CHAPTER 12

PHYSIOLOGICAL AND SOCIAL FACTORS INFLUENCING THE PSYCHO-EMOTIONAL STATE OF UNIVERSITY STUDENT-ATHLETES

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INTRODUCTION

The development of social needs in the field of physical education, the intensification of competition in the labor market significantly increases the requirements for the level of qualification of specialists working in this field. While the most important characteristics of an athlete's work are tension, increased responsibility, the presence of a wide range of responsibilities, which determines its stress. It is clear that an athlete who is systematically in a state of stress under the influence of factors of everyday life and the production environment will not be able to fully fulfill his professional duties without proper training. Therefore, at the stage of mastering the profession of determining the sources of psycho-emotional stress, mastering the methods of psychological unloading can be the key to the athlete's professional health[1].

Modern sports of higher achievements are inevitably associated with the intensification of the training process, with extreme physical loads for the athletes' body. Excessive physical loads lead to functional changes, primarily in the activity of the cardiovascular and neuromuscular systems, psycho-emotional sphere, causing not only the development of fatigue, but also a state of overstrain, overtraining, exacerbation of chronic diseases. Therefore, the study of the adaptive capabilities of the athlete's body in order to further improve sportsmanship, expand functional reserves and maintain health is an urgent problem of many years of sports training[2].

[1] Halian I., Kurova A., Stepanenko L., Semenov, O., Semenova, N. Comparison analysis of the correlation between emotional stability and mental health parameters in athletes of various skill levels. *Amazonia Investiga.* 2022. 11(54), P. 65–75. https://doi.org/10.34069/AI/2022.54.06.7

[2] Singh A., Kaur Arora M., Boruah B. The role of the six factors model of athletic mental energy in mediating athletes' well-being in competitive sports. Sci Rep. 2024. № 14(1). P. 2974. https://doi.org/10.1038/s41598-024-53065-5

It is well known that one of the main conditions for winning in sports is emotional stability, therefore early diagnosis of disorders of the neuro-emotional sphere is one of the important components of the complex of preventive measures to reduce the effectiveness of sports achievements and the development of overfatigue, overstrain, overtraining in athletes. In addition, recently there has been a trend that is becoming widespread, the content of which is the use of implicit personality diagnostics, namely: predicting a person's emotional stability based on indicators of other types of activity that he performs[3].

Under modern conditions, achieving success in activity and production, in work, everyday life, communication, sports largely depend on the ability to regulate one's behavior, restrain one's own feelings, and control mood. Such requirements for a person's personality are imposed by a particularly complex type of human activity – sports. Holding competitions, where the athlete is required to give his full attention, work at the limit of his capabilities, creates situations in which the athlete needs to regulate his mental state. If the physical exertion is high, and the athlete does not manage his condition well, excessive mental stress occurs, which reduces the effectiveness of the activity, leads to its disorganization. As a result, the athlete loses the competition, which can lead to loss of self-confidence, mental stress, and depression[4].

Undoubtedly, both among the achievements of success and among the reasons for defeat in a sports competition, the mental state of the athlete plays a certain role before and during the competition. The modern level of sports science allows us to recognize the dependence of the effectiveness and reliability of the athlete's competitive activity on his mental state preceding or accompanying it[5].

Emotional stability is a systemic quality of a person that an individual acquires, manifesting itself in intense activity. All these emotional mechanisms of intense activity receive their definition in the structure of the self-regulation system. Since emotional mechanisms contain an adaptive effect, acting in dynamic unity in relation to the success of achieving the goal, emotional stability can be presented as a holistic process of emotional self-regulation

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[3] Kalynychenko, I. A., Latina, H. O., Kopytina, Y. M., Protsenko, I. I., & Ivanii, I. V. Formation of professional-pedagogical culture of future specialists of physical culture and sports specialties. *Linguistics and Culture Review*. 2021. 5(S3), 396–410. https://doi.org/10.33423/jhetp.v22i5.5199

[4] Rakočević R. Influence of Physical and Sports Activity on Mental Health. *Facta Universitatis. Series Physical Education and Sport*. № 3. 2020. P. 559–568. https://doi.org/10.22190/FUPES190413050A

[5] Cosh S.M., McNeil D.G., Jeffreys A., Clark L., Tully P.J. Athlete mental health help-seeking: A systematic review and meta-analysis of rates, barriers and facilitators. *Psychology of Sport and Exercise*. 2024. V. 71. P. 102586. https://doi.org/10.1016/j.psychsport.2023.102586

of intense activity[6]. Therefore, studying the problem of studying emotional stability in sports activities, developing express assessment methods will allow us to adjust the training process and predict success.

The purpose of the study is to assess the physiological and social determinants of the psycho-emotional state of athletes who are students of a higher education institution.

Research methods. The study examined 78 athletes and students of higher education institutions aged 19-22 in the city of Sumy, including 57 men and 21 women. To assess the neuropsychiatric stability, 152 applicants for higher education were examined. To assess the mental stability (MS) of students, the "Prognosis" methodology developed by V.A. Bodrov was used[7]. The methodology contains 86 questions, each of which the subject must answer “yes” or “no”. The results of the examination are expressed in quantitative indicators (in points), on the basis of which a conclusion is made about the level of MS and the likelihood of neuropsychiatric breakdowns. According to quantitative indicators, a high level of MS corresponds to a sum of points up to 6 points, a good level – 7-13 points, a satisfactory level – 14-28 points, an unsatisfactory level – 29-33 points.

To achieve the goal of the study, heart rate variability (HRV) was assessed during a functional test to determine physical performance.

Physical work capacity (PWC) was assessed using the Harvard step test, according to the standard methodology. The index value was assessed when performing the Harvard step test as follows: unsatisfactory – 55 points, below average – 56–64 points, average – 65–79 points, good – 80–89 points, excellent – 90 points.

To assess the autonomic regulation of cardiac activity, the HRV analysis method was used using the “CardioSpectrum” express analysis system of Solveig JSC. Cardio intervals were recorded in the supine position, in a state of relative rest twice: the first time – before the start of the Harvard step test, the second time – immediately after the test was completed, within five minutes. 72 cardio intervals were recorded. The heart rate parameters recommended by the European Society of Cardiology and the North American Society of Pacing and Electrophysiology (1996) were used for the analysis. The analysis yielded statistical (NN, SDNN, RMSSD, pNN50), variational (Mo, AMo, MxDMn,

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[6] Popovych I., Bokhonkova Y., Sokolova H., Forostian O, Rodchenkova I, Yurkiv Y., Korniienko I. Impact of emotionality and locus of control on athletes’ motivation for success achievement and failure avoidance in individual sports. *Journal of Physical Education and Sport*. 2024. Vol. 24 (issue 2), pp. 292–302. https://doi.org/10.7752/jpes.2024.02035

[7] Корольчук М.С. Психофізіологія діяльності: підруч. [для студ. вищ. навч. закл.]. К.: Ельга. Ніка-Центр, 2003. 400 с.

