

*Original article***Development of physical qualities of athletes aged 9-11**Georgiy Georgievich Polevoy^{1,2*}**Abstract**

Background: Great importance is paid to the physical development of school children, the positive influence of physical culture for the growth and development of children has been proven. At the same time, indicators in sports schools are falling due to insufficient development of physical qualities. The problem requires studying and improving the training process of athletes. **The aim of the study:** To increase the effectiveness of the training process of athletes aged 9-11 years due to the development of certain motor qualities. **Study design:** Pedagogical experiment. **Research methods:** The pedagogical experiment was conducted on the basis of the Olympic Reserve School number 1 (Kirov, Russia) from August to November 2022. The study involved children aged 9-11 years. 2 groups were formed: experimental and control consisting of 25 boys each. Classes were held 3 times a week. Children from the control group were engaged in the usual program, and children from the experimental group performed exercises to develop physical qualities. The complex was used for 10 weeks. Tests that were used in the study: Long jump from a place, Shuttle run 3 x 10m, Squats for 30 seconds, Hand strength, Leaning forward from a sitting position. **Results:** After the study, the experimental group was ahead of the control group in almost all indicators. In the long jump test, the difference between the experimental and control groups was 2.3cm (P<0.05). In the test, the shuttle run is 3x10m, the difference is 0.5 sec (P<0.05). In the "Squat for 30 seconds" test, the difference is 1.6 squats (P<0.05). In the test, the brush strength is 2 kg difference (P<0.05). There is no difference in the forward tilt test at the end of the experiment (P>0.05). Comparison of the results of the children of the control and experimental groups at the end of the pedagogical experiment indicates the superiority of the children of the experimental group. Thus, analyzing the results of testing the physical fitness of athletes aged 9-11, we can talk about the positive impact of the methodology proposed during the pedagogical experiment for the development of physical qualities of younger athletes **Conclusion:** If a set of exercises aimed at developing physical qualities is purposefully applied in sports schools in working with children aged 9-11 years, then the indicators of children will improve significantly. This will increase the efficiency of the training process.

Keywords: athletics; physical education; physical development; hypokinesia; health of school children.

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Introduction:

The importance of physical culture in the school period of a person's life is to create a foundation for comprehensive physical development, health promotion, and the formation of various motor skills and abilities. All this leads to the emergence of objective prerequisites for the harmonious development of the individual^{1,2}. The full development of school-age children without active physical activities is practically unattainable. It was revealed that the lack of motor activity seriously worsens the health of the growing human body, weakens its defenses, does not provide full-fledged physical development. Restriction of motor

activity (hypokinesia) contradicts the biological laws of human development, negatively affects the activity of its morphological and functional systems, the development of intelligence, leads to a decrease in the body's resistance to various adverse environmental factors. With hypokinesia, a complex of polymorphic disorders occurs, which extend to the functions of blood circulation, respiration, and metabolic processes. In children and adolescents, the consequence of hypokinesia may be overweight. Hypokinesia leads to functional changes: cardiac and vascular diseases, circulatory insufficiency, coronary insufficiency, peripheral arterial circulation disorders, thrombosis, pulmonary diseases; changes

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in metabolic processes, diabetes, as well as bone density disorders and joint diseases (various variants). Common to all of the above symptoms is that they can be treated, and in some cases, prevented by exercise training^{3,4}.

An analysis of the literature indicates that significant changes in the morphological and functional order occur during physical activity, while the nature of their influence is not unambiguous for different body systems and is not the same in different periods of ontogenesis^{5,6,7}. Thus, it becomes obvious that physical activity can be used as a regulator and stimulator of morphological and functional development in human ontogenesis.

Unfortunately, many parents do not understand the health-improving importance of physical culture and sports, do not pay due attention to the physical education of children. Therefore, the task of physical education teachers and trainers is to explain the positive impact of physical culture on the health and physical development of children. As practice shows, children with an increased motor regime, that is, actively engaged in physical culture and sports, do better than their peers in secondary school. In addition, schoolchildren who are actively engaged in physical exercises have increased resistance to colds^{2,8,9}.

