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The Effect of Regular Physical Activity on the Cardiovascular System in Students

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It has been noticed that dosed muscle activity in the form of regular physical culture exercises is capable of providing a pronounced general health-improving effect at any age. Neglect of systematic rational physical activity always contributes to a persistent weakening of the state of health and especially often leads to the formation of various dysfunctions of the heart and blood vessels. The study was carried out in 2019-2020 on young men living in Central Russia (the city of Moscow and the Moscow region). In the work carried out, it was found that regular muscle activity in healthy adolescents and those with dysfunctions in the cardiovascular system provides a stable normalization of the parameters of cardiac activity. As a result of regular dosed physical training, all those under observation had a statistically significant increase in the vital capacity of the lungs. All physically training young men showed an increase in the level of general physical fitness. In all cases, the boys who increased their physical activity showed an increase in speed-strength capabilities and an increase in overall endurance. It can be considered that an increase in daily physical activity due to an increase in the distance covered on foot is a very effective means of improving the health of adolescents, including when they begin to develop disorders of the cardiovascular system.

Keywords: Adolescence; Cardiovascular Diseases; Muscle Activity; Physical Training; Walking.

Technological progress creates conditions for a gradual decrease in physical activity of a modern person [1,2]. This creates a dissonance between reality and the biological need of the human body for regular muscle activity[3,4]. Previous generations were much more physically active in order to obtain food and items necessary for daily life [5,6]. The development of science and industry has led to the fact that regular muscular efforts are no longer obligatory for a person to survive and obtain a livelihood[7,8]. These changes in lifestyle have significantly changed people's perception

of the world and the intensity of many biological processes in their body [9,10].

In modern society, the lack of activity of the muscular system is becoming common, and signs of its malnutrition are increasingly common[11,12]. This leads to very pronounced negative changes in the entire body of modern people[13]. The scale of the spread of hypodynamia in modern society is very large[14]. Deficiency of regular physical activity occurs in almost 80-90% of people of working age[15,16]. Lack of regular muscle activity inevitably weakens the adaptive capacity of the cardiovascular system and is often accompanied by an increase in excess body weight[17]. In economically developed countries, this situation is aggravated by the presence of persistent negative emotional stress in the majority of the population, which is an additional risk factor for the emergence of various diseases[18,19].

The high frequency of occurrence of deficits in motor activity provides conditions for an increase in the frequency of occurrence among the population of any disturbances in the work of the heart and blood vessels, contributing to the development of obvious dysfunctions in them already in adolescence[20,21]. An additional negative factor in the current situation is the residence of the majority of the population in large cities with a steadily deteriorating environment, which significantly weakens the physical capabilities of the majority of the population[22, 23].

It is known that in the case of activation of muscle contractions, it is possible to neutralize many of the negative consequences of the lifestyle inherent in large cities[26,27]. One of the options for improving the modern person suitable for widespread use can be long walks on flat terrain. They, according to a number of observations, are recognized as beneficial for the cardiovascular system[28,29]. Their serious advantage is a pronounced stimulation of physical parameters and emotional background of a person without significant material costs[30,31].

The strong healing effect of regular muscle activity in the lower extremities is caused by a pronounced activation of blood circulation in them with increased venous return to the heart as a result of the intensification of long-term uniform activity of their muscles, tendons and joints[32]. Walking options are traditionally considered hiking trips of various durations, walks and hiking trips. It is most rational to start long-distance walking in the conditions of sanatorium-resort treatment[33]. At the same time, these sessions should be carried out with a gradual increase in the duration of physical activity and with the achievement of the peak load in the middle of each session[34]. The serious health-improving effect of walking is also largely associated with the pronounced positive effect of the surrounding landscape and the existing weather conditions on the human body[35,36]. In view of the well-known general health-improving effect of walking, it was decided to conduct a study of their effect on the parameters of the cardiovascular system in adolescents with developing disorders of this organ system.

