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## **Results of motor abilities and anthropometric and functional characteristics of physical preparedness of students-powerlifters with musculoskeletal system with different experience of taking exercises**

**Abstract.** *Our investigation dedicates to the problem of improving students' health. Particularly, it refers to find out the ways of increasing students-powerlifters' health with musculoskeletal diseases based on powerlifting. **Purpose:** to study the influence of long – term powerlifting exercises on anthropometric and functional characteristics and motor abilities of students- powerlifters with musculoskeletal diseases. **Material and Methods:** methods of investigation: theory analysis, synthesis and generalization, testing and math's statistics and pedagogical experiment. There are 73 students with musculoskeletal diseases with different experience of taking exercises, 21 – had 1 year experience, 18 – 2 years, 12 – 3 years, 11 – 4 years and 11 – 5 years. **Results:** there are the differences of anthropometric and functional characteristics and the results of developing students' motor abilities with different experience of taking exercises. **Conclusion:** the investigation revealed that increasing of the students' sportsmanship shows the great growth almost all the investigated results.*

**Keywords:** *analysis, motor abilities, trainings, diseases, health, powerlifting, students, functional.*

**Introduction.** As experts note, the problem of the improvement of a state of health of students with defeats of the musculoskeletal system is particularly acute enough [1; 5; 8]. The analysis of the last researches and publications specifies that one of the perspective directions of its decision still remain the development and the deployment of the special techniques based on the use of powerlifting in out-of-school time [2; 6–8]. Thus it is most expedient to rely in the course of their development on the knowledge and approaches received in training of Paralympians and healthy sportsmen-powerlifters [6].

Studying of the big array of information specifies that the efficiency of the process of the development and the deployment of noted technique can be considerably increased under conditions of the solution of a number of problems [1; 3; 4; 6; 9]. One of such problems still remains a fragmentariness of data on what influence and on what systems are carried out by long-term powerlifting classes. It is noted above and caused the need of carrying out the research a purpose of which was to establish changes of anthropometrical, functional characteristics, and also indicators of the development of motive abilities of students with defeats of the musculoskeletal system in the course of long-term powerlifting classes.

**Communication of the research with scientific programs, plans, subjects.** The work is performed according to the comprehensive program of the research work of the chair of the Olympic and professional sport of Luhansk Taras Shevchenko National University developed behind a problem “Theoretic-methodical bases of study of physical culture and culture of health of student's youth” (subjects of education in norm and with special requirements), number of a state registration is 0110U000394.

**The objective of the research.** The above-mentioned caused the need of carrying out the research which purpose was a studying of influence of long-term powerlifting classes on anthropometrical, functional characteristics and indicators of the development of motive abilities of students with defeats of the musculoskeletal system.

**Material and methods of the research.** 73 students with defeats of the musculoskeletal system with a different experience of powerlifting classes took part in the experiment – 21 students had an experience 1 year, 18 – 2 years, 12 – 3 years, 11 – 4 years and 11 – 5 years respectively. The research methods: theoretical analysis, synthesis and synthesis of information, testing, mathematical statistics and pedagogical experiment.

Anthropometrical, functional characteristics and indicators of the development of motive abilities are determined at students by a research plan.

To anthropometrical characteristics of students were referred studying: age indicators (years old), length (sm) and weight (kg) of a body, size of thorax (sm) during an inhalation, an exhalation, and in a pause. Functional indicators estimated on the basis of registration of arterial pressure (mm mer.col.), vital capacity of lungs (ml) and a use “Shtange's test” (s) and Genchi's test” (s). Motive abilities or the level of physical fitness

of students with a different experience of classes defined by such tests: dynamometry of muscular groups of a hand, polydynamometry of five muscular groups of an arm (kg) behind a technique of B. M. Ribalka and to a bar press, lying – an assessment of power abilities; claps before itself and behind a back for 10 s in sitting position (number of times) – complex studying of high-speed and coordination abilities; a throwing of a stuffed ball from behind a head forward and through a head back (m) – a definition of high-speed and power characteristics; goniophotometry (gr.) behind a technique of B. V. Sermeyev – an assessment of mobility in shoulder joints; control exercise “static endurance of hands” (s) – a research of the level of endurance of muscles of hands of stronger and weaker arms. It was carried out after two-three days of rest for the purpose of an exception of influence of the previous classes on indicators of testing of the research.

