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Possibilities of Handball Practice in Strengthening Heart Function in University Students

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Abstract

Systematic handball training stimulates the entire body and especially the heart. To improve the methods of practicing handball, it is necessary to further study the aspects of adapting the heart of young handball players to regular training. The study aims to find out the dynamics of the functional capabilities of the heart in youth handball players. The observation was carried out on 25 completely healthy youth handball players with at least 2 years of sports training experience. The control group included 24 healthy young men who did not go in for sports during their life. In all cases, the study was carried out on an SSD-80 "Aloka" ultrasound device (Japan), finding out several indicators of heart function. Statistical processing of all the results of the study was performed using the Student's t-test. The phenomena of mild hypertrophy of the wall of the left ventricle were revealed in young handball players. This was indicated by an increase in the thickness of the muscle of the posterior wall and an increase in the mass of the left ventricle of the heart myocardium. In all handball players, the volume of the left cardiac ventricle was optimal. They are also characterized by a high rate of diastole realization when compared with young men in the control group. Systematic handball exercises strengthen the entire body. Handball promotes the growth of muscle mass in the wall of the left ventricle, which significantly increases its ability to work and stimulates blood supply to the whole body.

Keywords: Heart, Handball, Hemodynamics, Left ventricle, Physical activity

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Introduction

Regular physical training strengthens the capabilities of all organs and stimulates life processes in the body (Khitrov & Paukov, 1991; Amelina & Medvedev, 2009; Azeem & Mohammed, 2019; Permadi *et al*., 2020). Neglect of systematic physical activity always lowers the activity of the body and especially its heart muscle (Medvedev & Zavalishina, 2016; Zavalishina, *et al*., 2018). Regular training builds muscle mass and activates life processes in them (Bespalov *et al*., 2018; Makhov & Medvedev, 2021). At the same time, the efficiency of the activity of all adaptive mechanisms increases, and the entire metabolism increases (Tkacheva & Zavalishina, 2018a; Zavalishina, 2018c). The impact on the body of various types of regular training requires additional careful assessment, especially in terms of the upcoming changes in the work of the heart (Zavalishina, 2018b). Of particular interest in this regard is the state of the contractile function of the heart during sports activities (Medvedev, 2018c; Medvedev, 2021).

Often, well-trained athletes increase the volume of the entire myocardium and especially in the left ventricle, which sometimes reduces the heart cavity (Dembo & Zemtsovsky, 1989). In those who started systematic sports training, the value of cardiac output decreases in comparison with the level before the start of physical training (Makurina, 2018; Medvedev, 2018b).

Due to the undoubted vital importance of the optimal heart function, additional detailed studies of the course of adaptation processes in its work against the background of regular physical activity, including handball (Skoryatina & Medvedev, 2019; Zavalishina, 2020). To increase the effectiveness of handball

training aimed at their physical improvement, further in-depth studies of many aspects of the heart work in handball players are required (Mal *et al*., 2018a; Medvedev, 2018e).

Purpose: to find out the dynamics of the functional capabilities of the heart in youth handball players.

Materials and Methods

The conducted observation was carried out on 25 completely healthy students aged 17 to 21 years. All the subjects regularly practiced handball for an hour a day at least 4 times a week. Their continuous handball experience was at least 2 years. The control group consisted of 24 healthy students aged 17 to 21 years, who physically trained only in university physical education classes 2 times a week.

The study was carried out using an SSD-80 "Aloka" ultrasound device (Japan). The diastolic volume of the heart was calculated according to the obtained indicators. The value of the mass of the heart muscle was determined in a standard way. The ratio of the muscle mass of the left cardiac ventricle and the volume of its cavity was determined in the course of determining the value of the index of the end-diastolic volume of the heart.

Statistical data processing was carried out using the Student's t-test. Significant differences between the groups were registered in the case of $p<0.05$.

Results and Discussion

The performed observation made it possible to reveal the differences in the recorded indicators among the handball players and among the students who do not go in for sports **(Table 1)**. Some differences between both observation groups were associated with the considered morphological characteristics of the muscular part of the wall of the left cardiac ventricle, due to regular physical training (Tkacheva & Zavalishina, 2018b; Karpov *et al*., 2020b).

The diameter of the left atrium in the examined athletes turned out to be greater than its value in the control group by only 9.7%. This indicated greater severity of adaptation of their heart muscles to sports loads (Makhov & Medvedev, 2018a; Glagoleva & Medvedev, 2020). In handball players, the anteroposterior diameter of the left ventricle at the time of diastole exceeded 6.9% of that of physically untrained students. Such differences can be considered a consequence of the powerful anabolic processes occurring in handball players in the heart muscle (Karpov, *et al*., 2020a; Karpov *et al*., 2021a).

