Development of speed abilities by means of athletics in children with myopia

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ABSTRACT

The aim of the study is to develop the speed abilities of primary school children with mild myopia.

Methods

The pedagogical experiment was conducted for 6 months: September 2022 – February 2023. The study involved 16 primary school students who, according to the doctor's conclusion, were diagnosed with mild myopia. A total of 72 physical education lessons were held in each group. In the control group, students studied according to the program for secondary schools under the guidance of a physical education teacher. In the experimental group, children were engaged in athletics using a specially developed method for developing the speed abilities of younger schoolchildren with mild myopia. To evaluate the results of the study, basic tests were used: catching a ruler, the frequency of hitting a tennis ball against a wall in 20 seconds, jumping rope in 45 seconds, running 30 m.

Results

After the end of the study in the control group, the indicators improved in the test "catching a ruler" by 1% (P>0.05), "the frequency of hitting a tennis ball against a wall in 20 seconds" by 15% (P>0.05), "jumping rope in 45 seconds" by 11% (P>0.05) and "Running 30 m" by 2% (P>0.05). In the experimental group, the indicators improved significantly in all tests: "catching a ruler" by 26% (P>0.05), "the frequency of hitting a tennis ball against a wall in 20 seconds" by 34% (P>0.05), "jumping rope in 45 seconds" by 38% (P<0.05) and "Running 30 m" by 11% (P>0.05). Comparison of indicators between students of the control and experimental groups significant changes occurred in 3 indicators (P<0.05), except for the test "The frequency of hitting the ball against the wall in 20 seconds" (P>0.05).

Conclusion

At the end of the pedagogical experiment, the increase in the indicators of the speed abilities of the children of the experimental group is significantly higher than that of the children of the control group. The unreliable increase in indicators in the experimental group can be explained by the short duration of the study, as well as by the fact that the program of physical education lessons included an insufficient number of exercises for the development of speed abilities. Despite this, the developed technique has a positive effect on the development of speed abilities, which means it is effective. The developed experimental technique for developing the speed abilities of primary school children with mild myopia using athletics has proven its effectiveness and can be used in physical education lessons with children with visual impairments.

Keywords

Physical education, Schoolchildren, Athletics, Physical qualities, Children's health, Eye functions.

INTRODUCTION

Vision is an important type of perception of the surrounding world, which plays a huge role in the mental development of a child, having a huge informational meaning. It takes part in ensuring the regulation of posture, balance, orientation in space, and behavior control. Visual perception is the basis for the development of figurative forms of cognition at school age[1,2].

Visual disturbances occupy one of the central places in the list of diseases. According to published data from the World Health Organization, there are currently 37 million blind people and 124 million visually impaired people in the world, that is, more than 161 million people have serious visual impairments. Of these, one in four lost their eyesight in childhood[2,3].

The leading prerequisite for the decrease in visual functions in schoolchildren is myopia. The occurrence and development of myopia in childhood is being investigated more and more every year[4].

Firstly, the low effectiveness of the treatment of myopia by conventional methods, with an effect only on the accommodative apparatus of the eyes.

Secondly, the low effectiveness of sclerotic strengthening manipulations performed without preparatory complex treatment.

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Thirdly, the appearance of frequent, complicated forms of myopia in the presence of untreated, somatic and neurological diseases in children.

The key task of preventing myopia is considered to be the premature detection of the disease in children and adolescents, as well as the prevention of its progression[5].

Modern ophthalmology has different methods of vision correction and is divided into eyeglass, contact and surgical, each of which has its advantages and disadvantages[6].

Today, the three-factor concept of the origin of myopia is generally recognized[3,7]. According to this theory, two links can be distinguished in the mechanism of origin of myopia: the first is the discrepancy between the capabilities of the weakened eye accommodation apparatus and visual load; the second is the weakening of the strength qualities of the sclera and its stretching under the influence of intraocular pressure. High importance is given to hereditary factors. Weakened accommodation, enhanced visual work at close range becomes an extremely high load for the eyes. In such cases, the body is obliged to change the optical system of the eyes in such a way as to adapt it to work at close range without stress of accommodation. This is achieved by lengthening the anteroposterior axis of the eye during its growth period. The prerequisite for weakened accommodation is considered to be the lack of blood supply to the ciliary muscle as a result of its congenital morphological inferiority, insufficient training, as well as a result of endocrine shifts and general diseases of the body[7].