Observing the formation of the body for a number of years, we are usually interested in the state of their health, physical development and physical fitness, fixing it with appropriate indicators. The complex of these indicators creates a complete picture of the body of children.¹⁰

The degree of development of physical qualities of children determines the qualitative side of their motor activity, the level of their general physical fitness. Combining physical education with general physical training, we thereby carry out a process of comprehensive physical training, which has great health-improving value.

Usually, developing physical qualities, we improve the functions of the body, mastering certain motor skills. In general, this process is unified, interconnected, and the high development of physical qualities contributes to the successful development of motor skills^{1,11,12}.

For example, the better a teenager's speed is developed, the faster he will run short distances, drive the ball faster while playing football, move faster in any other games, that is, a high level of

speed development will have a positive effect on the performance of specific physical exercises. The same can be said about the development of strength and endurance. Therefore, it is necessary to develop these qualities first of all in terms of general physical fitness, using the appropriate most effective means for this purpose.

At a younger age, with intensive body growth, the use of exercises that promote muscle mass building is ineffective and therefore impractical, since the indicators of strength abilities are small. The relative strength increases most intensively in children from 9 to 11 years old^{13,14}.

With the development of speed at a younger age, they affect the speed of motor reaction, individual movements and the ability to increase their pace without burdening. For this purpose, various exercises are used that require a quick motor reaction to a predetermined signal. To develop high-speed capabilities, it is preferable to use natural movements in non-standard variants. Repeated standard repetition of exercises at maximum speed can lead to the emergence of a speed barrier, even at primary school age. A variety of options for speed games are the most effective.

In young athletes, the manifestations of static and high-speed endurance are insignificant. However, it is necessary to pay attention to cyclical work at a moderate pace, taking into account the age and physical fitness of children. But most often and most appropriately, the development of endurance at this page is carried out during outdoor games^{15,16,17}.

In connection with the above, it seems relevant to study the effect of physical fitness on the body of younger athletes. Their health in the future life depends on how the process of physical education will be built correctly.

The aim of the study: to increase the effectiveness of the training process of athletes aged 9-11 years due to the development of certain motor qualities.

To achieve this goal, it is assumed that the following tasks will be solved:

1. Analyze the special literature related to the development of physical qualities of young children.
2. To develop an experimental methodology for the development of physical qualities of young children.
3. Experimentally test the effectiveness of the

influence of a specially developed methodology for the development of physical qualities in training sessions

Hypothesis. It is assumed that the use of special tools and methods aimed at the development of motor qualities will improve the training process for younger athletes.

Materials and methods:

The pedagogical experiment was conducted on the basis of the Olympic Reserve School number 1 (Kirov, Russia) from August to November 2022. The study involved children aged 9-11 years. 2 groups were formed: experimental (EG) and control (CG) consisting of 25 boys each. The complex was used for 10 weeks. Each lesson was conducted according to a generally accepted scheme consisting of three interrelated parts: preparatory (10-15 min), main (35-40 min), final (5-10 min). Classes were held 3 times a week. At the beginning of the classes, the functional preparation of the athletes' body for performing increased loads was carried out. The developed methodology was used in the main part of the lesson. It was given 15 minutes of the main part's time. This technique was tested on an experimental group. During the experiment, the control and experimental groups were engaged in accordance with the training plan of the sports school¹⁰. In the experimental group, an additional number of means were used to develop physical qualities.

For the purposeful development of physical qualities, it was proposed to perform 6-7 exercises during one lesson. Exercises for the development of flexibility were included both in the preparatory part to fulfill their intended purpose – to increase the amplitude in the joints, and in the final part for a more active course of rehabilitation processes in tired muscles.

