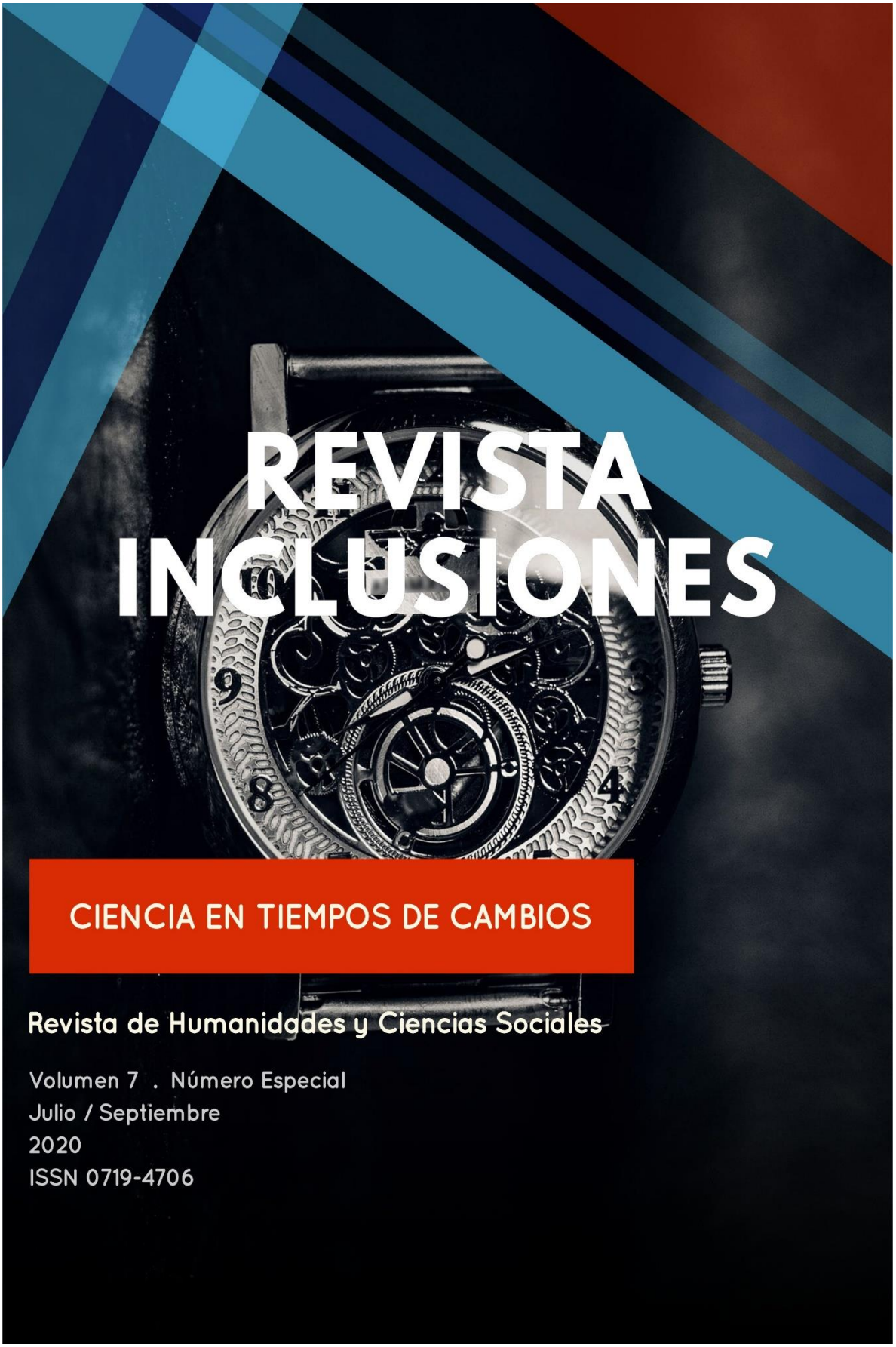

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ADAPTATION POTENTIAL AND ITS IMPROVEMET POSSIBILITIES IN FIRST YEAR STUDENTS AT PHYSICAL TRAINING CLASSES

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Abstract

The rationale for this study is to evaluate adaptation potential in students and to develop a training program for optimization of their functional status and physical work capacity. Scientific and methodical literature review, questionnaire survey, pedagogical experiment, physical fitness testing, methods of mathematical statistics. Four health status and physical fitness uniform groups were formed: 1st, 2nd, 3rd and reference. The parameters from the test groups were compared with the parameters from the reference group, where students had high adaptation potential and physical fitness. The students from the 3rd group had significant increase of speed and power characteristics; pull ups, run broad jumping and grenade throwing results were more informative on speed and power characteristics - the boys showed average results. “Trekrezan” therapy increased the efficiency of locally chosen means of general endurance improvement, which was confirmed by the tests like 1000 m running and 12-minute Cooper’s test. The results of the tests, that evaluated organism functional capacities, showed significant improvement of heart rate and maximal oxygen consumption values. The level of functional Indexes of Ruffier, Skibinsky and Shapovalova increased to “average” and “above average”. Mean value of adaptation potential was equal to 4 points, which was out of the “risk” zone. Individual “additional exercises” contributed to the improvement of functional status, physical fitness and physical work capacity. Activation of the necessary adaptation elements provided compensatory reactions to the training conditions. “Trekrezan” enhanced the efficiency of the developed health improving training program and increased adaptation potential.

Keywords

Adaptation — Students — Physical training — Trekrezan — Physiological

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Introduction

Astrakhan is one of the highly developed centers in Povolzhye. According to the State Committee on Hydrometeorology and Environmental control annual report, it is included into the list of polluted cities in Russia[1]. During the past years, a persistent increase in population of employable age with different pathologies is observed. This group also includes young students. Ecologic instability in the region, like increased air pollution rate and scale up chemical processing in industry, agriculture and household, contributes to the decrease of health level. An increased number of students with respiratory, cardiovascular, digestive and endocrine systems diseases and acoustic, visual and central nervous systems disorders is reported[2]. These disorders are characterized as chronic with periods of recurrence. Students, prone to periodic short-term and often diseases, are usually characterized by poor physical development and low functional status[3]. Efficient ways of these issues solving include wisely organizedphysical activity, healthy way of life, physical training, as well as analogue and effective substitutes of natural adaptogenes indication[4].The rationale for this study is the need in functional status improvement and disease progression prevention,

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increase of physical and mental capacities, adaptation to exogenous factors, fatigue mitigation and adaptation capacities increase.

The purpose of the study is to evaluate the adaptation potential of students and develop the method of functional status and performance optimization.

The authors of the study suggested that the development of students' health improvement efficient methods, based on special physical training under ecologically unfavorable conditions, and their means of implementation would contribute to the decrease of morbidity rate in students during the academic year, which would result in their adaptation potential increase and physical and academic performance.

Material and Methods

The following methods were used in this study: scientific and methodical literature review, questionnaire survey, observation, anthropometric measurements (body height (cm or m), body weight (kg), chest circumference (cm), vital lung capacity (ml)), physiologic methods, pedagogical experiment, pedagogical testing and methods of mathematical statistics[5].

