

Adaptation of the First-Year Students to University Environments: Integral Criteria

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Abstract: Students' adaptation to study at a university may be accompanied by a strain of adaptation mechanisms. Numerous monitoring studies conducted at the stage of students' adaptation to study at a higher educational institution indicate that their morphofunctional and mental state, the success of their studies depend on many factors, including gender, ethnic and national affiliation, place of residence, physical activity. The purpose of the study is to evaluate those factors contributing to the successful adaptation of the first-year students studying at the Natural-Technological Faculty of the South Ural State Humanitarian and Pedagogical University (Chelyabinsk, Russia) in the dynamics of the academic year, relying on a set of integral indicators of physical health. The study involved 56 first-year students. Indicators of physical development (length and body weight, heart rate, systolic blood pressure, diastolic blood pressure, vital capacity) were determined using standard techniques. Based on the obtained anthropometric data, the integral indices of physical health were calculated, namely the vital index, Robinson index, or double product, Kerdo vegetative index. The functional reserves of the cardiovascular system were determined by calculating the adaptive potential according to R. M. Bayevsky (1979). An analysis of the dynamics of integral indicators of physical health showed ambiguous changes in the functional state of the cardiorespiratory system. The authors indicated cases of students' successful adaptation relying on the values of such indicators as the vital and Kerdo vegetative indexes. More than that, the number of students with signs of decreased functional reserves and impaired regulation of the cardiovascular system (Robinson index) has increased. According to the dynamics of adaptive potential values, negative changes were observed among young men, increasing the risks of strain in adaptation mechanisms.

1. Relevance

Students of higher educational institutions are allocated to a special social category of the population, which is due not so much to age as to the peculiarities of working conditions, rest conditions [1]. Students, as a social group of the population, are given special attention in connection with the deterioration in the health status of modern youth [2, p. 17; 3; 4, p. 1401-1402]. Adaptation of students to study at the University due to changes in the learning system, socio-psychological environment, and may be accompanied by stress adaptation mechanisms [2, p. 17]. Optimal resistance to pathogenic agents, physical, mental, and social adaptation in changing living conditions are defined as the essential basis of human health [5, p. 55].

The author uses the model of prenosological diagnostics of health, which is based on the screening methods for assessing the physical development and functional state of vital systems of the body. This is the primary tool for monitoring health disorders-opens up prospects for the prediction and prevention of diseases, or changes in the human environment [5, p. 55; 6, p. 118; 7, p. 87]. Morphofunctional status is one of the main informative criteria for the individual development of the organism and the state of human health [8]. At the same time, the integral (intersystem) indicators of physical development and human health deserve the most of attention [5, p. 57]. Such indicators include the body mass index (BMI), Hildebrant index (Q), maximum oxygen consumption (VO₂ max), cardiorespiratory fitness index (CRFI), adaptive potential (R.M. Baevsky, 1979), the energy potential of the biosystem (G. L. Apanasenko, 1992), and others.

Numerous monitoring studies conducted at the stage of adaptation of students to study in higher education [9-12] indicate that the morphofunctional and mental state of students, the success of their training depend on many factors, including gender, ethnic and national affiliation, place of residence, motor activity, etc.

The purpose of the study was to evaluate the success of the adaptation of 1st-year students of the South Ural State Humanitarian Pedagogical University (Chelyabinsk), Faculty of Natural Technology, in the dynamics of the school year by the integral indicators of physical health.

2. Research Methods

The study involved 56 students (40 girls and 16 boys) of the 1st year of the Natural Technology Faculty of the Ural State Humanitarian Pedagogical University (Chelyabinsk) of the main medical group (17-18 years old). The study was conducted at the beginning (October) and end (April) of the 2018-19 academic year on the basis of the research laboratory "Adaptation of ideological systems to natural and extreme environmental factors" with the informed consent of the survey participants.

Physical development indicators (body length (BL) and body weight (BW), heart rate (BPM), systolic blood pressure (Systolic BP), diastolic blood pressure (Diastolic BP), vital capacity (VC)) were determined using standard methods. Based on the obtained anthropometric data, integral physical health indices were calculated using the index method. In particular, we calculated the vital index ($VI=VC(\text{ml})/MT(\text{kg})$), Robinson index, or double product ($DP=(\text{Systolic BP} \times \text{BPM})/100$), vegetative index (Index Kerdo = $(1 - \text{Diastolic BP}/\text{BPM}) \times 100$). The functional reserves of the cardiovascular system were determined by calculating the adaptive potential (AP), according to R.M. Baevsky (1979). Mathematical processing of the obtained data was carried out using statistical analysis methods. The statistical significance of the differences was determined by the Fisher test (ϕ -criterion) at a level of statistical significance $p < 0,05$.