SI (stress index) and spectral characteristics of the heart rate: TP – total spectrum power up to 0.4 Hz, VLF – power in the very low frequency range – less than 0.04 Hz, LF – power in the low frequency range 0.04-0.15 Hz, HF – power in the high frequency range 0.15-0.4 Hz, LF/HF (ratio of LF to HF). Standardized power indicators were calculated in the low (LFn) and high frequency (HFn) ranges, expressed in normalized units.

The type of heart rate regulation was determined by quantitative and qualitative criteria of heart rate variability indicators. The selection criteria were the tension index and the power indicator in the very low frequency range. A moderate advantage of central regulation (MACR) was determined when SI – more than 100 standard units, VLF – more than 240 ms^2, stable predominance of central regulation (SPCR) – SI – more than 100 standard units, VLF – less than 240 ms^2, moderate predominance of autonomic regulation (MPAR) – SI – more than 25, but less than 100 standard units, VLF – more than 240 ms^2, stable predominance of autonomic vegetative regulation (SPAR) – SI – less than 25 standard units, VLF – more than 500 ms^2[8].

The initial autonomic tone was assessed by the tension index: vagotonia (VVT) – less than 30 conditional units; eutonia (EVT) – 30–90 conditional units; sympathicotonia (SVT) – 90–160 conditional units; hypersympathicotonia (HVT) – more than 160 conditional units[9]

In order to assess the vegetative tone and type of vegetative support of activity in high school students with vegetative-vascular dysfunction for the purpose of assigning physical activity during classes in a special medical group, 12 boys and 13 girls aged 14-15 with a diagnosis of vegetative-vascular dysfunction were examined. The type of vegetative support of activity was assessed by the type of reaction to the active orthostatic test.

The assessment of the mental reliability of student athletes was determined using a questionnaire developed by V. M. Milman, which allowed to identify four components of mental reliability: competitive emotional stability, self-regulation, competitive motivation and resistance to obstacles. The number of points was calculated separately for each component. A score of 0 points corresponded to the average level of mental reliability. A score with a "–" sign indicated a decrease in the level of reliability for this component, respectively, a "+" sign indicated a high level of mental reliability.

The work was carried out in accordance with the research program of the Sumy State Pedagogical University named after A.S. Makarenko of the

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[8] Латіна Г. О. Спосіб оцінки загальної фізичної працездатності осіб 19-21 років за показниками варіабельності серцевого ритму. *Спортивний вісник Придніпров'я*. 2013. № 3. С. 124–134.

[9] Латіна Г. О. Вегетативний супровід фізичної працездатності студентів спеціальності «олімпійський та професійний спорт». *Науковий часопис НПУ імені М.П. Драгоманова. Серія 20 Біологія* : зб. наукових праць. К. : Вид-во НПУ імені М.П. Драгоманова. 2011. №3. С.144–147.

Department of Public Health and Medical and Biological Foundations of Physical Education on the topic “Comprehensive study of the functional state, adaptive capabilities of the organism and the risk of developing diseases in different population groups” (state registration number 0120U100799).

The research was conducted in compliance with the principles of voluntariness, with a guarantee of protection of human rights and freedoms, inviolability of his physical and mental integrity, in compliance with the principles of justice and equality, with preliminary detailed information of the volunteers about the essence of the research, written consent for participation was obtained from each subject of the scientific research in research and for carrying out diagnostic measures in accordance with the "Helsinki Declaration of the World Medical Association" (2005).

The obtained data were subject to mathematical and statistical processing using the “Statistica 8.0” application program.

1. Mental stability of higher education students

Mental stability is an integral set of innate and acquired personal qualities, mobilization resources and reserve psychophysiological capabilities of the organism, which ensure optimal functioning of the individual in adverse conditions of the professional environment. Certain individual-typological features of individuals with low emotional stability at the stage of professional orientation have been identified, in particular low activity and working capacity, low level of subject and social plasticity, high emotionality, excitability, emotionality, pronounced neuroticism and personal anxiety. All this indicates an imbalance in the structural elements of the personality, which cannot but affect the success of educational activities at the stages of professional orientation and training[10].

It should be noted that the relevance of conducting a study on the assessment of neuropsychiatric stability of higher education applicants is due to the high production and economic efficiency of assessing professional suitability and the preservation and rational distribution of the state's labor resources.

The surveyed contingent of higher education applicants is characterized by a satisfactory level of MS (22.8±0.6 points), which indicates possible manifestations of emotional breakdowns during extreme situations, significant physical and mental stress.

The results of the comparative analysis of the study data in gender and age groups did not allow establishing a significant difference in indicators. The average MS values of girls (22.8±0.7 points) are only 2.9 points higher

[10] Simões de Almeida R., Rodrigues A., Tavares S., Barreto J. F., Marques A., Trigueiro M. J. Mental Health and Lifestyle Factors Among Higher Education Students: A Cross-Sectional Study. *Behavioral Sciences*, 2025. 15(3), 253. https://doi.org/10.3390/bs15030253

than the indicator of boys (19.9±1.6 points, $p<0.005$). Among students of different ages, the difference ranges from 0.6 to 1.7 points. At the same time, the difference increases with an increase in the gap in the age of students towards an increase in neuropsychiatric stability. The established patterns may be evidence of a decrease in neuropsychiatric instability, that is, the probability of manifestations of disruptions in the activity of the nervous system, with the acquisition of experience in the teaching profession.

The distribution of MS levels among applicants is characterized by a significant predominance of a satisfactory level of MS ($p<0.005$). In second place in terms of prevalence are applicants with an unsatisfactory level of MS, the specific weight of which is 2.9 times less than the indicator of a satisfactory level ($p<0.005$). The third place among applicants is occupied by a good level of MS, which is 5.1 times less than the satisfactory level ($p<0.005$). A high level of MS is inherent only to a small percentage of respondents, which indicates a small proportion of applicants with innate and acquired personal qualities, mobilization resources and reserve psychophysiological capabilities of the body, which ensure optimal functioning of the individual's body in adverse conditions of the professional environment.

The gender distribution of MS levels indicates a probable predominance of satisfactory and unsatisfactory MS levels among girls and good and high MS levels among boys ($p<0.005$). The share of girls with an unsatisfactory level is 7.8% higher than that of boys. In addition, the share of girls with a satisfactory level is 12.1% higher than the corresponding indicator of boys, while boys with a good MS level are 20.7% higher than that of girls. It should be noted that among the surveyed contingent, a high level of neuropsychic stability is formed at the expense of boys.

The identified features indicate the presence of a risk of maladaptation in stress among students at the stage of professional training, in particular the female contingent.