Adaptation capacity, constantly exposed to environmental influence, was evaluated by the integral parameter – adaptation potential (AP)[6]. AP value was estimated by the following equation: AP = 0,011(HR)+0,014(SBP)+0,008(DBP)+0,014(age)+0,009(BW)-0,009(H)-0,27***,*** where: HR – heart rate, SBP – systolic blood pressure, DBP – diastolic blood pressure, BW – body weight (kg), H – height (cm). AP rating scale: 4 points - ***2,10*** – satisfactory adaptation – characterizes organism sufficient functional capacity; 3 points - ***2,11-3,20*** – functional exertion; 2 points - ***3,21-4,30*** - unsatisfactory adaptation – characterizes organism functional capacity decrease with insufficient adaptive reaction to physical loads; 1 point - ***>4,30*** – failure – characterizes acute decrease of organism functional capacity.

To improve organism adaptation capacity of students, Russian adaptogene and immune modulating drug "Trekrezan" was used[7]. "Trekrezan" was indicated to the volunteers in the two test groups. The students took 1 capsule of "Trekrezan" 300 mg q.d. for 2 weeks in the morning 15-30 minutes before breakfast in the beginning of each academic semester.

Stange's test (breath holding after deep inhalation). Maximal time of breath holding after deep inhalation with a closed mouth and shut nostrils. On average, healthy people can hold their breath for 40 – 50 seconds. The time of breath holding increases with improvement of physical fitness that results from adaptation to dynamic hypoxia.

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Hench's test (breath holding after deep exhalation). Maximal time of breath holding after deep exhalation. On average, healthy people can hold their breath for 25—30 seconds. Under chronic fatigue conditions, breath holding time decreases considerably.

Method of External Breathing Evaluation (Maximal Oxygen Consumption). Identification of maximal aerobic performance during physical work capacity evaluation allows the researchers to obtain reliable data. This function of external breathing was assessed with oxispirograph of closed type "META-1-25". Breathing curve, a spirogram, was registered. The evaluation was done by special tables. The curve of oxygen feeding defined the amount of oxygen consumption per minute. The calculations were done by spirograph scale and speed of paper strip movement. Assessment of maximal oxygen consumption (MOC) was done directly during exercising with increasing power and simultaneous registration of oxygen consumption. The moment, when oxygen consumption stopped increasing, despite the increase of work power, defined MOC value. The dosing was performed with veloergometer. The students that completed medical examination were enrolled into the testing. Absolute and relative (per 1 kg of weight) values of MOC were calculated by the following formula: MOC_{1kg} = MOC/Weight (ml/min/kg)*.*

Evaluation of general physical work capacity. For evaluation of physical work capacity (PWC) the authors used the classic test «PWC-170»[8] [9]. The students were offered two consecutive physical exercises of moderate intensity on a veloergometer "Medicor Budapest KE-13-22" (Hungary). There was a ten-minute rest interval between the two five-minute cadence exercises at 60 rpm. The first power load was equal to 1 W per 1 kg of a student weight, the second power load was 1.5 W/kg. The students followed these recommendations: the test had to begin after a 20-minute rest, since even mild preliminary load decreased PWC by 8%. If the first and second exercises last more than 5 minutes, PWC-170 value would be overestimated, if they last less than 5 minutes, the value would be underestimated[10]. The calculation of PWC level was performed by means of mathematic extrapolation by the following formula: $PWC_{170}=W_1+(W_2-W_1) \bullet ((170-f_1)/(f_2-f_1))$,where: W_1 and W_2 – first and second power load in W; f_1 and f_2 – heart rate per minute in the end of the first and second power loads.

Skibinsky's Index (SI) was used for combined evaluation of cardiovascular and respiratory systems[11]. SI = (VLC * inhale TBH * 10)/HR,where: VLC — vital lung capacity (L); inhale TBH—time of breath holding after inhalation (sec); HR — heart rate per minute. The results were assessed by the following scale: < 5 – very bad; 5-10 - unsatisfactory; 10-30 - satisfactory; 30-60 - good; > 60 – very good.

Ruffier's Index (RfI) characterizes insufficient level of adaptation capacity and cardiovascular system response to physical loads. It is calculated by the following formula:
RfI=(4*(P1+P2+P3)-200)/10*,* where: P1 – heart rate per 15 seconds during relax; P2 – heart rate per 15 seconds after physical load; P3 – heart rate per last 15 seconds from the first

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minute of relax; 4, 200, 10 – constant coefficients. The results were estimated by the evaluation tables[12].

Robinson's Index (RbI) evaluates cardiovascular system regulation status. RbI=(HR*SPB)/100**.** The assessment of physical development and physical fitness parameters was performed by the following tests: dead lift dynamometry[13], handgrip test[14], Cooper's test[15] and Shapovalova's Index test (ShT). Shapovalova's Index test estimates the development of strength, agility and speed endurance of back and abdominal muscles: ShT = (body weigh/height)/(NL/60), where: NL – number of lifts per 60 seconds; 60 – constant coefficient. Assessment of the students main nervous system characteristics was performed by means of common methods[16] and the following tests: tremormetry[17]; Munsterberg test (perception psychological test (attention selectivity)); reaction to a moving object**;** Romberg's test[18] and Yarotskiy's test[19].

"Numbers arrangement" test evaluates voluntary attention and is performed by filling in a blank with two tables. The first table contains one- and two-digit numbers in random order. The second table is blank. The students had to fill it in quickly and correctly with numbers from the first tablein ascending order starting from the lowest. Two minutes were given for this test and the students have to rearrange as many numbers as possible.

Landolt's rings test (visual acuity) is used for evaluation of voluntary attention, attention efficiency and precision of performance. The students were offered a table with 22 lines with 30 circles in each one. It is necessary to find and cross out a circle with a gap in 12 o'clock high position. The check is done line by line from the left to the right crossing out all the circles with gaps. Results processing was performed in two steps: 1) E = S * A, where E – efficiency, S – number of all the checked circles, A – precision; 2) A = å :(å +O), where å – number of correct cross outs; O – number of errors. If there were any errors present, the parameter value was less than 1. The test was performed in the facilities of "Astrakhan State Technical University" (ASTU) at the Department of Physical Training among the students with low adaptation potential, who were not distributed into special medical group, in 2015 – 2017. On average, during all the stages of the study 2,342 students per year were enrolled. Obligatory condition of the study was the comparison of initial and final results. The authors evaluated physical status, physical fitness, physical work capacity and academic progress of the students in the control and test groups.

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Pedagogical testing was used as a method of evaluation of main physical parameters development and as a basis for the group formation for pedagogical experiment. Standard tests were used for effective evaluation of the students' physical condition: 1,000 m running (endurance); standing long jump (legs strength); sit ups, pull ups, grenade throwing (force capacity) and 3*10 m shuttle run (dexterity).

Mathematical statistical analysis of the study results was performed on IBM PC by the software package "SPSS Statistics 17.0" (2008). Statistical analysis of the study results was done considering students population sex. The difference was considered significant at 1-5% level of significance (p = 0.01-0.05), which is accepted as quite high and reliable.

Study design. Four health status and physical fitness uniform groups were formed at the first stage of the main experiment: 1st group included 62 students, 2nd group included 64 students, 3rd group included 70 students and the control group included 60 people. Test results of the students from these groups were compared with the test results of the students from the reference group (n=60), who had high adaptation potential and physical fitness with average interval within the normal range[20]. The students from the 1st group trained by the specially developed program that focused on health improvement and adaptation potential increase. Additional tasks with elements of loads control in pauses between the main exercise sets were widely used. Exercise complex development was based on health status, disease peculiarities and adaptation to academic activities. Special attention was drawn to the parameters that characterized individual levels of students' physical fitness and respective ways, methods and means that improved and increased these parameters to the norm[21]. The students from the 2nd group trained according to the curricular schedule at PT classes, based on the requirements of the State Standard for students of higher educational institutions. To increase their physical and mental capacity, prevent exhaustion and improve their immune system, the students volunteered to take "Trekrezan". The students from the 3rd group trained by the specially developed health improving program that focused on impact on decreased physical and functional qualities, level of health and low adaptation potential. To improve their immune system, they volunteered to take "Trekrezan"[22].