For the development of speed and strength qualities:

1. Multi-jumps 3-4 series of 10 repulsions, rest between series 1-2 minutes (active). Perform in-line (back straight, follow the work of the hands, push forward-up, do not run).
2. Jumping over barriers 3-4 series, 8 barriers, rest 1-2 minutes (active), perform in-line (do not tilt your back forward)
3. Jumping on the mat with pulling up the knees to the chest 3 series of 10-15 jumps, rest for 1-2 minutes (try to jump as high as possible and pull up the knees to the chest as much as possible).

For the development of strength qualities:

1. Deep lunges forward 3-4 series at a distance of 15 meters (passive rest 1-2 min.). perform line-by-line (lunge deeper, back straight, hands on shoulders).
2. Squat on one leg with a hand on the wall 3-4 series of 10-15 squats on each leg (passive rest 1-2 minutes).
3. Flexion-extension of the trunk lying down, 3-4 series of 20 times, passive rest for 1-2 minutes (legs bent, hands behind the head)
4. Lifting-lowering of the legs on the gymnastic wall 3 series of 10-15 lifts, passive rest for 2 minutes (lift the legs to an angle of 90 degrees, without bending the knee joints).
5. Flexion-extension of the arms lying down 3-4 series of 10-15 times, passive rest for 2 minutes (trunk straight, look forward, bend your arms until your chest touches the floor).

For the development of speed of movement:

1. Shuttle run 3x10 m. 2-3 series, active rest until full recovery, perform 3-4 people using with an element of competition.
2. Running on the spot with a maximum frequency of 3 series of 10 seconds, active rest until full recovery (back straight, follow the work of the hands, lift the hip as high as possible).

To develop flexibility:

1. Body tilts to the right-left, forward-backward 3 series of 10-12 repetitions, passive rest for 1-2 minutes, method of instruction: try to achieve a greater amplitude of movement.
2. Deep lunges forward and to the sides 2-3 series of 10-15 repetitions, passive rest for 2 minutes
3. Foot swings 3-4 series of 10-12 repetitions, passive rest (perform swings with the greatest amplitude to slight pain).

Coordination exercises:

Running from various starting positions (sitting; lying on your back, stomach; from the prone position, crouching position, etc.). Perform 4 people 15-20 meters under a team using a competitive element, active rest for 2 minutes.

Before and after the experiment, the children passed the control standards:

1. Long jump from a place (speed and strength

qualities). The result is in centimeters (3 attempts), and the best result is recorded in the protocol¹⁰.

2. Shuttle running 3x10 m (speed and agility associated with changing the direction of movement). Two parallel lines are drawn in the hall at a distance of 10 m from each other. At the command "March!" the participant starts from the first line, runs to the second, crosses it and returns to the first. The time is detected with an accuracy of 0.1 seconds¹⁰.
3. Squats for 30 seconds (speed and strength qualities of the leg muscles). During the execution, the heels do not come off the support, the hands are brought forward. The maximum number of times that the participant will have time to complete within 30 seconds is estimated¹⁰.
4. Strength of the hand (static strength of the muscles of the hand and forearm). The participant presses the dynamometer with force. The results of the dynamometer are evaluated¹⁰.
5. Leaning forward from a sitting position (active flexibility of the spine and hip joints). Sitting on the floor, legs stretched out, feet vertically, the distance between the heels 20-30 cm; arms stretched forward. The partner presses his knees to the floor, does not allow bending his legs during bends. A ruler was used as a meter. Counting from the zero mark, located at the level of the heels. The participant performs 3 slow inclines first, the fourth is the main one. The results are counted by the fingertips. They are written with a "+" sign if the fingertips were behind the zero mark, and with a "-" sign if the fingers did not reach from it¹⁰.

Methods of mathematical statistics

The results of the study were processed using the Student's t-test.

The arithmetic mean (M), mean deviation (σ), Student's t-criterion were calculated. The obtained values of the criterion were compared with their boundary values at a 5% significance level. The differences were considered reliable at $P < 0.05$ ^{18,19}.

