

Physiological Effects of Regular Football Training in Adolescents Using Visual Analyzer Pathology

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ABSTRACT

Recently, various pathologies of the visual analyzer are increasingly common among Russian youth. The presence of violations of the organ of vision inevitably leads to a significant decrease in physical activity, weakening of the development of the musculoskeletal system and all internal organs. This creates in this category of adolescents the risk of developing a large number of pathologies. At the same time, a systematic increase in motor activity in adolescents with reduced vision, due to regular classes in various types of adaptive sports, can help in their general health improvement. It was found that football training provides a pronounced increase in physical development and a significant increase in functional capabilities in visually impaired adolescents. In addition, regular football training helped to improve the development of the motor characteristics of the visually impaired adolescents. Regular physical activity within the framework of traditional physical education for the visually impaired could not significantly increase the strength, endurance and reserve capabilities of the body in this contingent of trainees. The obtained results of assessing the impact of dosed football trainings indicate that it is very promising to use regular physical activity in adolescents with visual impairment in this sport. They increase the general physical fitness and stimulate the functionality of the internal organs in this category of adolescents.

KEY WORDS: ADOLESCENTS, VISION, PATHOLOGY, PHYSICAL ACTIVITY, ADAPTIVE FOOTBALL, DISABLED PEOPLE.

INTRODUCTION

Currently, there is a tendency towards a deterioration in the health status of Russian youth. In recent years, a significant number of adolescents with various health disorders have been studying in the general education system (Kotova et al., 2017). Often, the pathology of the visual analyzer is encountered in Russian youth. The presence of violations of the organ of vision inevitably leads to a significant decrease in the physical activity of adolescents, weakening the development of the musculoskeletal system and all internal organs. This circumstance forms in such adolescents the risk of developing overt pathology in all parts of the body.

The situation is aggravated by the low degree of consideration in the school curriculum of the peculiarities of adolescents with physical disabilities, including

those with a pathology of the organ of vision. In addition, many schools do not have enough specialized sports equipment, and the available premises do not fully meet the standards for the implementation of physical education classes with the visually impaired (Kulkova, 2013). It is known that an increase in physical activity due to physical activity, including in the framework of physical culture or sports, can very strongly stimulate all body systems in healthy adolescents and adolescents with various dysfunctions and pathologies (Vorobyeva et al., 2018 Karpov et al 2020).

At the same time, there is little information regarding the increase in the muscular activity of the visually impaired and the blind, despite the urgent need of society for their health improvement and socialization (Karpov et al., 2018). It becomes clear that in the course of systematic physical activation of blind and visually impaired adolescents, muscular sense should be used to coordinate their movements, teaching to use it as the basis for orientation in space. In this regard, such a contingent of athletes must perfectly coordinate their

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own movements in conditions of a minimum or complete absence of vision, relying on bodily sensations.

This task, in the absence of the possibility of visual imitation, is very difficult, but solvable. In this regard, the physical development of such a contingent of adolescents should be based on a gradual build-up of motor experience. To form such baggage, one should begin teaching a teenager with a pathology of the organ of vision to the basic movements: walking in a straight line, jumping in length, running in a straight line, measured movements in both directions along the stairs. These muscular actions should be brought to a level of high precision, consistency, and freedom. Only in this case, these adolescents will be able to master more complex sports movements and be able to subsequently reproduce them independently during training (Ivleva, 2019).

Increasing motor activity in adolescents with reduced vision through regular adaptive sports seems to be very promising in terms of their general improvement (Kulkova, 2013; Ivleva, 2019). At the same time, the real

possibilities of this approach have not been clarified. For this purpose, the authors evaluated the results of regular adaptive football training with this contingent. Purpose of the present study was to assess the effectiveness of regular football training in relation to the development of general physical characteristics and dynamics of the main functional characteristics of the body of adolescents with visual impairment.

MATERIAL AND METHODS

The study was carried out on high school students, a total of 25 boys of 15-16 years old with visual impairment in the degree of low vision. The study took into account data from medical records and anamnesis life of the examined, including prenatal and postnatal periods. Particular attention was paid to the process of development of pathology arising during life. In most cases, adolescents with visual analyzer pathology taken into the study were exposed to a number of health hazards throughout their lives. In more than 80% of cases, prolonged or rapid labor took place, traumatic obstetric methods of obstetric assistance were used, including the application of forceps and manual stimulation of labor.

Table 1. Results of the initial testing of the subjects

Physical condition assessment option	Control group, n=13, M $\pm$ m	Experimental group, n=12, M $\pm$ m
Running at a distance of 30 m, s	9.82 $\pm$ 0.87	9.98 $\pm$ 0.77
Distance of standing jump in length, m	125.6 $\pm$ 3.81	129.7 $\pm$ 4.12
Throwing range of a ball weighing 3 kg, m	1.26 $\pm$ 0.62	1.33 $\pm$ 0.49
Leading hand wrist dynamometry level, kg	10.2 $\pm$ 0.45	10.6 $\pm$ 0.53
Romberg sample index, s	2.6 $\pm$ 0.40	2.5 $\pm$ 0.35
Flexibility index, cm	-14.7 $\pm$ 0.86	-14.9 $\pm$ 1.10

Note: There was no significant difference between the groups.