The prevalence of visual impairment in schoolchildren is primarily due to overwork of the eyes as a result of long static loads on the entire body during academic work, as well as in violation of the hygiene of reading and writing, working at the computer[8].

Myopia is the most common visual impairment, as a result of which people suffering from it do not see distant objects well. This is a disadvantage (refractive error) of the visual function, in which the image is projected not on the retina of the eye, but in front of it[9].

The vision of a person with myopia differs from that of a healthy person due to the fact that light entering the eye after its refraction by the lens is projected not onto the retina, but in front of it. Due to the fact that the focal point is located in front of the retina, the eye is unable to see objects in the distance. The image is blurred. However, the nearest objects are clearly visible to him.

There are a number of factors contributing to the occurrence of myopia[10]:

1) genetic predisposition;
2) unfavorable visual work conditions;
3) systematic long-term work with an object located at a close distance. For this reason, there are so-called professional and school myopia. This factor has a particularly strong effect on an unformed growing organism;
4) an unbalanced diet, which leads to the fact that the body's reserves of important elements and vitamins are thinning. In particular, this applies to magnesium, zinc, manganese, copper;
5) increased eye strain. Overwork leads to the fact that the mucous membranes of the eye begin to dry out, and the muscles supporting it degrade;
6) reading in motion, in the dark, lying down. Incorrect landing during reading, writing and other work that requires visual tension;
7) permanent long-term stay at the computer or in front of the TV;
8) lack of proper physical exertion on the body, prolonged sitting, sedentary lifestyle in general;
9) primary weakness of accommodation, leading to a compensatory increase in the anteroposterior size of the eyeball;
10) an imbalance in the tension of accommodation and convergence, leading to a spasm of accommodation and the development of false myopia first, and then true;
11) weakness of the sclera tissue in combination with increased intraocular pressure, leading to an increase in the size of the eyeball;
12) transmitted viral, bacterial and fungal infections;
13) birth injuries;
14) suffered traumatic brain injuries.

Clinical classification of myopia[11]:

1. During the course of the disease:

- inpatient (not progressive) - easily corrected and does not require treatment;
- slowly progressive (less than 1.0 diopters per year);

- rapidly progressive (1.0 diopters or more during the year).

2. By origin:

- Congenital myopia. It appears due to a violation of the intrauterine development of the eye.
- Acquired myopia. It appears due to the abnormal growth of the eyeball in a child. The patterns of such growth have not been fully investigated. It stops at the moment of maturation of the body or after some time.
- Hereditary myopia. It occurs infrequently.
- Transmitted by autosomal dominant type. It does not manifest itself in the first years of a child's life and does not reach high degrees.
- Transmitted by autosomal recessive type. It is characterized by early manifestation, predisposition to progression and the appearance of complications. It is usually found in children from related marriages.

3. According to the degree of severity:

- Mild myopia (less than 3.0 diopters).
- Moderate myopia (3.25 - 6.0 diopters).
- High degree myopia (more than 6.0 diopters).

In children, according to the age period of occurrence, it is advisable to distinguish between congenital myopia, acquired early and acquired at school age.

Congenital myopia is formed during the period of fetal development.

Early acquired myopia appears in the preschool period and often has a predisposition to rapid progression, which is associated with early familiarization of children with visual work at close range.

Myopia acquired at school age is most common. Crucial importance in the development of "school" myopia is given to visual work at close range, especially under not very favorable hygienic conditions, burdened heredity and weakness of accommodation.

The main cause of myopia in children is a change in the normal shape of the eye towards its elongation. This can be justified[3,6,8]:

- hereditary factor;
- overwork;
- prolonged eye work at close range;
- violation of visual hygiene;
- general weakness of the body.

More often, myopia develops and progresses at school age, which is associated with increased visual load, impaired posture, unbalanced nutrition (lack of calcium, magnesium, zinc, etc.), incorrect organization of the workspace, excessive introduction of a computer or TV into the child's life, as well as accelerated growth of the child. Concomitant diseases (for example, diabetes mellitus) and infections, which can provoke the development of myopia, play an essential role[4,9,10].