The students from the control group also trained according to the curricular schedule at PT classes. The trainings were based on physical exercises taken from all the spheres of physical training in an institution of higher education, they focused on health improvement and development and advancement of main kinetic qualities and functions[23]. For all year students the experimental training program was divided into two stages respective to the academic semester. The first stage focused on development and advancement of psychophysical students' status, and was described as health improving and correcting. During the second stage, the impact was made on the underdeveloped functional qualities

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and targeted the correction aim[24]. The students were tested twice, in the beginning of the first semester and in the end of the main experiment. At the final stage of the study, the authors evaluated the work done, made conclusions and defined the most efficient design and methods of students' education.

Discussion

For the assessment of the level of kinetic qualities, objective physical fitness and physical development, functional disorders and adaptation parameters, the authors used special physiological, pedagogical andpsychophysical tests (Tables 1, 2, 3).

Tests	**Sex**	**Experimental groups (n=256)**		**Reference group (n=60)**	
		II year (n_m=60) (n_f=70)	**III-IV years (n_m=62) (n_f=64)**	**II year (n_m=15) (n_f=15)**	**III-IV years (n_m=15) (n_f=15)**
Height, cm	M F	174.9±5.3* 168.8±7.8*	176.8±4.2* 169.1±5.0*	172.6±6.4* 170.3±9.7*	176.1±5.0* 169.3±4.1*
Body weight, kg	M F	64.5±8.2* 63.2±6.3*	67.7±6.1* 65.3±5.1*	63.2±9.1* 59.6±7.9*	66.0±5.8* 62.8±5.6*
Chest circumference, cm	M F	82.6±2.9* 79.8±1.8*	83.3±2.1* 78.1±1.6*	86.4±2.2* 82.1±1.6*	87.1±2.0* 82.6±1.4*
Chest rise, cm	M F	5.9±1.6* 5.8±1.6*	6.0±0.8* 5.4±1.4*	7.6±1.7* 6.4±1.1*	7.4±1.2* 6.5±1.0*
Vital index, ml/kg	M F	59.6±0.7 46.6±1.2	58.1±1.2 45.6±1.6	63.2±1.1 52.1±0.6	65.2±1.6 54.8±2.0
HR, bpm	M F	74.3±0.9 75.9±0.8	72.3±0.5 77.9±1.3	68.6±0.7 71.2±0.6	66.9±0.6 69.5±0.5
SBP, mm Hg	M F	128.9±0.7 132.1±1.6	129.3±1.1 133.0±2.5	109.8±1.2 118.5±2.1	110.2±2.6 113.5±2.2
DBP, mm Hg	M F	81.1±1.3 84.9±1.2	84.2±1.1 86.6±0.8	71.5±1.5 72.1±0.8	71.9±0.4 74.6±1.2
VLC, ml	M F	3,607.2±73.5 3,086.5±58.7	3,541.3±55.4 3,126.5±50.2	3,771.0±98.1 3,128.8±64.8	3,802±44.6 3,206±51.3
Breath volume, cm^3	M F	261.3±18.2* 249.1±21.3*	260.9±11.3* 236.8±18.7*	274.7±12.3* 258.3±11.5*	278.6±15.1* 259.6±16.7*
Low voluntaryventilation, L	M F	13.42±1.16* 10.54±1.01*	13.51±1.05* 10.61±0.81*	13.96±1.12* 10.87±1.11*	13.99±1.07* 11.05±1.17*
Stange's test, sec (inhale)	M F	36.4±2.5 31.2±1.3	38.9±1.3 30.5±0.9	51.1±2.7 41.4±1.1	50.3±2.0 40.5±1.6
Hench's test, sec (exhale)	M F	23.1±3.8 22.3±2.2	23.4±1.6 21.0±1.8	32.5±5.4 29.1±2.6	32.4±4.6 30.3±1.5
MOC, ml/kg/min	M F	31.0±2.6 30.9±1.7	30.5±2.4 29.4±1.1	37.4±2.1 35.9±1.1	38.8±2.7 36.1±2.0
PWC170, W	M F	261.5±7.8 233.3±10.2	273.4±6.4 245.7±8.6	311.7±16.8 274.5±15.1	315.6±15.7 281.1±18.3
Skibinsky's Index	M F	2,302.6±23.8 1,530.3±26.1	2,318.6±31.0 1,608.8±22.5	2,657.7±22.1 1,846.7±24.8	2,754.1±8.7 1,995.6±17.6
Ruffier's Index	M F	17.2±4.8 21.6±2.1	16.3±2.1 19.5±2.6	9.6±4.2 11.3±3.0	10.9±3.8 11.1±2.4

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Shapovalova's Index	M F	228.7±9.5 232.3±9.8	237.3±7.1 238.8±8.2	309.9±12.3 308.8±11.3	312.8±18.3 310.2±14.0
Robinson's Index	M F	117.2±2.1 109.4±2.2	110.6±3.0 113.7±3.1	93.1±1.7 98.8±1.6	89.7±2.5 95.6±2.8
Adaptation potential	M F	2.64±0.09 3.11±0.08	2.89±0.10 3.21±0.12	1.98±0.01 2.08±0.02	2.01±0.05 2.06±0.03

*Significance of difference between the parameters of the students at p≤0.05; * The difference is insignificant at p>0.05.*

Table 1
Physiological functions development parameters in students
in the beginning of the experiment

Physiological functions parameters, obtained in test and reference groups, on average, agree with age-related norms. Morphological parameters of height, body weight, chest circumference, breath volume and low voluntary ventilation were within the mean values range for this age. There was no significant difference observed in the recorded data (p>0.05). The analysis of the reference group data, obtained from students with high adaptation potential (AP ≤2.10), showed that functional development of the third and fourth year students was not significantly different from younger students. Despite age-related peculiarities, mean parameters of height, body weight, chest circumference and functional characteristics increase was not significant. Comparison of parameters mean values of physical development and functional characteristics in students with low adaptation potential with norm values showed that the majority of parameters were significantly different from the parameters of students in the reference group. Mean HR in the test group (70.3 bpm in boys and 75.9 bpm in girls) was higher than in the reference group (68.6 bpm in boys and 71.2 bpm in girls), but remained within the physiological norm (p≤0.05). However, in 23.1% (28 students) of boys and in 34.2% (46 people) of girls from the test group increased SBP was observed, which can be taken for borderline hypertension, if observed persistently (p≤0.05). Only 8.0% (4 students) of the boys from the reference group had increased SBP and 11.9% (5 students) of the girls (p≤0.05). VLC values in the test and reference groups were different. Mean VLC value = 3,574.2 ml in boys from the test groups indicated on the respiratory muscles weakening, chest and lung compliance reduction and venostasis in pulmonary blood circulation. The girls parameters values in the test group showed similar tendency with mean VLC value equal to 3,106.5 ml. Evaluation of cardiovascular system functional capacities under physical loads was informative (Ruffier's Index). This functional test allowed the authors to estimate adaptation to muscle performance and regenerative reactions tendencies. The analysis of the study results showed that 72.1% (88 people) of boys and 58.6% (79 people) of girls in the test group had normotonic reaction to physical loads. Hypertonic reaction type in the test group was observed in 11.8% (14 students) of boys and in 31.4% (42 students) of girls, which indicated on organism fatigue and pre-hypertonic status (p≤0.05). Low Robinson's Index (117.2) was registered in boys – 2 points (low level) and in girls (109.4) – 2 points (low level), which indicated on the cardiovascular system regulation disorders (p≤0.02). The students with low Robinson's Index are prone to the risk of hypertension development, syndrome of vegetative dysfunction and heart rate disorders. The students in the reference group had Robinson's Index equal to 93.1 – 3 points (average level) in boys and 98.8 – 3 points (average level) in girls (p≤0.02). Average level of Skibinsky's Index in both test (117.2 in boys and 109.4 in girls) and reference groups (93.1 and 98.8, respectively) showed insufficient functional capacity of respiratory system and reduced organism resistance to hypoxia, which resulted in reduced resistance to acute respiratory viral infections. Shapovalova's Index was average (228.7 in boys – 3 points) and below average (232.3 in girls – 2 points), which indicated on insufficient power and speed endurance development and led to postural disorders, rachiocampsis, cyllosis and a number of other diseases (p≤0.05). The results of hypoxic tests (Stange, Hench) in the students from