The next stage of our study was to establish the features of the distribution of MS levels among students of different ages. The surveyed contingent is characterized by a large age gap. The first-year students are aged 17 to 22 years. The percentage distribution shows that among applicants, persons aged 17–19 years probably predominate, whose share is 96.7%. Therefore, the analysis of the distribution of MS was carried out precisely among this contingent.

The results of the comparative analysis of the distribution of MS groups among applicants of different ages indicate a corresponding advantage of a satisfactory level among students aged 17 (73.3±0.7%), 18 (57.8±0.6%) and 19 (72.1±0.7%). However, the share of a satisfactory level among applicants of 18 years is probably lower than among students of other ages ($p<0.005$).

According to the structure of the MS groups of applicants of all years, the second place is occupied by an unsatisfactory level (20.0±0.4%, 26.8±0.4%, 14.8±0.3, respectively), the third place is occupied by a good level (6.7±0.2%, 14.1±0.3%, respectively), and among eighteen-year-olds there is a share of students with a high MS level (1.4±0.1%). However, the unsatisfactory level is formed by applicants aged 18 (26.8±0.4%), satisfactory – applicants aged 17 (73.3±0.7%) and 19 (72.1±0.7%), good – applicants aged 18 (14.1±0.3%), 19 (13.1±0.3%).

The established features indicate the possibility of increasing neuro-emotional stability with age under physical and mental stress in the professional environment, which is due to the acquisition of experience in professional activity.

As a result of a comparative analysis of the distribution of MS levels among applicants from different faculties, who are receiving education in four common areas of pedagogical specialization, a number of patterns have been established. First, an unsatisfactory level of MS, i.e. a high probability of emotional breakdowns, is inherent in applicants from the Faculty of Natural Sciences and the Faculty of Pedagogy and Practical Psychology. The specific weight of the share of unsatisfactory MS levels among applicants from these two faculties is 11-13.3% higher than the share of applicants from the Physics and Mathematics and Philology faculties. Secondly, applicants from the Philology Faculty with specialties in Foreign Language, Ukrainian Language and Literature are characterized by a satisfactory level of MS (73.1±0.7%). It should also be noted that it is precisely applicants from these specialties who have a share of 1.9% of high levels of neuropsychiatric stability.

Thirdly, a good level of MS, that is, the low probability of maladjustment in stressful situations, of applicants to a pedagogical higher education institution, is formed at the expense of students of the physics and mathematics faculty. The formation of this level at the expense of students of the physics and mathematics specialty occurs due to the prevalence among the contingent of young men, compared to the contingent of other faculties.

It is known that physical culture and sports have a significant impact on the formation of a person's personal qualities, therefore, in order to verify the influence of systematic sports and recreational physical culture on the MS of students, the fact of practicing various sports was determined. The conducted studies revealed that among the surveyed contingent of applicants, only 19.2% go in for sports. The following types of sports are represented: game sports (volleyball, basketball, football, table tennis), athletics, single combat sports (taekwondo, kickboxing), swimming, sports dances, fitness.

The distribution of MS levels among applicants involved in physical education and sports allowed us to establish an identical general distribution of levels. However, in the partial correlation, a significant difference was established between the indicators of applicants involved in physical education and sports and those who are not. Thus, students involved in physical education and sports have a 19.1% (26.02±0.4%) lower indicator of high neuropsychiatric instability compared to applicants without a chosen sport (6.9±0.2%). The good level of MS of athletes is 1.6% higher (12.2±0.1%) than the corresponding indicator of applicants not involved in sports (13.8±0.7%).

In further research, to clarify the role of physical culture and sports in the formation of MS, we consider it necessary to compare the MS levels of applicants for pedagogical specialties in general subjects and applicants for the specialty of physical education.

2. Vegetative support of physical performance of athletes and students of higher education institutions

According to the analysis of HRV indicators, we established the presence of three types of heart rate regulation in the surveyed contingent: with a moderate predominance of central regulation, with a moderate predominance of autonomous regulation and with a stable predominance of autonomous vegetative regulation. At the same time, the indicators of students with the MPAR type (62.2±1.2%) probably prevail, which indicates the optimal state of the regulatory systems of the body.

The share of students with the SPAR type is 33.3±0.9%, which corresponds to the second value in the distribution and reflects the state of overfatigue. The third type of heart rate regulation – MACR – was established in 4.4±0.3% of students and corresponds to moderate stress of the regulatory systems.

Analysis of HRV indicators by gender allowed us to establish that the formation of the MACR type occurs at the expense of men, since the share of this type is 100%. It should be noted that the established type of heart rate regulation in men may be due to sports activities, since all men engage in sports with qualification levels – I, II, III sports category. However, no significant difference in HRV indicators by sports gradation has been established.

The other two types are formed at the expense of women, so the share of the MPAR type is 60.7±1.2% compared to men – 39.3±0.9%. The specific weight of the SPAR type in women (60±.2%) is probably higher than the corresponding share in men (40±0.9%).

HRV indicators in students with the optimal type of heart rate regulation (MPAR) are characterized by higher-than-normal indicators of SDNN (116.3±56.7 ms), RMSSD (141.6±96.9 ms), pNN50 (53.1±21.7%), which confirms the autonomous regulation of heart rate, i.e. the increase in the influence of breathing on heart rate. In addition, the stress index is below normal – 43.9±20.5 standard units. and the indicator of the number of intervals of the same type in duration (AMo – 23.4±5.8%) has a tendency to decrease compared to indicators of other types of regulation.

A similar trend of indicators, but significantly higher values were found in students with the type of SPAR. The indicators of SDNN (217.9±7.7 ms), RMSSD (259.5±122.5 ms), pNN50 (67.3±18.7%) have significantly higher values than the indicators of the type of SPAR regulation ($p<0.001$), which indicates an increase in the role of autonomic regulation and indicates the phenomena of overfatigue in students of this type.

The values of the indicators of the type of MACR are different from the indicators of the two types of autonomous vegetative regulation. The values of the indicators of the type of SPAR are probably lower than the values of the indicators of the type of SPAR: SDNN (55.5±14.8 ms, $p<0.01$), RMSSD (56.5±27.7 ms, $p<0.05$), pNN50 (24.5±12%, $p<0.01$), which confirms the influence of the central regulatory circuit. In support of this conclusion, the values of the tension index (138±50.9 conventional units, $p<0.001$) and the amplitude of the mode (36±2.8%, $p<0.001$) are probably higher compared to the indicators of the students of the type of SPAR, since it is known that the number of intervals of the same duration increases when the central regulatory circuit is activated.