The purpose of the study is to find out the effect of long-term regular walking in young men on the cardiovascular system.

MATERIALS AND METHODS

The study was carried out in 2019-2020 on young men living in Central Russia (the city of Moscow and the Moscow region). The observation was carried out in full compliance with ethical standards. All adolescents in the study gave written informed consent to participate in it.

The observation group consisted of 24 young men (19.7±1.2 years) studying at the university, male adolescent age, who had a diagnosis of high normal blood pressure in a hospital setting. All those included in the observation group had a burdened heredity for hypertension (each of them had one or both parents for a long time suffering from various forms of hypertension). The control group consisted of 25 completely healthy adolescent males (19.5 ± 0.8 years) who did not have a hereditary predisposition to any pathology.

When taken under observation, young men of both groups had a comparable low level of physical fitness. All of them experienced physical activity higher than that of everyday life only in the course of regular academic physical education classes at the university.

In the observation group and in the control group, the same physical activity was applied in the form of daily walks at a speed of 4-5 km/h. During the first month, the duration of dosed

walking gradually increased from 30 minutes to 90 minutes. Subsequently, the duration of walking was 90-100 minutes a day in any weather. The surface on which the walks were made was horizontal or had an ascent or descent of no more than 20 °. The observation period for both groups was 6 months.

The general condition and the presence of complaints were found out from the persons included in the observation group and the control group on a daily basis. A complete examination of all those taken under observation according to the methods used in the study was carried out two times - at the time of taking into the study and at its completion. The vital capacity of the lungs was measured in all those taken under observation, the pulse value and the level of systolic and diastolic blood pressure were taken into account[37]. The state of their physical fitness was recorded in all the examined subjects, using a number of test physical loads. The results of the test were taken into account in the form of a 12-minute run (Cooper's test), a test of running at a distance of 20 meters, a test for recording the maximum possible number of flexions and extensions of the arms with an emphasis on the bench for 10 seconds and a test with registration of the throwing range of a ball having a mass of 1 kg from the initial sitting position.

Mathematical processing of the results obtained in the course of the study was performed using the Student's t-test.

RESULTS

The young men who were under observation, who made up both groups, as a result of their increased physical activity, began to notice an improvement in their general well-being. All of them indicated a decrease in fatigue, disappearance of episodes of headaches, increased emotional stability and improved sleep. The episodes of increased blood pressure that were noted during admission to the study in the observation group first began to occur less frequently, and then by the end of the observation disappeared in all cases. In the representatives of both observation groups, there was a significant decrease in the incidence of acute respiratory diseases in the cold season compared to the outcome level in the observation group by 35.2%, and in the control group by 33.3%.

The results of the observation performed are shown in Table 1.

Table 1. The results of the study

Indicators taken into account	At the start of the study, M±m		At the end of the study, M±m	
	Control group, n=25	Observation group, n=24	Control group, n=25	Observation group, n=24
Cooper's test, m	1322.0±2.75	1311.5±2.02	1926.7±3.07 p<0.01	1963.2±2.63 p<0.01
Throwing a ball from a sitting position, weighing 1 kg, cm	337.5±1.92	324.2±2.42	432.3±1.90 p<0.01	456.7±2.26 p<0.01
Flexion and extension of the arms in the lying position for 10 seconds, the number of times	4.4±0.36	4.2±0.32	6.7±0.27 p<0.01	7.3±0.34 p<0.01
Running 20 m, sec	4.5±0.06	4.6±0.09	3.2±0.10 p<0.01	3.0±0.07 p<0.01
Lung vital capacity, l	2.92±0.31	2.79±0.19	3.36±0.17 p<0.05	3.41±0.21 p<0.01
Systolic blood pressure, mm Hg	124.7±0.76	136.2±1.38	121.3±0.48	122.4±0.68
Diastolic blood pressure, mm Hg	78.9±0.41	87.3±0.34	80.2±0.53	77.3±0.44p0.05 p<0.05
Heart rate, beats / min	77.2±0.32	83.6±0.35	65.3±0.32 p<0.05	62.7±0.29 p<0.01

Note: p - reliability of the dynamics of indicators during the study in each group.

