











## Dynamics of Physical Fitness of Students during Powerlifting Classes

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### Abstract

The article defines the dynamics of physical fitness of students after the introduction of method of forming special skills and abilities during powerlifting classes. The study was carried out at Poltava V. G. Korolenko National Pedagogical University, which was attended by 294 students from different faculties. We found out, that physical activity, physical fitness and health of students in higher educational institutions are at a fairly low level. We investigated, that the lack of motor activity of students can be compensated only by a complex combination of curricular and extracurricular activities that will contribute to desired result achievement during physical education classes. We found that the effectiveness of powerlifting exercises is closely related to the effectiveness of other test exercises. This may indicate that training and extracurricular powerlifting classes in combination with cardio increase the level of strength of the main muscle groups of boys and girls, resulting in an improvement in the level of general physical fitness of students.

**Keywords:** physical education, physical fitness, powerlifting, students.

### 1. Introduction

The problem of preserving and strengthening the health of the younger generation has always attracted the attention of public figures, for example: coaches in sports, scientists, cultural figures, educators [1, 2, 3]. The practical significance of its solution is related to the implementation of the provisions of legal documents, which are designed to carry out agitational and propagandist work to involve children and youth in active forms and methods of physical training, achieving sports results [4, 5, 6]. Nowadays, the urgency of this problem is due to socio-cultural, scientific, pedagogical and organizational factors. Modern lifestyle encourages young people to physical perfection. A healthy lifestyle, the formation of a beautiful athletic physique is very relevant [7, 8, 9]. Encouragements to this are the standards of beauty of ancient Greece: Hercules, Pythagoras, Platon and modern handsome athletes: V. Virastyuk, A. Krymov, V. Naleykin, O. Solovyov, O. Shepel. Classes in the gym, under the guidance of a coach allow you to become strong [10, 11, 12]. They stood out in a separate sport – powerlifting [13, 14].



Powerlifting (from «power» – strength, capacity and «lifting» – elevate) is a relatively young sport, the essence of which is to overcome the maximum weight during the performance of three exercises: squats with a barbell on his shoulders (squatting); barbell press lying on a horizontal bench (bench press) and lifting barbell while standing (deadlifting) [15, 16]. The amount of points scored for the exercises determines the qualification of the athlete. This sport is gaining more and more popularity every year, as evidenced by the dynamics of participation of athletes in competitions. Participation in trainings and competitions of not only men, but also women is considered to be an indicator of the development of power triathlon. It has also recently become popular to hold competitions using a single exercise namely bench press, which is recognized both among amateurs and among professional athletes [13, 17].

It is a proven fact, that success is achieved by young people who are able to optimally combine a high level of physical fitness and special knowledge in the field of physical education [18, 19]. Intellectual development and acquired special knowledge allow the student to correctly assess the social significance of physical culture and sports, to understand the objective laws of physical education as a pedagogical phenomenon, as a leading link between cognition and self-improvement, to show a greater desire for independence and creativity in classes and competitions [20, 21, 22].

Analysis of scientific, methodological and special literature shows, that the problem of students special skills and abilities formation in the process of powerlifting classes is studied in the following main areas: development of methods for training highly qualified athletes in powerlifting [12, 14]; research of features of youth sports in powerlifting [13, 15]; identification of means and methods of recovery during powerlifting classes [16, 17]; use of powerlifting in the physical education process [14, 23]; improving the technique of competitive powerlifting exercises [13, 15]; substantiation of features of women's powerlifting [12].

**The aim of the study** is to determine the dynamics of physical fitness of students after the introduction of methods of forming special skills and abilities in the process of powerlifting classes.

## 2. Method

The study was carried out at Poltava V. G. Korolenko National Pedagogical University, which was attended by twelve study groups of students (a total of 294 students, including 161 – boys and 133 – girls) from historical, natural, psychological-pedagogical, physical-mathematical and philological faculties. All students were divided into control and experimental groups by the method of even distribution of groups. According to the schedule, physical education classes in all groups were held twice a week in the morning. Students of control groups were engaged in the curriculum for higher education institutions. Students of experimental groups were engaged in the developed authors' method of formation of special abilities and skills in powerlifting. Training sessions, as part of compulsory and independent classes, were held three times a week in powerlifting and two classes, which included running and swimming. The duration of training sessions in groups was 90 minutes. The effectiveness of the proposed method was evaluated by the results of control tests. At the beginning of the year (September), physical training tests were conducted and the level of special physical training in powerlifting in control and experimental groups was assessed. Control tests were conducted at the end of the year (May-June). Students who dropped out of the experimental and control groups during their studies were not included in the statistical processing and were not replaced by others.