Thus, the following risk factors for the development of myopia are distinguished:

1. Heredity.
2. Congenital abnormalities of the eyeball.
3. Prematurity (myopia occurs in an average of 40%).
4. Increased visual load.
5. Unbalanced nutrition.
6. Violation of visual hygiene.
7. Infections and concomitant common diseases (frequent acute respiratory infections, diabetes mellitus, Down syndrome).

8. Congenital glaucoma.

From the above, the following conclusions can be drawn:

1. Visual impairments occupy one of the first places in the list of diseases.
2. Myopia is the most common disease among visual impairments.
3. Most often, myopia progresses at school age – school myopia.

Disruption of the visual analyzer causes significant difficulties in children's cognition of the world around them, limits social contacts and opportunities for many types of activities. People with visual impairments have peculiar features of activity, communication and psychophysical development. These features are manifested in the lag of formation, non-compliance and originality of the development of the motor sphere, coordination capabilities, spatial orientations, the formation of ideas and concepts, in the methods of practical activity, in the peculiarities of the emotional-volitional sphere, communication, socialization, adaptation to work[11,12].

Visual impairment impedes spatial orientation, inhibits the formation of motor abilities, and leads to a decrease in motor and cognitive activity. A significant proportion of children have a significant lag in physical development. Due to the problems that arise with visual repetition, mastering ideas about space and motor actions, the correct posture when walking, running, in natural movements, in outdoor games, coordination and accuracy of movements are disrupted[13,14].

Violations of the visual analyzer accompany such deviations as impaired posture, spatial images, self-discipline, and coordination of movements. In addition, there is curvature of the spine, flat feet, weakness of the respiratory muscles, diseases of the respiratory and cardiovascular systems, neuroses, fatigue increases[15,16].

Until recently, physical education in mild myopia was unacceptable. Meanwhile, moderate-intensity physical exercises (running, walking, swimming) have a positive effect on the circulatory system and improve the ability to accommodate. Only when exercising on high-intensity gymnastic equipment, jumping rope, acrobatics, there is a shift in the working capacity of the ciliary muscle for the worse. Sports games can be extremely useful, during which you constantly have to switch your attention (volleyball, basketball, and tennis). The rapid and frequent change of gaze from close to distant helps to enhance the accommodation of the visual apparatus, which is the prevention of the subsequent progression of myopia[17,18].

Adaptive physical education for visually impaired children is of great importance, since it is not only a means of improving health, increasing motor activity, but also a powerful factor in correcting and compensating for impaired functions, by introducing children to professional activities and full-fledged preparation for life. Physical education and wellness classes are held not only for the purpose of improving the health and physical development of students. They are focused on creating a certain vitality in visually impaired children, on reducing fatigue, which they experience much earlier than in healthy children[19].

Special attention should be paid to students in grades 1-4, since it is during this period that the eyes adapt to the increasing visual load and at the same time there is a sharp decrease in motor activity. This period is one of the most effective for the formation of students' skills for systematic exercise. The period is positive for instilling in children the skill of correct posture, for the development and improvement of many physical qualities, including speed[20].

Since physical rehabilitation involves the use of physical culture in order to restore or compensate for lost body functions after illness or injury, in case of myopia it involves the introduction of therapeutic gymnastics, training of accommodation, physiotherapy, methods of hardware and video computer vision correction[18-20].

Physical exercises, outdoor games not only in the conditions of a gym, but also in nature, and sports should take one of the first places in the complex of measures for the prevention of myopia and its development, since physical culture contributes not only to the overall strengthening of the body and activation of its functions, but also increases the efficiency of the eye muscles and strengthens the ocular sclera[20,21].

Myopia is especially common in children and adults with a lack of physical development. Thus, in the prevention of myopia and its progression, it is possible to re-evaluate the semantic meaning of physical culture and exercise[22].

Sports are very relevant, since the uniformity of movements produced by a person throughout the day, while he is in class or at work, puts his body out of order. Muscle spasms in the spine and neck have a detrimental effect on the nervous system, including the work of the eyes. Physical exercises strengthen the muscular corset, increase blood flow and the delivery of nutrients to the ciliary muscle, which regulates the condition of the lens of the eyes, responsible for regulating the focus of vision[23].

Physical exercises have a restorative ability, which consists in stimulating the intensity of biological processes and protective qualities of the body, activating its functional capabilities, accelerating the formation of compensations and their improvement, improving metabolism and regenerating processes, restoring impaired motor functions, including the functions of the eye muscles, strengthening the sclera of the eye, reducing the results of reduced motor activity, increasing efficiency and strengthening the body[20-23].