RESULTS AND DISCUSSION

The examined adolescents with visual pathology initially had a very reduced working capacity, they felt tired early and were quickly distracted, which lowered the quality of physical exercises. The initial physical state of the examined adolescents was comparable in all the parameters taken into account. Their physical capabilities were low, indicating their poor initial fitness (table 1). Initially, the subjects could run a distance of 30m in a little less than 10 seconds. This indicated that they had a very average running ability. Opportunities for long jump from a spot in the subjects were also low, amounting to 125.6 $\pm$ 3.81 m and 129.7 $\pm$ 4.12 m in both groups. The throwing range of a ball weighing 3 kg among adolescents when included in the observation group was modest, amounting to 1.26 $\pm$ 0.62 m in the control group, and 1.33 $\pm$ 0.49 m in the experimental group.

The muscle strength of the leading hand, which was judged by the results of dynamometry, in the outcome was low and amounted to 10.2 $\pm$ 0.45 kg in the control and 10.6 $\pm$ 0.53 kg in the experimental group. The results of the Romberg test were low and comparable in both groups at the first examination. They pointed to the low stability of the body of adolescents with visual impairment in space. In addition, in the outcome, all subjects showed a comparably low flexibility. Regular physical activity contributed to the stimulation of their physical development in all observed. The results obtained were more pronounced in the experimental group. Table 2 shows the results of the physical testing of adolescents in the control and experimental groups at the end of the study.

Evaluating the data given in table 2, it was possible to note the statistical significance of the differences between the control and experimental groups according

to the results of all the tests used. Regular physical activity provided a more pronounced development of physical capabilities in the experimental group. So in the adolescents who made it up, more pronounced speed abilities were achieved. This was judged at the end of the observation by the acceleration of their run at a distance of 30 m for a time significantly shorter than in the control group. By the end of the observation, the jumping distance in adolescents from the experimental group was 33.3% more than in the control group. The distance the teenagers trained according to the author's scheme were able to throw a ball weighing 3 kg exceeded that in the control by 2.9 times. The power capabilities of the leading hand, assessed by dynamometry by the end of the observation, were 93.5% lower in the control group than in the control group.

The time in Romberg's test among adolescents in the experimental group increased 2.6 times during the training period, prevailing by the end of the observation over the level in the control group by 2.3 times. At the same time, the indicator of flexibility in the surveyed during their physical training has changed positively. More pronounced dynamics of this indicator was noted

in the experimental group (4.2 times), which ensured its prevalence over the same indicator in the control group by 3.3 times.

The existing scientific and methodological base for the process of adaptive physical education of adolescents with visual pathology is still very modest. This speaks of gaps in the theoretical foundations of their training process, especially in the field of football. The scarce scientific literature available today, devoted to sports games for the blind and visually impaired, needs to be supplemented and seriously clarified in order to help coaches in the practical implementation of training with this contingent of athletes. In conditions of low physical activity, which is especially often the case with visually impaired, there is a high risk of many diseases and especially the cardiovascular system (Skoryatina and Zavalishina, 2017). This is facilitated by hypotrophy of the muscular system, weakening of the heart muscle and impaired vascular tone, which contributes to the development of pre-pathological conditions. In this regard, the appearance of asthenia, vegetative vascular dystonia and arterial hypertension in persons with low physical activity is very likely (Kulkova, 2013).

Table 2. Results of the final testing of the surveyed

Physical condition assessment option	Control group, n=13, M $\pm$ m	Experimental group, n=12, M $\pm$ m
Running at a distance of 30 m, s p<0.01	9.69 $\pm$ 0.74	7.06 $\pm$ 0.46
Distance of standing jump in length, m	130.4 $\pm$ 4.62	173.8 $\pm$ 3.82 p<0.01
Throwing range of a ball weighing 3 kg, m	1.38 $\pm$ 0.42	3.97 $\pm$ 0.51 p<0.01
Leading hand wrist dynamometry level, kg	10.8 $\pm$ 0.52	20.9 $\pm$ 0.47 p<0.01
Romberg sample index, s	2.9 $\pm$ 0.33	6.6 $\pm$ 0.58 p<0.01
Flexibility index, cm	-11.6 $\pm$ 0.92	-3.5 $\pm$ 0.50 p<0.01

Note: p is the reliability of the differences in the test results of adolescents in both groups at the end of the observation.