During physical training, the examinees had an increase in the level of physical fitness. In both groups of observation, the indicators of speed-power characteristics increased and overall endurance increased. In the control group, the speed of running at a distance of 20 m increased by 40.6%. The number of performed flexion and extension of the arms in the conditions of the lying position for 10 seconds increased by 52.3%. In control, the distance of throwing a ball weighing 1 kg from a sitting position increased by 28.2%, and the value of the indicator in the Cooper test increased by 45.7%.

The physical fitness of the young men who made up the observation group also increased. Among the subjects in the observation group, the time for running a distance of 20 m decreased by 53.3%, the number of flexions and extensions of the arms performed in the conditions of a supine position for 10 seconds increased by 73.8%, the distance of throwing the ball increased by 40.7% with an increase in the indicator registered in the Cooper test, by 49.7%.

As a result of regular walking lessons in the observed young men of both groups, it was possible to increase the volume of vital lung capacity - in the control group by 15.1%, in the observation group by 22.2%. Regular walks, carried out daily, contributed to a stable optimization of the heart rate in both groups of young men. In the course of the entire study, this indicator in the boys of the control group decreased by 18.2%, in the observation group it decreased by 33.3%. The level of systolic blood pressure decreased in the control group by 2.4%, in the observation group by 11.5%. There was also a decrease in the value of diastolic blood pressure in both groups - by 2.6% and by 12.9%, respectively. The results obtained in the study give reason to believe that regular walking can eliminate the manifestations of high normal blood pressure.

DISCUSSION

Physical activity is traditionally considered to be a strong stimulating factor for the whole organism[38]. By increasing the work of a certain number of striated muscles, the body enhances metabolic processes in them, hemodynamics and synthetic processes[39]. In working muscles, the number of active capillaries increases, which begin to pass through themselves not only plasma, but also blood corpuscles[40]. With an increase in general physical activity, more oxygen, plastic and energy substances enter the muscles. In this situation, the muscles begin to synthesize more protein and more adenosine triphosphate. This leads to an increase in their volume and an increase in their functionality[41].

Earlier studies have shown that various physical activities, provided they are adequate to the existing state of the body, can stimulate all its organs and tissues[42]. This was previously noted in the conditions of a healthy young organism and a healthy mature organism. There were no gender differences in the direction of the response to physical activity in different studies[38].

Studies devoted to the effect of physical activity on a human body with pathology have always been of particular interest. At the same time, regular feasible muscular activity was often considered as an option or a component of therapeutic action. At the same time, with an already formed pathology, it was often not possible to achieve a significant improvement in a person's condition with the help of only physical training. They have found their place as one of the components of general health effects on the body as part of often complex treatment complexes for various pathologies[43].

More possibilities in terms of health improvement in increasing muscle activity are recognized at the initial stages of pathology development and in conditions of its risk. development. At the same time, the possibilities of physical training in relation to individual variants of the initial manifestations of pathology have not been fully studied. Unfortunately, the possibilities of increasing physical activity in the case of incipient cardiovascular pathology remain not fully understood[44]. Its health-improving capabilities in the onset of arterial hypertension, which is very common in modern society, have not been definitively established[37]. Special attention to it determines its ability to progress quickly enough and lead to various complications that are dangerous for the viability and working capacity of a person[29].

Recently, arterial hypertension increasingly begins in people of adolescence and first adulthood, which leads to an early decrease in their labor potential, often causing disability.

In this regard, it is very important for society to search for means to reduce the risk of this disease in young people and effective options for inhibiting its progression. An important factor that can help in this process is regular exercise. Their capabilities in arterial hypertension have been evaluated in a number of few studies. With their help, it turned out to be possible to restrain the progression of arterial hypertension[45]. At the same time, the preventive possibilities of increasing physical activity in persons at risk of developing arterial hypertension remained highly controversial. An unambiguous judgment did not exist here due to the paucity of scientific information on this issue. In this regard, it was decided to conduct this study with the aim of closing the gaps in the existing system of scientific knowledge.

