

## EDUCATION OF PHYSICAL QUALITIES OF SCHOOLCHILDREN

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### Abstract

The article discusses the relationship between the structural foundations of the development of physical qualities and progressive morphological and biochemical changes in the musculoskeletal system, central and peripheral nervous systems, and internal organs, as well as the methodology for educating the physical qualities of senior schoolchildren.

**Keywords:** Physical qualities, musculoskeletal system, education of physical qualities, general endurance.

### Introduction

Recently, world culture has developed under the strong influence of the achievements of Western science and technology, which determined the superiority of human Hippocratic views over many things in the world around him.

In search of the optimal level of motor activity, it is necessary to rely not only on age and gender norms, but also on deep knowledge of the specific characteristics of the organism.

Age-related developmental periods are determined based on the weight and size of the body and its organs, the degree of hardening of the bones of the skeleton, the appearance of teeth, the development of connective tissue in the endocrine glands, the characteristics of cortical activity and other signs.

The final conclusions of many studies have proven that traditional physical education classes in general secondary schools do not fully meet the requirements of the growing young organism due to the imperfection of the content, volume and intensity of the exercises, and the lack of consideration for the individual capabilities of students.\

## RESULTS AND DISCUSSION

The structural basis of the development of motor qualities is associated with progressive morphological and biochemical changes in the musculoskeletal system, central and peripheral nervous systems, and internal organs. Based on this, the level of development of physical qualities directly depends on the coordination of somatic and vegetative functions.

L.V. Volkov, V.P. Guba, R.N. Dorokhov, V.A. Bykov, I.V. Lyakh noted that the development of physical qualities in school-age children has age-specific characteristics, namely [3, 4, 5]:

- the development of various physical qualities occurs heterochronously;
- annual growth rates are not the same at different age periods and differ in their relative magnitude when comparing growth;
- in most children of junior and senior school age, indicators of physical qualities differ in their level (for example, strength, static endurance level, as a rule, do not coincide with the level of dynamic endurance);
- when given physical loads of the same volume and intensity, a special training conducted by one method allows comparing the data of children of different ages, genders and different physical development, while achieving different pedagogical effects;
- the level of development of physical qualities in adolescent athletes during the period of natural growth (sensitive periods) is much higher than the average level of development of the same qualities in children and adolescents who do not engage in sports;

The main tasks in the training of young athletes are to strengthen the health and comprehensive physical development of children, to implement a gradual goal-oriented transition to the chosen sport, to increase the level of mental preparation based on teaching the technique of the chosen sport, and to select promising young athletes for further training in the chosen sport.

On the issues of studying the movement functions, age-specific characteristics of young athletes and the development of their physical qualities, V.P. Filin, V.P. Guba, I.V. Lyakh, L.V. Volkov and many other specialists conducted scientific research. According to them, childhood is an important stage for many years of physical development and a favorable period for starting sports training [3, 4, 5, 8].

Good physical fitness is determined by the level of development of basic physical qualities and is the basis of high performance in all types of activities.

In the process of physical education, it is necessary to take into account the basic laws of the development of the child's organism and not treat the child as a small copy of an adult. The younger the child, the more unique his organism is, the more it differs from adults, and the process of his maturation is subject to certain laws.

The education of physical qualities in school-age children has a number of features associated with the development and growth of the organism:

- the development of one physical quality in adolescence and youth has a positive effect on the growth of other qualities, teachers are required to take an integrated approach to the education of physical qualities;
- the growth of physical qualities in the development of the organism occurs especially rapidly in some young people. These are called sensitive periods. For example, the highest growth rate for muscle strength is characteristic of 13-15 years old, 14 years old is the most favorable for developing endurance, and 8-11 years old is the most favorable for developing agility.

In the scientific works of a number of researchers, it is emphasized that it is necessary to take into account the age, gender and training of those involved in the selection of physical education tools.

The main type of activity of students is mental labor. The constant increase in the volume of information, the complexity of the curriculum requires a lot of time for lesson preparation, club activities and significantly limits motor activity. In such conditions, regular physical exercise is important, which helps to mobilize the functional capabilities of the body of children and adolescents. This involves restructuring not only the functions of individual organs and systems, but also their interaction. The child's age, gender and somatotype significantly affect the formation of physical performance in the process of ontogenesis.

The criterion of normal hormonal physical development is not the expression of each anthropometric sign, but their mutual expression, the mutual compatibility of their combined effects. This determines the proportionality and harmony of development.

The physical qualities of students are not formed evenly and simultaneously, growth is different at different age periods.

Although in the normal state of the organism the growth and development of qualities are in very close contact and cooperation with each other, they do not occur simultaneously and at the same speed, since the increase in the mass of any organ does not mean its simultaneous functional improvement.