**Results of the research and their discussion.** From the tab. 1 it is visible that there are no reliable differences ( $p > 0,05$ ) between such anthropometrical parameters of students – sportsmen of adjacent courses, as age, growth and body weight. So, for example, length of a body of the surveyed is ranging from 168,9 to 171,2 sm, and indicators of body weight fluctuate ranging from 59,1 to 61,9 kg. Thus the one-direction improvement of indicators of size of a thorax is recorded. All parameters of size of a thorax grow parallel to the increase in an experience of classes: powerlifters with an experience of 1 year have indicators of size of thorax registered during an inhalation are equal 81,4 sm, during an exhalation and a pause – 71,9 and 76,7 sm respectively; at powerlifters who are engaged 5 years, the corresponding characteristics make 86,9 sm, 79,7 and 80,3 sm. Thus reliable differences ( $p < 0,05$ ) are recorded: in indicators of size of thorax during an inhalation – between data of students with an experience 1 years and 2 years, and 3 and 4 years; in characteristics of size of thorax during an exhalation – between data of students of the 1 and 2 courses.

Such changes of anthropometrical indicators, in our opinion, connected with the improvement of certain functional characteristics (in particular, the vital capacity of lungs) and strengthening so-called “muscular of a corset” under the influence of regular trainings by powerlifting. Thus in the course of the experimental research the following dynamics of functional characteristics of students was recorded. It is revealed that arterial pressure in the course of long-term classes by powerlifting remains stable, answering indicators of a healthy person. Its values fluctuate within 120/75 – 122/76 mm mer.col.).

The analysis of indicators of vital capacity of lungs indicates their one-direction reliable ( $p < 0,05$ ) growth at powerlifters in parallel with the increase of their experience of classes: students of the 1<sup>st</sup> course – 2667,8 ml; students the 2<sup>nd</sup> course – 3211,2 ml; students the 3<sup>rd</sup> course – 3256,5 ml; students the 4<sup>th</sup> course – 3351,3 ml; students of the 5<sup>th</sup> course – 3587,2 ml. Such increase of characteristics, in our opinion, should be connected with the positive influence of regular classes by powerlifting on the activity of cardiovascular and respiratory systems that causes including the increase of aerobic opportunities of a person. It is coordinated with opinion of many scientists concerning the influence of classes by physical exercises on a human body.

Table 1  
 Anthropometrical and functional indicators of students with defeats of the musculoskeletal system in the course of powerlifting classes from the first to the fifth courses

Research indicators	The first course (n=21)		p	The second course (n=18)		p	The third course (n=12)		p	The fourth course (n=11)		p	The fifth course (n=11)	
	$\bar{X}$	m		$\bar{X}$	m		$\bar{X}$	m		$\bar{X}$	m		$\bar{X}$	m
Age, years old	18,5	0,26	>0,05	20,2	0,36	>0,05	21,4	0,38	>0,05	22,5	0,40	>0,05	23,5	0,40
Body length, sm	168,9	1,47	>0,05	169,2	1,52	>0,05	170,6	1,98	>0,05	170,9	1,99	>0,05	171,2	1,98
Body weight, kg	59,4	0,42	>0,05	59,1	0,37	>0,05	61,2	0,64	>0,05	60,9	0,58	>0,05	61,9	0,61
Size of thorax, sm	81,4	0,36	<0,05	83,9	0,38	>0,05	84,8	0,35	<0,05	86,9	0,39	>0,05	86,9	0,41
	71,9	0,44	<0,05	76,7	0,42	>0,05	78,5	0,51	>0,05	79,4	0,50	>0,05	79,7	0,49
	76,7	0,51	>0,05	79,5	0,63	>0,05	79,7	0,61	>0,05	79,8	0,68	>0,05	80,3	0,73
Blood pressure, mm	120/75	0,08	>0,05	120/75	0,08	>0,05	121/76	0,12	>0,05	122/75	0,14	>0,05	120/75	0,07
Vital capacity of lungs, ml	2667,8	8,5	<0,05	3211,2	10,1	<0,05	3256,5	11,2	<0,05	3351,3	11,6	<0,05	3587,2	10,87
Power of a stronger arm, kg	29,9	0,08	<0,05	37,7	0,07	<0,05	40,2	0,06	<0,05	44,2	0,08	<0,05	48,7	0,09
Power of a weaker arm, kg	28,1	0,06	<0,05	35,4	0,08	<0,05	39,2	0,08	<0,05	42,5	0,07	<0,05	46,5	0,08
Shtange's test, s	49,8	0,22	>0,05	51,4	0,23	<0,05	53,9	0,18	>0,05	55,0	0,19	<0,05	58,1	0,21
Genchi's test, s	31,3	0,18	>0,05	31,5	0,27	<0,05	34,8	0,19	<0,05	38,5	0,24	<0,05	42,2	0,25