General scientific and special research methods were used to achieve the aim and solve the problems, interconnected and consistently applied throughout the study: theoretical (for the formation of theoretical and methodological foundations of the study) – analysis and generalization of philosophical, sociological, psychological, pedagogical, valeological literature; study of educational programs; regulatory and legislative documents; methodical recommendations and textbooks on psychological and pedagogical disciplines; study of the experience of physical education departments in the development of powerlifting in higher education institutions; empirical (to determine the general health of students) – methods of collecting information (questionnaires, surveys, pedagogical testing and observation of students' educational and training activities), analysis of learning outcomes, interviews, methods of expert assessments, self-assessment, generalization of independent characteristics; experimental (for the analysis of the basic ways of research of complex indicators) – ascertaining, formative, control stages of pedagogical experiment using the Diary of physical self-improvement in powerlifting, visual aids; statistical (to assess the statistical

significance of differences in the status and dynamics of changes in health indices) – descriptive statistics, determination of statistical significance of differences between groups by the Student's t-test and correlation analysis by the Pearson method.

### 3. Results and Discussion

One of the most important aspects of management of long-term training in powerlifting is the system of complex control, which allows the trainer-teacher to assess the level of physical and functional readiness of students, the correctness of the chosen direction of training, dynamics of training and timely make adjustments to the training process [12, 24, 25].

The methodological basis of comprehensive control is: the correct choice of tests and their compliance with statistical reliability criteria, objectivity and informativeness; determining the optimal amount of indicators to assess the functional status and level of preparedness of students, its sufficiency, standardization of conditions and sources of information; compliance of control methods with testing tasks.

Important role in the physical education process plays the accounting system, which characterizes its effectiveness. Accounting makes it possible to monitor the state of health, level of preparation of students, physical development, and the dynamics of their sports results. Analysis of accounting for quantitative and qualitative indicators allows the teacher not only to control the educational process of physical education, but also to actively intervene in it, to correct and improve it [11, 13, 26].

As a result of the introduction of the developed method of forming special skills and abilities of students in powerlifting in the process of physical education, there were statistically significant positive changes in the results of all motor tests. According to the authors' method on physical education for boys of the experimental group EG1, with above average and high level of health and physical fitness, statistically significant ( $p < 0.05-0.001$ ) improved performance of motor tests in the 3000 m run; flexion and extension of the arms in a supine position; pull-up on the crossbar; lifting the torso to the sitting position for 1 min; long jump from a place; 100 m run and shuttle run 4x9 m; tilt the torso forward from a sitting position; swimming for 12 min. The boys of the control group CG1 statistically significantly improved the results of motor tests in the 3000 m run; swimming for 12 minutes, 100 m run and shuttle run 4x9 m ( $p < 0.05-0.001$ ).

Students of the experimental group EG1 improved their performance in the 3000 m run from 14.47 min to 13.20 min, and the control group CG1 – from 15.15 min to 14.18 min; in swimming for 12 min – students of the EG1 – from 444 m to 470 m, and the CG1 – from 423 m to 441 m; in the 100 m run – students of the EG1 – from 14.21 s to 13.64 s, and the CG1 from 14.57 s to 14.16 s. The results of the shuttle run improved by 0.58 s in the EG1 and by 0.37 s in the CG1 (Table 1).

Because different types of muscle fibers are involved in powerlifting exercises (in squats it is fast-shrinking fibers, in running it is slow-shrinking) so their share in the leg muscles is increased, and students cannot perform long-term physical work, which is caused by the peculiarities of this sport and significantly affects the indicators of physical fitness, but in combination with cardio, the physical fitness of students in the experimental groups EG1, EG2, EG3 and control groups CG1, CG2, CG3 improved significantly.

We should note the positive dynamics of the growth of power qualities. In the boys of the experimental EG1 and control CG1 groups, there was an improvement in the results in pull-ups on the crossbar from 13.4 times to 16.12 times in the EG1 and from 12.6 to 15.0 times in the CG1; in the exercise of flexion and extension of the arms in a supine position improvement was from 38.6 to 44.8 times in the EG1 and from 37.2 to 41.6 times in the CG1, respectively. Performance in pull-ups on the crossbar is closely correlated with performance in bench press and lifting while standing, because while performing the bench press, test participants try to work the widest muscles of the back, and when performing deadlifting, these muscles take an active part in ensuring the final phase of movement.

