

**INFLUENCE OF CROSSFIT EXERCISES ON THE POWER ABILITIES OF
HIGH SCHOOL PUPILS**

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Purpose: to determine the influence of CrossFit exercises on the power abilities of high school-age children.

Materials and methods: theoretical analysis and generalization of scientific and methodological literature, pedagogical testing, pedagogical experiment, and methods of mathematical statistics. Such tests as the lifting of straight legs hanging (number of times); bending and extension of hands lying on the floor (number of times); triple jump on the right and left leg (m) were used to determine the level of the strength development of the 10th–11th-grade pupils. The studied results were compared to norms and evaluated with a certain number of points. Statistical analysis: the research materials were processed using the licensed program Excel. The study involved 113 schoolchildren in grades 10-11.

Results: at the beginning of the school year, we conducted the stating experiment, according to the results of which it was established below the average level of development of power abilities in high school pupils. According to the results of the primary research, pupils were assigned to the main and control groups for further conducting the forming experiment. Pupils of control groups were engaged only in the generally accepted state program on physical education for the 10th–11th grades of general secondary education institutions, and the educational process on

physical education of pupils of the main groups was supplemented by the variant module “CrossFit” developed by us. According to the results of researches obtained after the introduction of the experimental technique into the educational process for physical education, it was determined that in schoolchildren of the main groups, the level of development of power abilities increased from below average to above average. Changes weren't found on the score scale in the test control groups. In the age aspect, there is mainly an improvement in results with age, both in the main and control groups ($p > 0,05$). In the gender aspect, it was revealed, mainly, the reliable primacy of the data of boys over the indicators of girls ($p < 0,05 - 0,001$).

Conclusions: significant positive changes were revealed in the indicators of the level of the strength development of the 10th–11th-grade pupils of the main groups, after using the experimental technique proposed by us in the educational process on physical education.

Keywords: variable module, CrossFit, high school pupils, power, physical culture lessons, motor activity.

Introduction

The problem of deterioration of the state of health and decrease in the level of motor preparedness of pupils was on a number of priority problems of the national level [8]. Numerical research [1; 2; 4; 20] determined that most often the cause of various abnormalities in the health of children and adolescents is insufficient motor activity, which progresses every year. Therefore, today the most urgent task of our country is to increase the movement activity of pupils as a foundation for maintaining health and increasing the level of physical fitness [15].

Scientific research [3; 5; 14; 22] proved that physical training and sports contribute to the improvement of the physical and functional state of the body of children of different school ages. However, according to a number of experts [1; 6; 8; 9], it is determined that the modern lesson of physical culture not only doesn't compensate for the deficit of motor activity but also is not effective enough for pupils

of different school age. The main reasons for this problem are the uniformity of the educational material, a decrease in pupils' interest in physical education, insufficient awareness, and limited access of teachers to modern trends in physical education [1; 9; 10]. That is why; the priority issue of today is the modernization of the educational process of physical education, due to the inclusion of innovative sports in the system of school physical education.

A number of leading specialists in the field of physical culture and sports were engaged in the problem of improving the educational process of physical education, through the introduction of new, innovative types of motor activity, as a result of which there is an increase in the level of physical preparedness of pupils, in particular, the development of strength abilities [1; 2; 4; 8; 10; 13]. It is known that force is an integral motor quality, on which the manifestation of all other motor abilities depends, which indicates the great importance of its purposeful upbringing [17]. Particular attention in this aspect should be paid to older children of school age since the sensitive period of development of strength falls at the age of 15–18 years. At this age, the intense increase in strength can be explained by an increase in muscle mass, puberty, an increase in the rate of muscle contraction to a long static tension [18].

Numerous studies of leading specialists proved the improvement of the level of development of strength under the influence of classes of various types of motor activity. So, scientists T.M. Kravchuk, T.V. Karpunets, I. V. Stepanenko [5], indicate that the introduction of functional exercises in the main part of the lesson contributed to a significant improvement in the strength abilities of high school pupils; T.I. Suvorova, M.S. Moroz, A.H. Karabanov [14], note that under the influence of athletic gymnastics, the level of development of strength in high school pupils significantly improved; L. Horbunov [3], shows that boys and girls of the 10th grade have a tendency to improve the level of development of power under the influence of health tourism; I. M. Skrypka, S.V. Cheridnichenko, M.O. Lysiak [13] showed positive dynamics of the level of development of power capabilities among 16–17-year-old boys after the introduction into the training process of the developed

program of power direction. It should be noted that the available scientific and methodological literature doesn't reveal scientific papers that would raise questions about the impact of CrossFit exercises on the level of development of high school pupils, which justified the feasibility of our research.

In Ukraine, CrossFit every day becomes very popular among people of all ages, including pupils. Its uniqueness lies in variability, a wide range of effects on the basic systems of the body, the combination of exercises from different sports [19; 21; 23; 24].

Thus, we believe that the use of CrossFit in the educational process of physical education is appropriate and timely; because it will optimize the content of the lesson of physical culture, make it more modern, interesting, and effective.

The purpose of the research is to determine the influence of CrossFit exercises on the power abilities of high school-age children.

