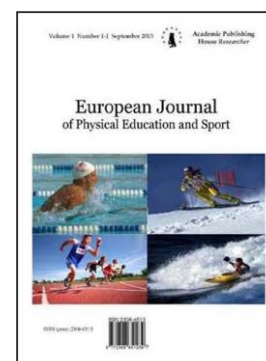


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Experimental Integrated Characteristics of Physical Performance of Students with Chronic Health Conditions in Physical Education

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Abstract

The control of physical performance in physical training in physical education of students with chronic health conditions, which provides maximum mobilization of the body during the absence of physiological limits, is considered. The task of the work – implement analysis the dynamics of the physical performance during the training under the influence of experimental control technology in physical education students with chronic health conditions. Experimental integral characteristic of the dynamics of integrated students of different chronic health conditions under the influence of experimental control technology in their physical education is presented. Results of the study show that the application in practice of experimental control technology in physical education of students with chronic health conditions allows activating compensatory mechanisms and consequently significantly increasing of physical performance. Info empirical research confirms the practical effectiveness of the developed technology and its impact on the effectiveness of the functional state of an organism of students with disabilities in health. The experimental results are necessary for a comprehensive monitoring psychophysiological condition of students to assess their health and improve management in physical education of students with chronic health conditions. The information obtained empirical research for effective interaction between the subjects of teaching and healing process of physical education of students with chronic health conditions in the form of person-centered anthropic technology can be used to create a basis.

Keywords: physical education, student, chronic health conditions, control, physical performance.

1. Introduction

The high level of psychophysiological condition of students with chronic health conditions provides an opportunity for effective realization of their psychomotor and intellectual potential. This implies the existence of an appropriate level of efficiency to ensure the effective performance of professional duties in the production environment (Dalen et al., 2017).

A high level of efficiency, which provides the potential ability to perform the maximum amount of work satisfactorily, is formed against the background of a specific psychophysiological state of the organism (Santana et al., 2020). The latter requires a proper synthesis of its components, the interaction of which is aimed at achieving a positive result. The compromise balance of these components determines the level of physical performance, which, in turn, provides

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maximum mobilization of the organism in the process of activity in the absence of physiological limitations (Zhai et al., 2020).

Given the above and the presence of functional abnormalities in the health of students with chronic health conditions, the issue of forming a high level of efficiency of such students and its proper control during their stay in the university, becomes especially relevant.

The problem of ensuring a high level of professional readiness of student youth is the subject of scientific research of many scientists in the field (Adyrkhaiev, 2014; Iedynak et al., 2017; Viktorov et al., 2018). However, today the experimental research of domestic scientists is focused on the contingent of student without chronic health conditions, to which a significant amount of work is devoted. So far, the problems of institutional transformations of physical performance have been studied in a rather discreet scientific substantiation.

Analysis of the theoretical achievements in relation to the above, revealed the lack of research in this area for students with disabilities. A comprehensive study of the assessment of physical performance indicators in physical education of students with chronic health conditions is quite limited, which significantly complicates the identification of regular trends in this perspective.

At the same time, a constructive analysis of the scientific and methodological literature gives grounds to state that determining the effectiveness of physical education for students with chronic health conditions involves studying the dynamics of their ability to work as an indicator of professional suitability and informative integrated indicator of health (Adyrkhaiev, 2014; Iedynak, et al., 2017; Di Tore et al., 2016). In addition, it is believed that the quantitative assessment of physical performance is one of the main factors that determine the organization of physical education of students with chronic health conditions to avoid desynchrony in students, on the basis of which it is possible to deepen existing diseases (Anikieiev, 2015; Douglas et al., 2013).

The purpose of the study is to analyze the dynamics of physical performance in during training under the influence of experimental control technology in physical education of students with chronic health conditions.

2. Methods

Research methods. The following research methods were used to solve the tasks, namely: general scientific methods of theoretical level: analysis and synthesis, and methods of obtaining empirical data: pedagogical experiment, pedagogical testing, mathematical methods of digital processing arrays.

Calculation method for evaluating of physical performance (Metzler, 2017):

Physical performance = $700 - 3 \times \text{heart rate} - 2,5 \times \text{ADmedium} - 2,7 \times \text{age} + 0,28 \times \text{body weight}/350 - 2,6 \times \text{age} + 0,21 \times \text{growth}$

Where:

1. Heart rate – heart rate for 1 minute at rest
2. Average blood pressure (ADcr.). It is determined by the formula:
ADmedium = $\text{ADd} + (\text{ADcr.} - \text{ADd})/3$
3. Age/
4. Body weight (in kilograms)/
5. Growth (in centimeters).

