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**INCREASING OF ADAPTIVE CAPABILITIES OF STUDENTS IN
PRACTICAL TRAININGS OF PHYSICAL EDUCATION**

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Abstract

The study involved 69 first-year students, young men aged 17-18. Some significant differences in lower results of main group`s right hand dynamometry ($p<0.05$) were revealed. In functional tests, control group indicators significantly exceed main group similar indicators in Genche`s test and speed of pulse recovery after exercises ($p<0.05$). There is a high percentage of main group`s students, having a bad reaction of pulse recovery speed (42.9%), while in control group 28.6% had a bad reaction. Main group had a significant improvement in parameters of pulse recovery speed ($p<0.01$). The growth is also registered in Stange`s test by 6.1% and Genche`s test by 14.2%. Main group testees improved the results for most of investigated characteristics` parameters ($p<0.01$; 0.05), except for static endurance of arm and back muscles. The greatest improvements were found in the study of working efficiency by 10.2%, strength endurance by 15.0% and dynamic endurance by 18.6%. In Juhász test there was an increase (by 21.0%) of total points. Comparison of inter-group differences shows that main group boys had more responsible changes in terms of step-test ($p<0.01$). It`s revealed that at the beginning of the experiment the majority of main group students have a lower level of some qualities and functions that determine the adaptive capabilities of a body. At the end, a positive trend for most indicators in both groups was observed. Health-improving methods of increasing the adaptive capability of first-year students are an effective means of correction and students` health saving in practical trainings of physical education.

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Keywords: Adaptive capability, first-year students, practical trainings, readiness for training.



1. Introduction

The modern stage of scientific and technological progress, computerization and informatization suffers from one significant drawback-hypodynamia, which is gradually becoming universal.

Meanwhile, it is one of the major causes of metabolic disorders in a human body, diseases of the central nervous and cardiovascular systems, musculoskeletal system, upper airway, the formation of chronic fatigue syndrome, which is confirmed by many researchers (Iordanskaya, 2015; Kuznetsov, Kuraleva, & Santynov, 2008; Armstrong & Welsman, 1997; Burov, Erohina, & Fedorova, 2014; Bolotin, Shchegolev, & Bakayev, 2014; Bolotin, Piskun, & Pogodin, 2017; Bolotin & Bakayev, 2018). With the intensification of mental and physical activity, energy expenditure increases, the number of substances providing it decreases sharply, the resources of the body are significantly spent, etc. Needless to say that in such conditions the role of physical culture and sports is increasing immeasurably. The process of training and education in schools and Universities plays an important role in the overall physical development of personal enhancement of young people, who can subsequently work productively, make important decisions dispassionately, bravely endure the failures and strive for success in any activity under any circumstances, that has been shown in many studies (Baka, 2004; Guba, 2012; Kuchma, 2003; Kirshina, 2008; Armstrong & Welsman, 1997; Barker, Williams, Jones, & Armstrong, 2011; Hicks & Heastie, 2008; Singh, Uijtdewilligen, Twisk, Mechelen, & Chinapaw, 2012; Sushchenko, Shchegolev, & Korshunov, 2016). Functional changes, occurring in the body under the influence of training, are determined by the nature of the applied loads, their intensity and amount. The most effective means of increasing the adaptive capability are exercises for various types of endurance, as exertion of this quality depends on the state of the cardiovascular and respiratory systems. But getting the desired results is achieved only by systematic physical exercises, which should be based on the knowledge of laws of adaptation abilities development of the organism, ways of increasing working efficiency during muscular activity, as confirmed by the studies of the authors (Fritz, 2009; Herda, Siedlik, Trevino, Cooper, & Weir, 2015; Janssen & Leblanc, 2010; Shchegolev, Sushchenko, & Piskun, 2017). Properly planned process of health and fitness training, using the principle of continuity, can significantly reduce the impact of factors, negatively affecting the formation and increase of adaptive capability of a body. Alternation of trainings of different nature, variation of loads` intensity produces the stereotype of sequential change of functional states, which increases adaptive capability. This is stated by many researchers (Iordanskaya, 2015; Langford et al., 2014; Freitas, 2007; Trevino & Herda, 2016). With the help of properly organized physical training a number of indicators of physical development and functional state of a body can be changed in a wide range and systematically (Chesnokov, 1998; Kuchma, 2003; Armstrong & Welsman, 1997; Herda, Siedlik, Trevino, Cooper & Weir, 2015; Mikolajczyk et al., 2008; Bakayev, Vasilyeva, Kalmykova, & Razinkina, 2018). In connection with the above, the study of evaluating the effectiveness of training sessions aimed at improving the adaptive capability of a body of engaged people, is an urgent task of physical culture and significantly expand the methodological base of sports disciplines.