Uneven growth, that is, the unevenness of the growth and development rates of internal organs and physiological systems in the organism, is manifested in the alternation of smooth and rapid periods of development. The period of elongation alternates with the period of rounding.

As a result of the lack of necessary conditions, growth and development stop, that is, the phenomenon of retardation occurs. For example, due to illness or other reasons, physical development may stop for a long time. Later, a lag in weight and height is formed, a specific type of constitution is formed (hypostature). The number of children with retardation has reached 13-20% in age groups, which is especially important to take into account when designing the educational process. In order to achieve good results in educating such children, it is necessary to carry out educational work in a uniform manner.

If the existing conditions accelerate the use of all the capabilities of the organism, rapid growth of the organism occurs - acceleration. Accelerations are common among adolescents. Such children make up an average of 13-20% of the total number of children of this age. They have a fairly high height, great muscle strength, Their characteristic features are the large capabilities of the respiratory system. Such children reach puberty much earlier, growth stops prematurely (usually at the age of 15-17), and, according to most scientists, mental development occurs somewhat faster. Unfortunately, the phenomenon of acceleration does not always have a positive effect on the functional capabilities of the organism. The development of the height and heart of accelerated children lags behind the growth of the body. This leads to impaired functioning. Such children absolutely need a special approach.

The different pace of biological maturation of school-age children creates special conditions for them in the process of physical education.

Heterochronism (development ahead of time) is well observed in the development of motor function. For example, the increase in muscle strength from 7 to 16 years is 260% and is most pronounced in the first 2-3 years after the puberty (Latin "sexual maturity") growth spurt. Boys reach this stage at the age of 18.

If we assume that the maximum muscle strength potential is 100%, then muscle strength in boys is 70% at the age of 13-14, 80% at the age of 15-16. And at the age of 17-18 it is about 90%.

Taking into account the age-specific characteristics of children, two main methods are used in strength training - the use of repetitive and dynamic loads. It is recommended to use exercises involving overcoming the resistance of various objects (stuffed balls, dumbbells, etc.), the resistance of a partner, the external environment, various weights, and personal weight.

Regular training accelerates the development of motor qualities, but their growth is different at different age periods. Morphologically more favorable conditions for the development of strength occur at the age of 9-10 and 14-17. Early exposure to strength training in children can lead to changes in their stature, as the skeleton is still forming at this age. The development of muscle strength depends on the type of muscle fibers (fast-twitch or slow-twitch). If there are many fast-twitch fibers in the muscles, then a person can develop maximum strength during intense force movements, while slow-twitch fibers allow muscle tension to be maintained for a long time.

Strength has the property of controlling muscle work and is closely related to the growth of bone and muscle tissue.

According to most authors, muscle strength naturally increases with age. During puberty, as a result of accelerated physical development, muscle strength indicators increase even more. According to the results of the study, in 13-14-year-olds, the biceps brachii, the flexor muscles of the hand, and the adductor muscle of the thumb reach greater values during dynamic work than in younger children (8-9 years old). The increase in muscle strength in various groups occurs much more rapidly in 13-14-year-old adolescents per kilogram of body weight than in 8-9-year-old children. One of the reasons for the increase in muscle strength in children is the increase in muscle mass in the body, that is, an increase in the transverse dimensions of the muscles. As it turned out, the differentiation of the neuromuscular apparatus plays an important role in the development of strength during this period. Muscle strength changes with age, but in various data cited by experts about age, its further increase is observed.

According to V.P. Filin, at the age of 10-14, absolute strength increases steadily, at the age of 15-16 it decreases, and at the age of 17 it increases significantly again. The periods of rapid growth of absolute and relative strength do not

coincide with each other. The opinions of specialists working with children and adolescents are divided regarding the possibilities of developing muscle strength. Other experts doubt the feasibility of systematically training muscle strength in schoolchildren. Numerous studies have proven the effectiveness of using strength exercises in preparing students for schoolwork [8]. At the age of 12-15, strength development is carried out mainly with the help of exercises performed with the participant's own body weight, weight balls, dumbbells, gymnastic shells. Various pebbles and a barbell are used as weights.

The development of endurance is of particular importance depending on age. Starting from the age of 12-14, the ability to continue tiring work without a decrease in strength appears, while increasing fatigue is compensated for by vegetative changes. Endurance continues to develop until the age of 20-30.

General endurance is a person's ability to perform unusual activities for a long time and successfully.

The manifestation of general endurance is based on the functional properties of the human body. They form a non-specific basis for the manifestation of endurance for various types of motor activity.

It is advisable to start the development of general endurance with the use of a continuous standardized training method. The optimal duration of exercise ranges from 20-30 minutes for physically fit individuals to several hours for highly trained athletes specializing in sports that require a high level of endurance.