the test group (44.4 and 26.2 in boys; 35.2 and 23.1 in girls) were lower than in the students from the reference group (51.1 and 32.5; 31.4 and 29.1, respectively) (p≤0.05). This indicated on the fatigue and reflected general status of organism oxygen providing systems, under breath holding after deep inhalation or deep exhalation, and overall fitness of a person. Average values of adaptation potential in the test and reference groups were significantly different. The students from the test group had low level of AP – 3 points (2.64 in boys and 3.11 in girls), which indicated on functional tension of organism mechanisms (p≤0.01). It should be noted that among them 8.4% (22 students: 9 boys and 13 girls) of students with low level of AP – 2 points (from 3.74 to 4.02), were not fit for intensive physical loads by their organism functional capacities. The students from the reference group had average level of AP – 4 points (1.98 in boys and 2.08 in girls) and had satisfactory adaptation capacity that characterized organism functional capacities (p≤0.01).

Test	**Sex**	**Test groups (n=256)**		**Reference (n=60)**	
		II year (n_m=60) (n_f=70)	**III-IV years (n_m=62) (n_f=64)**	**II year (n_m=15) (n_f=15)**	**III-IV years (n_m=15) (n_f=15)**
Running 100 m, sec	M F	15.9±0.5 17.9±0.8	15.1±0.8 17.2±0.2	13.8±0.5 16.4±0.4	13.6±0.2 16.2±0.2
Running 1000 m, sec	M F	252.6±2.3 329.2±3.6	245.7±3.4 330.6±2.1	203.6±3.4 290.3±2.8	208.1±2.1 302.1±3.9
Standing long jump, cm	M F	201.5±8.3 153.6±9.1	202.9±10.5 149.5±8.4	229.1±9.6 178.2±8.8	231.2±7.4 181.1±8.2
Deadlift dynamometry, kg	M	120.2±8.6	122.2±6.5	148.4±10.4	148.8±8.6
Handgrip test, kg Left Right	M	30.1±3.3* 31.5±3.8*	30.6±3.1* 31.6±2.8*	34.6±2.6* 36.4±3.4*	34.9±1.6* 36.8±3.1*
	F	6.5±1.5* 8.3±1.9*	6.8±1.1* 8.4±1.4*	7.4±1.3* 10.1±2.1*	7.8±1.5* 10.2±1.9*
Pull ups, times	M	8.4±1.9	7.6±1.3	14.8±2.6	13.5±1.8
Sit ups, times/mins	F	19.6±3.4	23.6±2.8	32.6±2.3	35.4±2.8
Running broad jump, cm	M F	374.5±10.1 306.4±8.4	346.5±9.2 331.3±8.3	431.3±8.9 368.6±7.5	453.2±9.2 370.3±7.3
Running 30 м, sec	M F	4.4±0.2 4.9±0.1	4.5±0.1 4.9±0.2	3.9±0.1 4.4±0.2	3.8±0.2 4.3±0.1
Grenade throwing, m	M F	30.5±1.2 22.4±1.6	31.5±2.0 23.3±1.9	41.2±1.3 28.7±1.8	42.0±1.8 29.4±1.3
Shuttle running 3*10 m, sec	M F	10.1±0.04 11.2±0.03	10.0±0.06 11.2±0.01	9.3±0.05 10.8±0.07	9.1±.008 10.4±0.04
Copper's Test, m (12 min)	M F	2,086.4±21.3 1,633.4±20.6	2,105.6±26.4 1,678.1±23.9	2,539.5±18.9 2,015.1±17.8	2,543.0±21.2 2,031.2±17.8

*Significance of difference between the parameters in students at p≤0.05; * The difference is insignificant at p>0.05.*

Table 2

Physical fitness parameters in students in the beginning of the experiment

The results of pedagogical tests in the beginning of the experiment showed that the student's parameters in the reference group were higher than in the test group in all types of tests. This fact also confirmed the suggestion that the students from the test groups had reduced organism functional capacities. Significant differences in parameter values were recorded in speed (running 100 m, running 30 m) and power (sit ups, pull ups, grenade throwing) capacity. Cooper's test of endurance, that evaluated physical work capacity and indirectly reflected functional status of cardiovascular and respiratory systems, showed low

level of oxygen supply in the students from the test groups (2,086.4 m in boys and 1,633.4 m in girls), which also confirmed their low level of adaptation potential AP – 3 points (2.64 in boys and 3.11 in girls)($p \leq 0.05$). Handgrip test was not informative, since there was no significant difference between the groups ($p \geq 0.05$). Motional fitness parameters, based on pedagogical test results in students from reference group, agreed with the "average" level of respiratory capacity development, while the students in the test group showed average results only in the handgrip test. The study results showed (Table 3) that psychophysical characteristics of the students were also different between the test and reference groups, which was confirmed by significant difference in quantitative and qualitative parameters that characterize attention, memory and analytical capacities. Average time spent on "Numbers arrangement test", which evaluated attention span, was 189.4 sec in boys and 194.6 sec in girls from the test group. These results were worse than in the reference group, where the time was 165.2 sec and 173.5, respectively ($p \leq 0.05$). The obtained data indicated on certain exhaustion of the students' attention and memory capacities. This agreed with the results of Landolt's rings test, which evaluated attention precision and efficiency (in the test group 524.3 pcs in boys and 551.8 pcs in girls, in the reference group 561.0 pcs and 580.1 pcs, respectively) ($p \leq 0.05$). Dynamic and static tremormetria, as well as dynamic and static balance, in the test group was lower than normal level and significantly lower than in the reference group. The results of the "Reaction to the moving object" test was especially low in the test group (in boys 2.86 sec and in girls 3.12 sec) in comparison with the reference group (2.64 in boys and 3.01 in girls) ($p \leq 0.05$).