2. Problem Statement

- 2.1. To assess the impact of cyclic exercises on the level of formation of adaptive capabilities of students in the course of training sessions of physical culture.

- 2.2. To put to an evaluation test the modular method of continuous development of different types of endurance to improve the adaptive capability of students, having a weakened level of physical health.

3. Research Questions

It is assumed that the use of the modular methodology of continuous development of different types of endurance on practical training sessions of physical culture, will allow to improve the level of adaptive capability of first-year students with a weakened level of physical health, which in its turn will increase their readiness for further training at the University.

4. Purpose of the Study

Development of adaptive capabilities of first-year students in practical training of physical education.

5. Research Methods

5.1. The study involved 69 first-year students enrolled in technical specialties, young men aged 17-18 years old. An informed consent for participation in this experiment was obtained from all participants.

5.2. The study was conducted in three stages with students of Astrakhan State Technical University.

5.3. 2 groups of students were formed: control group (n=30), engaged in the standard program of physical education for higher educational institutions and main group (n=39), where classes had health-correction orientation. The main group included students according to the results of a self-assessment survey of their own health and those suffering from colds 4 or more times during the academic year.

5.4. All annual physical load ("load quantum") is divided into 7 modules. At the same time I-III modules are aimed at the development of general endurance, IV-VII modules - of special one. As the main means of forming the overall endurance, we used a long uniform running, defining three of its working areas in exercise heart rate: I module - HR 120-140 beats/min; II – 140-160; III – 160-180 beats/min. The development of special endurance was carried out with the help of repeated running on distances from 80 to 1000 m. Each of the 7 modules of "quantum load" (except the first one) included 8 training sessions (2 times a week) and 8 independent ones, according to the individual task of the teacher.

5.5. Running work was accompanied by the implementation of auxiliary complexes of circular training for the development of physical qualities. Circular training complexes include exercises aimed at influencing on certain muscle groups in accordance with the mode of running.

5.6. Functional data was assessed using tests that characterize the state of respiratory (Stange's test, Genche's test - timed expiratory capacity) and cardiovascular system (speed of pulse recovery after exercise load). We determined the overall working efficiency (Harvard step-test). Strength endurance was assessed by a Juhász test. Static endurance of arm and back muscles, dynamic endurance of back and abdominal muscles were determined.

5.7. The following indicators were used in the statistics: arithmetic mean (X), mean square deviation (δ), standard error of the arithmetic mean (SX), correlation index (R). The significance of differences was determined by Student's criterion and was considered essential at 1-5% significance level, which is confessed quite reliable in pedagogical researches (Seluyanov, Shestakov, & Kosmina, 2001).

6. Findings

In table 01. the data characterizing physical development of students under investigation at the beginning of the pedagogical experiment are presented.

Table 01. Indicators of physical development of students at the beginning of the academic year

№	Indicators	Testee contingent		R
		Control group (CG), n=30	Main group (MG), n=39	
		X ± m		
1	Body length (cm)	176,6 ± 1,6	177,0 ± 1,4	>0,05
2	Body weight (kg)	66,7 ± 0,9	67,3 ± 1,4	>0,05
3	Chest circumference (cm)	87,5 ± 0,8	87,1 ± 0,9	>0,05
4	Lung capacity (ml)	3611,8 ± 92,3	3607,1 ± 134,2	>0,05
5	Back strength (kg)	114,1 ± 4,2	126,4 ± 8,1	>0,05
6	Dynamometry (kg) right hand	51,8 ± 1,4	46,2 ± 2,3	<0,05
	left hand	47,3 ± 0,9	48,8 ± 2,0	>0,05

The results of functional training of students are presented in table 02.

Table 02. Indicators of the functional state of the testees at the beginning of the academic year

№	Indicators	Testee contingent		R
		Control group (CG), n=30	Main group (MG), n=39	
		X ± m		
1	Stange`s test, (s)	50,7 ± 1,9	47,6 ± 3,2	>0,05
2	Genche`s test (timed expiratory capacity), (s)	47,9 ± 2,4	39,3 ± 3,3	<0,05
3	Speed of pulse recovery, (s)	31,7 ± 1,1	36,0 ± 1,5	<0,05

Next, we evaluated different types of endurance as the most informative indicators of the cardiovascular system`s state (table 03).