Speed and power qualities improved in students of the experimental group EG1, that is, the range of the long jump from a place increased from 241.1 cm to 248.24 cm, and the control group CG1 – from 239.5 cm to 243.1 cm, which is a high increase in this quality. This is due to the specifics of training classes in powerlifting. The effectiveness of the long jump from a place has a high correlation with the maximum performance in the deadlift.

**Table 1.** Dynamics of indicators of physical fitness of boys with a high level of physical fitness during the period of pedagogical experiment

Tests	Groups	Before the experiment	After the experiment	Changes during the year	Significance of the difference	
		X±m	X±m	ΔX	t	p
3000 m run, min	EG1	14.47±0.21	13.12±0.13	1.35	2.66	<0.05
	CG1	15.15±0.14	14.18±0.08	1.37	2.71	<0.05
Swimming for 12 min, m	EG1	444±3.23	470±2.47	26	2.39	<0.05
	CG1	423±2.65	441±1.60	18	2.14	<0.05
Flexion and extension of the arms in a supine position, times	EG1	38.6±0.46	44.8±0.95	6.2	3.67	<0.001
	CG1	37.2±0.33	41.6±1.08	4.4	2.03	>0.05
Pull-ups on the crossbar, times	EG1	13.40±0.46	16.12±0.62	2.72	3.21	<0.01
	CG1	12.60±0.61	15.00±0.49	2.40	2.03	>0.05
Lifting the torso to the sitting position for 1 min, times	EG1	42.40±0.51	47.21±0.75	4.81	2.39	<0.01
	CG1	40.40±0.78	44.24±0.86	3.84	1.96	>0.05
Long jump from a place, cm	EG1	241.10±1.75	248.24±2.36	7.14	2.43	<0.05
	CG1	239.50±1.56	243.10±1.74	3.60	1.98	>0.05
100 m run, s	EG1	14.21±0.15	13.64±0.12	0.57	2.46	<0.05
	CG1	14.57±0.14	14.16±0.07	0.41	2.04	<0.05
Shuttle run 4x9 m, s	EG1	9.51±0.06	8.93±0.05	0.58	3.27	<0.001
	CG1	9.59±0.45	9.22±0.05	0.37	1.99	<0.05
Tilt the torso forward from a sitting position, cm	EG1	14.20±0.52	17.20±0.33	3.00	2.67	<0.05
	CG1	13.75±0.84	15.90±0.41	2.15	2.13	>0.05

This indicates that during the active extension of the torso, when performing a jump, the longitudinal muscles of the back are involved in the work, which provides movement in the basic exercise of powerlifting – deadlifting. Statistically significant changes in the boys of the experimental group EG1, in contrast to the control group CG1, at the end of the pedagogical experiment occurred at the level of development of muscle flexibility ( $p < 0.05$ ). Tilts of the torso forward from a sitting position increased from 14.2 cm to 17.2 cm in students of experimental group EG1 and from 13.75 cm to 15.9 cm of control group CG1. There was a high correlation between the increases in maximum number of lifts of the torso to the sitting position in 1 min (from 42.4 to 47.21 times and from 40.4 to 44.24 times, respectively) with performance in squats with a barbell on shoulders. This indicates that the level of development of the abdominal muscles is of great importance in these exercises, as these muscles together with the back muscles form a kind of «corset» during these exercises.

Dynamics of the results shown by the boys of the experimental group EG1, with above average and high level of health and physical fitness, in the above tests was quite high and at the end of the pedagogical experiment reached the level of statistical significance at  $p < 0.05$ .

Girls of experimental group EG1, who have above average and high levels of health and fitness, statistically significantly improved performance ( $p < 0.05-0.001$ ) of all tests, except for the tilt of the torso forward from a sitting position ( $p > 0.05$ ). In girls of the control group CG1 statistically significant improvements in the results of motor tests in the 2000 m run; swimming for 12 minutes, 100 m run and shuttle run 4x9 m ( $p < 0.05-0.001$ ) (Table 2). Girls of experimental group EG1 improved performance in the 2000 m run from 11.55 min to 10.51 min, and the control group CG1 from 12.24 min to 11.49 min; in swimming for 12 min – students of the EG1 – from 355 m to 372 m, and the control group CG1 from 347 m to 369 m; in the 100 m run – students of the EG1 – from 17.4 s to 16.4 s, and the control group CG1 from 17.6 s to 17.2 s. The results of the shuttle run improved by 0.4 s in the girls of the experimental group EG1 and by 0.1 s in the control group CG1.