Comparative analysis of HRV spectral indicators of students with different types of heart rate regulation indicates a probable superiority of the total spectrum power (TP) indicator in students with the type of SPAR (45822.5±29356.1 ms^2) compared to the indicators of the type of MACR (2727±1132.8 ms^2, $p<0.05$) and MPAR (12691.1±11023.9 ms^2, $p<0.001$). It should be noted that the indicators of the components of the total spectrum power have probable differences between the types of autonomic regulation: MPAR and SPAR. Significantly higher values of VLF (9210.1±6169.6 ms^2), LF (14954.6±12476.1 ms^2), HF (21657.9±1634 ms^2, $p<0.001$) were found in students with the type of SPAR compared to the indicators of the type of SPAR (2710.6±3294.2 ms2, 3787.6±3218.1 ms2, 6193.1±6271.7 ms^2, respectively). The established patterns confirm the influence of autonomous vegetative regulation on heart rhythm.

Evaluation of the results of testing the level of PWC of athletes using the Harvard step test showed that 45.5% of athletes have an average level of PWC (73.9±4.4 points), good (85.8±3.5 points) – 18.2%, excellent (99.8±8.8 points) – 36.4% of athletes.

Analysis of the Harvard Step Test index assessment data of student-athletes showed excellent physical performance indicators in 53.3±1.1% of the studied contingent according to the average HST indicators (106.9±3.1 points, $p<0.001$). At the same time, 31.1±0.8% of student-athletes were found to have an average level (73.6±1.04 points) of physical performance, while 15.6±0.6% had a good level (85.3±0.9 points), which indicates low indicators of physical performance and adaptation of some students to physical activity.

Assessment of the dynamics of heart rate indicators during recovery after physical exertion in student-athletes of different levels allows us to establish the following patterns of formation of HST levels: firstly, the initial of heart rate data in student-athletes are the lowest with an excellent IGST level (37.5±2.3 beats per 30 s, $p<0.05$) and suffer with average (46.9±4.9 beats per 30 s) and good levels (33.4±0.8 beats per 30 s).

Secondly, after performing the functional test, the lowest heart rate indicators are those of student athletes with an excellent level of HST (61.3±2.4 beats per 30 s, $p<0.001$) compared to those of an average (79.4±0.5 beats per 30 s) and a good level (75.4±2.7 beats per 30 s, $p<0.05$), which affects the impact. insignificant physical activity for the category of an excellent level of HST.

Thirdly, the higher the level of physical performance, the faster the recovery of heart rate indicators occurs. Thus, in student-athletes with an excellent level of HST, recovery occurred at 3 minutes (39.3±0.8 beats per 30 s) of registration indicators after the functional test, while in student-athletes with an average (39.6±0.4 beats per 30 s) and good (50.7±1.7 beats per 30 s) level, recovery occurred at 4 minutes.

Studies of the typological features of heart rate regulation before the start of the functional test allowed us to establish the predominance of parasympathetic regulation of heart rate with stable (54.6±2.2%) and moderate (45.5±2.1%) levels. After the functional test, the proportion of athletes with a moderate predominance of autonomic regulation increased (64.6±2.4%), the proportion of a stable predominance of autonomic regulation decreased (27.3±1.6%), and a single case of dysregulation of the autonomic nervous system was detected in the direction of changing the type of regulation from autonomous to central regulation circuit (9.1±0.9%).

As a result of the study of statistical indicators of HRV of athletes with different levels of physical fitness, differences were found in the initial state – before the start of the Harvard step test. Thus, students with a good level of PWC recorded the highest level of RMSSD (338.5±6.5 ms), which is 2.3 times higher than the indicator with an average level of PWC (148±42.7 ms) and 2.4 times higher than the indicator of athletes with a high level of PWC (140.3±44.5 ms). In addition, athletes with an average level of PWC have a higher SDNN index (245.5±1.5 ms), compared to students with an excellent level of PWC (125±26.3 ms). Therefore, relatively higher SDNN, RMSSD indices in athletes with a good level of PWC indicate the superiority of the autonomous regulatory circuit, compared to athletes with other levels of PWC, these data are confirmed by the AMo index, the decrease of which indicates the superiority of parasympathetic vegetative regulation. The difference in its values between athletes with a good (10±1%) and excellent level of PWC (24.3±1.7%) is 14.25%.

Spectral indicators of HRV before exercise have differences in the indicators of vasomotor waves: the values of athletes with a good level of PWC (17800.5±4336.5 ms^2) are significantly lower than the indicator of athletes with an average level of PWC (4706.2±2032.9 ms^2). A difference in respiratory waves towards an increase was registered in athletes with a good level of PWC (26386.5±408.5 ms^2), compared with students with an excellent level of PWC (6240.3±3218.8 ms^2). Such differences confirm the stable superiority of the autonomic circuit of activity regulation in athletes with a good level of PWC in a state of relative rest.

After the Harvard step test, the discrepancies in HRV indicators increased depending on the level of PWC, which occurred due to differences in spectral indicators of heart rate. Thus, the sympathovagal index of students with an excellent level of PWC (1.79±0.56 standard units) is significantly higher than that of athletes with an average level of PWC (0.39±0.1 standard units). Accordingly, athletes with an average level of PWC have a higher proportion of the parasympathetic regulation index in normalized units (72.2±2.6%) and a lower proportion of the sympathetic regulation index in normalized units (27.8±2.6%). Whereas, athletes with an excellent level of PWC have a higher proportion of the sympathetic link index (59.8±7%), compared to the proportion of the parasympathetic link (40.3±7%) of vegetative regulation.

Probable differences in statistical indicators of HRV after the functional test were preserved in the RMSSD index among students with a good and excellent level of PWC. However, the difference between the indicators of both groups increased and amounted to 3.3 times, which occurred due to a decrease in the RMSSD index in athletes with an excellent level of PWC (61.8±14.9 ms), compared to the indicator of athletes with a good level of PWC (202±59 ms). Such a decrease in the RMSSD index in athletes with an excellent level of PWC may indicate an increase in the sympathetic link in the regulation of the heart rate.

Thus, the dependence of HRV indicators on the levels of physical fitness has been established. Vegetative support of a good level of PWC occurs due to parasympathetic vegetative regulation, which reflects functional readiness and adaptation to physical exertion. Students with an average and excellent level of PWC achieve their results when including the central regulatory circuit in the process of regulating the activity.

3. A method for assessing the emotional stability of female athletes based on heart rate variability indicators

Based on the conducted research, the dependence of mental reliability indicators on the level of sports qualification was established. Thus, the general emotional stability of athletes of the lower qualification level is at a low level (-7.6±1.1 points). In athletes with a high qualification level, emotional stability is set at a level below average (-5.5±1.5 points). The established data indicate greater emotional arousal during the training process of athletes of the lower qualification level.

The indicators of self-regulation (-0.64±0.4 points) and competitive motivation (-1.4±0.6 points) in first-class athletes indicate a decrease in mental reliability in these components. In second-class athletes and candidates for master of sports, these indicators were 0.5±0.5 points and 1.0±1.0 points, respectively, which indicates the formed level of self-regulation and motivational sphere.