The tasks of rehabilitation measures carried out for patients with myopia are as follows[8,20,23]:

- correct the impaired functions of the organs of vision;
- promote the proper functioning of the visual apparatus;

- to promote the activity of oculomotor muscles and mobility of the eyeball in children;
- improve the ability of the eye analyzer;
- to prevent possible complications;
- to form motor skills and abilities;
- to promote the development of intellectual abilities, the correction of psycho-emotional states, the development of the ability to manage negative feelings, to stabilize the general and psychological state of the child;
- to pursue the goal of improving the interaction of children with their parents and increasing the interest of the latter in the formation of a healthy lifestyle of the child.

The motor activity of the muscles has a strong effect on the formation of the brain. The child's psychophysical, sensory, mental and thinking abilities are closely related to the motor activity of the muscles[24].

Limiting the physical activity of people suffering from myopia, as recommended not so long ago, is recognized as incorrect. Currently, the significant role of physical culture in preventing myopia and its progression has been shown, since physical exercise helps to activate the functions of the entire body. Physical exercises play a significant role in correcting myopia. However, there are practically no special programs for the introduction of AFC funds into school conditions that would be aimed at correcting visual impairments in children[22,25].

Physical fitness is considered one of the components of physical activity. For a child, the result of physical education is important, expressed in the achieved level of performance, formed motor qualities that contribute to the effective functioning of a person, his physical health and creative activity[18,26].

It has been found that in children with myopia, the strength endurance of certain muscle groups, namely, the back, neck and abdominal muscles, is reduced. This dependence is due to the fact that myopia leads to a violation of the working posture in a sitting position, and this leads to overwork of these muscle groups, which in turn reduces their strength endurance and makes it difficult to maintain the correct posture, contributing to the development and progression of myopia[9,13,27].

Thus, the combination of physical exercises of a general developmental nature with special exercises for the muscles of the eyes has a positive effect on the functions of the impaired eye. Special exercises recommended for short-sighted people can be performed independently at home, in nature, during rest. It is necessary to strictly ensure that the exercises correspond to the age of the participants, gender, state of health, their physical fitness, severity of the defect, and the condition of the fundus. Gymnastics for the eyes should be combined with general developmental exercises[4,28].

Physical education has every chance to have a positive effect on the condition of the eyes with uncomplicated myopia. The positive effect is expressed in preventing the subsequent confusion of vision for the worse. The basis of such classes are general developmental exercises aimed at strengthening the muscles of the neck and back. These exercises should be performed in combination with eye movements[19-21].

With complicated myopia, exercises with strenuous transitions from a sitting position to a lying position and back are excluded[19,23].

Breathing exercises also play a significant role in physical education lessons, which enhance pulmonary ventilation, blood supply, and improve recovery processes in the body. In addition, breathing exercises are a means of repetitively reducing physical activity[6,20,24].

To relieve eye fatigue, physical exercises, self-massage of the eyes should be performed during gymnastics before classes and in free time throughout the day[29].

It is recommended to perform breathing exercises 2 times a day: in the morning (during morning hygienic gymnastics) and during physical therapy classes[30].

The key goal of physical education classes is considered to improve the well-being of students, increase the indicators of physical development and physical fitness, and prevent the progression of myopia. At the same time, it should be remembered about the work and rest regime, a variety of qualitative and quantitative nutrition, as well as other hygiene products[22,30].

The authors recommend the following forms of independent study[4,9,16,22]:

1. Morning hygienic exercises;
2. Therapeutic gymnastics (gymnastics for the eyes);
3. Physical education classes according to the chosen program;
4. Physical education break during study;
5. Components of self-massage;

6. Hardening of the body.

Physical exercises for the muscles of the back, neck and abdominal press serve as a means of healing and prevention for the organs of vision. For the prevention of myopia, the following game means of physical education are used[7,12,18]:

- various sports games with a moving object;

- game exercises that are elements of these games or summing exercises;

- sedentary games;

- throwing on marks and at the target;

- outdoor ball games.

Only long-term and constant use of correctly selected physical exercises in accordance with the functional capabilities of the child can guarantee his adaptation to stress and eliminate or reduce the general and local disorders resulting from the disease[21,24].