**Table 2.** Dynamics of indicators of physical fitness of girls with a high level of physical fitness during the period of pedagogical experiment

Tests	Groups	Before the experiment	After the experiment	Changes during the year	Significance of the difference	
		X±m	X±m	ΔX	t	p
2000 m run, min	EG1	11.55±0.17	10.51±0.11	1.04	2.78	<0.05
	CG1	12.24±0.8	11.49±0.21	1.15	3.92	<0.001
Swimming for 12 min, m	EG1	355±2.1	372±1.37	17	2.86	<0.05
	CG1	347±2.3	369±1.46	22	3.43	<0.001
Flexion and extension of the arms in a supine position, times	EG1	13.2±0.52	20.4±0.46	7.2	4.01	<0.001
	CG1	14.3±0.61	15.2±0.39	0.9	1.87	>0.05
Hanging on bent arms, s	EG1	7.6±0.46	13.6±0.52	6.0	3.94	<0.001
	CG1	6.8±0.41	9.4±0.73	2.6	2.11	>0.05
Lifting the torso to the sitting position for 1 min, times	EG1	22.00±0.46	45.60±0.75	23.6	3.83	<0.001
	CG1	21.20±0.63	33.96±0.59	12.76	2.06	>0.05
Long jump from a place, cm	EG1	172.6±1.56	179.6±1.37	7.0	2.27	<0.05
	CG1	168.4±2.18	169.5±2.38	1.10	1.68	>0.05
100 m run, s	EG1	17.4±0.15	16.4±0.9	1.00	3.14	<0.001
	CG1	17.6±0.4	17.2±0.21	0.4	2.28	<0.05
Shuttle run 4x9 m, s	EG1	10.9±0.15	10.5±0.07	0.4	2.23	<0.05
	CG1	10.8±0.25	10.7±0.3	0.1	1.75	>0.05
Tilt the torso forward from a sitting position, cm	EG1	15.7±1.41	17.6±0.94	1.9	2.20	<0.05
	CG1	15.9±1.12	16.36±0.73	0.46	1.64	>0.05

Let us note the positive dynamics of the growth of power qualities. In the experimental EG1 and control CG1 groups, there was an improvement in the results in hanging on bent arms from 7.6 to 13.6 s in the experimental group and from 6.8 to 9.4 s in the control group; in the exercise of Flexion and extension of the arms in a supine position from 13.2 to 20.4 times in the experimental group and from 14.3 to 15.2 times in the control group, respectively. Performance in hanging on bent arms is closely correlated with performance in bench press and deadlifting. Speed and power qualities improved in the experimental group EG1, namely the range of the long jump from the place increased from 172.6 cm to 179.6 cm, and in the control group CG1 from 168.4 cm to 169.5 cm, which is a high increase in this quality. This is due to the specifics of training classes in powerlifting. The effectiveness of the long jump from a place has a high correlation with the maximum performance in the deadlift. This indicates that during the active extension of the torso, when performing a jump, the longitudinal muscles of the back are involved in the work, which provides movement in the basic exercise of powerlifting – deadlifting.

Statistically significant changes among the girls of the experimental group EG1, in contrast to the control group CG1, at the end of the pedagogical experiment occurred at the level of flexibility ( $p < 0.05$ ). Tilts of the torso forward from a sitting position increased from 15.7 cm to 17.6 cm in experimental group EG1 and from 15.9 cm to 16.36 cm in control group CG1. There was a close relationship between the maximum number of lifts of the torso to sitting position in 1 min – from 22 to 45.6 times and from 21.2 to 33.96 times, respectively, and the effectiveness of squats with a barbell on shoulders. Dynamics of the results shown by the girls of the experimental group EG1, with above average and high level of health and physical fitness, in the above tests was quite high and at the end of the pedagogical experiment reached statistical significance.

Thus, the results of the pedagogical experiment show that physical education classes in combination with cardio, on the basis of powerlifting, with students, which have a high level of health, physical and functional fitness, contribute to maintaining a high level of development of functional systems of the body, as well as improving physical abilities.

Let us consider the dynamics of the studied indicators of students of experimental EG2 and control CG2 groups, who have an average level of health and physical fitness. The boys of the experimental group EG2 showed an improvement in the results of the 3000 m run from 15.24 min at the beginning of the

experiment to 14.27 min at the end; in swimming for 12 min – from 332 m at the beginning of the experiment to 359 m after it; in 100 m run – from 14.7 s at the beginning of the experiment to 14.16 s at the end; in shuttle run 4x9 m – from 9.72 s at the beginning of the experiment to 8.98 s at the end. In the control group KG2 the results of the 3000 m run improved from 16.08 min at the beginning of the experiment to 15.24 min after it; in swimming for 12 min – from 325 m at the beginning of the experiment to 344 m at the end; in 100 m run – from 14.90 s at the beginning of the experiment to 14.59 s at the end; in shuttle run 4x9 m – from 9.82 s at the beginning of the experiment to 9.27 s at the end (Table 3).