Connection of work with scientific programs, plans, topics. The research was conducted according to the Thematic Plan of the Research Work of Kharkiv state academy of physical culture for 2015–2020 on the topic “Improving the process of physical education in educational institutions of different profiles” (number of state registration 0115U006754) and for 2020–2026 “Improving the process of physical education of different segments of the population” (state registration number 0120U101110).

Material and Methods of research

The following methods were used during the experiment: theoretical analysis of scientific and methodological literature on this problem; testing, experiment (pedagogical), and methods of mathematical statistics.

The level of development of the strength of the 10th–11th grade pupils was determined by tests proposed by L.P. Serhiienko [12] and V.A. Romanenko [11], namely: the lifting of straight legs hanging (number of times); bending and extension of hands lying on the floor (number of times); triple jump on the right and left leg (m).

Statistical analysis: research materials were processed using the licensed program Excel. Calculated: arithmetic mean of variation series (\bar{x}); error of representativeness (m) and reliability of differences (p) in order to establish homogeneity of control and main groups, degree of difference of indicators in the age aspect, and change of mean values of the studied parameters after the experiment using the parametric Student criterion (t) at the level of significance not lower than 0,05.

The research was conducted on the basis of secondary schools № 146 and № 57 in Kharkiv during the academic year. 113 pupils aged 16–17 took part in it, of which 2 main and 2 control groups were formed. The main groups included 59 pupils: the first group - boys and girls 16 years (n=27), the second group - boys and girls 17 years (n=32); the control groups included 54 pupils: the first group - boys and girls 16 years (n=21) and the second group - boys and girls 17 years (n=33). All children who took part in the research were referred to the main and preparatory medical group, were practically healthy, and were under the supervision of a school doctor. The parents of all pupils agreed to participate in the pedagogical experiment.

In the course of the research, pupils of control groups were engaged in the generally accepted state program on physical culture, and the educational process for physical education of pupils of the main groups was supplemented by the variable module “CrossFit” developed by us. CrossFit classes were held twice a week. The content of which included theoretical information, special physical training (elements of gymnastics, light and weightlifting, weight sports, general development exercises), and technical training (specially selected CrossFit exercises “Burpee”, “Box Jump”, “Farmer’s Walk”, “Burpee bench jump”, etc. After the development of the "Crossfit" module, pupils performed a set of exercises in lightweight conditions, which consisted of special and technical elements of CrossFit in different modes of operation (EMOM, AMRAP, AFAP, Tabata, Chipper) and with a specified number of rounds [16].

Results of the research

Considering the indicators of the level of development of force obtained as a result of the statement experiment (Table. 1), the absence of reliable differences between the results of the investigated groups on all parameters ($p > 0,05$) was found.

Table 1

Comparison of development indicators of power abilities of pupils of the main and control groups before the experiment

Grades		Groups				t	p
		n	Main groups	n	Control groups		
Sex		Indicators $\bar{X} \pm m$					
Lifting of straight legs hanging (number of times)							
10 grade	Boys	17	14,35±1,74	10	12,90±1,26	0,68	>0,05
	Girls	12	7,83±1,93	11	7,27±1,44	0,23	>0,05
11 grade	Boys	10	16,00±2,35	17	14,76±0,83	0,50	>0,05
	Girls	22	9,86±0,99	16	9,31±1,41	0,32	>0,05
Bending and extension of hands lying on the floor (number of times)							
10 grade	Boys	17	27,47±2,10	10	27,60±3,82	0,03	>0,05
	Girls	12	8,50±1,68	11	9,82±1,35	0,61	>0,05
11 grade	Boys	10	30,70±2,54	17	31,76±2,46	0,30	>0,05
	Girls	22	11,50±1,28	16	12,06±0,99	0,35	>0,05
Triple jump on the right and left leg (cm)							
10 grade	Boys	17	5,63±0,15	10	5,33±0,30	0,89	>0,05
	Girls	12	3,94±0,17	11	3,65±0,17	1,24	>0,05
11 grade	Boys	10	5,71±0,21	17	5,64±0,20	0,25	>0,05
	Girls	22	4,96±1,13	16	4,94±0,18	0,02	>0,05

In the age aspect, the improvement of data with age in pupils of both studied groups is established, but these distinctions are inaccurate ($p > 0,05$). It should be noted that the true nature of the differences is observed only by the results of a triple jump on the right and left leg in girls of control groups ($p < 0,001$). Comparing the indicators for the article revealed, basically, a reliable prevalence of boys data, over the results of girls ($p < 0,05-0,001$).

Determining the general level of development of power abilities to conduct a pedagogical experiment, it is established that for the 10th–11th-grade pupils, both groups, the results correspond to below the average level.

After applying the variation module “CrossFit” in the educational process of physical education, a significant improvement in all the parameters studied, both in boys and girls of the main groups, and these distinctions are reliable ($p < 0,05 - 0,001$). Thus, the increase in results reflecting the level of development of the maximum dynamic strength of abdominal muscles in the 10th-grade boys was - 24,5%, the 11th-grade - 23,7%; in girls, respectively - 55,3% and 43,3%; maximum strength - for the 10th grade boys is 27,8%, the 11th-grade - 17,9%; in girls - 44,1% and 30,8% respectively; speed power - for the 10th-grade boys is 6,6%, the 11th-grade - 9,4%; in girls, 20,5% and 46,7% respectively.