Table 2  
Indicators of physical fitness of students with defeats of the musculoskeletal system in the course of powerlifting classes from the first to the fifth courses

Research indicators	The first course (n=21)		p	The second course (n=18)		p	The third course (n=12)		p	The fourth course (n=11)		p	The fifth course (n=11)	
	$\bar{X}$	m		$\bar{X}$	m		$\bar{X}$	m		$\bar{X}$	m		$\bar{X}$	m
Claps before itself and behind a back for 10, quantity of times	22,34	0,26	<0,05	24,95	0,27	<0,05	28,41	0,19	>0,05	30,15	0,21	<0,05	35,2	0,20
A throwing of a stuffed ball from behind a head forward (m)	4,48	0,05	>0,05	4,76	0,04	<0,05	6,07	0,05	<0,05	8,11	0,09	<0,05	10,57	0,18
A throwing of a stuffed ball from behind a head back (m)	4,15	0,04	<0,05	4,48	0,03	<0,05	5,39	0,06	<0,05	7,13	0,07	<0,05	9,18	0,09
A bar press lying, kg	67,71	2,36	<0,05	76,59	2,41	<0,05	90,42	2,23	<0,05	99,73	2,19	<0,05	107,89	2,37
Mobility in shoulder joints of a stronger arm, gr.	71,87	2,31	>0,05	72,43	2,42	>0,05	72,58	2,51	>0,05	73,15	2,76	>0,05	73,18	2,84
Mobility in shoulder joints a weaker arm, gr.	70,42	2,85	>0,05	71,63	2,79	>0,05	72,37	2,63	>0,05	72,41	2,68	>0,05	72,52	2,78
Static endurance of a hand of a stronger arm, s	10,5	0,02	<0,05	12,9	0,03	<0,05	21,75	0,06	<0,05	31,18	0,07	<0,05	39,47	0,08
Static endurance of a hand of a weaker arm, s	9,4	0,01	<0,05	11,3	0,02	<0,05	19,42	0,07	<0,05	29,76	0,08	<0,05	37,63	0,06
Total indicator of power of 5 muscles groups of a stronger arm, kg	abs.	171,3	4,56	198,9	4,03	<0,05	246,8	4,28	<0,05	264,1	4,59	<0,05	281,2	4,63
	rel.	2,88	0,02	3,36	0,02	<0,05	4,17	0,01	<0,05	4,47	0,01	<0,05	4,76	0,02
Total indicator of power of 5 muscles groups of a weaker arm, kg	abs.	158,7	4,63	189,3	4,62	<0,05	235,4	4,81	<0,05	252,8	4,82	<0,05	269,3	4,45
	rel.	2,67	0,01	3,20	0,02	<0,05	3,98	0,01	<0,05	4,28	0,02	<0,05	4,56	0,02

Dynamics of indicators of Genchi's and Shtange's tests – other characteristics of functional preparedness of students – also indicates their essential growth along with the increase of sports skill of students. So, at powerlifters with an experience 1 year these indicators make 49,8 s and 31,3 s, with an experience of 2 years – 51,4 s and 31,5 s, 3 years – 53,9 s and 34,8 s, 4 years – 55 s and 38,5 s, 5 years – 58,1 s and 42,2 s respectively. It should be noted that thus statistically significant differences ( $p < 0,05$ ) were recorded between the relevant data of students of 2 years of study and third-year students, and also – in the 4th year study and fifth-year students.

Studying of dynamics of indicators of motive abilities of students-sportsmen with defeats of the musculoskeletal system which are presented in tab. 2, also testifies to their one-direction increase in the course of long-term classes. So, also their power opportunities significantly improved parallel to a growth of the level of sports skill of students. Thus it is established a reliable ( $p < 0,05$ ) growth of power abilities of powerlifters in all tests. So, for example, indicators of force of a hand of stronger and weaker arms of men steadily improve ( $p < 0,05$ ): students of the 1 course – 29,9 and 28,1 kg; students the 2 course – 37,7 and 35,4 kg; students the 3 course – 40,2 and 39,2 kg; students the 4 course – 44,2 and 42,5 kg; students of the 5th course – 48,7 and 46,5 kg.

During the performance of the main competitive exercise – to a bar press lying – at powerlifters with an experience of classes of 1 year the result of 67,71 kg which authentically grew ( $p < 0,05$ ) parallel to the increase of the level of sports skill was recorded, reaching in those who is engaged 2 years, – 76,59 kg, 3 years – 90,42 kg, 4 years – 99,73 kg, 5 years – 107,89 kg respectively.