**Table 3.** Dynamics of indicators of physical fitness of boys with an average level of physical fitness during the period of pedagogical experiment

Tests	Groups	Before the experiment	After the experiment	Changes during the year	Significance of the difference	
		X±m	X±m	ΔX	t	p
3000 m run, min	EG2	15.24±0.14	14.27±0.1	1.37	2.45	<0.05
	CG2	16.08±0.21	15.24±0.09	1.24	2.26	<0.05
Swimming for 12 min, m	EG2	332±1.3	359±2.92	27	2.34	<0.05
	CG2	325±1.4	344±1.1	19	2.23	<0.05
Flexion and extension of the arms in a supine position, times	EG2	29.3±0.86	36.1±0.74	6.8	3.27	<0.001
	CG2	29±0.94	33.5±0.9	4.5	2.13	>0.05
Pull-ups on the crossbar, times	EG2	8.12±0.54	12.21±0.6	4.09	3.43	<0.001
	CG2	7.84±0.67	10.58±0.47	2.74	2.26	>0.05
Lifting the torso to the sitting position for 1 min, times	EG2	39.53±1.32	43.24±1.1	3.71	2.75	<0.01
	CG2	36.87±0.88	39.1±0.75	2.23	2.08	>0.05
Long jump from a place, cm	EG2	219.6±2.21	227.2±1.9	7.6	2.23	<0.05
	CG2	219.1±2.35	222.9±2.1	3.8	1.84	>0.05
100 m run, s	EG2	14.70±0.08	14.16±0.1	0.54	2.42	<0.05
	CG2	14.90±0.09	14.59±0.07	0.31	2.37	<0.05
Shuttle run 4x9 m, s	EG2	9.72±0.04	8.98±0.03	0.74	2.89	<0.01
	CG2	9.82±0.05	9.27±0.04	0.55	2.47	<0.05
Tilt the torso forward from a sitting position, cm	EG2	10.28±0.86	14.42±0.5	4.14	2.81	<0.05
	CG2	10.10±0.94	13.12±0.68	3.02	2.05	>0.05

According to the results of pull-ups on the crossbar, flexion and extension of the arms in a supine position, lifting the torso to sitting position for 1 min, long jump from a place the level of development of power qualities of boys was defined. When performing exercises: pull-ups on the crossbar, the students of the experimental group EG2 improved their result by 4.09 times, the control group CG2 – by 2.74 times; flexion and extension of the arms in a supine position, the students of the experimental group EG2 improved their results by 6.8 times, and the control group CG2 – by 4.5 times, lifting the torso to sitting position for 1 min, the students of the experimental group EG2 improved their result by 3.71 times, and the control group CG2 – by 2.23 times, respectively. The range of the long jump from a place increased in the experimental group EG2 by 7.6 cm, in the control group CG2 – by 3.8 cm. During the pedagogical experiment, the boys of the experimental EG2 and control CG2 groups with an average level of health and physical fitness showed growth rates in flexibility. If the average value of the tilt of the torso forward from a sitting position before the beginning of physical education classes was 10.28 cm in the experimental group EG2, and at the end of the pedagogical experiment it was 14.42 cm, then in the control group CG2 – 10.1 cm and 13.12 cm, respectively. The analysis of the obtained results of motor tests of the boys of the experimental EG2 and control CG2 groups at the end of the pedagogical experiment showed that the average values of physical fitness improved.

The girls of the experimental group EG2 showed an improvement in the results of the 2000 m run from 12.44 min at the beginning of the experiment to 11.10 min after its end; in swimming for 12 min – from 245 m at the beginning of the experiment to 271 m after its end; in the 100 m run – from 17.9 s at the

beginning of the experiment to 16.7 s after it, in shuttle run 4x9 m – from 12.04 s at the beginning of the experiment to 11.44 s at the end (Table 4). Girls of the control group CG2 improved the results of the 2000 m run from 12.15 min at the beginning of the experiment to 11.29 min after it; in swimming for 12 min – from 220 m at the beginning of the experiment to 238 m at the end; in 100 m run – from 18.1 s at the beginning of the experiment to 17.5 s at the end; in shuttle run 4x9 m – from 11.94 s at the beginning of the experiment to 11.49 s at the end.