The indicator of resistance to obstacles, which reflects the stability of motor skills and sports techniques when exposed to various types of obstacles on the body, is at a higher level in athletes with a higher qualification level (0.5±0.5 points) compared to athletes with a low level of sports qualification (-0.1±0.4 points).

As a result of the analysis of the heart rate variability indicators of female athletes before the start of training, a moderate predominance of parasympathetic activity was established (55.6±8.2%), which reflects the optimal state of the body. According to the distribution, the share of athletes with a significant predominance of the sympathetic division in heart rate regulation (30.6±7.7%) is in second place and reflects the level of training of high-class female athletes. The shares of female athletes with a moderate (4.5±8.3%) and a significant predominance of the sympathetic system in heart rate regulation (5.6±3.8%) were equally distributed, which in the first case indicates a moderate tension of the regulatory systems, while in the second, a state of vegetative dysfunction. At the end of training in female athletes, the distribution of regulation types changed towards an increase in the share of female athletes with a moderate predominance of sympathetic regulation (16.7±6.2%) and female athletes with a significant predominance of the central circuit of heart rate regulation (8.3±4.6%). Such changes occurred due to a decrease in the proportion of athletes with a significant predominance of the parasympathetic department of regulation (22.2±6.9%), while the proportion of athletes with a moderate predominance of parasympathetic regulation remains unchanged (53.8±8.3%). The established changes indicate the presence of a proportion of athletes with a sharp change in the type of heart rate regulation of athletes, which may indicate manifestations of dysregulation and a decrease in the level of training of athletes.

The results of the conducted studies allowed us to develop a method for assessing the emotional stability of athletes taking into account the type of vegetative regulation of heart rate during the training process. The developed indicator of general emotional stability (GES) is based on the calculation of the general statistical characteristics of the initial data set, correlation and regression analysis ($F=6.5054$; $p<0.004$):

$$GES = -17.5+1.8\times THRR_b+1.3\times THRR_a,$$

where GES – general emotional stability (points); $THRR_b$ – type of heart rate regulation before the athlete's training (points); $THRR_a$ – type of heart rate regulation after the athlete's training (points).

The method of assessing the general emotional stability of athletes consists in the step-by-step implementation of the stages of the study: measurement of HRV indicators at rest before the start of training; measurement of heart rate variability indicators at rest after training; filling out a data recording card; calculation of the WES indicator and determination of the level of emotional stability.

Measurement of heart rate variability indicators at rest is carried out using electrocardiographic signal recording devices. Equipment intended for the analysis of short-term heart rate variability indicators should have the ability to perform non-parametric and preferably parametric spectral analysis. Industrial equipment used for HRV assessment should be standardized and meet technical requirements. In order to standardize physiological research, it is necessary to use a five-minute recording in physiologically stable conditions. These requirements are met by HRV analysis systems based on computer cardiographs.

The conditions for recording cardio intervals are a five-minute recording of indicators in a supine position, which should take place in the first half of the day after a 10-minute rest in the absence of external emotional, sound stimuli. In women, registration should be carried out from the 7th to the 20th day of the menstrual cycle. When registering indicators, the researcher must select the following for calculation: the stress index (SI), which reflects the correspondence between statistical and spectral indicators of heart rate variability, and VLF (power in the very low frequency range – less than 0.04 Hz), which reflects the central energotropic component of the spectrum.

To calculate the WES, the initial data must be obtained by filling out a specially designed data recording card (table 1). The card provides for determining the type of vegetative regulation.

The data recording card includes the GES formula and a stencil, filling in which the total quantitative indicator of GES is determined. The obtained GES result is identified according to Table 2 to establish the level of emotional stability of the athlete. The formation of GES level ranges was carried out using the method of sigmal deviations.

Table 1

Data recording card

Last name, first name			
Date of event			
Criteria	Encoding values	Symbols	Indicator
Type of heart rate regulation before the athlete's training	If SI is more than 100 standard units, VLF is more than 240 ms^2, 1 point is assigned. If SI is more than 100 standard units, VLF is less than 240 ms^2, then 2 points. If SI is more than 25, but less than 100 standard units, VLF is more than 240 ms^2, then 3 points. If SI is less than 25 standard units, VLF is more than 500 ms^2, then 4 points.	$THRR_b$	____ points
Type of heart rate regulation after the athlete's training		$THRR_a$	____ points
GES = -17.5+1.8×$THRR_b$+1.3× $THRR_a$			
GES = -17.5+1.8×______+1.3× _____ GES =			

Table 2

Quantitative assessment of emotional resilience in female athletes

Quantitative assessment for GES	**Level of overall emotional resilience**	**Qualitative characteristics**
-7 and above	I	high
from -7.1 to -9.3	II	average
from -9.4 and less	III	low

The three levels of general emotional stability in athletes obtained have the following characteristics:

– low level of emotional stability in an athlete – characterized by a sharp change in the type of heart rate regulation at the beginning and at the end of training. At the same time, types of vegetative regulation opposite in regulation are registered: a stable advantage of sympathetic regulation of heart rate before training and a stable advantage of parasympathetic regulation of heart rate after training. Dysregulation of heart rate is registered in an athlete;

– average level of emotional stability in an athlete – characterized by a change in the type of heart rate regulation at the beginning and at the end of training within one link of regulation, in particular parasympathetic regulation. At the same time, changes in HRV indicators from moderate to stable parasympathetic regulation are registered;

– a high level of emotional stability in an athlete – characterized by the absence of changes in the type of heart rate regulation at the beginning and at the end of training or the transition of the type of vegetative regulation to a state of optimal regulation (moderate advantage in the activity of parasympathetic regulation) at the end of training compared to the beginning of training. Moreover, at the beginning of training, a distinctive feature of high-class athletes is the stable advantage of the parasympathetic vegetative system in the regulation of heart rate.

4. Method for assessing the general physical performance of individuals aged 19–21 years using heart rate variability indicators

Studies of the initial autonomic tone indicators showed that among the examined athletes-athletes under physiological conditions there were 57.8±1.1% of people with a predominance of parasympathetic tone – vagotonia, 35.6±0.9% with indicators of autonomic balance – eutonia, 4.4±0.3% – with a predominance of sympathetic tone and 2.2±0.2% had indicators of hypersympathocotony (table 3). The established data may indicate an adequate state of rest autonomic tone for athletes due to the adaptation of the mechanisms of autonomic regulation to physical exertion and confirms the data of studies by other authors.

Assessment of the type of heart rate regulation in athletes-athletes at rest confirms the data of the assessment of autonomic tone. Thus, in athletes-athletes at rest, a stable predominance of the autonomic regulation circuit was established in 46.7±1.1%. The type of heart rate regulation with a moderate predominance of the autonomous regulatory circuit was established in 46.7±1.1% of athletes, which corresponds to the optimal state of regulatory systems. A moderate predominance of the central regulatory circuit was established in 6.7±0.4% of athletes with a probable predominance of SI indicators, which indicates a moderate tension of regulatory systems at rest (table 3).