Thus, the analysis of scientific and methodological literature concerning the issues of adaptive physical education of primary school children with myopia has shown that at present the causes of visual disorders have been studied in sufficient detail, ways of their prevention and correction have been developed while observing the daily routine, the basics of hygiene, and there are various programs of the physical rehabilitation system for schoolchildren, suffering from myopia. It has been proven that the normal physical development of children with visual impairments is facilitated by systematic physical education, and exemption from classes leads to a decrease in visual function. However, existing rehabilitation methods are not always effective and often do not lead to a rapid positive effect. In addition, the existing rehabilitation programs do not specify the components of the load for performing complexes of physical exercises, and the effect of correctional and recreational means on the development of speed abilities in visually impaired primary school children has been poorly studied. In this regard, there is a need to improve the wellness programs used in regular forms of classes. According to the analysis of literary sources, the greatest research requires the development of high-speed qualities in children with myopia. Moreover, athletics promotes the development of speed due to the huge number of different exercises performed from different starting positions, as well as with varying intensity of the load performed.

MATERIAL AND METHODS

The pedagogical experiment was conducted for 6 months: September 2022 – February 2023. The study involved 16 primary school students from secondary school No. 5 in Kirovo-Chepetsk, who, according to the doctor's conclusion, were diagnosed with mild myopia. In total, 72 physical education lessons were held in each group, classes were held according to the academic schedule 3 times a week.

The control group (CG) included 8 students of the class who were diagnosed with mild myopia. The students of this group studied according to the program for secondary schools under the guidance of a physical education teacher.

The experimental group (EG) also included 8 students of the class who were diagnosed with mild myopia. The students of this group were engaged in athletics using a specially developed method for developing the speed abilities of younger schoolchildren with mild myopia. The division into groups was carried out by random sampling.

An experimental technique for developing the speed abilities of primary school children with mild myopia using athletics in lessons on adaptive physical education in secondary schools was built taking into account the age and health status of children and was obliged to guarantee the harmonious development of a child with myopia.

The developed methodology involved conducting 3 scheduled classes per week in an experimental group. The sets of special exercises were supposed to be used in the first half of the main part of the lesson for 15-20 minutes during the 24 academic weeks allotted for the study. The exercises were performed at a moderate and fast pace.

The peculiarity of the study was that for the first time a technique for developing the speed abilities of primary school children with mild myopia was developed using athletics, since athletics is rich in a variety of exercises that are feasible and not contraindicated for children with mild myopia. So, when conducting a lesson with

such children, longer rest intervals between sets of exercises were required than with healthy children. The time allotted for rest was used to perform special exercises for the eyes:

1) Close the eyelids of both eyes for 3-5 seconds, then open them for 3-5 seconds.
2) Blink both eyes quickly for 10-15 seconds, then repeat the same thing at intervals of 7-10 seconds.
3) Close the eyelids of both eyes and massage them with your index finger in circular movements for one minute. Exercise relaxes muscles and improves blood circulation.
4) Close the eyelids of both eyes and lightly press on the eyeballs through the upper eyelids for 1-3 seconds.
5) Raise your eyes up, make a clockwise circular motion with them, make a counterclockwise circular motion. Repeat 5-6 times.
6) The eyes move along the line of the sign "infinity". The head is motionless. The duration of the exercise is 1 min.
7) Close your eyes tightly for 3-5 seconds, and then open your eyes for 3-5 seconds. Repeat 6 to 8 times.
8) Extend your hand forward, look at the end of the finger of the outstretched hand located along the middle line of the face, slowly bring your finger closer, without taking your eyes off it until the finger begins to double.

At the end of the physical education lesson, after stretching exercises, a visual game was performed, which helped to reduce the tension of the leading functional structures of the visual apparatus.

«Blindman». The game is played in the hall or on the playground. The players close their eyes tightly for 3-4 seconds. At this time, the teacher changes the location of the objects on the site (pins, chips, flags). At a signal, the children open their eyes and try to fix the changes that have occurred. The teacher selectively asks students what changes in subjects they have noticed. Closing their eyes, students strain their eyelids as much as possible. The total duration of the game is up to 1.5 minutes.