The results of this study indicate the great health-improving potential of regular daily walking long distances in adolescents, including those with dysfunctions of the cardiovascular system[38]. The results obtained make it possible to consider that walking can normalize the activity of the heart, optimize vascular tone and significantly increase overall physical fitness [39].

Exercise previously used for various stages of arterial hypertension had a therapeutic focus. As a rule, these were jogging and different versions of athletics. They had a therapeutic effect on the body of hypertensive patients, but their preventive potential in terms of curbing the initial stages of hypertension remained unclear. However, despite this, it could be argued unequivocally that there is a positive effect of increased physical activity on vascular tone and the degree of development of most of the skeletal muscles. The information obtained in this study confirms the previously obtained results of studies on people with already formed arterial hypertension[2,12]. The slightly more functionally beneficial changes revealed at the end of the study in the observation group are apparently associated with a more responsible approach of young men in this group to physical activity as a means of eliminating their existing cardiovascular dysfunction[46,47]. In this regard, the use of physical activity in the form of walking long distances can be considered a very effective means of strengthening the function of the cardiovascular system in healthy young men with high normal blood pressure.

The authors confirm the previously obtained data of other researchers on the possibility of improving the work of the cardiovascular system[48], including in conditions of hypertension[37]. At the same time, there is reason to assert that regular walking for long distances can prevent the development of arterial hypertension at the very beginning of the development of this pathology.

An increase in physical activity in a person in the form of an increase in walking distance increases the level of adaptive capabilities of all organs in his body[46]. One of the leading mechanisms for increasing the body's functional capabilities to increase physical activity in these conditions is an increase in the reserves of the cardiovascular system[49]. This enhances its ability to deliver oxygen to all organs of the body. Regular walking increases the severity of blood flow, normalizes vascular tone, has a positive effect on the rheological parameters of the blood and enhances the delivery of oxygen to the cells. In addition, under conditions of increasing daily physical activity in humans, the fitness of the heart muscle increases and the mechanisms of hemostasis weaken, which contributes to the improvement of tissue trophism[50].

Considering the literature data and the results of our observations, there is reason to believe that as a result of regular moderate physical exertion in the form of an increase in the distance traveled per day, the degree of elasticity and strength of a number of muscles increases and the flexibility of joints increases[48]. Systematic walking exercises lead to the normalization of the formation of various biologically significant substances in the walls of blood vessels and tissues, optimizing the course of life processes throughout the body. In this regard, it can be thought that an increase in the daily traversed distance forms a reliable balance of regulation processes in the cerebral cortex, as well as sympathetic and parasympathetic, contributing to the overall health of the body and inhibition of the development of pathology to which the body is predisposed[51].

CONCLUSION

Systematic physical training in the form of walking in the group of healthy young men and in the group of young men suffering from high

normal blood pressure ensured a consistently normal level of heart rate and blood pressure. As a result of regular walking in the examined groups, it was possible to achieve a comparable increase in the volume of the vital capacity of the lungs. Obviously, this was a consequence of the increase in the level of physical fitness among the young men who go in for walking. This was accompanied by an increase in the trainees' speed-strength capabilities and the level of endurance. The results obtained make it possible to talk about the great health-improving possibilities of regular walking in adolescents, including those with high normal blood pressure. These physical activities optimize heart function, normalize vascular tone, and increase overall physical fitness. Given the results obtained, regular walking can be considered a very effective option for improving the functioning of the cardiovascular system in adolescents, including with its incipient dysfunction.

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Conflict of interest

No conflict of interest is declared.

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Ethics Committee Resolution

The study was approved by the local ethics committee of the Russian State Social University on September 15, 2019 (protocol ¹11).

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