Table 03. Indicators of different types of first-year students` endurance at the beginning of the pedagogical experiment

№	Indicators		Testee contingent		R
			Control group (CG), n=30	Main group (MG), n=39	
			X ± m		
1	Overall working efficiency (step-test)				
	dynamics of heart rate (30 s)	HR after 1 min	71,2 ± 0,9	73,1 ± 0,8	>0,05
		HR after 2 min	66,5 ± 0,9	68,0 ± 1,1	>0,05
		HR after 3 min	64,6 ± 1,0	65,4 ± 1,3	>0,05
	Step-test index	74,1 ± 0,9	72,7 ± 1,1	>0,05	
2	Strength endurance (Juhász test)				
	Number of repetitions	first exercise	44,1 ± 1,6	36,5 ± 1,3	<0,01
		second exercise	28,7 ± 1,3	24,3 ± 1,0	<0,05
		third exercise	47,3 ± 1,3	46,2 ± 1,5	>0,05
		fourth exercise	39,5 ± 1,3	33,6 ± 2,1	<0,05
		fifth exercise	23,6 ± 1,1	16,1 ± 2,7	<0,05
		sixth exercise	22,3 ± 0,8	16,4 ± 1,4	<0,01
	Sum of all repetitions (Σ)	205,5 ± 1,2	173,1 ± 1,7	<0,01	
	Number of points (level)	1213	938		
3	Static endurance of arm, back and abdominal muscles				
		10 kg load retention (s)	40,9 ± 1,3	37,9 ± 1,0	>0,05
		Keeping the angle of 90° in suspension (s)	5,25 ± 1,1	5,52 ± 1,8	>0,05
4	Dynamic endurance of back and abdominal muscles				
		Raising body in 1 min	29,8 ± 1,3	26,3 ± 0,9	<0,05

At the end of the experimental studies to assess their effectiveness, we carried out a final test, which was conducted in both groups of testees, using the same diagnostic methods as at the beginning of the pedagogical experiment (table 04).

Table 04. Indicators of the functional state of students at the end of the pedagogical experiment

Indicators	Stages of experiment	Testee contingent		R
		Control group (CG), n=30	Main group (MG), n=39	
		X±m		
Stange`s test, (s)	Beginning	50,7 ± 1,9	47,6 ± 3,2	>0,05
	Ending	51,1 ± 1,2	50,5 ± 1,7	>0,05
	R	>0,05	>0,05	
Genche`s test (timed expiratory capacity), (s)	Beginning	47,9 ± 2,4	39,3 ± 3,3	<0,05
	Ending	45,7 ± 1,8	44,9 ± 2,0	>0,05
	R	>0,05	>0,05	
Speed of pulse recovery, (s)	Beginning	31,7 ± 1,1	36,0 ± 1,5	<0,05
	Ending	31,1 ± 1,2	31,2 ± 0,9	>0,05
	R	>0,05	<0,01	

Strength endurance was determined by a complex Juhász test, consisting of six diverse exercises (figure 01).