Test	**Sex**	**Test groups(n=256)**		**Reference group(n=60)**	
		II year (n_m=60) (n_f=70)	**III-IVyears (n_m=62) (n_f=64)**	**II year (n_m=15) (n_f=15)**	**III-IVyears (n_m=15) (n_f=15)**
Dynamic tremormetry – Touch rate, 1/sec – Number of touches, times	M	2.58±0.12 42.1±1.8	2.53±0.10 44.7±1.9	2.33±0.07 38.1±1.2	2.35±0.12 36.8±2.0
	F	2.68±0.28 45.1±1.6	2.72±0.21 44.8±1.8	2.22±0.15 40.2±1.4	2.34±0.14 40.3±1.6
Static tremormetry – Touch rate, 1/sec – Number of touches, times	M	0.27±0.06 3.9±0.6	0.28±0.04 4.2±0.8	0.23±0.08 3.1±0.3	0.22±0.07 3.0±0.2
	F	0.29±0.08 4.8±1.2	0.30±0.07 4.9±1.1	0.24±0.05 3.4±1.0	0.23±0.08 3.3±1.4
Attention selectivity (Munsterberg's test) – Number of words found – Number of errors	M	20.6±2.2 2.5±0.15	20.9±2.0 1.8±0.13	24.2±1.2 2.1±0.08	24.5±1.4 1.9±0.07
	F	20.3±2.3 2.1±0.17	21.7±1.6 2.3±0.20	23.4±1.6 1.9±0.02	24.5±1.0 2.0±0.06
Reaction of a moving object, msec	M F	2.86±0.08 3.12±0.11	2.91±0.10 3.18±0.16	2.64±0.04 3.01±0.06	2.61±0.08 3.03±0.08
Static balance evaluation (Romberg's test), sec	M F	9.1±1.1 8.2±0.9	8.9±1.6 8.5±0.8	13.4±1.2 13.1±0.8	14.0±1.2 12.9±0.9
Dynamic balance evaluation (Yarotskiy's test), sec	M F	16.3±2.3 15.4±2.6	15.8±1.2 14.6±2.1	27.8±1.5 26.5±2.2	28.1±2.1 27.9±2.7
Attention distribution test «Numbers arrangement» – time, sec – Number of errors	M	189.4±6.11 3.9±0.6	191.1±8.12 3.8±0.4	165.2±8.14 2.5±0.6	166.1±6.13 2.8±0.5
	F	194.6±7.33 3.8±0.3	195.1±8.66 3.6±0.4	173.5±7.51 2.4±0.7	172.8±8.56 2.8±0.2

Landolt's rings test (pcs) – Attention efficiency – Performance precision	M	524.3±21.3 0.86±0.01	526.6±22.3 0.84±0.06	561.0±18.8 0.93±0.03	566.4±19.8 0.89±0.12
	F	551.8±20.8 0.74±0.08	547.3±18.4 0.72±0.14	580.1±21.1 0.93±0.07	584.4±17.8 0.97±0.06

Significance of difference between the parameters in students at p≤0.05

Table 3

Psychophysical development parameters in students in the beginning of the experiment

Physical and psychophysical development and physical advancement in the test and reference groups were significantly different, which was explained by the development delay in the students from the test group due to low AP. Initial testing allowed the authors to select the most informative tests for the study, which showed the associations between the studied parameters and students health levels. A number of anthropometric and physiological parameters (height, body weight, chest circumference, chest rise, breath volume, low voluntary ventilation), that did not reflect the specifics of the set tasks, were excluded from the study (p≥0.05). Thus, functional capacities, level of physical fitness and students' health levels directly depended on the level of environmental pollution. Structural impact of air pollutants and a range of diseases correlated with physical work capacity, functional and psychophysical parameters of the students (r=0.73÷0.92, p≤0.01). The students with low AP level were more sensitive to air pollutants. The students with high level of physical fitness and functional capacities were more resistant to negative influence. The main task in the beginning of the study was to identify certain factors that contributed to the development of specific short-term diseases. For this reason, the authors enrolled a group of students with low AP (n=256) into the study and suggested that the improvement of their functional capacities would significantly reduce their morbidity rate and absence from school, which in its turn, would increase their professional competence as future highly-qualified specialists. The main experiment was conducted to check the efficiency of the developed physical and health improvement programs, which focused on adaptation potential improvement and normal and obtained values disagreement reduction. Students parameters from the reference group (n=60: 30 boys, 30 girls), what were characterized by high adaptation potential, were taken as the respective norms. Curricular requirements of the State Standard on "Physical Training" for institutions of higher education did not contradict with the chosen respective parameters. By the end of the experiment it was determined that there were no significant changes in the anthropometric data, obtained in the test and control groups (p≥0.05). For this reason, they were excluded from the further analysis. The students training in the control group (n=60; 31 boys, 29 girls) was not focused on the reduced capacities improvement. The students in this group trained according to the curricular schedule, required by the State Educational Standard (Tables 4, 5, 6).

Tests	**II year**		**III-IV years**	
	n_m=15	**n_f=15**	**n_m=16**	**n_f=14**
Running 100 m, sec	15.6±0.3	17.5±0.1	14.8±0.1	16.9±0.2
Running 1000 m, sec	246.0±7.7	326.3±5.1	238±8.8	322.4±6.7
Standing long jump, cm	208.5±13.2	157.0±11.5	211.2±19.8	150.5±11.4
Pull ups, times	8.7±1.3	-	7.9±1.4	-
Sit ups, times/min	-	20.5±4.1	-	24.5±2.1
Running broad jump, cm	382.3±9.1	315.6±6.2	353.1±7.5	339.4±9.7
Cooper's test, m (12 mins)	2,105.4±16.2	1,721.3±17.9	2,098.2±23.0	1,708.5±20.8
Grenade throwing, m	30.6±1.8	24.3±2.3	32.8±1.9	24.8±2.2

Significance of difference between the parameters in the beginning and in the end of the experiment at p>0.05

Table 4

Physical fitness parameters in students from the control group in the end of the experiment

Tests	II year		III-IV years	
	n_m=15	n_f=15	n_m=16	n_f=14
HR, bpm	73.5±1.0	75.8±1.2	72.1±2.0	74.5±1.6
SBP, mm Hg	129.1±0.9	130.8±1.9	131.2±1.	129.8±1.5
DBP, mm Hg	87.5±0.8	88.6±0.7	86.7±1.4	88.1±1.3
Stange's test, sec (inhale)	46.4±1.5	32.2±0.8	42.5±1.7	31.8±1.0
Hench's test, sec (exhale)	27.6±1.2	23.3±0.9	26.8±1.6	24.0±1.1
MOC, ml/kg/min	31.4±1.1	30.1±1.4	31.5±1.8	30.6±1.5
PWC170, W	278.7±8.3	241.5±7.9	264.5±7.1	236.1±8.2
Skibinsky's Index	2,318.5±19.6	1,573.3±20.1	2,418.4±21.1	1,616.4±19.7
Ruffier's Index	16.8±1.3	14.8±2.4	15.1±1.3	16.4±1.8
Shapovalova's Index	238.6±7.3	244.8±8.1	231.3±9.1	251.3±8.6
Robinson's Index	87.2±2.1	72.6±1.9	89.3±1.6	77.5±1.8
Adaptation potential	2.86±0.05	3.05±0.08	2.93±0.09	3.07±0.06

Significance of difference between the parameters in the beginning and in the end of the experiment at p>0.05

Table 5
Physical functions development parameters in students
in the control group in the end of the experiment