The content of the study focused on the speed of movement of individual parts of the body using exercises from athletics and outdoor games. The main part of the physical education lesson included exercises aimed at the multilateral development of high-speed abilities (reaction speed, frequency of movements, speed of single movement, speed of holistic actions). In the plan we developed, great attention was paid to the inclusion of outdoor games, which were held in order to develop speed and other physical qualities in gentle conditions, as well as emotionally saturate the training sessions. Afterwards, stretching exercises were performed for all tasks, which allowed the children to better carry the load.

During the experiment, the following exercises were used in physical education lessons:

- general developmental exercises without subjects that contributed to the gradual involvement of the student's body in the process of physical education lesson and increase the overall vitality of students;
- exercises for the formation of correct posture;
- running from the start from all possible starting positions was used to develop children's ability to quickly respond to a sound signal and develop the ability to navigate in space;
- special running exercises that strengthen the mobility of ligaments and joints in children, as well as develop their physical qualities;
- outdoor games were used to develop speed and coordination of movements;
- stretching exercises;
- Special eye exercises and visual games that were used to prevent undesirable results of intense visual work during a physical education lesson.

To conduct the experiment, the material was planned for scheduled classes for primary school children.

Control tests:

1) To assess the speed of a simple and complex reaction, the "Catching a ruler" test was used.

The initial position of the student is sitting on a chair, with a strong arm extended forward with the edge of the palm downwards. At a distance of 1-2 cm from the palm of the teacher holds the ruler, while the zero mark is located at the level of the lower edge of his palm. Within 5 seconds after the preliminary command "Attention!", the teacher releases the ruler. The student's

task is to quickly squeeze his fingers and catch the ruler falling down as quickly as possible. The reaction speed is determined by the distance from the zero mark to the lower edge of the palm (to the grip). The shorter the distance, the better the student's reaction. The average result of 3 attempts is determined.

2) To assess the speed of a single movement: the test "The frequency of the ball hitting the wall in 20 seconds".

The teacher counts the number of hits of the ball against the wall. If the student loses the ball, then it is necessary to take it and continue the exercise, while time does not stop.

3) To assess the speed of movement in different joints: the test "Jumping rope in 30 seconds".

Jumps are performed at the fastest possible pace. At the command of the teacher "March!" the students begin to perform jumps and at the command "Stop!" they finish.

4) To assess the speed manifested in holistic motor actions, most often in short-distance running: the "30 m Run" test.

The running distance is placed on a hard-surfaced sports ground. The measurement of the exercise time is carried out with a stopwatch.

Mathematical processing of the research results is necessary in order to make generalizing conclusions based on the results of studies on a limited contingent, as well as to verify the reliability of the results obtained and the effectiveness of the applied methodology for the development of high-speed abilities. The processing of the level of development of students' speed abilities was carried out using the Student's t – test. If the calculated t was greater than the tabular t, then $P < 0.05$, then the result is reliable.

RESULTS

As a result of the application of the methodology for developing the speed abilities of primary school children with mild myopia, the following data were obtained from athletics. Table 1 shows the indicators of the development of the speed abilities of children in the control and experimental groups at the beginning of the pedagogical experiment.

Table 1. Level indicators of the speed abilities of schoolchildren of the control and experimental groups at the beginning of the pedagogical experiment (M±m)

Indicators of speed abilities	The control group (n=8)	The experimental group (n=8)	Comparison of Student's t – test data
The speed of a simple reaction - the "Catching a ruler" test (cm)	7.4±0.5	7.8±0.4	t=0.6 P>0.05
The speed of a single movement – the test "The frequency of hitting a tennis ball against a wall in 20 seconds" (number of times)	6±0.8	6.7±1.1	t=0,5 P>0.05
Speed of movement in joints – test "Jumping rope in 45 seconds" (number of times)	28.7±2.1	28±1.3	t=0,3 P>0.05
Speed of movement of a holistic motor action – test "Running 30 m" (sec)	7.1±0.5	6.4±0.3	t=1,2 P>0.05

Table 1 shows that at the beginning of the pedagogical experiment, the level indicators of the development of speed abilities in schoolchildren of the control and experimental groups do not differ from each other and are not reliable (P>0.05). This indicates the homogeneity of the groups according to the studied indicators. Table 2 shows the indicators of the development of the speed abilities of children in the control group from the beginning to the end of the pedagogical experiment.