Ethical clearance:

This research was conducted in compliance with the needed research ethics. In addition, consent for participation was obtained from the participants before the beginning of their involvement in the study. All data were recorded and analyzed anonymously.

Results:

In the course of the work, the physical fitness of athletes aged 9-11 years was analyzed, for these 5 tests were conducted, which were processed by methods of mathematical statistics.

The physical fitness of the children reflected the degree of mastery of motor skills and the development of their physical qualities. The study of the indicators of physical fitness of children during the experiment was carried out twice. The digital material and its analysis helped to determine the rationality of the methodology used, the success of mastering the program material, to outline ways of further development and elimination of mistakes made.

Table 1 presents a comparative analysis of the indicators of physical fitness of younger athletes in the control and experimental groups before the experiment.

Table 1: Indicators of physical fitness of athletes aged 9-11 years before the experiment

Tests	Groups	Statistical indicators			
		M	σ	t	P
Long jump from a place	EG	140	1,84	0,92	P>0,05
	CG	139	3,07		
Shuttle run 3x10	EG	8,6	0,27	1,23	P>0,05
	CG	8,8	0,25		
Squat for 30 seconds.	EG	16,6	2,45	0,48	P>0,05
	CG	17	1,53		
Brush Power	EG	9,8	1,53	0,9	P>0,05
	CG	9,4	1,53		
Tilt forward	EG	3,8	0,34	1,75	P>0,05
	CG	3,6	0,21		

Table 1 shows that the differences between the groups at the beginning of the experiment are insignificant and unreliable ($P>0.05$).

Tables 2 and 3 show changes in the indicators of physical fitness of young athletes of the experimental and control groups over the period of the experiment.

Table 2: Changes in the indicators of physical fitness of schoolchildren in the experimental group during the period of the experiment

Tests	Groups	Statistical indicators			
		M	σ	t	P
Long jump from a place	Before	140	2,1	1,62	$P>0,05$
	After	142,6	1,8		
Shuttle run 3x10	Before	8,6	0,39	3,3	$P<0,05$
	After	8,0	0,33		
Squat for 30 seconds.	Before	16,6	2,45	3,5	$P<0,05$
	After	20,6	2,45		
Brush Power	Before	9,8	1,23	2,5	$P<0,05$
	After	13,3	1,53		
Tilt forward	Before	3,8	0,34	0,83	$P>0,05$
	After	3,9	0,24		

Table 2 shows that in the experimental group, absolutely all test indicators improved in a positive way, but not all test indicators turned out to be reliable. In the long jump test, the result increased by 2.6 cm ($P>0.05$). In the 3x10m shuttle run test,

the result improved by 0.6 sec ($P<0.05$). In the “Squat for 30 seconds” test, the result increased by 4 squats ($P<0.05$). In the brush strength test, the result improved by 3.5 kg ($P<0.05$). In the forward tilt test, the result increased by 0.1 cm ($P>0.05$).

Table 3: Changes in the indicators of physical fitness of schoolchildren in the control group during the period of the experiment

Tests	Groups	Statistical indicators			
		M	σ	t	P
Long jump from a place	Before	139	3,07	1,26	$P>0,05$
	After	140,3	1,84		
Shuttle run 3x10	Before	8,8	0,25	1,4	$P>0,05$
	After	8,5	0,18		
Squat for 30 seconds.	Before	17	1,53	4	$P<0,05$
	After	19	1,23		
Brush Power	Before	9,4	1,53	4,1	$P<0,05$
	After	11,3	2,15		
Tilt forward	Before	3,6	0,21	0,83	$P>0,05$
	After	3,9	0,21		

Table 3 shows that the test scores also improved, but not as much as in the experimental group. In the long jump test, the result increased by 2.3 cm ($P>0.05$). In the 3x10 m shuttle run test, the result improved by 0.3 sec ($P>0.05$). In the “Squat for 30 seconds” test, the result increased by 2 squats, the result is reliable ($P<0.05$). In the brush strength test, the result improved by 1.9 kg ($P<0.05$). In the forward tilt test, the result

increased by 0.3 cm ($P>0.05$).