3. Results and Discussion

The intensification of blood flow in actively working organs is an important mechanism for ensuring students' adaptation, including mental stress, which is why many indicators of the cardiovascular and respiratory systems are widely used to test the functional state of the body, for example, physical endurance. The Robinson Index, or double product (DP), integrates the two most important hemodynamic indicators (Systolic BP and BPM), characterizing the efficiency of the heart at rest. The negative dynamics of the DP value indicates an improvement in the mechanical component of the activity of the heart and the state of the circulatory system as a whole, more economical work of the heart at rest and an increase in the functional reserve, reflects the intensity of metabolic processes in the myocardium – oxygen consumption per unit of muscle mass [13].

At the beginning of the academic year, 73% of the first-year students had excellent and normal levels of functional reserves of the cardiovascular system, and only 2% of the students examined showed signs of impaired regulation of the cardiovascular system (Fig. 1). At the end of the first year of study at the university, the proportion of students with a lack of functionality and impaired regulation of the cardiovascular system increased (a total of 24%). Thus, the excess of the normative DP values may indicate a low degree of adaptation of the body in some of the students studied.

Figure 2 shows data on the distribution of students by type of vegetative regulation at rest (Index Kerdo) in the dynamics of the academic year. Most of the students, both at the beginning and at the end of the academic year (59% and 55%, respectively) were attributed to sympathotonics, a smaller part of the students (8% and 2%, respectively) dominated the tone of the parasympathetic nervous system, which corresponds to the previously obtained data in the survey of students of the 1st year of NSPU [11]. By the end of the academic year, there was an increase in the proportion of students (by 10%) with an equilibrium tone of the sympathetic and parasympathetic systems of vegetative regulation.

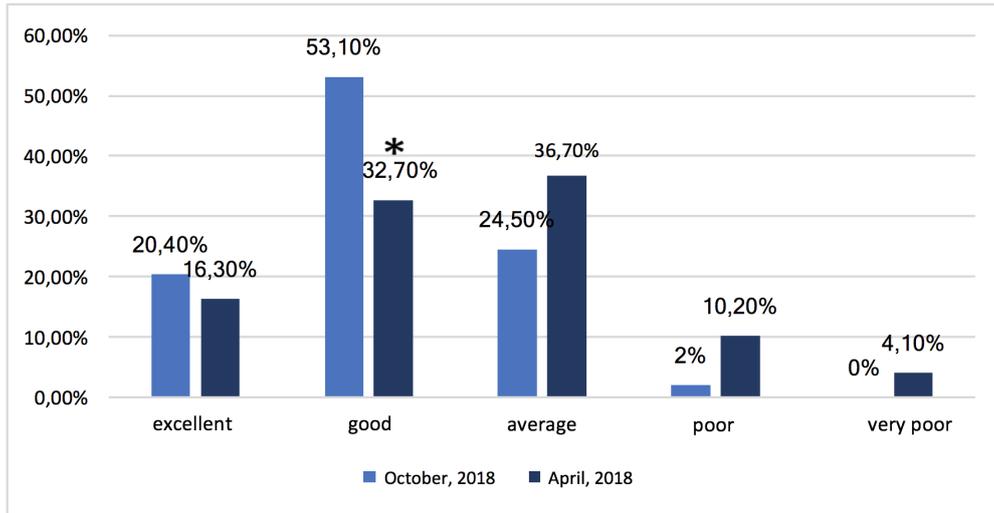


Fig. 1. Distribution of 1st-year students by the value of the Robinson Index (DP) in during the academic year, % (* – reliability of intergroup differences in dynamics of academic year at $p < 0,05$).