The assessment of the initial physical development of adolescents suffering from the pathology of the visual analyzer confirmed that it is low in all cases. As a result, they, as a rule, have weakened general functional capabilities and have a low level of motor characteristics in comparison with age norms. There is evidence that in people with pathology, including the visually impaired, at any age, the vessels often have a tendency to spasm. Because of this, there are several risk factors at once, contributing to the development and progression of various pathologies (Bespalov et al., 2018). Low muscular activity present with visual impairment leads to a progressive decrease in the available functional reserves of all internal organs, creating conditions for the appearance and strengthening of dysfunctions, and then the development of pathology in vital organs. Functionally unfavorable changes in the activity of the heart and blood vessels developing in the visually

impaired are very significant in this process (Zavalishina, 2020).

In this regard, for the visually impaired and the blind, early manifestation of atherosclerosis is very characteristic, which significantly increases the risk of early angina pectoris and early myocardial infarction. Systematic physical training in adolescents, especially those with pathology, always very effectively increase the level of adaptive capabilities of initially weakened internal organs. To ensure the process of proper adaptation of the whole organism in response to physical activity, first of all, the functional reserve of all its life support systems increases. At the same time, the functional abilities of the musculoskeletal system increase rapidly, the volume of blood flow increases biologically, vascular tone is optimized, and the rheological properties of blood are adapted. All this significantly increases the volume of

oxygen delivery to all cells of the body of physically exercising adolescents (Karpov et al., 2020).

To eliminate low physical fitness in the visually impaired, it is strongly recommended to use feasible regular physical activity. At the same time, the optimal approaches to increasing the level of physical fitness and optimizing the functional capabilities of the muscles of the trunk and limbs, lungs and cardiovascular system in people with visual impairment have not yet been fully determined. This suggests the need to continue studying the issues of the influence of regular active muscular activity on the general condition of an organism with a pathology of the organ of vision (Gridneva and Nalobina, 2016). The presence of this gap in the base of accumulated physiological knowledge stimulated this study.

When performing this study, the effectiveness of two options for physical recovery of visually impaired adolescents with a risk of various somatic pathologies was followed. We compared functional changes in adolescents' bodies as a result of active football training and under the influence of standard loads for the visually impaired. Football training according to the author's scheme provided a marked increase in the level of physical development and a significant increase in the functional capabilities of adolescents in the experimental group. In addition, the complex of applied football lessons contributed to a pronounced positive development of motor abilities in adolescents from the experimental group.

The result achieved as a result of football training in visually impaired adolescents has shown a high efficiency of the football training program in terms of overall health improvement of their body (Stepanova et al., 2018). Under the conditions of long-term regular and feasible football training in adolescents, there was an increase in the fitness of the heart muscle and, apparently, a physiologically beneficial weakening of the activity of many elements of hemostasis occurred, which significantly thinned the blood and could provide optimal conditions for the work of the whole organism (Zavalishina, 2018).

Obviously, a serious positive effect in relation to the whole organism of adolescents with visual pathology of football training was realized due to a greater activation of metabolic processes than under the influence of standard physical training loads. At the same time, as a result of football training, there was a more pronounced increase in their level of fitness, which optimized overall vitality, the work of the heart and blood vessels, and significantly increased the available reserves of internal organs, endocrine glands with the achievement of a strict balance between the components of the autonomic nervous system (Kotova et al., 2017).

In the study, it was noticed that during football training, the elasticity of muscles and their strength capabilities increase rather quickly, and the entire skeletal system is significantly strengthened. Regular football loads

undoubtedly led to an increase in the level of basic biologically active substances in the blood, creating conditions for the activation of anabolic processes in all tissues (Vorobyeva et al., 2018). Against the background of regular physical activity in the framework of traditional physical education for the visually impaired, representatives the control group could not significantly increase their strength and endurance and kept the reserve capacity of the body at a low level.

There is reason to believe that football training more than regular physical education stimulates the body of the visually impaired. In this regard, regular football training should be widely recommended as an activation of the muscular system in people with visual impairment. The assessment of the results of the approach to muscle stimulation used in the work gives grounds to consider it highly effective in terms of improving the health of people with visual impairments. For this reason, regular football training in adolescents with visual impairments may be in great demand to stimulate the hidden reserves of the body in this contingent.

CONCLUSION

The physical development of adolescents with visual analyzer pathology is usually low. This is due to the pronounced weakness of their musculoskeletal system. Football training was able to provide this contingent of trainees with an increase in speed characteristics, strength and flexibility. The results obtained allow us to consider the applied version of health improvement as very effective in terms of somatic strengthening of this category of adolescents. The results of the study provide a basis for a broad recommendation of football training as an option for improving the physical performance and overall health of visually impaired adolescents.

Conflict of Interest: Authors declares no conflicts of interests to disclose.

Ethical Clearance Statement: The Current Research Work Was Ethically Approved by the Institutional Review Board (IRB) of Russian State Social University, 129226, Moscow, Russia.

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