Dynamics of other power characteristics of students – total indicators of absolute and relative force of five muscular groups of stronger and weaker arms – also specifies on their steady ( $p < 0,05$ ) growth along with the increase of sports skill of students:

- characteristics of absolute force make 171,3 and 158,7 kg, relative force – 2,88 and 2,67 kg are noted at powerlifters with an experience 1 year;
- indicators of absolute force – 198,9 and 189,3 kg, relative force – 3,36 and 3,2 kg at powerlifters with an experience 2 years;
- parameters of absolute force – 246,8 and 235,4 kg, relative force – 4,17 and 3,98 kg at powerlifters with an experience 3 years;
- characteristics of absolute force make 264,1 and 252,8 kg, relative force – 4,47 and 4,28 kg are noted at powerlifters with an experience of 4 years;
- indicators of absolute force – 281,2 and 269,3 kg, relative force – 4,76 and 4,56 kg respectively at powerlifters with an experience 5 years.

The analysis of results of the experimental research presented in tab. 2 also specifies that the increase of sports qualification of students-powerlifters with defeats of the musculoskeletal system is followed steady ( $p < 0,05$ ) by the improvement of their high-speed and coordination abilities. So, the result of 22,34 times which authentically grew ( $p < 0,05$ ) parallel to the increase of level of sports skill was recorded during the implementation of the test “claps before itself and behind a back for 10 s (in sitting position)” at powerlifters with an experience of classes of 1 year, reaching in those who is engaged 2 years, – 24,95 times, 3 years – 28,41 times, 4 years – 30,15 times, 5 years – 35,2 times.

The analysis of results of a throwing of a stuffed ball from behind a head forward and through a head back also specifies on a steady ( $p < 0,05$ ) improvement of high-speed and power characteristics of students-sportsmen in the course of long-term classes by powerlifting: students of the 1 course show 4,48 and 4,15 m; students of the 2 course – 4,76 and 4,48 m; students of the 3 course – 6,07 and 5,39 m; students of the 4 course – 8,11 and 7,13 m; students of the 5th course – 10,57 and 9,18 m. The research of influence of long-term classes by powerlifting on indicators of mobility in shoulder joints found a considerable ( $p < 0,05$ ) growth of these parameters – from 71,87 gr. (a stronger hand) and 70,42 gr. (a weaker hand) at students-sportsmen with a one-year experience of classes, to 73,18 and 72,52 gr. at students-powerlifters with a five-year experience. Thus it wasn't recorded statistically significant ( $p > 0,05$ ) differences between noted indicators of students-sportsmen of the adjacent courses. The analysis of results of the conducted experimental researches also specifies that the increase of sports qualification of students-powerlifters with defeats of the musculoskeletal system is followed steady ( $p < 0,05$ ) by the improvement of the level of static endurance of hands:

- static endurance of a hand of a stronger hand of students-sportsmen with a one-year experience of classes equals 10,5, a weaker – 9,4 s;
- students with an experience of 2 years – respectively 12,9 and 11,3 s;

- students with an experience of 3 years – respectively 21,75 and 19,42 s;
- students with an experience of 4 years – respectively 31,18 and 29,76 s;
- students-powerlifters with a five-year experience – respectively 39,47 and 37,63 s.

#### Conclusions:

1. On the one hand, the conducted experimental research allowed finding as far as anthropometrical, functional parameters and indicators of the development of motive abilities at students with defeats of the musculoskeletal system differ which have the different experience of classes by powerlifting and respectively the different level of sports skill. Thus it was established that the increase of sports skill of students is followed a reliable ( $p < 0,05$ ) growth of practically all studied indicators.

2. The greatest number of statistically significant ( $p < 0,05$ ) differences is recorded between indicators of students-sportsmen of the adjacent courses which characterize:

- functionality (Genchi's test);
- vital capacity of lungs;
- power opportunities (a measurement of force of a hand, a definition of total indicators of absolute and relative force of five muscular groups of a hand, the test "a bar press, lying");
- high-speed and coordination abilities ("claps before itself and behind a back for 10 s");
- high-speed and power opportunities (tests "a throwing of a stuffed ball from behind a head forward and through a head back");
- mobility in joints (an assessment of mobility in shoulder joints).

3. On the other hand, results which are coordinated with materials of researches of F. Hassan, A. Mutasem and other experts were received who point to the powerful positive influence of specially developed techniques based on the use of physical exercises on an organism of persons with defeats of the musculoskeletal system, in particular, on anthropometrical, functional characteristics and motive abilities.

**Prospects of the subsequent researches** can be connected with studying of the influence of classes by powerlifting on mental health of students.

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