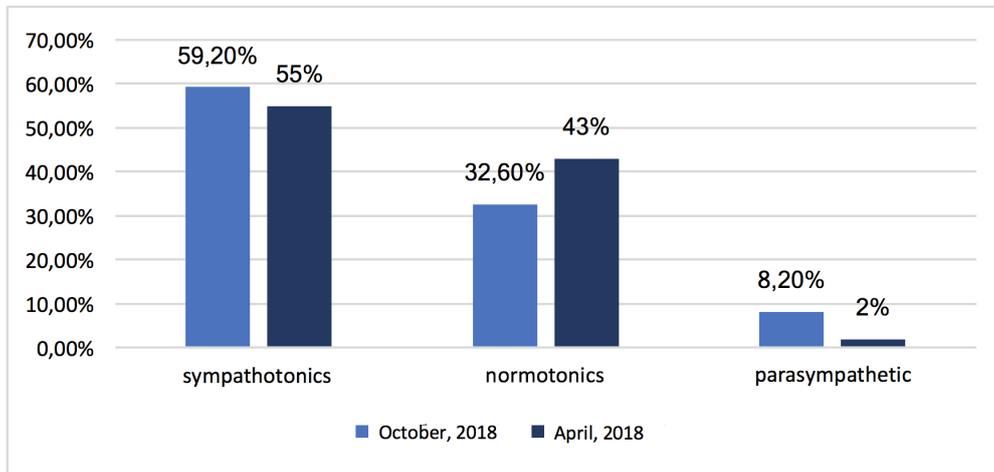


Fig. 2. Distribution of 1st-year students according to the Kerdo Index in during the academic year, %.

The average values of such an integral indicator of the functional state of the cardiovascular system as the adaptive potential ($AP < 2.1$) indicated satisfactory adaptation of students in the dynamics of the academic year. Those boys were excluded whose AP at the end of the academic year reached 2.09 ± 0.10 points (indicates a risk of tension in adaptation mechanisms).

The functional reserves of the respiratory system were evaluated by the vital index (VI). By the end of the first year of study (Fig. 3), the number of students with VI values “below average” decreased by 1.9 times, while the proportion of students with “average” and “above average” VI indicators increased (by 3.3 and 1.7 times, respectively). The result indicates an increase in the functional reserves of the respiratory system in a third of the examined students in the dynamics of the academic year.

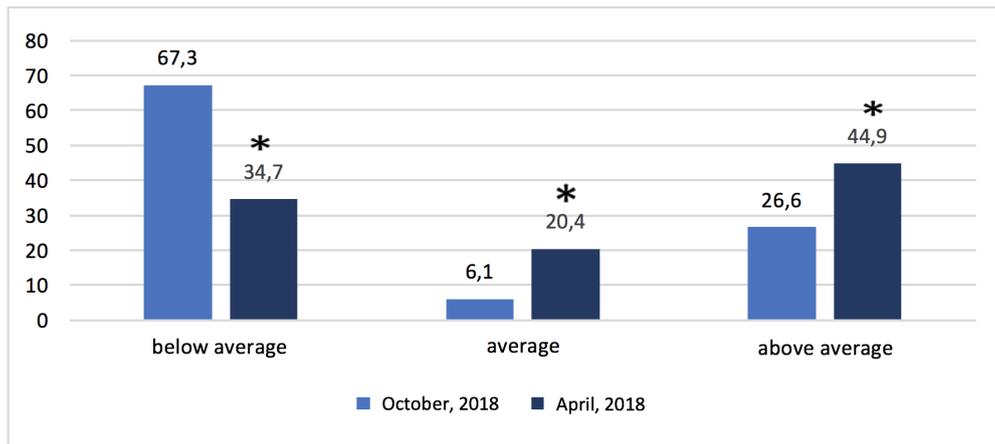


Fig. 3. Distribution of 1st-year students by the value of the vital index (VI) in the dynamics of the academic year, % (* – reliability of intergroup differences during the academic year at $p < 0,05$).

4. Conclusion

Thus, the analysis of the dynamics of integral indicators of physical health (DP, Index Kerdo, AP, VI) showed ambiguous changes in the functional state of the cardiorespiratory system of first-year students. The dynamics of the values of indicators such as VI (reflects the body's ability to saturate tissues with oxygen) and Index Kerdo (characterizes the balance of regulatory influences in the autonomic nervous system) testified to the successful adaptation of the examined 1st year students to educational activities at the university. Along with this, the number of students with signs of decreased functional reserves and impaired regulation of the cardiovascular system (Robinson index) has increased. According to the dynamics of AP values, negative changes were observed among boys, increasing the risks of tension in adaptation mechanisms.

The data obtained indicate the need for further monitoring of the physical development and health status of students in the dynamics of the first and subsequent years of study at the university, with the aim of revising regional standards of physical development, medical and pedagogical correction of the educational process and planning of recreational activities.

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