The analysis of secondary data by age and gender in pupils of the main groups found that basically, the trend of discrepancies remained unchanged compared to the initial results. By examining the pupils of control groups after the experiment, it was found that they also improved somewhat, but these changes are insignificant or reliable ($p > 0,05$). Thus, the increase in results varied from 0,3% to 10,1%. It should be noted that there are no changes in age and gender compared to the original data.

Table 2

Comparison of development indicators of power abilities of pupils of main and control groups after the experiment

Grades Sex		Groups				t	p
		n	Main groups	n	Control groups		
		Indicators $\bar{x} \pm m$					
Lifting of straight legs hanging (number of times)							
10 grade	Boys	17	17,88±2,11	10	13,70±1,34	1,67	>0,05
	Girls	12	12,17±2,06	11	7,91±1,31	1,74	>0,05
11 grade	Boys	10	19,80±1,53	17	15,12±0,86	2,67	<0,05
	Girls	22	14,14±0,93	16	10,19±1,25	2,54	<0,05
Bending and extension of hands lying on the floor (number of times)							
10 grade	Boys	17	35,12±1,56	10	27,80±3,78	1,79	>0,05
	Girls	12	12,25±1,69	11	10,82±1,45	0,64	>0,05
11 grade	Boys	10	36,20±2,00	17	32,94±2,54	1,01	>0,05
	Girls	22	15,05±1,20	16	12,38±1,00	1,71	>0,05
Triple jump on the right and left leg (cm)							
10 rade	Boys	17	6,01±0,13	10	5,42±0,29	1,83	>0,05
	Girls	12	4,75±0,18	11	3,79±0,20	3,62	<0,01
11 grade	Boys	10	6,25±0,18	17	5,65±0,20	2,20	<0,05
	Girls	22	7,27±0,16	16	4,97±0,17	9,74	<0,001

Comparing the data obtained by pupils of the main and control groups (Table 2) after the introduction of CrossFit exercises, we found that the results of pupils of the main groups are better than those of pupils of control groups. It should be noted that the true nature of the differences is traced by the indicators of the lifting of straight legs hanging of the 11th-grade pupils ($p < 0,05$); triple jump on the right and left leg in the 10th-grade girls ($p < 0,01$) and the 11th-grade pupils ($p < 0,05$; 0,001).

By establishing the general level of development of power abilities, after applying the variable module “CrossFit” in the system of school physical education, it is determined that the data improved from below average to above average in the 10th–11th-grade pupils of the main groups. It should be noted that the indicators of pupils of control groups didn’t change significantly and correspond, as at the beginning of the research below the average level.

Therefore, the above indicates that the introduction of CrossFit exercises in the educational process of physical education positively influenced the level of development of strength of pupils of older school-age of the main groups.

Conclusions / Discussion

According to the results of the research, it is established that after the introduction into the educational process of physical education of the experimental program, there is a significant improvement in the level of development of power abilities of high school pupils. Thus, reliable changes are traced to all the parameters studied, both in boys and in girls of the main groups ($p < 0,05$; 0,001).

The obtained by us results are consistent with the data of H.M. Shamardina (2007), B.M. Shyian (2009), Yu. Kuramshin (2010), shows that the highest rates of increase in absolute strength, according to the nine main muscle groups are noted in boys from 13–14 and 16–18 years-old, in girls from 10-11 and 16–17-years-old. The relative strength indicators of especially significant rates increase in of 9–11 and 16–17-year-old children.

These are supplemented by numerous works, leading specialists, according to which there is an improvement in the level of development of strength in high school children under the influence of classes of various types of motor activity. So,

scientists T.M. Kravchuk, T.V. Karpunets, I. V. Stepanenko (2019), indicate that the introduction of functional exercises in the main part of the lesson contributed to a significant improvement in the strength abilities of high school pupils; T.I. Suvorova, M.S. Moroz, A.H. Karabanov (2011), note that under the influence of athletic gymnastics, the level of development of strength in high school pupils significantly improved; L. Horbunov (2016), shows that boys and girls of the 10th grade have a tendency to improve the level of development of power under the influence of health tourism; I. M. Skrypka, S.V. Cheridnichenko, M.O. Lysiak (2018) showed positive dynamics of the level of development of power capabilities among 16–17 year old boys after the introduction of the developed program of power direction into the training process.

Considering the level of development of pupils of control groups obtained after the experiment, it is determined that they also improved somewhat, but these changes are less significant than in the experimental groups and inaccurate ($p > 0,05$).

So, our studies indicate the positive impact of the proposed CrossFit exercises on the level of development of strength abilities of the 10th–11th-grade pupils, which makes it possible to recommend teachers of physical culture to introduce a variable module “CrossFit” into the educational process of physical education of high school pupils.

Prospects for further research in this area can be carried out by determining the level of physical preparedness of high school pupils under the influence of CrossFit exercises.

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