The level of physical fitness is:

- low if the physical performance is below 0.375;
- below average – at physical performance is 0.376-0.525;
- average – at physical performance is 0.526-0.675;
- above average – at physical performance is 0.676-0.825;
- high – at physical performance is above 0.825.

Organization of the study. In accordance with the defined goal, the study was conducted on the basis of the Department of Physical Education of Lviv Polytechnic National University during a three-year course in a particular discipline. The number of experimental groups formed of students with chronic health conditions was equal – 120 boys and 120 girls, including 40 people of the same nosology: cardiovascular and respiratory diseases, diseases of the musculoskeletal system, pathologies of the nervous system, digestive disorders and metabolism and ophthalmic diseases. The research was conducted annually within the timeframe set by the university curriculum.

3. Results and discussion

Providing operational, informative and meaningful information to obtain accurate data on the state of physical performance students with chronic health conditions implemented through the use of mobile and easy to use and interpret data diagnostic calculation methods. Urgent research of a significant number of students is secured by the efficiency of its application (Metzler, 2017). It is also fundamentally important that the diagnosis covers the full period of training, and its results are easy to compare. Taking into account all the above, a method was chosen that indirectly evaluates the integrated of physical performance based on the study of informative parameters of functional reserves of the body, which is considered the best method for assessing the physical condition of students to manage the educational process of physical education.

The integrated monitoring of physical performance was carried out according to the operational-procedural criterion: control measurements were carried out, the results were generalized on the basis of quantitative evaluation of information. The null hypothesis assumed that the results taken from the general population of the sample are subject to the same distribution law, and the differences are random. The effectiveness of the test tasks by the students of the sample during the course of physical education in the university were calculated and presented their averages (Table 1).

Analysis of the results at the beginning of the experiment of physical performance indicators of EG and CG students showed no significant difference between them, which is statistically confirmed ($p > 0.05$). The study showed that significant differences in the level of physical performance between groups of different nosologies in boys and girls of the first year were also not found ($p > 0.05$). A low level of the research parameter (< 0.375) was found in 100 % of the studied sample of students at the beginning of the experimental study. In this aspect, we note that physical performance is limited by the state of the cardiorespiratory system and is its indirect criterion, which in all students of the study sample to some extent before the experiment has certain deviations from the appropriate values.

According to the variability of individual indicators, the groups were homogeneous, as evidenced by the value of the coefficient of variation V : in EG they amounted to 2.3-9.1 %, in CG – 2.2-11.7 %, which increased the objectivity of conclusions about the effectiveness of the developed technologies in physical education of students with chronic health conditions.

The use during three school years of experimental and current versions of the content of the control system in the physical education of students with chronic health conditions led to the following results. The introduction of the developed technology in the educational process of students with chronic health conditions contributed to the development of positive processes in the body of students, which is reflected in the dynamics of physical performance. Accordingly, these changes lead to the neutralization of negative mental symptoms of fatigue, increase the tone of the central nervous system and, above all, the brain, which leads to an increase in the level of efficiency and normalization of neurodynamics in general. As a result, the parameters of the psychophysical state improve: perception, thinking, processing, judgment, increases the ability to abstraction, improves memory, and so on.

The results of statistical-probabilistic analysis of the obtained results of test control show that at the end of the study the average indicators of physical performance in EG students in general on average reach the upper limit below the average level.

However, it was found that the relative values of physical performance in students of different nosologies significantly level. The analysis of the obtained statistical data shows that the lowest indicators of physical performance for the period of experimental research are observed in students with neurological diseases. Specific lesions of the emergency, cause a significant disability, as we see in our case: the level of physical performance in students of this nosological group, compared with others is much lower. In the first year of study, its quantitative indicators undergo virtually no qualitative changes in students with neurological diseases. However, by the end of the study we observe their increase to 34.36 % ($p > 0.05$). Note that in this nosology, the rate of physical performance is characterized by the most pronounced sexual demorphism. At the same time, the insignificant growth rates of physical performance in students of this nosology are explained by the low level of motor activity and a much higher incidence rate, compared with other nosological groups.