Table 3

Heart rate variability indicators of athletes according to vegetative tone and type of heart rate regulation in the initial state (M±m)

Initial autonomic tone	SI (standard units)	Type of heart rate regulation	SI (standard units)	VLF (мс^2)
VVT	16,5±1,6	moderate predominance of autonomic regulation	47,3±4,3	3216,1±560,9
EVT	46,2±4,4	stable predominance of autonomic vegetative regulation	13,8±1,6	8738,1± 1308,1
SVT	102,2±0,1*	moderate advantage of central regulation	126±24*	680,8±207
HVT	174	stable predominance of central regulation	-	-

*Note: * – p<0.05 – significant difference between types of initial vegetative tone and types of heart rate regulation.*

The next stage of the study was the assessment of the vegetative support of physical performance in athletes depending on their initial vegetative tone. In athletes with vagotonia, after physical exertion, there was an increase in SI (45.4±12.9 conditional units, $p<0.001$) by 2.8 times, compared to the state of rest (IN – 16.2±1.6 conditional units). Along with this, a decrease in the NN-intervals after physical exertion (685.7±38.1 ms) was found compared to the rest state (NN-intervals – 819.7±31.3 ms, $p<0.05$) and the low-frequency component of the power spectrum (LF physical exertion – 11235.38± ms^2, LF rest state – 5166± ms^2, respectively, $p<0.05$), which indicates a decrease in heart rate variability and an increase in heart rate due to the influence of physical exertion, which corresponds to the natural reaction of the body to physical exertion.

By type of vegetative regulation, in athletes with a stable predominance of the autonomous circuit after physical exertion, the proportion decreased to 33.3±0.9%, while the proportion of athletes with an optimal state of regulatory systems increased to 48.9±1.03%.

In athletes with initial vegetative tone eutonia, the increase in SI occurred from 46.2±4.4 standard units to 82.1±22.6 standard units ($p<0.001$), which indicates a tendency to increase the centralization of heart rate regulation due to the action of physical activity. The inclusion of centralization mechanisms in heart rate regulation is confirmed by a 1.5-fold decrease in the pNN50 index (46.8±7.5%, 30.7±6.9%, respectively, $p<0.05$). In athletes with sympathicotonia, the response to physical activity was an increase in SI by 1.3 times (102±0.1, 135±0.1 standard units, respectively, $p<0.05$). Along with changes in the stress index, athletes experienced an increase in the power index of the low-frequency component of the spectrum (LF – 840±0.1 ms^2) compared to the resting state (441±0.1 ms^2, $p<0.05$), which confirms the increase in the activity of the sympathetic branch of the autonomic nervous system in the regulation of heart rate and indicates a moderate predominance of the central regulatory circuit in this category.

According to the changes in the type of heart rate regulation with a moderate predominance of the central regulation circuit, as a result of physical activity (17.8±0.6%), an increase in the proportion of athletes with this type by 11.1% compared to the state of rest was established. The stress index after exercise was 194.4±34.6 conditional units, which goes beyond the physiological norm of the balance of regulatory systems.

Thus, as a result of physical activity in athletes with vagotonia and eutonia, compensatory activation of the sympathetic nervous system occurred, because when performing physical exercises, the sympathoadrenal system is activated. However, an increase in the proportion of students with a moderate predominance of the central regulation circuit of the heart rate indicates the inclusion of the central link of the regulation of the heart rate and puts these athletes in the "risk" group, as athletes who may have a low level of recovery after physical activity.

The next stage of the study was to identify individual indicators of statistical and variational indicators of heart rate variability during physical activity using a regression model. As a result of the study, we developed a method for assessing general physical performance for individuals aged 19-21 using heart rate variability indicators.

To use the proposed method for assessing physical performance for individuals aged 19-21, the presented assessment algorithm should be used. The physical performance indicator (PPI) is based on the calculation of general statistical characteristics of the original data set, correlation and regression analysis ($F=3.41$; $p<0.01$).

A method for assessing physical performance in athletes is proposed:

$$PPI = 43{,}7+0.5\times P+0.3\times SI+0.7\times M,$$

where PPI is the physical performance indicator (points); P is the RMSSD index at rest – the square root of the average value of the sum of the squares of the difference between neighboring RR intervals (ms); SI is the stress index at rest – an indicator that reflects the level of centralization of the heart rate, and is also associated with the state of sympathetic tone (s. units); M is the Mody index (Mo) after performing the step test – the range of RR intervals that are most frequently encountered indicates the most likely level of functioning of the circulatory system, or more precisely, the sinus node (ms).

To calculate the PPI, the initial data must be obtained by filling out a specially designed data recording card (table 4). The card provides for the determination of three components of the physical performance indicator and the establishment of its level. The formation of the PPI level ranges was carried out using the sigmal deviation method.

To calculate the PPI, the initial data must be obtained for three stages of assessing heart rate variability indicators and conducting the Harvard step test:

Stage I – determine statistical and variational heart rate indicators using the “CardioSpectrum” express analysis system of JSC Solveig at rest. Cardio intervals should be recorded for 5 min. – in the first half of the day after a 10-minute rest in the absence of external emotional and sound stimuli (Note: in women, registration should be carried out from the 7th to the 20th day of the menstrual cycle). Record the RMSSD indicators (ms), stress index (ms. units) in the data recording card.

Table 4

Data recording card

Indicator	Indicator value	
RMSSD at rest	P	
stress index at rest	IH	
Mo after performing the step test	M	
PPI = 43,7+0.5×P+0.3×SI+0.7×M PPI = 43,7+0.5×____+0.3×____+0.7×____		
PPI =		

Stage II – perform the Harvard step test according to the classical method: 30 climbs per step are performed for 5 minutes at a rate of 30 cycles per minute, with each cycle consisting of 4 steps. The height of the step for men is 50 cm, for women 43 cm.

Stage III – determine the variation indicators of the heart rate using the express analysis system "CardioSpectrum" of JSC Solveig after completing the Harvard step test. Record the Mo indicator (ms) in the data recording card. Make calculations.

The obtained PPI result is identified according to table 5 to establish the level of physical performance.

Table 5

Quantitative assessment of athletes' physical performance

Quantitative assessment by PPI	**Physical work capacity level**	**Qualitative characteristic of the level**
518 and less	I	high
from 519 to 610	II	average
from 611 and more	III	low

Characteristics of the levels of physical performance:

I – high level of physical performance. Characterized by a low level of variability indicators in the state of rest and the state of physical exertion.

II – average level of physical performance. Characterized by manifestations of parasympathetic activity in the state of rest (low RMSSD and stres index) and a high level of sympathetic activity after physical exertion (high level of Mo indicator).