The results obtained allow us to conclude that the proposed methodology showed more significant changes in the indicators of physical fitness of children from EG. Differences in the indicators of physical fitness of children of the control and experimental groups at the end of the study are significant for most indicators are reliable ($P<0.05$) (Table 4).

Table 4: Indicators of physical fitness of athletes aged 9-11 years after the experiment

Tests	Groups	Statistical indicators			
		M	σ	t	P
Long jump from a place	EG	142,6	1,8	3,09	P<0,05
	CG	140,3	1,84		
Shuttle run 3x10	EG	8,0	0,33	4,62	P<0,05
	CG	8,5	0,18		
Squat for 30 seconds.	EG	20,6	2,45	3,02	P<0,05
	CG	19,0	1,23		
Brush Power	EG	13,3	1,53	2,62	P<0,05
	CG	11,3	2,15		
Tilt forward	EG	3,9	0,24	0	P>0,05
	CG	3,9	0,21		

Table 4 shows that the experimental group at the end of the study is ahead of the control group in all indicators. In the long jump test, the difference between the experimental and control groups was 2.3 cm (P<0.05). In the test, the shuttle run is 3x10 m, the difference is 0.5 sec (P<0.05). In the "Squat for 30 seconds" test, the difference is 1.6 squats (P<0.05). In the test, the brush strength is 2 kg difference (P<0.05). There is no difference in the forward tilt test at the end of the experiment (P>0.05).

Comparison of the results of the children of the control and experimental groups at the end of the pedagogical experiment indicates the superiority of the children of the experimental group.

Thus, analyzing the results of testing the physical fitness of athletes aged 9-11, we can talk about the positive impact of the methodology proposed during the pedagogical experiment for the development of physical qualities of younger athletes.

Discussion:

The analysis of scientific and methodological literature has shown that the importance of physical culture in the school period of a person's life is to create a foundation for comprehensive physical development, health promotion, formation of various motor skills and abilities^{9,20,21}.

It should be noted the problem of hypokinesia, the solution of which can be the use of physical culture and physical exercises both in school lessons and in sports schools^{3,4,22}.

One of the most important stages for the development

of physical qualities is primary school age, namely 9-11 years. The positive dynamics of the development of physical abilities in this age range with targeted exposure was noted^{13,14}.

Based on this, a methodology was developed for the development of physical fitness of primary school children.

For the participants of the experimental group, during the experiment, almost all the test indicators have significant differences. This indicates the positive impact of the proposed methodology, in the course of a pedagogical experiment, for the development of physical qualities of children aged 9-11 years.

The children who studied according to the usual method in the control group were able to improve their performance, but the improvement was not significant, and the indicators lagged behind the children from the experimental group.

In the modern scientific world, a lot of attention is paid to the issues of health and physical education.^{23,24,25}

Physical educations at school plays an important role for the growth and development of the student's body.^{26,27,28} However, in some studies, methods and means of physical education are not disclosed objectively and clearly enough.^{29,30} Therefore, the topic is relevant and promising for further study.

Thus, we were able to solve the tasks set and achieve the research aim, since the experimental technique gave a significant positive effect

Conclusion:

If a set of exercises aimed at developing physical

qualities is purposefully applied in sports schools in working with children aged 9-11 years, then the indicators of children will improve significantly. This will increase the efficiency of the training process.

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Author's contribution:

Data gathering and idea owner of this study: Polevoy G.G.

Study design: Polevoy G.G.

Data gathering: Polevoy G.G.

Writing and submitting manuscript: Polevoy G.G.

Editing and approval of final draft: Polevoy G.G.

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