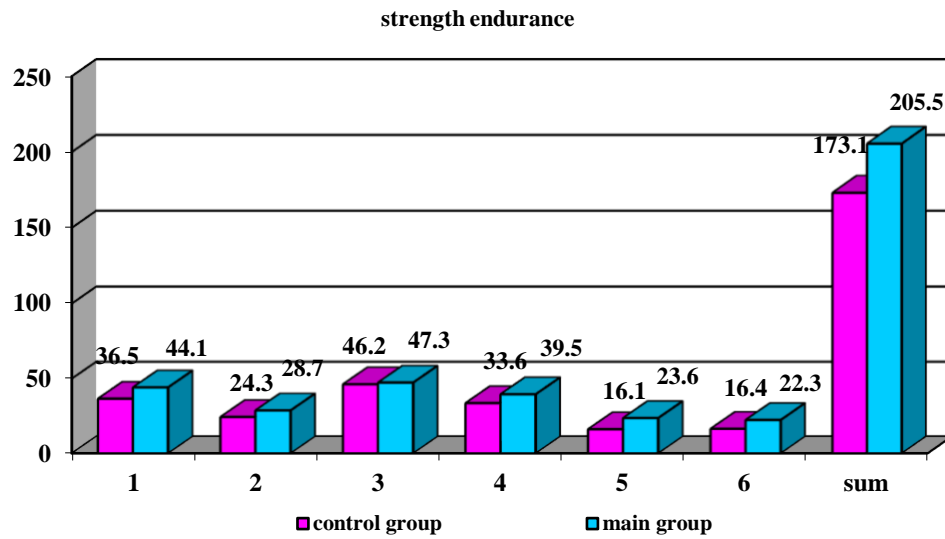


Figure 01. The ratio of the average indicators of testees by type of probations in Juhász test at the beginning of the experiment.

Further, the analysis of the level of different types of endurance formation as an integral adaptive index was carried out. The obtained data are shown in table 05.

Table 05. Indicators of the level of students` development of endurance at the end of experimental studies

№	Indicators	Stages of experiment	Testee contingent		R
			Control group (CG), n=30	Main group (MG), n=39	
			X ± m		
1	Overall working efficiency (step-test)				
	Step-test index	beginning	74,1 ± 0,9	72,7 ± 1,1	>0,05
		ending	75,2 ± 0,8	80,1 ± 0,8	<0,01
		R	> 0,05	< 0,01	
2	Strength endurance (Juhász test)				
	Sum of all exercises	beginning	205,5 ± 1,2	173,1 ± 1,7	<0,01
		ending	200,6 ± 1,5	199,1 ± 1,4	>0,05
		R	< 0,05	< 0,01	
	Total points earned (score)	beginning	1213	938	
		ending	1197	1195	
3	Static endurance of arm, back and abdominal muscles				
	10 kg load retention (s)	beginning	40,9 ± 1,3	37,9 ± 1,0	>0,05
		ending	40,5 ± 0,7	39,6 ± 0,6	>0,05
		R	> 0,05	> 0,05	
	Keeping the angle of 90° in suspension (s)	beginning	5,25 ± 1,1	5,52 ± 1,8	>0,05
		ending	5,77 ± 1,2	5,98 ± 0,9	>0,05
R		> 0,05	>0,05		
4	Dynamic endurance of back and abdominal muscles				
	Raising body in 1 min.	beginning	29,8 ± 1,3	26,3 ± 0,9	<0,05
		ending	30,9 ± 0,7	31,2 ± 0,8	>0,05
		R	>0,05	< 0,01	

According to the data, most students of the main group at the beginning of the pedagogical experiment have a lower level of state of some qualities and functions that determine the adaptive capabilities of a human body, namely:

- the first-year students of the main group, having the main group's work out, but with a weakened level of physical health, are characterized by the worst indicators of functioning of the cardiovascular (speed of pulse recovery after exercises) and respiratory systems (Genche's test with breath-holding), which are the most important for the formation of adaptive potential of a body and these differences are statistically significant ($p < 0.05$). Low resilience for physical activity is typical for 42.9% of students in this group.
- it is established that a lower initial level of formation of special conditioned qualities is noted in the main group. Thus, in the test of strength endurance, they are significantly inferior to peers from the control group in all components and in the total amount of all exercises ($p < 0.01$; 0.05). Significantly worse results were also obtained for the main group in the tests that evaluate the dynamic endurance of the back muscles ($p < 0.05$).

The results of the study, obtained at the end of the pedagogical experiment, allow us to state the positive dynamics of the majority of indicators in both groups of testees. But the most significant positive changes in comparison with the initial data were influenced by the activities in the main group, namely:

- significant improvement of functional indicators occurred in the parameters of the speed of pulse recovery after exercises ($p < 0.01$), characterizing the adaptability to long-term physical work. Improvement of indicators at this stage of the experiment is also observed in both respiratory tests: Stange's test by 6.1% and Genche's test by 14.2%;
- the greatest improvements were noted in the study of working efficiency by 10.2% ($p < 0.01$), strength endurance by 15.0% ($p < 0.01$), dynamic endurance by 18.6% for students of the main group;
- a significant increase in the results of all professionally studied important qualities was revealed ($p < 0.01$). In Juhász test, the total score increased by 21.0%, which corresponds to the average level of strength endurance compared to the low level, registered at the beginning of the academic year.

6.9. The method of increasing the adaptive capability of students with impaired level of physical health through the development of complex endurance in practical trainings of physical culture, is an effective means of improving the level of functional readiness for further training of first-year students in the University.