**Table 4.** Dynamics of indicators of physical fitness of girls with an average level of physical fitness during the period of pedagogical experiment

Tests	Groups	Before the experiment	After the experiment	Changes during the year	Significance of the difference	
		$\bar{X} \pm m$	$\bar{X} \pm m$	$\Delta X$	t	p
2000 m run, min	EG2	12.44±0.2	11.10±0.17	1.34	2.46	<0.05
	CG2	12.15±0.14	11.29±0.07	1.26	2.28	<0.05
Swimming for 12 min, m	EG2	245±1.4	271±1.5	26	2.57	<0.05
	CG2	220±1.6	238±1.2	18	2.31	<0.05
Flexion and extension of the arms in a supine position, times	EG2	8.0±1.2	13.3±0.73	5.3	3.78	<0.001
	CG2	7.8±0.86	11.8±0.8	4.0	2.96	<0.05
Hanging on bent arms, s	EG2	3.05±0.8	6.2±1.75	3.15	3.68	<0.001
	CG2	2.86±1.05	5.45±1.84	2.59	2.19	<0.05
Lifting the torso to the sitting position for 1 min, times	EG2	17.06±2.1	39.94±1.75	22.88	2.87	<0.01
	CG2	16.89±2.25	38.63±1.89	21.74	2.12	>0.05
Long jump from a place, cm	EG2	166.5±2.9	173.1±2.5	6.6	2.58	<0.05
	CG2	166.2±2.56	169.5±2.36	3.3	1.73	>0.05
100 m run, s	EG2	17.9±0.21	16.7±0.24	1.2	3.07	<0.001
	CG2	18.1±0.32	17.5±0.22	0.6	2.43	<0.01
Shuttle run 4x9 m, s	EG2	12.04±0.3	11.44±0.13	0.6	2.99	<0.01
	CG2	11.94±0.32	11.49±0.28	0.45	2.61	<0.05
Tilt the torso forward from a sitting position, cm	EG2	12.12±1.30	14.23±0.63	2.11	2.23	<0.05
	CG2	11.89±0.83	13.47±0.74	1.58	1.85	>0.05

According to the results of hanging on bent arms, flexion and extension of the arms in a supine position, lifting the torso to sitting position for 1 min, long jump from a place we determined the level of development of strength qualities in girls. Strength training is important for conducting physical education classes using powerlifting, since it is power that is the integral physical quality on which the manifestation of all other physical qualities depends to one degree or another. Powerlifting is characterized by such basic qualities as simplicity, accessibility and efficiency, which contributes to the effectiveness of training and extracurricular activities.

During the following exercises girls of the experimental group EG2 improved their results in hanging on bent arms by 3.15 s, and from control group CG2 by 2.59 s; flexion and extension of the arms in a supine position the girls of the experimental group EG2 improved their result by 5.3 times, and the control group CG2 by 4.0 times; lifting the torso to sitting position for 1 min – girls of the experimental group EG2 improved their results by 22.88 times, and the control group CG2 by 21.74 times, respectively. The range of the long jump from the place increased in the girls of the experimental group EG2 by 6.6 cm, the control group CG2 by 3.3 cm. During the pedagogical experiment in the experimental EG2 and control CG2 groups the rates of growth in indicators of flexibility were noted. If the average value of the tilt of the torso forward from a sitting position before the physical education classes was 12.12 cm in the girls of the experimental group EG2, and at the end of the pedagogical experiment it was 14.23 cm, then in control group CG2 it was 11.89 cm and 13.47 cm, respectively. The obtained results of tests of girls of experimental EG2 and control CG2 groups at the end of pedagogical experiment testified to significant improvement of results at students of experimental groups.

The indicators of students of experimental EG3 and control CG3 groups with a low level of physical fitness are given in Table 5. The increase in results in the 3000 m run was 1.04 min in the boys of the EG3 and 1.27 min in the CG3; in swimming for 12 min – 22 m in the EG3 and 13 m in the CG3; in the 100 m run – 0.48 s in the EG3 and 0.27 s in CG3; in the shuttle run 4x9 m – 0.53 s in the EG3 and 0.31 s in the CG3, respectively.