We assume that a significant increase in hemodynamic parameters in EG students and with cardiovascular systems diseases during the experimental study ensured the establishment of compensatory mechanisms in their body to maintain optimal performance. As a result, the growth of physical performance in this nosological group before the end of the experiment is up to 25.62 % ($p > 0.05$).

Table 1. Dynamics of physical performance of students of research groups

NOSOLOGY (disease)	Course	Sex	EG			CG			p
			X	S	%	X	S	%	
Cardiovascular systems	I	m	0,3465	0,0116		0,3429	0,0121		>0,05
		f	0,3297	0,0095		0,3291	0,0077		>0,05
	II	m	0,4041	0,0180	16,62	0,3437	0,0155	1,39	<0,05
		f	0,4024	0,0154	22,05	0,3299	0,0109	2,43	<0,01
	III	m	0,4353	0,2417	25,62	0,3443	0,0127	4,08	<0,001
		f	0,4105	0,233	24,51	0,3302	0,0133	3,34	<0,01
Respiratory systems	I	m	0,3501	0,0122		0,3541	0,0155		>0,05
		f	0,3343	0,0128		0,3321	0,0109		>0,05
	II	m	0,4101	0,0184	17,13	0,3547	0,0123	1,69	<0,05
		f	0,4088	0,0135	22,28	0,3326	0,0117	1,50	<0,05
	III	m	0,4412	0,0151	26,04	0,3550	0,0107	2,54	<0,01
		f	0,4208	0,0163	25,87	0,3328	0,0128	2,10	<0,01
Nervous systems	I	m	0,3201	0,0149		0,3209	0,0137		>0,05
		f	0,3051	0,0188		0,3001	0,0169		>0,05
	II	m	0,3318	0,0151	3,65	0,3212	0,0155	0,93	>0,05
		f	0,3177	0,0167	4,12	0,3005	0,0134	1,33	>0,05
	III	m	0,4301	0,0212	34,36	0,3215	0,0183	1,86	<0,01
		f	0,4082	0,0207	33,71	0,3007	0,0177	1,99	<0,001
Musculoskeletal system	I	m	0,3698	0,0079		0,3677	0,0118		>0,05
		f	0,3512	0,0101		0,3509	0,0125		>0,05
	II	m	0,4218	0,0124	15,76	0,3684	0,0125	1,91	<0,05
		f	0,4118	0,0177	17,25	0,3515	0,0172	1,70	<0,05
	III	m	0,4688	0,0214	26,77	0,3689	0,0185	3,26	<0,01
		f	0,4414	0,0211	25,68	0,3519	0,0167	2,84	<0,01
Digestive organs and metabolism	I	m	0,3386	0,0133		0,3392	0,0115		>0,05
		f	0,3253	0,0107		0,3241	0,0128		>0,05
	II	m	0,3891	0,0207	14,91	0,3397	0,0166	1,47	<0,05
		f	0,3986	0,0215	22,53	0,3244	0,0114	0,92	<0,05
	III	m	0,4319	0,0261	27,55	0,3402	0,0115	2,94	<0,001
		f	0,4112	0,233	26,40	0,3247	0,0128	1,85	<0,01
Ophthalmic	I	m	0,3201	0,0132		0,3209	0,0121		>0,05
		f	0,3124	0,0117		0,3119	0,0133		>0,05
	II	m	0,3526	0,0182	10,15	0,3214	0,0125	1,60	<0,05
		f	0,3603	0,0201	15,33	0,3122	0,0166	0,96	<0,05
	III	m	0,4067	0,0233	27,05	0,3218	0,0172	2,80	<0,05
		f	0,3913	0,0201	25,25	0,3125	0,0145	1,92	<0,05

Legend: EG – experimental groups, CG – control groups, m – male students; f – female students

In EG students with respiratory diseases, an increase in the quantitative indicators of physical performance (up to 25.87 %, $p > 0.05$) was accompanied by economization of ventilatory function and a decrease in energy expenditure for the implementation of the respiratory act. Given the fact that the functional reserves of the respiratory system are a limiting factor of physical performance, such changes are obviously due to the growth of functional reserves and increase the

adaptive capacity of the body of these students. Accordingly, this is accompanied by the optimization of gas homeostasis and respiratory function of the body as a whole, which was manifested to a greater extent as the level of physical performance.