Tests	II year		III-IV years	
	n_m=15	n_f=15	n_m=16	n_f=14
Dynamic tremormetry – Touch rate, 1/sec – Number of touches, times	 2.52±0.18 42.4±2.4	 2.64±0.12 44.6±1.5	 2.57±0.11 43.1±1.2	 2.69±0.11 45.1±1.8
Static tremormetry Touch rate, 1/sec Number of touches, times	 0.26±0.05 4.0±0.8	 0.31±0.07 4.6±0.9	 0.31±0.07 4.5±0.5	 0.33±0.07 4.7±1.1
Attention selectivity (Munsterberg's test) – Number of words found – Number of errors	 21.1±1.8 2.5±0.15	 22.6±1.2 2.3±0.18	 21.6±1.7 2.3±0.17	 22.0±1.2 2.0±0.19
Static balance evaluation (Romberg's test), sec	9.4±1.0	8.4±0.8	9.3±1.2	9.1±0.6
Dynamic balance evaluation (Yarotskiy's test), sec	19.8±1.6	18.9±2.0	20.7±1.4	18.6±2.5
Landolt's rings test (pcs) Attention efficiency Performance precision	 150.3±8.2 2.1±0.9	 162.9±7.1 2.4±0.1	 158.8±7.3 2.1±0.2	 161.2±7.6 2.4±0.1

Significance of difference between the parameters in the beginning and in the end of the experiment at p>0.05

Table 6
Psychophysical development characteristics in students
from the control group in the end of the experiment

Development dynamics analysis of the pedagogical, physiological and psychophysical parameters and functions in the students from the control group showed that physical loads during the study period did not influence significantly on the main organism functions. The results of nearly all the tests did not change significantly (p>0.05). This fact can be explained by often absence from PT classes due to short-term infections and insufficient number of PT classes in the curriculum of the 3rd and 4th year students (2 academic hours). Thus, the training period of the 3rd and 4th academic year allowed the students only to keep the necessary level of life-sustaining activities, which reflected the successful curricular program completion. The students from the 1st group (n=62, 28 boys, 34 girls) used the method of additional tasks in pauses between the sets of main physical exercises. Such tasks had specific selective orientation aimed at improvement of organism functional capacities, adaptation potential and health status. The ways of students training organization and methodical principles were applied during the planning and depended on

the curricular schedule. The complex of exercises was selected based on curricular plan and physiological recommendations. This method increased motor density and total efficiency of PT classes. The analysis of the 1st group students test results was done in the end of the study (Tables 7, 8, 9).

Tests	**II year**		**III-IV years**	
	n_m=14	**n_f=18**	**n_m=14**	**n_f=16**
Running 100 m, sec	14.2±0.1	16.3±0.2	14.3±0.2	16.4±0.1
Running 1000 m, sec	221.8±6.4	306.9±3.5	214.5±4.2	309.2±2.1
Standing long jump, cm	216.6±9.3	168.4±8.7	218.1±5.1	162.2±6.3
Pull ups, times	10.1±0.8	-	9.5±0.7	-
Sit ups, times/min	-	26.3±2.2	-	31.5±1.7
Running broad jump, cm	402.3±9.5	343.1±10.4	408.6±6.3	350.1±8.7
Cooper's test, m (12 mins)	2,243.5±10.2	1,804.3±11.2	2,276.6±12.3	1,844.7±10.6
Grenade throwing, m	34.1±1.5	29.5±1.8	36.6±1.1	27.4±1.7

Significance of difference between the parameters of the 1st and control groups at p≤0.05

Table 7

Physical fitness parameters in students from the 1st group in the end of the experiment

The analysis of physical fitness testing results showed that in the end of the experiment intragroup statistically significant changes (p≤0.05) were observed in physical fitness in the students from the 1st group, which was explained by the direct influence of the developed program of local additional tasks. Physical fitness parameters in the students from the 1st group were close to the parameters in students from the reference group and significantly exceeded the parameters in students from the control group.

Speed and power characteristics significantly changed, especially, in the 2nd year students (boys) in 100 m running test - 14.2 sec, standing long jump – 216.6 cm). Insignificant intragroup and intergroup changes were observed in boys at pull ups (10.1 times) and in girls at grenade throwing (27.4 m). The most significant increase of parameters was recorded by the results of the endurance tests (Cooper's test, in boys 2,243.5 m, in girls 1,804.3 m), which was explained by the influence of local additional tasks on students' aerobic capacities.

Tests	**II year**		**III-IV year**	
	n_m=14	**n_f=18**	**n_m=14**	**n_f=16**
HR, bpm	68.6±0.5	71.9±0.8	66.1±1.1	70.8±0.6
SBP, mm Hg	127.2±0.4	126.4±1.5	128.3±1.2	126.4±1.1
DBP, mm Hg	83.4±0.4	84.6±0.3	84.1±0.6	83.3±07
Stange's test, sec (inhale)	49.4±0.4	34.8±0.3	48.4±0.8	33.3±0.7
Hench's test, sec (exhale)	29.5±0.7	25.1±1.1	31.0±1.2	28.2±0.7
MOC, ml/kg/min	33.0±1.3	32.6±1.1	34.9±1.0	32.9±1.4
PWC170, W	288.5±6.4	268.7±5.7	267.6±7.1	262.8±6.3
Skibinsky's Index	2,408.8±18.4	1,626.6±19.2	2,583.4±21.2	1,813.5±18.7
Ruffier's Index	12.8±3.3	12.1±2.4	13.3±2.8	14.9±2.3
Shapovalova's Index	286.7±8.4	273.6±9.2	266.6±9.1	269.3±8.7
Robinson's Index	108.2±2.0	102.1±2.2	107.5±1.9	103.8±2.3
Adaptation potential	2.11±0.12	2.14±0.15	2.12±0.10	2.13±0.14

Significance of difference between the parameters of the 1st and reference groups at p≤0.05

Table 8

Physiological functions development parameters in students from the 1st group in the end of the experiment

Tests	II year		III-IV year	
	n_m=14	n_f=18	n_m=14	n_f=16
Dynamic tremormetry – Touch rate, 1/sec – Number of touches, times	2.48±0.14 40.3±2.7	2.58±0.16 43.7±1.6	2.50±0.12 41.7±1.8	2.63±0.09 44.3±1.5
Static tremormetry Touch rate, 1/sec Number of touches, times	0.27±0.03 4.8±0.4	0.30±0.06 4.4±0.2	0.30±0.05 4.3±0.3	0.31±0.08 4.1±0.5
Attention selectivity (Munsterberg's test) – Number of words found – Number of errors	21.6±2.1* 3.2±0.14	22.0±2.2* 2.8±0.2	21.8±1.7* 2.8±0.3	22.7±0.8* 2.4±0.1
Static balance evaluation (Romberg's test), sec	10.7±0.6	10.4±0.7	11.2±0.4	10.9±0.3
Dynamic balance evaluation (Yarotskiy's test), sec	23.5±0.7	21.6±0.9	23.8±0.9	21.3±1.1
Landolt's rings test (pcs) Attention efficiency Performance precision	160.8±4.2 4.1±0.2*	168.7±5.1 4.0±0.3*	161.8±5.2 3.8±0.1*	162.5±5.3 3.7±0.2*

Significance of difference between the parameters of the 1st and control groups at p≤0.05
** The difference is insignificant at p>0.05.*

Table 9
Psychophysical parameters development in students
from the 1st group in the end of the experiment

Physiological parameters development changed significantly after training by the developed complex of additional tasks (p≤0.05). Differentiated approach to their implementation led to the increase of maximal oxygen consumption in boys to 34.9 ml/kg/min and in girls to 32.9 ml/kg/min. Adaptation potential reached the lower borders (in boys 2.11-2.12 units, in girls 2.13-2.14 units), which excluded the organism functional tension during physical loads. Psychophysiological parameters improved, on average. However, some parameters, like attention selectivity (in boys 21.6 words, in girls 22.0 words) and attention distribution (in boys 160.8 sec, in girls 168.7 sec), did not change significantly (p>0.05). The students from the 2ndgroup (n=64; 31 boys, 33 girls) took "Trekrezan" to enhance physical and mental work capacity, to prevent fatigue and to stimulate the immune system (Tables 10, 11, 12).

