength of right wrist muscles, kg	26,12±1,39	24,56±1,09*	p>0,05
Strength of left wrist muscles, kg	25,54±1,22	23,42±1,25*	p>0,05
Strength of back muscles, kg	55,13±1,93*	58,45±3,03*	p>0,05
Heart rate, beats/min	82,67±1,39	82,12±1,84	p>0,05
Vital capacity, l	2,94±0,10	3,01±0,28	p>0,05
Girls, who did sports			
Body length, cm	164,72±1,45	166,84±1,68	p>0,05
Body mass, kg	56,32±1,43	58,93±2,11	p>0,05
Strength of right wrist muscles, kg	30,21±1,60	33,13±1,21 *	p<0,05
Strength of left wrist muscles, kg	29,74±1,91	32,45±1,25 *	p<0,05
Strength of back muscles, kg	75,35±5,33 *	86,12±3,09 *	p<0,05
Heart rate, beats/min	76,47±3,45	74,28±4,72	p<0,05
Vital capacity, l	2,90±0,10	3,47±0,20	p<0,05

Note: \* - statistically significant differences between indicators of female students, who do and do not do sports ( $p>0,05$ ).

**Results and discussion.** Body length and mass are considered as main medical and social indicators, values of which can allow to determine both positive and negative effect of various environmental conditions [1]. Human body length is

a genetic determined indicator, which is less influenced by various conditions, including physical loads. In our study, the body length did not have significant differences between those of girls, who did and did not do sports both on the 1st year and on the 3rd year of study. It needs to be noted, that the increase of body length among girls, who did not do sports, was 2,36 cm on the 3rd year of study. Among female students, who regularly did sports, the increase was 2,12 cm. This fact can be explained by the biological regulation, because definitive body dimensions achieve their maximum value by the age of 21-23 years [3, 8]. Body mass, unlike body length, is a changeable indicator, which depends on many factors (age, gender, functional state, motor activity). Body mass of girls, who did sports, was ranging  $56,32\pm1,43$ - $58,93\pm2,11$  kg but did not have any significant differences from the given indicator of girls from the other examined group, whose body mass was  $55,34\pm1,37$  kg on the 1st year of study and  $56,89\pm1,33$  kg on the 3rd year of study.

We determined the strength of wrist flexor muscles and the strength of spinal column extensor muscles, which were shown by indicators of dynamometry. It was discovered, that on the first year of study those values did not have any significant differences in examined groups. Thus, the average indicator of the strength of the right wrist among girls, who did not do sports, was  $26,12\pm1,39$  kg, value of the strength of the left wrist was  $25,54\pm1,22$  kg. Among girls, who did additional physical activities, the mean value of the strength of the right wrist was  $30,21\pm1,60$  kg, the strength of the left wrist was  $25,54\pm1,22$  kg. During the 3rd year of study, there was an increase of strength indicators among female athletes, there were also statistically significant differences of strength of wrist muscles of examined groups of female students according to the level of motor activity.

Values of back strength had statistically significant differences between indicators of female students, who did and did not do sports, both on the 1st and on the 3rd year of study. Thus the average indicator of back strength among female students of the 1st year of study, who did not do sports, was  $55,13\pm1,93$  kg, among those, who did sports, it was  $75,35\pm5,33$  kg, which was significantly higher. During the 3rd year of study, examined girls, who had special physical preparedness, also had statistically pronounced higher indicators of back strength ( $86,12\pm3,09$  kg) in comparison with indicators of girls, who did not do sports ( $58,45\pm3,03$  kg). Noted differences can be explained by the high motor activity of girls, who regularly worked out and did sports. Systematic training sessions throughout three years contributed to the strengthening of wrist flexor muscles and back extensor muscles.

Heart rate (HR) serves as an objective indicator of the body's functional state, depends on age, gender and individual characteristics of a person, on the level of physical loads [7]. Mean value of HR in groups of female students, who had regular motor activity, was  $76,47\pm3,45$  beats/min on the 1st year of study, decreased

insignificantly to  $76,47 \pm 3,45$  beats/min on the 3rd year of study, and it was lower, than those among girls, who did not do sports, but those differences were not statistically significant. The underlined tendency of the HR decrease among girls, who trained to develop endurance, showed that a heart is functioning in a more practical mode, which is reflected in a decrease of the body energy consumption and in a decrease of volume of oxygen consumption with a simultaneous process of a sustainable blood supply to organs and systems [3].

Such indicator as VC is irreplaceable during examination of the apparatus of external respiration, which is why it is widely used in medical and sports practice [4]. Indicators of VC in girls with low motor activity increased from the 1st to the 3rd year of study, ranging between  $2,94 \pm 0,10$  liters and  $3,01 \pm 0,28$  liters, but statistically significant differences were not discovered. Among those, who did sports, this indicator was significantly increased on the 3rd year of study in comparison with the studying period on the 1st year of study.

**Conclusion.** Therefore, results of the study showed an improvement of morphofunctional state of girls, who did sports, on the 3rd year of study. The main morphofunctional indicators of female students with low motor activity on the 1st year of study did not have statistically pronounced differences from those of female athletes, excluding back muscles strength. On the 3rd year of study indicators of dynamometry and back strength in girls with additional physical loads significantly increased in comparison with those among girls, who did not do sports. Everyday physical loads positively influenced on health and adaptive processes of female students of the northern city, which was reflected in the tendency of the HR decrease, body mass increase due to the development of the muscular system, while body mass of girls, who did not do sports, decreased, strength indicators of wrists almost were not increased. This tendency could have negative consequences in the future. Health protecting technologies are applied and directions of “health-improving support” are offered on the school stage of education, but there is often no systematic health-protecting work in higher education institutions. In order to resolve the issue of health and life quality improvement, we need to study thoroughly ways to improve the health of students in conditions of the northern region and to include balanced physical loads in their daily routine.

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