Students with metabolic and digestive diseases also, compared with other nosological groups, reduced physical performance, due in some way to the presence in this group of people with hormonal disorders. And since hormones provide the intensity of metabolic processes, it largely determined the level of physical performance in students of this nosological group. However, at the end of the course of physical education, the positive dynamics of the studied indicator in this group reached 27.55 % ($p > 0.05$).

Slightly lower in qualitative characteristics indicators of the studied parameter in the group of students with ophthalmic diseases and slightly better expressed positive dynamics during the years of study at the university (up to 27.05 %).

The annual change in indicators in the experimental groups differed significantly. We follow a clear trend of the dynamics of the studied parameter during the courses according to sexual demorphism, namely: in girls a significant improvement in the quality of physical performance occurs in the second year, with further stabilization, and in boys – at the end of the third year. When evaluating the indicators, it is noteworthy that the largest values in absolute terms in girls at the end of the fourth semester. At the same time, the second-year students have the lowest CG: physical performance in these students has no significantly significant changes before its completion ($p < 0.05$), which accordingly indicates a decrease in the aerobic potential of the body and, consequently, its resistance to stress. In general, at the end of the study, the average rates of physical performance in 70.8 % of CG students were virtually unchanged and correspond to a low level, according to assessment scales ($p > 0.05$).

Differences in the values of physical performance students EG and CG ($p > 0.05$) at the end of the class indicate the positive impact of the developed technology and increase the efficiency of the body during physical activity.

Our study is based on the fact that certain levels of physical activity in the process of physical education of students with chronic diseases should focus not only on the level of physical fitness of students but also on the real capabilities of their body due to health, that is physical performance (Bertills et al., 2018; Koryahin et al., 2019). Therefore, we have expanded our information on the use of physical performance indicators as one of the most objective criteria for health (Di Tore et al., 2016; Zhai et al., 2020). The lower the performance, the more carefully you need to adjust the load during training (Ayers, 2004).

The results of the study confirmed the available scientific data that the increase in the process of physical education physical performance in students is accompanied by a set of morphological and functional adaptive changes in various body systems (Overton et al., 2016; Zhai et al., 2020). Appropriate use of physical education classes helps to increase the level of physical performance, and thus increase the level of physical health (Bertills et al., 2018; Iedynak et al., 2017; Koryahin et al., 2019).

Scientific data on the control of the process of physical education of students with disabilities have been expanded and the feasibility of using in the control of physical performance (Anikieiev, 2015; Koryahin et al., 2019; Viktorov et al., 2018).

The difference in the quantitative indicators of physical performance can be traced in the aspect of sexual demorphism, namely, boys have an initial level of its quantitative indicator higher than girls ($p < 0.001$). The reduction of physical performance in the latter to critical values is obviously combined with those health disorders, which are based on failures in autonomic and endocrine regulation, given that the state of adaptation is determined by the functional maturity of hormonal and autonomic regulation of homeostasis (Douglas et al., 2013; Iedynak et al., 2017).

Our research confirms the available data on the specifics of psychophysical development of students with ophthalmic disease (Aiman et al., 2016).

4. Conclusion

Given that the level of physical performance is closely correlated with the level of functional state, physical fitness, motor activity and depends on the level of fitness, statistical analysis of the final data obtained at the end of the experimental study confirmed the practical effectiveness of the

developed technology and its impact on functional status, the body of physical performance students.

Thus, the results of the study show that the application in practice of experimental control technology in the physical education of students with chronic health conditions allows to activate the compensatory mechanisms and, as a consequence, significantly increase the level of physical performance (up to 34.36 % ($p > 0.05$), which indicates In general, the results of three-year (from the first to the third year) use of experimental technology in physical education of students with chronic health conditions, showed higher ($p < 0,05$) efficiency of the content of the control system in improving the condition of students with chronic health conditions,, compared to the current.

The obtained data of experimental-experimental integral characteristics of physical performance of students of different nosologies of students with chronic health conditions and taking into account that indirect indicators of working capacity in the course of performance of work worsen much earlier than its direct criteria, can serve as the basis for elucidation of adaptation mechanisms. Functional states of the body in the physical education of students with chronic health conditions

Prospects for further research are to study the dynamics of neurodynamic functions of students with chronic health conditions in the process of physical education in higher education.

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