Table 2. Changes in the indicators of the speed abilities of schoolchildren in the control group from the beginning to the end of the pedagogical experiment (M±m)

Indicators of speed abilities	The control group (n=8)	The experimental group (n=8)	Comparison of Student's t – test data	Growth
The speed of a simple reaction - the "Catching a ruler" test (cm)	7.4±0.5	7.5±0.5	t=0,1 P>0.05	1%
The speed of a single movement – the test "The frequency of hitting a tennis ball against a wall in 20 seconds" (number of times)	6±0.8	6.9±0.6	t=0.9 P>0.05	15%
Speed of movement in joints – test "Jumping rope in 45 seconds" (number of times)	28.7±2.1	32±1.6	t=1,3 P>0.05	11%
Speed of movement of a holistic motor action – test "Running 30 m" (sec)	7.1±0.5	7.0±0.4	t=0.2 P>0.05	2%

Table 2 shows that in the control group, the results improved from the beginning to the end of the pedagogical experiment, but they should be considered unreliable (P>0.05). Table 3 shows the indicators of the development of the speed abilities of children in the control group from the beginning to the end of the pedagogical experiment.

Table 3. Changes in the indicators of speed abilities of schoolchildren of the experimental group from the beginning to the end of the pedagogical experiment (M±m)

Indicators of speed abilities	The control group (n=8)	The experimental group (n=8)	Comparison of Student's t – test data	Growth
The speed of a simple reaction - the "Catching a ruler" test (cm)	7.8±0.4	9.9±1.1	t=1.75 P>0.05	26%
The speed of a single movement – the test "The frequency of hitting a tennis ball against a wall in 20 seconds" (number of times)	6.7±1.1	9±1.1	t=1.5 P>0.05	34%
Speed of movement in joints – test "Jumping rope in 45 seconds" (number of times)	28±1.3	38.7±1.2	t=6 P<0.05	38%
Speed of movement of a holistic motor action – test "Running 30 m" (sec)	6.4±0.3	5.7±0.3	t=1.75 P>0.05	11%

Table 3 shows that in the experimental group, the results improved in all tests during the study period, but only the "Jumping rope in 45 seconds" test is reliable (P<0.05). For the rest of the samples, the result is unreliable. This can be explained by the short duration of the study, as well as the fact that the program of physical education lessons included an insufficient

number of exercises for the development of speed abilities. Despite this, the developed technique has a positive effect on the development of speed abilities, which means it is effective.

Based on the results shown in Tables 2 and 3, it can be noted that the increase in speed indicators of children in the experimental group is significantly higher than in children in the control group. Table 4 shows the indicators of the speed abilities of children in the control and experimental groups by the end of the pedagogical experiment.

Table 4. Level indicators of the speed abilities of schoolchildren of the control and experimental groups by the end of the pedagogical experiment (Mm)

Indicators of speed abilities	The control group (n=8)	The experimental group (n=8)	Comparison of Student's t – test data
The speed of a simple reaction - the "Catching a ruler" test (cm)	7.5±1.4	9.9±1.1	t=4 P<0.05
The speed of a single movement – the test "The frequency of hitting a tennis ball against a wall in 20 seconds" (number of times)	6.9±0.6	9±1.1	t=1.75 P>0.05
Speed of movement in joints – test "Jumping rope in 45 seconds" (number of times)	32±1.6	38.7±1.2	t=3.35 P<0.05
Speed of movement of a holistic motor action – test "Running 30 m" (sec)	7.0±0.5	5.7±0.3	t=2,6 P<0.05

By the time of the end of the pedagogical experiment between the students of the control and experimental groups, significant changes occurred in 3 indicators (P<0.05), except for the test "The frequency of hitting the ball against the wall in 20 seconds" (P>0.05). Thus, the developed experimental methodology for the development of high-speed abilities of primary school children with mild myopia by means of athletics has proven its effectiveness and can be used in physical education lessons with children with visual impairments.

DISCUSSION

Based on the studied scientific and methodological literature, it can be concluded that the problem of physical education of children diagnosed with mild myopia is relevant today[4,9,16,23]. Children with visual impairments have a lag in physical development, and quite often there are violations of posture and curvature of the spine[8,11]. The main causes of the development of myopia are the genetic factor and the increasing load on the visual apparatus[6,14]. It has been established that the lack of proper physical exertion on the body, long-term sitting and a sedentary lifestyle in general have a detrimental effect on visual function[12,15.22].