Tests	II years		III-IV years	
	n_m=15	n_f=17	n_m=16	n_f=16
Running 100 m, sec	14.5±0.2	16.9±0.2	14.7±0.1	16.7±0.2
Running 1000 m, sec	231.4±4.2*	314.6±2.6*	219.7±6.0*	312.4±2.3*
Standing long jump, cm	206.4±6.5	155.2±8.4	210.2±15.6	146.8±12.1
Pull ups, times	8.6±1.2	-	8.0±1.3	-
Sit ups, times/min	-	20.7±3.6	-	26.4±2.5
Running broad jump, cm	381.6±8.5	331.6±7.7	372.3±8.5	332.5±9.7
Cooper's test, m (12 mins)	2,169.7±14.2*	1,786.5±15.5*	2,202.8±16.5*	1,779.5±13.3*
Grenade throwing, m	31.7±1.9	24.7±1.8	33.9±2.0	25.3±1.7

Significance of difference between the parameters of the 2nd and control groups at p≤0.05
** The difference is insignificant at p>0.05.*

Table10
Physical fitness parameters in students from the 2nd group in the end of the experiment

The analysis of physical fitness in students from the 2nd group showed that all the studied parameters did not change significantly (p>0.05). This was explained by the lack of differentiated loads on the reduced parameters and characteristics and time intended for their improvement. BAA "Trekrezan" therapy significantly improved aerobic characteristics in students. Endurance test results (Cooper's test and 1000 m running) showed significant improvement (in boys 2,169.7 m and 231.4 sec, in girls 1786.5 m and 314.6 sec) (p≤0.05).

Tests	**II year**		**III-IV years**	
	n_m=15	**n_f=17**	**n_m=16**	**n_f=16**
HR, bpm	69.6±0.8	72.3±1.1	68.7±1.1	70.3±1.2
SBP, mm Hg	121.8±0.7	124.1±0.9	123.6±1.1	125.1±0.8
DBP, mm Hg	83.3±0.6	84.7±0.9	84.5±0.7	84.9±0.6
Stange's test, sec (inhale)	49.2±0.7	35.3±0.9	46.5±1.2	34.2±0.8
Hench's test, sec (exhale)	28.8±0.8	26.9±1.2	27.3±1.1	26.7±0.9
MOC, ml/kg/min	34.6±0.8	32.8±1.0	32.0±1.2	31.6±0.9
PWC170, W	298.6±6.3	257.7±7.2	278.7±6.8	264.3±5.4
Skibinsky's Index	2,320.3±14.2	1,608.7±12.6	2,415.5±17.3	1,722.8±14.7
Ruffier's Index	14.6±0.6	14.2±0.3	13.9±0.5	14.0±0.6
Shapovalova's Index	247.1±6.3*	245.2±7.1*	256.8±7.3*	254.6±6.8*
Robinson's Index	90.1±1.9	84.6±1.2	92.4±1.8	82.8±2.0
Adaptation potential	2.32±0.04	2.34±0.06	2.26±0.07	2.28±0.03

Significance of difference between the parameters of the 2nd and control groups at p≤0.05
** The difference is insignificant at p>0.05.*

Table 11
Physiological functions parameters development in students
from the 2nd group in the end of the experiment

The majority of physiological development parameters significantly changed (p≤0.05): HR improved (in boys to 68.7 bpm, in girls to 70.3 bpm), BP decreased by 7-9 units on average, physical work capacity increased (MOC in boys 32.0 ml/kg/min, in girls 31.6 ml/kg/min). Adaptation potential significantly improved in comparison with the control group (in boys to 2.26, in girls to 2.28), which reduced the students absence rate by 15.8% in this group. Insignificant differences were observed in the development of power, speed and speed endurance of back and abdominal muscles (Shapovalova's Index in boys 256.8 units, in girls 254.6 units) (p>0.05).

Tests	**II year**		**III-IV years**	
	n_m=15	**n_f=17**	**n_m=16**	**n_m=16**
Dynamic tremormetry – Touch rate, 1/sec – Number of touches, times	2.46±0.09 40.1±2.1	2.55±0.12 42.6±1.9	2.52±0.13 42.5±1.6	2.61±0.16 44.7±1.3
Static tremormetry Touch rate, 1/sec Number of touches, times	0.25±0.03 4.1±0.7	0.30±0.04 4.5±0.8	0.29±0.06 3.8±0.2	0.31±0.07 4.2±0.4
Attention selectivity (Munsterberg's test) – Number of words found – Number of errors	22.4±0.7* 2.1±0.1	23.1±0.8* 1.9±0.2	22.7±0.6* 2.0±0.2	23.5±0.4* 1.8±0.3
Static balance evaluation (Romberg's test), sec	11.7±0.6	10.8±0.4	11.2±0.5	11.0±0.3
Dynamic balance evaluation (Yarotskiy's test), sec	24.4±1.6	21.1±1.1	24.1±1.2	20.9±1.4

Landolt's rings test (pcs) Attention efficiency Performance precision	152.4±6.2* 3.2±0.4	166.7±7.1* 2.7±0.2	171.1±5.3* 3.6±0.3	168.2±6.3* 2.4±0.1

Significance of difference between the parameters of the 2nd and control groups at p≤0.05
** The difference is insignificant at p>0.05.*

Table 12
Psychophysical parameters development in students
from the 2nd group in the end of the experiment

Statistically significant dynamics development of psychophysical characteristics in students from the 2nd group was observed in the end of the experiment in dynamic and static tremormetry parameters (in boys 2.46 and 0.25 times/sec, in girls 2.55 and 0.30 times/sec) and static and dynamic balance (in boys 11.7 and 24.6 sec, in girls 10.8 and 21.1 sec) (p≤0.05). There was no significant difference in parameters of distribution and selectivity of attention (p>0.05). The students from the 3rd group (n=70; 32 boys, 38 girls) trained by the developed health improving program and additionally took "Trekrezan" (Tables 13, 14, 15).