The diameter of the myocardium in the posterior part of the left ventricle during diastole was 17.9% more in handball players than in students who were control group ($p<0.05$). This is due to the active work of handball players of the left ventricle of the heart during training (Medvedev, 2018d; Karpov *et al.*, 2021b). The value of the diastolic heart volume in handball players showed a tendency to decrease in comparison with the control indicator by (5.9%) (Makhov & Medvedev, 2018b; Glamazdin *et al*., 2021). The stroke volume in examined both groups was comparable, which was a marker of the optimal functioning of the heart in all cases (Medvedev, 2018a; Makhov & Medvedev, 2020b).

Table 1. Indicators taken into account in all examined

Indicators of cardiac activity	Group of handball players, M±m, n=25	Control group, M±m, n=24
End-diastolic volume to myocardial mass, cm^3/kg	0.64±0.19	0.96±0.13 p<0.01
Impact volume, cm^3/kg	1.15±0.22	1.06±0.08
Myocardial mass, cm^3/kg	2.67±0.31	2.09±0.24 p<0.05
The diastolic thickness of the left ventricle in the posterior wall, cm	1.25±0.12	1.06±0.05 p<0.05
End diastolic volume of the heart, cm^3/kg	1.87±0.26	1.98±0.12
The greatest relaxation rate of the left ventricle in the posterior wall, cm/s	13.9±1.71	10.1±0.68 p<0.05
Ejection fraction, %	61.71±1.14	60.06±0.92
Left atrium diameter, cm/m^2	1.92±0.15	1.75±0.15
Anteroposterior diameter of the left ventricle in diastole, cm	5.41±0.24	5.06±0.07
Reduction of the anteroposterior size of the left ventricle, %	35.01±0.38	32.96±0.84

Note: p is the mathematical significance of the differences in the indicators taken into account between the groups under consideration.

In handball players, the value of myocardial mass was 27.7% higher compared to physically untrained students in the control group (Skoryatina & Zavalishina, 2017; Mal *et al*., 2018b). This indicated the formation of slight hypertrophy of the heart muscle during regular handball exercises (Medvedev, 2018g; Zavalishina, 2018d; Medvedev *et al*., 2021). Its severity did not affect the volume of cardiac systolic output (Zavalishina, 2018g; Medvedev, 2018h). The volume of this fraction was comparable in both groups of patients, confirming their normal heart function (Zavalishina, 2018f; Zavalishina *et al*., 2021a; Zavalishina *et al*., 2021b).

In the muscle located in the posterior wall of the left cardiac ventricle, the maximum rate of the relaxation process was observed in the examined handball players. In this category, this indicator was 37.6% higher than the control values, as a result of an increase in the volume of their cardiomyocytes (Makhov & Medvedev, 2018c; Medvedev, 2018f).

The ratio of diastolic volume and myocardial mass in handball players was less than in the control group by 50.0%. This is due to the greater sensitivity of this parameter to regular muscle training, which is aerobic (Glagoleva *et al*., 2018; Zavalishina, 2018e; Makhov & Medvedev, 2020a).

The conducted observation demonstrated in both groups taken into the study the comparability of the size of the left atrium, the value of the indicator of the volume of the left ventricle, and the value of the volume of its cavity. All examined students had comparable characteristics of their central hemodynamics and the ability of the heart to contract. The ratio of the value of the final diastolic volume of the heart to the mass of the heart muscle under conditions of regular sports training significantly decreased due to the increase in the volume of the entire myocardium, especially in the part of the posterior wall of the left cardiac ventricle. A decrease in the ratio of the end-diastolic volume to the value of the myocardial mass to the level of 0.64±0.19 in handball players can be considered a consequence of the prevalence of the phenomenon of hypertrophy in them over the phenomenon of expansion of the cardiac cavities (Tkacheva & Zavalishina, 2018c; Zavalishina *et al*., 2021c).

Handball training is associated with intense physical activity **(Figure 1)**.

Figure 1. Handball practice (https://tltolimp.ru/wp-content/uploads/2017/12/171218-1149.jpg)

Obviously, in conditions of regular handball loads, hypertrophy of the muscle wall of the left ventricle occurs. This is indicated by the tendency to increase the diameter of its posterior wall and an increase in the value of its mass while maintaining the optimum volume of the cavity of the left cardiac ventricle (Zavalishina, 2018a).

Significant acceleration of diastole development, which takes place in handball players, develops as a result of systematic sports training[3]. Accelerated relaxation of the posterior wall muscle of the left cardiac ventricle is evidence of this. However, this ultrasound parameter is subject to pronounced changes even during the study of one person. In this regard, for its correct interpretation, additional observations are required on different groups of athletes.

Conclusion

Regular handball during adolescence can strongly train the heart muscle and stimulate overall hemodynamics. Systematic handball training increases the muscle mass of the left ventricle but maintains a normal volume of its cavity. Trained handball players have a highly biologically beneficial high rate of diastolic relaxation of the posterior wall of the left ventricle of the heart.

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