An analysis of modern methods of adaptive physical education of primary school children with myopia has shown that currently there are many rehabilitation programs for children with myopia[11,18.20-22]. The methodology of physical education with such children is obliged to take into account the peculiarities of not only visual disorders, gender and age of the child, but also the peculiarities of physical development, the functional state of the main organs and systems of the body, physical fitness and psycho-emotional status. At the same time, methods of adaptive physical education of children with visual pathology should include not only exercises aimed at correcting, maintaining the function of visual analyzers and developing compensatory capabilities, but also at the general physical training of such children. The main means of adaptive physical education for younger schoolchildren with myopia can be physical exercises from athletics, which promote the development of speed abilities in children with visual pathology[6,11,19-24].

An experimental technique for the development of the speed abilities of primary school children with mild myopia by means of athletics has been developed. The methodology includes: general developmental exercises without objects, exercises for the formation of correct posture, running from the start from various initial positions, special running exercises, outdoor games, stretching exercises, special exercises for the eyes and visual games. The sets of exercises were used in the first half of the main part of the lesson for 15-20 minutes during the 6 months allotted for the study. The exercises were performed at a moderate and fast pace.

As a result of the conducted pedagogical experiment, it was shown that in the experimental group, from the beginning to the end of the study, an increase in indicators was noted for all tests, however, only the test "Jumping rope in 45 seconds" is reliable ($P<0.05$). For the rest of the samples, the result is not reliable. This can be explained by the short duration of the study, as well as the fact that the missing number of exercises for the development of speed abilities was included in the program of physical education lessons. Despite this, the developed technique has a positive effect on the development of speed abilities, which means it is effective.

Thus, the developed experimental technique for developing the speed abilities of primary school children with mild myopia using athletics has proven its effectiveness and can be used in physical education lessons with children with visual impairments.

Practical recommendations:

1. To determine the level of development of speed abilities in primary school children with myopia, it is necessary to conduct comprehensive testing: to determine the level of development of the speed of simple and complex reactions, the speed of single movement, the speed of movements in different joints and the speed manifested in holistic motor actions.

2. For the development of high-speed abilities, it is necessary to use the "Methodology for the development of high-speed abilities of primary school children with mild myopia by means of athletics", because it contains components of novelty, namely, it includes: general developmental exercises without objects, exercises for the formation of correct posture, running from the start from various starting positions, special running exercises, outdoor games, stretching exercises, special eye exercises and visual games.

3. The peculiarity of the developed technique is the use of eye exercises in the rest intervals between the main exercises.

4. When conducting sets of exercises, it is necessary to take into account the age and health status of each student individually.

5. Sets of exercises should be carried out both in the gym and outdoors for 15-20 minutes at the beginning of the main part of the physical education lesson.

The scientific novelty lies in the fact that for the first time an experimental technique has been developed for the development of the speed abilities of primary school children with mild myopia by means of athletics.

The theoretical significance of this work consists in studying the causes of myopia in primary school children and developing a methodology for developing the speed abilities of primary school children with mild myopia by means of athletics.

The practical significance of the study lies in the fact that the developed methodology for the development of the speed abilities of primary school children with mild myopia by means of athletics can be used in regular forms of classes in secondary schools, as well as in special (correctional) schools.

For comparison, it should be noted that we have already conducted research on the health of children and schoolchildren[31-33]. In all studies, positive results were obtained from the use of one or another technique for the development of physical qualities or the improvement of children's health was achieved with the help of physical culture, namely physical exercises. Thus, the research topic is relevant, and the results of the pedagogical experiment are promising for further research concerning the health and physical development of children.

CONCLUSION

At the end of the pedagogical experiment, the increase in the indicators of the speed abilities of the children of the experimental group is significantly higher than that of the children of the control group. The unreliable increase in indicators in the experimental group can be explained by the short duration of the study, as well as by the fact that the program of physical education lessons included an insufficient number of exercises for the development of speed abilities. Despite this, the developed technique has a positive effect on the development of speed abilities, which means it is effective. The developed experimental technique for developing the speed abilities of primary school children with mild myopia using athletics has proven its effectiveness and can be used in physical education lessons with children with visual impairments.

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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.

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