The ability to resist fatigue in a number of activities is called endurance. Children of average development adapt faster to physical loads that develop endurance. Children of tall and short stature have difficulty adapting. A significant increase in the duration of work in anaerobic power exercises is observed from 10-12 years to 13-14 years.

The positive changes in the development of general endurance achieved with the help of cyclic exercises have a positive effect on the ability to work from movements that differ in structure. In other words, a high increase in endurance is observed with exercises performed in zones of small and large physiological intensity.

Like other physical abilities, the development of endurance is not uniform. At the age of 10-13 and 16, the endurance indicator increases significantly, and it is necessary to consistently influence the development of this quality from the junior school age. According to V. Nikitushkin, during the period of puberty in boys,



endurance does not increase in the anaerobic range of power, but significantly decreases. At the same time, the volume of work performed at a marginal intensity increases significantly in children aged 8-10, then stabilizes and increases again after 15 years. According to V.I. Lyakh, the growth of endurance has its own age dynamics. In children from 7 to 10-11 years, the results improve rapidly. By the age of 14-15, the results begin to stabilize [5, 6]. The main means of developing endurance are: sports performed at subcritical speeds, such as running, rowing, swimming, and cycling. Endurance levels can be achieved using continuous and intermittent exercise methods. For a uniform application of the method, exercises are performed at a constant speed, that is, 75-80% of the time is 20 minutes or more.

Ya.S. Weinbaum in his sources cited the fact that the duration of the loads aimed at developing general endurance for schoolchildren is more than 3 minutes, with the average BMR being around 140-160 beats per minute [2].

General endurance, provided by aerobic processes, according to V.L. Volkov, increases sharply in the period from 8 to 9 years, then remains at this level until about 11 years, then increases slightly and stabilizes at 14-15 years [3].

It is reflected in the ability of fast-strength muscles to quickly perform movements associated with overcoming relatively small external resistance.

In his scientific research conducted among 11-13 year old children, V.M. Volkov concluded that children of this age can withstand short-term rapid-force loads well [3]. As a result of his scientific research, N.A. Bernstein found that a significant increase in the maximum speed of running in 8-12-year-olds is determined by the natural development of speed of movement, and at 12-14 years old, the increase in running speed occurs mainly due to an increase in speed-power qualities and muscle strength. The author substantiated the fact that the movement analyzer matures at the age of 8-12, the formation of important locomotor acts of running occurs [1].

I.V. Lyakh developed the following methodological rules for performing exercises for developing speed qualities [5]:

- The exercise should not be complicated in terms of technique;
- The exercises should be well mastered by the participants;
- The duration of the exercises should be such that at the end of their execution speed does not decrease due to fatigue;

- The duration of speed exercises in children and adolescents should not exceed 16-17 seconds;
- The following exercises are performed in the recovery phase;
- before repeating speed exercises, it is necessary to use active rest, which can last 1-2 minutes;
- speed exercises are performed among the first in the training.

It is advisable to include sports games, relay races, movement games, exercises that develop strength and flexibility, various jumps, gymnastic and acrobatic exercises, running from low and high starts, long jumps in the training program for schoolchildren aged 12-13.

In the process of training speed, it is necessary to strive to maximize the speed of movements that do not require large muscle tension, to ensure the optimal amplitude of movements as much as possible, and to maximally relax muscle groups that are not involved in the work.

In the process of training speed, it is necessary to pay attention to muscle relaxation during the exercise. It is very important for the trainee to feel the difference between the tense and relaxed state of the muscles.

The age dynamics of the energy cost per meter of distance traveled when running at an average speed is of great interest. It has been noted that energy expenditure becomes more and more economical as the child grows older. This leads to an increase in the endurance of senior students.

With increasing age, the development of speed abilities occurs. Studies on heredity show that speed abilities are closely related to genotype factors. According to the authors, the speed of a simple motor reaction is determined by heredity in approximately 60-88% of cases. According to experts, various indicators of speed abilities significantly predict the children's motor talents at the initial stage of selecting them for one or another type of sports. When a child is at school, the development of speed abilities is not as pronounced as the development of strength and slows down with age. From 7 to 17 years old, indicators characterizing a person's speed improve by 20-60% or more. As in boys, in girls, the results improve more rapidly from 7 to 10 years old. By 14-15 years old, the results begin to stabilize.

Although the speed of short-distance running in adolescents continues to improve from 15 to 17 years old, it is not as fast as in previous years. There is a heterochrony in the changes in the main structural components of running, step



length and speed. Their contribution to the structure of the locomotor cycle of running at 7-8 years old is almost the same. At 9-10 years old, an increase in the frequency of running steps is observed. At 11-12 years old, the frequency of running steps decreases, and running speed increases due to an increase in step length.