7. Conclusion

Analysis of the data shows that at the beginning of the experiment significant differences in the indicators of physical development between the testees of both groups were revealed only in the lower results of the right hand dynamometry ($p < 0.05$) of the young men of the main group. This suggests that the study groups are homogeneous in terms of physical development.

The comparison of the obtained initial results of functional tests shows that the studied indicators in the control group significantly exceed the similar indicators in the main group in terms of Genche's test and the speed of pulse recovery after exercises ($p < 0.05$). No significant differences between the groups were found in the data obtained from Stange's test ($p < 0.05$). It should be noted that a high percentage of young men in the main group, who according to the evaluation of this technique, have a poor response of

pulse recovery speed (42.9%), while in the control group a bad reaction was registered for 28.6% of students. This suggests that the majority of the testees of the main group, engaged in physical culture in the main group, have some deviations in the functioning of the cardiovascular and respiratory systems, the most important for the formation of the adaptive capability of a body. Especially important function, in our opinion, is the speed of pulse recovery, because it characterizes the adaptation of the body to some physical activities, which is the key to the development of endurance and working efficiency. The dynamics of HR indicators during the recovery period and the step-test index of the experimental group exceed the similar indicators of the control group, but these differences are not statistically significant ($p > 0.05$). The results of the step test index in both groups correspond to the average level of physical working efficiency.

The initial results obtained in this test indicate a significant advantage of the control group students in all components of the test ($p < 0.01$; 0.05), except for the third exercise - side leg abduction for 1 min. ($p < 0.05$). By the sum of all exercises, young men of the control group also significantly exceed ($p < 0.01$) the indicators of their peers from the main group at the beginning of the pedagogical experiment. This indicates a low ability to work long-term of the testees of this group, which was manifested in rapid fatigue and reduced productivity of physical activity.

Significantly lower values in the main group were also obtained from tests, evaluating the dynamic endurance of the back muscles ($p < 0.05$), regional differentiation of muscle forces ($p < 0.05$) and the accuracy of motor responses ($p < 0.05$). The study of static endurance of arm, back and abdominal muscles revealed no statistical differences between the compared contingent ($p > 0.05$).

Repeated survey (after the pedagogical experiment) of functional parameters of first-year students allowed to reveal ambiguous inter-group dynamics of characteristics of respiratory and cardiovascular systems in both groups. Thus, a positive shift was noted in the main group for all the studied functions, but a significant improvement occurred only in the parameters of the speed of pulse recovery after exercises ($p < 0.01$), characterizing the adaptation to long-term physical work. The increase in the parameters of the main group at this stage of the experiment is observed in both respiratory tests: Stange's by 6.1% and Genche's by 14.2%. There was also an improvement of the functional parameters of Stange's sample by 0.8% and the reaction of load tolerance by 1.9% in the control group, and in Genche's respiratory sample there was a decrease of breath-holding time in out-breath by 4.6%, but all these changes are not reliable ($p > 0.05$). As for the inter-group differences in the functional state of the testees, at this stage of the experiment, the young men of the control group lost their significant superiority in the level of functioning of the respiratory and cardiovascular systems, revealed at the beginning of the academic year. Some deterioration in the results of the test for strength endurance ($p < 0.05$) was recorded in the control group, which resulted in a decrease in the number of points scored on the sum of all exercises.

In the rest of the tests of the control group there was a slight increase in the studied parameters, but no statistically significant differences were registered ($p > 0.05$). In the main group, the qualitative changes recorded at the end of the pedagogical experiment are more significant. Thus, the students of this group significantly improved the results for most of the parameters of the studied characteristics ($p < 0.01$; 0.05), except for static endurance of arms and back muscles. The greatest improvements in this group were found in the study of working efficiency by 10.2%, strength endurance by 15.0% and dynamic endurance by 18.6%. In Juhász test there was a significant increase of the total points by 21.0%, which corresponds to

the average level of strength endurance compared to the low level registered at the beginning of the academic year. Comparison of inter-group differences shows that significant changes were also registered in favor of the main group in terms of the step test indicators ($p < 0.01$).

For the rest of the final indicators, the results of the main group testees exceed similar data of the control group students, but this advantage is not statistically significant, despite the fact that at the beginning of the pedagogical experiment the first-year students of the control group had a significant advantage in most of the studied characteristics of endurance.

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