**Table 5.** Dynamics of indicators of physical fitness of boys with a low level of physical fitness during the period of pedagogical experiment

Tests	Groups	Before the experiment	After the experiment	Changes during the year	Significance of the difference	
		X±m	X±m	ΔX	t	p
3000 m run, min	EG3	16.05±0.17	15.01±0.9	1.04	2.47	<0.05
	CG3	16.30±0.31	15.43±0.12	1.27	2.87	<0.05
Swimming for 12 min, m	EG3	298±1.2	320±1.6	22	2.68	<0.05
	CG3	292±1	305±1.4	13	2.31	<0.05
Flexion and extension of the arms in a supine position, times	EG3	20.58±0.9	24.64±0.78	4.06	3.12	<0.01
	CG3	20.04±1.15	23.11±1.06	3.07	2.11	>0.05
Pull-ups on the crossbar, times	EG3	4.66±0.44	9.08±0.51	4.42	3.67	<0.001
	CG3	4.47±0.56	8.39±0.61	3.92	2.74	<0.05
Lifting the torso to the sitting position for 1 min, times	EG3	29.84±1.50	32.56±1.12	2.72	3.05	<0.01
	CG3	29.86±1.12	31.34±0.96	1.48	2.03	>0.05
Long jump from a place, cm	EG3	199.8±1.90	206.3±1.40	6.5	2.18	<0.05
	CG3	197.4±1.75	200.2±1.6	2.8	1.79	>0.05
100 m run, s	EG3	15.48±0.09	15.0±0.06	0.48	2.13	<0.05
	CG3	15.37±0.05	15.1±0.05	0.27	1.67	<0.05
Shuttle run 4x9 m, s	EG3	10.20±0.03	9.67±0.52	0.53	2.70	<0.01
	CG3	10.45±0.04	10.14±0.36	0.31	2.28	<0.05
Tilt the torso forward from a sitting position, cm	EG3	7.87±0.56	10.21±0.72	2.34	2.82	<0.05
	CG3	8.08±0.68	9.36±0.79	1.28	1.93	>0.05

The results in pull-up on the crossbar of boys of the experimental group EG3 improved by 4.42 times, and of the control group CG3 – by 3.92 times. The indicators of flexion and extension of the arms in a supine position showed that in the experimental group EG3 they improved by 4.06 times, and in the control group CG3 – by 3.07 times. The results of lifting the torso to sitting position for 1 min in the experimental group EG3 improved by 2.72 times, in the control group CG3 – by 1.48 times; in long jump from a place in the EG3 increased by 6.5 cm, in the CG3 – by 2.8 cm. The change in the results of control tests in the experimental group EG3 was statistically significant at  $p < 0.05$ . The average indicators of torso tilts forward from a sitting position at the end of the pedagogical experiment in the experimental group EG3 increased by 2.34 cm and became equal to 10.21 cm, in the control group CG3 increased by 1.28 cm and became equal to 9.36 cm.

During the pedagogical experiment the positive dynamics of the level of physical fitness of girls with a low level of development of motor qualities is noted. Indicators of improvement of results of 2000 m run made 1.27 min at the EG3 and 0.32 min of CG3; in swimming for 12 min – 20 m in the EG3 and 12 m in the CG3; in 100 m run – 0.46 s in the EG3 and 0.25 s in the CG3; in shuttle run 4x9 m – 0.37 s in the EG3 and 0.23 s in the CG3. Indicators of hanging on bent arms in girls of the experimental group EG3 improved by 0.51 s, and in the control group CG3 – by 0.4 s. Regarding the Flexion and extension of the arms in a supine position, we have the following data: in the EG3 the indicator improved by 2.1 times, and in the CG3 – by 1.7 times. Similarly, there were changes for the better in other tests to assess the physical fitness of girls with low levels of physical fitness (Table 6).



**Table 6.** Dynamics of indicators of physical fitness of girls with a low level of physical fitness during the period of pedagogical experiment

Tests	Groups	Before the experiment	After the experiment	Changes during the year	Significance of the difference	
		X±m	X±m	ΔX	t	p
2000 m run, min	EG2	13.1±0.25	12.23±0.18	1.27	2.38	<0.05
	CG2	13.24±0.14	12.92±0.11	0.32	2.17	<0.05
Swimming for 12 min, m	EG2	195±1.4	215±1.2	20	2.25	<0.05
	CG2	175±1.2	187±1.8	12	2.16	<0.05
Flexion and extension of the arms in a supine position, times	EG2	4.2±0.56	6.3±0.82	2.1	3.47	<0.001
	CG2	3.9±0.73	5.6±0.68	1.7	2.06	>0.05
Hanging on bent arms, s	EG2	2.42±0.74	2.93±1.43	0.51	3.89	<0.001
	CG2	1.5±0.61	1.9±1.93	0.4	1.87	>0.05
Lifting the torso to the sitting position for 1 min, times	EG2	12.1±1.8	21.73±1.42	9.63	2.84	<0.01
	CG2	11.8±1.15	20.7±1.24	8.90	2.36	<0.05
Long jump from a place, cm	EG2	150.9±2.75	157.1±3.20	6.2	2.23	<0.05
	CG2	148.8±2.64	151.0±2.97	2.2	1.58	>0.05
100 m run, s	EG2	20.1±0.17	19.64±0.19	0.46	2.32	<0.05
	CG2	21.0±0.34	20.75±0.19	0.25	1.84	>0.05
Shuttle run 4x9 m, s	EG2	12.29±0.21	11.92±0.15	0.37	2.25	<0.05
	CG2	12.85±0.33	12.62±0.42	0.23	1.83	>0.05
Tilt the torso forward from a sitting position, cm	EG2	8.3±1.54	11.1±0.43	2.78	2.38	<0.05
	CG2	8.1±0.67	10.2±0.52	2.10	1.93	>0.05