III – low level of physical performance. It is characterized by high heart rate variability at rest and especially after physical exertion.

5. Assessment of vegetative support of the activity of high school students with vegetative-vascular dysfunction when choosing physical activity for classes in a special medical group

Autonomic disorders are one of the urgent problems of modern medicine. Today, autonomic dysfunction is diagnosed in 20–45% of children of the general population, which is associated with the anatomical and physiological characteristics of the child's body and hormonal changes in adolescence. Any stress, especially a severe chronic disease, can cause autonomic imbalance and, under the influence of heredity, lead to the development of autonomic dysfunction and arterial hypertension in the future. Therefore, the study of the manifestations of autonomic dysfunction in adolescence is the problem of this study.

Vegetative-vascular dysfunction (VSD) is widely distributed among children of prepubertal and pubertal periods. The relevance of this problem for modern pediatrics, pedagogy and hygiene is due to the steady trend towards an increase in the density of children suffering from this pathology. VSD is a disease of polyetiological genesis, which is based on an imbalance in the activity of the vegetative nervous system at the intracellular, membrane and tissue levels. It is important to note that the vegetative nervous system is the main link in the homeostatic system, and therefore the adaptive capabilities of the organism as a whole and individual systems and organs, and, consequently, the severity of the course of VSD, depend on its functional state. As a result of the examination of school-age children, it was found that when assessing the vegetative state, the tone of the sympathetic nervous system prevails in 45.4% of cases, the tone of the parasympathetic nervous system – 9.2%, eutonia – 45.4%. They differ according to the data of the study of children of primary school age by scientists L. V. Kvashnina, T. B. Ignatova, Yu. A. Makovkina, O. V. Oniskova and I. S. Maidan. According to the results of the analysis of the state of vegetative homeostasis with the determination of the initial vegetative tone, it was found that vagotonia was observed in most children (81.1%), eutonia in 13.5% of children, and sympathicotonic initial vegetative tone in only 5.4% of children. When conducting a clinoorthotest, a violation of vegetative reactivity was detected in the form of asympathicotonia (43.5% of children) and hypersympathicotonia (15.1% of children). Only 40.3% of children had normal vegetative reactivity.

Thus, the assessment of vegetative homeostasis in adolescents is an indicator of the adaptive capabilities of the body in VSD, which determines the relevance and novelty of research in the direction of health preservation.

The relevance of the research direction is confirmed by social and environmental factors, difficulties in organizing medical care, which have led to an increase in almost all types of diseases and a reduction in the life expectancy of the population of Ukraine, a decrease in physical development indicators, a decrease in the number of children with manifestations of accelerated development, and an increase in disability, including children's.

Analysis of the study results indicates a violation of vegetative homeostasis in adolescents with VSD towards hypersympathicotonia (44±9.9%). At the same time, the index of tension of regulatory systems was 312.2±12.2 conditional units. which is 59.9% higher than the indicator of SI (124.5±12.5 conditional units) in students with sympathicotonia (24±8.5%). However, among the surveyed contingent, a proportion of adolescents with vagotonia (28±8.9%), with average values of SI of 73.2±1.9%, was found. The proportion of students with eutonia is 4±3.9%.

The state of vegetative support of adolescents' activity according to the results of the orthostatic test indicates the predominance of the hypersympathicotonic (HS) (80±8%) over the normotonic (NT) (20±8%) variant of the autonomic nervous system's reaction to stimuli, which is associated with impaired nerve innervation.

As can be seen from Table 6, the initial hemodynamic indicators of students do not differ, the Kerdo index indicates the balance of the vegetative system. However, in the first minute after changing the body position, adolescents with a hypersympathicotonic type of reaction showed an increase in systolic blood pressure (SBP), the value of which was 17 mmHg. ($p<0.05$) higher than the SBP of adolescents with a normotensive type of reaction to stress. At the same time, a change in the Kerdo index (27.2±4.4%) was recorded in favor of the sympathetic nervous system, which proves the inclusion of the central regulatory circuit in the vegetative support of the circulatory system during changes in the body's activity in students with VSD.

To date, different effects of the activity of the sympathetic and parasympathetic nervous systems have been identified in physically trained and untrained individuals. Thus, for people who are physically inactive or those who are on prolonged bed rest, the excitation of the sympathetic nervous system is characteristic (dissimilation processes prevail). On the contrary, athletes and physically active people are characterized by excitation of the parasympathetic nervous system (predominance of assimilation processes), which is more beneficial for the body (table 6).

The effect of physical exercises is closely related to the physiological properties of muscles. Muscle contractions occur under the influence of impulses from the central nervous system. The central nervous system regulates movements by receiving impulses from proprioceptors located in muscles, tendons, ligaments, joint capsules, and periosteum. In response, the motor reaction of the muscle to irritation is called a reflex. The path of transmission of

Table 6

Changes in hemodynamic parameters during active orthostatic testing in adolescents with vegetative-vascular dysfunction

Indicators		Reaction type	SBR, mmHg	DBR, mmHg	HR bpm	Kerdo index, %
Horizontal position		NT	113±5,4	66±4	74,4±4,8	10,3±5,8
		HS	110,5±2,4	67,7±2,3	81,6±3,6	11,4±7,3
Vertical position	1 m.	NT	118,4±2,1*	71,2±6,1	87,2±5,5	17,7±6,3
		HS	135,6±2,1	67,8±1,9	96,9±3,6	27,2±4,4
	3 m.	NT	119,9±1,8	89±5,6	94±2,4	5,3±5,1
		HS	125,6±2,5	90,2±2,4	96,2±2,3	5±3,6
	5 m.	NT	111±3,3	77±6,9	94±3,4	17,1±9,2
		HS	112,1±2,1	72,7±2	89,6±2,2	17,8±3,7

*Notes: * – $p<0.05$ – significant difference between the indicators of reaction types.*

excitation from the proprioceptor in the central nervous system and the response of the muscle constitute a reflex arc.

Physical exercises stimulate physiological processes in the body through nervous and humoral mechanisms. Muscular activity increases the tone of the central nervous system, changes the function of internal organs and especially the circulatory and respiratory systems by the mechanism of motor-visceral reflexes. The effect on the heart muscles, vascular system, and extracardiac factors of blood circulation is enhanced. Physical exercise ensures better pulmonary ventilation and a constant carbon dioxide level in arterial blood.

Physical exercises are carried out with the simultaneous participation of both the mental and physical spheres of a person. Therefore, the basis of the method of selecting physical activity when training in a special medical group is the process of dosed training, which develops the adaptive abilities of the body.

Physical exercises are a biological stimulant, enhancing the protective and adaptive reactions of the body. In their development, the adaptive-trophic function of the sympathetic nervous system plays a major role. The stimulating effect is manifested by the strengthening of proprioceptive afferentation, increasing the tone of the central nervous system, activation of all physiological functions of bioenergetics, metabolism, increasing the functional capabilities of the body.