Sexual differences in the level of development of agility skills are not significant until the age of 12-15. Later, sexual dimorphism becomes more pronounced in performance indicators. Along with the increase in the speed of movement with age, it has been proven that the time required to reach the maximum speed of movement is practically the same for all participants and is 6 seconds.

The constancy of this indicator indicates the uniformity of the characteristics of muscle contraction during individual development after birth.

The speed of movement is an important characteristic of agility. High-speed movement is characteristic of the movement of the arms and legs, and low-speed movement is characteristic of the ankle-heel joint. The increase in the speed of movement at different age periods is the same. The greatest increase is observed in children aged 4 to 6 years and 7 to 9 years. In later age periods, the growth rate decreases.

There are specific characteristics and forms of agility: the speed of movement reaction under the influence of simple or complex signals, the speed of a single movement, the speed of transition from one movement to another.

By the age of 13-14, the speed of individual movements increases, approaching that of adults, and by the age of 16-17, growth partially slows down.

The speed of movement reflects the acceleration properties of the whole organism. Sexual maturity and the level of physical development associated with it play an important role in the emergence of acceleration properties during puberty. By the age of 14-15, the growth of speed decreases. At the age of 10-11, for example, the frequency of running steps reaches its peak. At this age, adolescents are ahead of children aged 12-14.

There is enough information on the age-related changes in speed.

In young athletes, speed of movement is best developed at the age of 13-14. Although this advantage is still maintained in later years, the differences decrease. This indicates that a further increase in speed of movement is more effective at a young age.

A number of scientists recommend using the following to develop speed-strength qualities:

- 1) exercises designed to develop muscle strength and the speed of their contraction;
- 2) exercises aimed at developing speed-strength qualities;
- 3) exercises with a specific speed-strength feature (various jumping exercises).

Differences in the characteristics of the energetic provision of speed of movement also affect the analysis of the age-related development of speed-strength qualities in children and adolescents. Some researchers indicate that the development of speed-strength qualities is important at the age of 9-10, and some at the age of 13-14. The reasons for the differences in the dynamics of the development of speed-strength qualities have not been definitively resolved.

Coordination abilities are the capabilities of a person (individual), which determine the level of his readiness to optimally control and regulate motor activity. Complex processes of coordination of movements are ensured by neurophysiological mechanisms. The child's motor experience has a certain influence on the emergence of coordination skills: the more mobility and skills a person has, the more developed his coordination of movements.

It has been established that at different ages the development of coordination skills occurs in different directions. However, the most productive indicators of coordination skills of varying complexity increase from 11 to 12 years, as confirmed by numerous studies.

As children grow, the ability to repeat movements at a given pace improves, and 11-14-year-old students are able to perform complex coordinated movements, quickly master new exercises.

At 12-13 years old, there is a decrease in the growth rate of coordination skills, over the next two years, absolute indicators increase, and by 14-15 years old they are able to assess the position of the body or its individual parts in space at the level of adults. The most complete differentiation of muscle tone is formed by the age of 15-17.

Flexibility is associated with the nervous control of muscle tone, as well as the tension of antagonist (opposite) muscles. Flexibility is one of the qualities that develops quite early. Starting from the age of 4, it rapidly improves in children throughout the entire period of preschool and primary school age due to the good

elasticity of muscle fibers and tendons. At all ages, flexibility is better expressed in the female body than in the male body.

Unlike physical qualities, which can improve several times during the child's school years, flexibility begins to decline from the first years of life. This is due to the transformation of cartilage tissue into bone and a decrease in the elasticity of tendons.

The data presented indicate that the development of the main physical qualities is uneven. Strength, endurance indicators are fully developed by 16-18 years, speed-strength capabilities, speed of movements, clearly stratified muscle strength, stability of the vestibular apparatus by 13-14 years, and coordination of movements, flexibility and agility by 9-12 years.

## CONCLUSION

One of the main problems of the theory and method of physical education is the relationship between physical qualities. According to the literature, most authors have considered the issues of physical fitness of students involved in sports, but only some specialists describe this problem in the process of school lessons.

Undoubtedly, regular physical exercise during the educational process has a significant impact on the physical fitness of students. Therefore, additional research is needed on the use of a stratified method when working with adolescents with different biological maturity and body structure.

The analysis showed that the intensity, volume and standards for the use of the recommended methods for developing the physical qualities of schoolchildren have not been developed.

Based on the results of the above-mentioned analysis of scientific and methodological literature, it is possible to determine the goals and objectives of our scientific work. These tasks include the selection of complex exercises that effectively help develop strength, agility, agility-strength and endurance qualities, the determination of their intensity, volume and norms, the development of a methodology for their implementation in practice and the justification of their effectiveness.

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