According to the authors' method on physical education for boys and girls of experimental groups EG1, EG2, EG3 with high, above average, and low level of health and physical fitness statistically significantly ( $p < 0.05-0.001$ ) improved performance in most tests: 3000 m run for boys and 2000 m run for girls; swimming for 12 minutes; flexion and extension of the arms in a supine position; pull-ups on the crossbar for boys and hanging on bent arms for girls; lifting the torso to sitting position for 1 min; long jump from a place; 100 m run and 4x9 m shuttle run; tilt the torso forward from a sitting position. In the control groups CG1, CG2, CG3 statistically significant improvements in test results occurred in the 3000 m run among boys and in the 2000 m run among girls; swimming for 12 minutes; 100 m run and 4x9 m shuttle run ( $p < 0.05-0.001$ ).

Summarizing the above it can be argued that the effectiveness of powerlifting exercises is closely related to the effectiveness of other test exercises. This may indicate that training and extracurricular powerlifting classes in combination with cardio increase the level of maximum strength of the main muscle groups of boys and girls, resulting in an improvement in the level of general physical fitness of students.

Studies [1, 3, 5, 27] have shown that physical activity, physical fitness and health of students of higher educational institutions are at a fairly low level. Deficiency of motor activity of students can be compensated only by a complex combination of educational and extracurricular activities, which will contribute to achieving the desired result in physical education classes [28, 29]. The preference for this method of solving this problem is due to the fact that extracurricular activities can increase the time of exercise, in combination with training sessions, provide optimal continuity and effectiveness of physical education.

Analysis of the level of physical fitness of students engaged in the traditional curriculum in physical education, revealed the preservation of the results of control tests at a low level. In the future, the negative dynamics of the development of physical qualities, deterioration of physiological parameters, the level of mastery of special skills and abilities of students of all courses were clearly traced. Therefore, we can agree with the opinion of many scientists [6, 20, 27] that the teaching methods used today in the organization of physical education in higher educational institutions are not effective enough to ensure the proper level of physical fitness of the students. Among the reasons can be noted: insufficient level of formation of theoretical and methodological knowledge, motor activity, somatic health, general and special physical fitness in the

routine of educational activity.

#### 4. Conclusions

The developed method of formation of special abilities and skills of students during the powerlifting classes has realized the basic methodical provisions of the organization of educational process of physical education. The use of tests and standards for the assessment of physical fitness allowed to organize a formative pedagogical experiment on the basis of three groups of students: with high, average and low level of health, physical fitness and the level of formation of special skills and abilities. Ensuring the effectiveness of powerlifting classes with students was based on the algorithm of the method of forming special skills and abilities. This allowed achieving compliance between the factors of pedagogical influence, the rational use of various methods, forms and means in the process of powerlifting.

The effectiveness of powerlifting classes depended on planning the optimal amount of load, duration, intensity and frequency of training sessions, taking into account the individual physical capabilities of the body, selection of optimal means and methods of development of strength qualities, motivational aspirations and physical culture and sports interests of students (lose weight, increase muscle volume, increase performance in your chosen sport, etc.). Load regulation during training is based on heart rate control.

The basis of the content of the method of development of physical qualities by means of powerlifting became the sets of exercises developed for students with high, average and low health, physical fitness level and the level of formation of special skills and abilities. The effectiveness of the developed method for the development of physical qualities by means of powerlifting was established on the basis of the dynamics of indicators included in the normative table of physical development, functional training and the level of formation of special skills and abilities of students.

Powerlifting classes had a positive effect on students (boys and girls) of all typological groups. However, the degree of influence on different body systems and motor readiness was ambiguous, which confirms the hypothesis of individualization of learning while conducting classes with students. The positive dynamics of improving the level of health, functional training and the formation of special skills and abilities after the training sessions confirms their effectiveness in improving the general and special physical fitness of students engaged in powerlifting.

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