According to the studies of L.G. Sorokina on the correction of the functional state depending on the type of vegetative regulation of the heart rate. Thus, aerobic exercise of low intensity increases the activity of the parasympathetic department of the vegetative nervous system and relatively reduces the tone of the sympathetic regulatory chain. Speed-strength exercises performed in anaerobic mode, on the contrary, increase the activity of the sympathetic nervous system.

For individuals with insufficient activity of the sympathetic nervous system and central regulatory mechanisms, it is recommended to use anaerobic loads that stimulate the cerebral cortex and do not exert a debilitating effect on the cardiovascular system. The complex of therapeutic gymnastics in the work of special medical groups is recommended to include finger, eye movement, articulation, sound gymnastics and breathing exercises, coordination exercises. Exercises should be prescribed without increasing power and intensity.

For individuals with the work of the central department in an enhanced mode, it is desirable to maintain a balance between tension and relaxation of the central regulatory circuit. For this, it is necessary to maintain and improve the functioning of local regulatory mechanisms of the cardiovascular system. In this case, aerobic exercises are recommended. Physical exercises for coordination are recommended in combination with exercises for relaxation of the central nervous system (breathing exercises without coordination load and relaxation exercises). When the condition improves, exercises for stimulation of extracardiac factors of blood circulation should be recommended. Therefore, the development of complexes of physical exercises in a special medical group taking into account the influence of physical exercises on the autonomic nervous system should be the basis of health care in general education institutions.

CONCLUSIONS

Higher education applicants are characterized by a satisfactory level of neuropsychiatric stability, which is characterized by neuropsychiatric breakdowns in extreme situations, significant physical and mental stress. Gender and age characteristics of the distribution of MS are characterized by neuropsychiatric instability of future female teachers; the possibility of increasing neuropsychiatric stability with age, which is due to the acquisition of experience in pedagogical activity. A good level of neuropsychiatric stability, i.e. the low probability of maladjustment in stressful situations, of students of a pedagogical institution of higher education is formed at the expense of young students of the Faculty of Physics and Mathematics.

Analysis of HRV indicators of students established the presence of three types of heart rate regulation: with a moderate predominance of central regulation, with a moderate predominance of autonomous regulation and with a stable predominance of autonomous vegetative regulation. The indicators of students with the MPAR type (62.2±1.2%) probably prevail, which indicates the optimal state of the regulatory systems of the body. The proportion of students with a stable predominance of autonomous regulation is in a state of overfatigue.

The established features of HRV indicators with different types of heart rate regulation correspond to the established types and confirm the fact of the need to determine the predominant type of heart rate regulation of the body to determine pre-pathological states in the body.

The physical performance of athletes is characterized by an average level (73.9±4.4 points) with a share of 45.5%. The vegetative regulation of the heart rate of athletes is provided by the parasympathetic link of the autonomic nervous system with stable (54.6±2.2%) and moderate (45.5±2.1%) levels.

The vegetative support of the physical performance of athletes is associated with its levels. The maximum and minimum results of the Harvard step test index are achieved by students due to moderate tension of the regulatory systems. A good level of physical performance is characterized by an autonomous regulatory circuit, which indicates the functional readiness of students for loads.

According to the data on heart rate variability, it is possible to create an individual portrait of the regulatory systems of the body and establish its connection with the psychophysiological indicators of athletes and students of higher educational institutions.

As a result of assessing the type of vegetative regulation in athletes with different levels of emotional stability, an express method for assessing the emotional stability of athletes was developed.

A natural reaction to physical activity in athletes with different types of initial vegetative tone was established, namely the inclusion of the sympathoadrenal system in the regulation of heart rate. However, in 17.8% of student-athletes, physical performance is ensured by the central link of vegetative regulation of heart rate.

A method for assessing the general physical performance of individuals aged 19-21 years using heart rate variability indicators was developed. The resulting method has the following advantages: efficiency in determining the level of physical performance based on individual heart rate variability indicators; improvement of the structure of the educational and training process; the ability to control and optimize the training process, prevention of pathological conditions (overexertion, overtraining) in athletes.

It was established that the adaptation of the organism to the development of vegetative-vascular dysfunction occurred with overstrain of the adaptation apparatus as a result of hypersympathicotonic reaction of the autonomic system in response to distress influences. The obtained data confirm the need to include in the pre-nosological diagnostics of diseases among the children's contingent the assessment of vegetative homeostasis.

The development of health-preserving technologies in a modern educational institution should be based on the assessment of vegetative homeostasis. The goal of which should be to improve the work of physical education specialists during classes in a special medical group of children with pathology of internal organs.

SUMMARY

The purpose of the study is to assess the physiological and social determinants of the psycho-emotional state of athletes who are students of a higher education institution.

As a result of the research, the following patterns were established. Higher education applicants are characterized by a satisfactory level of neuropsychiatric stability, which is characterized by neuropsychiatric breakdowns in extreme situations, significant physical and mental stress. Gender and age characteristics of the distribution of MS are characterized by neuropsychiatric instability of future female teachers; the possibility of increasing neuropsychiatric stability with age, which is due to the acquisition of experience in pedagogical activity. A good level of neuropsychiatric stability, i.e. the low probability of maladjustment in stressful situations, of students of a pedagogical institution of higher education is formed at the expense of young students of the Faculty of Physics and Mathematics.

Analysis of HRV indicators of students established the presence of three types of heart rate regulation: with a moderate predominance of central regulation, with a moderate predominance of autonomous regulation and with a stable predominance of autonomous vegetative regulation. The indicators of students with the MPAR type (62.2±1.2%) probably prevail, which indicates the optimal state of the regulatory systems of the body. The proportion of students with a stable predominance of autonomous regulation is in a state of overfatigue.

The established features of HRV indicators with different types of heart rate regulation correspond to the established types and confirm the fact of the need to determine the predominant type of heart rate regulation of the body to determine pre-pathological states in the body.

The physical performance of athletes is characterized by an average level (73.9±4.4 points) with a share of 45.5%. The vegetative regulation of the heart rate of athletes is provided by the parasympathetic link of the autonomic nervous system with stable (54.6±2.2%) and moderate (45.5±2.1%) levels.

The vegetative support of the physical performance of athletes is associated with its levels. The maximum and minimum results of the Harvard step test index are achieved by students due to moderate tension of the regulatory systems. A good level of physical performance is characterized by an autonomous regulatory circuit, which indicates the functional readiness of students for loads.

According to the data on heart rate variability, it is possible to create an individual portrait of the regulatory systems of the body and establish its connection with the psychophysiological indicators of athletes and students of higher educational institutions.

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The development of health-preserving technologies in a modern educational institution should be based on the assessment of vegetative homeostasis. The goal of which should be to improve the work of physical education specialists during classes in a special medical group of children with pathology of internal organs.

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