Tests	**II years**		**III-IV years**	
	n_m=16	**n_f=20**	**n_m=16**	**n_m=18**
Running 100 m, sec	14.0±0.2	16.2±0.1	13.7±0.3	16.1±0.3
Running 1000 m, sec	201.5±3.2	298.4±4.8	203.5±8.1	300.2±6.0
Standing long jump, cm	225.6±13.8	189.4±12.6	228.2±17.1	185.1±15.6
Pull ups, times	12.4±1.2	-	11.6±1.2	-
Sit ups, times/min	-	30.2±5.6	-	36.1±2.2
Running broad jump, cm	428.2±15.8	371.5±14.4	426.7±17.2	368.3±14.1
Cooper's test, m (12 mins)	2,389.6±27.6	1,999.5±18.4	2,488.1±19.9	2,061.0±18.6
Grenade throwing, m	40.5±1.6	31.4±2.1	42.1±1.5	31.9±2.0

Significance of difference between the parameters of the 3rd and control groups at p≤0.05

Table 13
Physical fitness parameters in students from the 3rd group in the end of the experiment

The analysis of physical fitness in the students from the 3rd group in the end of the experiment showed that these students parameters significantly exceeded the students parameters from the control group and from other test groups. Speed and power characteristics in students from the 3rd group, necessary for health improvement, significantly increased (p≤0.05), and the parameters in students from the control group didn't change significantly (p≥0.05). Thus, 100 m running test result in boys from the 3rd group was on average 14.0 sec, in boys from the control group – 14.8 sec, in girls from the 3rd group – 16.2 sec, in girls in the control group 17.0 sec. Average pull ups result in boys from the 3rd group was 12.4 times, in boys from the control group was 8.7 times, sit ups result in girls from the 3rd group was 30.2 times, in girls from the control group – 20.5 times. Running broad jump and grenade throwing results were significant in speed and power characteristics (r=0.91, at p≤0.001). Running broad jump result in boys from the 3rdgroup was, on average, 428.2 cm, in girls from the 3rd group – 371.5 cm, grenade throwing result in boys from the 3rd group was 40.5 m, in girls from the 3rd group – 31.4 m. Implementation of health improving exercises from cyclic types of sports (continuous steady running and swimming) improved general organism endurance. This fact was confirmed by the results of 1000 m running test (in boys from the 3rd group – 201.5 sec, control group 246.0 sec, in girls from the 3rd group - 298.4 sec, control group 326.3 sec) and 12-minite Cooper's test (boys from the 3rd group 2,389.6 m, control group 2,105.4 m, girls from the 3rd group 1,999.5 m, control group 1,721.3 m). It should be noted that the dynamics of physical work capacity in the end of each stage of the main experiment in all the other groups generally reduced.

This was confirmed by the test results in students from the 1st group in 1000 m running (boys 221.8 sec, girls 306.9 sec), Cooper's test (boys 2,243.5 m, girls 1,804.3 m) and PWC-170 (boys 278.5, girls 298.7). "Trekrezan" therapy improved physical work capacity and increased the parameters in students from the 3rd group to the level of the reference group.

Tests	**II years**		**III-IV years**	
	n_m=16	**n_f=20**	**n_m=16**	**n_m=18**
HR, bpm	65.3±0.8	69.3±1.6	64.8±1.3	69.1±1.8
SBP, mm Hg	110.9±0.6	113.5±1.2	111.5±1.1	115.2±1.4
DBP, mm Hg	73.8±1.1	74.1±0.8	70.5±1.5	73.1±1.0
Stange's test, sec (inhale)	53.8±1.9	38.7±1.3	52.2±2.1	35.3±0.9
Hench's test, sec (exhale)	32.2±2.6	29.5±1.8	33.5±1.3	30.0±1.5
MOC, ml/kg/min	38.9±1.4	34.3±1.2	36.4±1.3	35.8±2.0
PWC170, W	318.4±6.8	273.7±8.4	331.0±7.1	283.2±6.7
Skibinsky's Index	2,699.2±21.6	1,824.6±22.1	2,725.6±22.9	1,901.3±20.6
Ruffier's Index	10.0±2.1	10.2±1.7	11.0±1.2	10.5±1.6
Shapovalova's Index	308.3±8.6	318.7±7.7	304.5±9.1	311.2±8.4
Robinson's Index	114.2±3.0	105.9±2.1	113.0±3.4	105.3±3.0
Adaptation potential	1.87±0.07	2.09±0.03	1.89±0.04	2.03±0.06

Significance of difference between the parameters of the 3rd and control groups at p≤0.05

Table 14

Physiological functions parameters development in students from the 3rd group in the end of the experiment

The data in the Table 14 shows that in some students, who trained by the developed program focused on reduced capacities improvement and took "Trekrezan", functional capacities increased. In the 3rd group a number of parameters were significantly higher than in the control group (HR in boys from the 3rd group 65.3 bpm, in girls 69.3 bpm, in boys from the control group 73.5 bpm and in girls 75.8 bpm, respectively (p≤0.05)).

MOC parameter increased in students from the 3rd group to 38.9 ml/kg/min, 34.3 ml/kg/min (p≤0.05)).

Ruffier's, Skibinsky's and Shapovalova's Indexes increased to the level "average" and "above average" (p≤0.05), which confirmed the efficiency of the implemented health improving program focused on reduced parameters. In the control group the indexes did not increase significantly (p≥0.05).

The students mean value of adaptation potential in the 3rd group was 4 points (1.87 in boys and 2.09 in girls), which removed them from the "risk" zone, and in the control group – 3 points (2.86 in boys and 3.05 in girls), which indicated on the functional tension of organism mechanisms (p≤0.01).

Tests	**II years**		**III-IV years**	
	n_m=16	**n_f=20**	**n_m=16**	**n_m=18**
Dynamic tremormetry – Touch rate, 1/sec – Number of touches, times	2.38±0.12 38.1±1.4	2.33±0.16 40.2±2.3	2.33±0.15 38.1±0.7	2.35±0.20 41.3±1.9
Static tremormetry Touch rate, 1/sec Number of touches, times	0.23±0.03 3.5±0.9	0.25±0.09 4.0±1.0	0.24±0.05 3.1±0.8	0.25±0.06 3.8±1.8

Attention selectivity (Munsterberg's test) – Number of words found – Number of errors	23.7±1.2 2.0±0.13	24.6±1.4 1.8±0.16	24.0±1.1 1.8±0.09	24.3±0.8 1.7±0.11
Static balance evaluation (Romberg's test), sec	13.2±1.2	12.6±0.9	13.5±1.8	12.4±1.0
Dynamic balance evaluation (Yarotskiy's test), sec	27.5±2.1	23.3±2.0	27.7±1.8	22.8±2.4
Landolt's rings test (pcs) Attention efficiency Performance precision	163.8±5.86 3.0±0.1	171.8±6.52 2.8±0.2	172.4±6.82 3.2±1.3	179.3±7.15 3.0±0.3

Significance of difference between the parameters of the 3rd and control groups at p≤0.05

Table 15

Psychophysical parameters development in students from the 3rd group in the end of the experiment

By the end of the study psychophysical parameters changed in both groups. However, the changes in the 3rd group (under "Trekrezan" treatment) were more significant (p≤0.05). Dynamic and static parameters of tremormetry in the 3rd group in boys were 2.38 and 0.23 times/sec, in girls 2.33 and 0.25 times/sec. Static and dynamic balance parameters improved to 13.2 sec, 27.5 sec, 12.6 sec and 23.3 sec, respectively.

Attention distribution and efficiency and performance precision were better in the students from the 3rd group (boys 163.8 sec, girls 171.8 sec). By the end of the study, the parameters in the control group did not change significantly (p≥0.05). Significant changes of all the parameters were registered in 3rd and 4th year students from the 3rd group in comparison with the students from the control group (p≤0.05).

Conclusion

Thus, the improvement of physical work capacity and health status and the minimization of negative environmental influence can be successfully achieved due to individually developed training complex, focused on reduced and underdeveloped physiological parameters. The combination of the offered method and "Trekrezan" therapy enhances organism resistance.

The program efficiency evaluation was performed by the changes in final data, obtained by physiological, psychophysical and pedagogic methods of study. The study was based on the idea of improvement of low parameters to the required levels due to implementation of additional local health improving physical exercises. During the study all the parameters significantly improved (p≤0.05), which confirmed the efficiency of the offered means and methods.

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