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EVALUATION OF THE BLOOD VENOUS LEAVE IN VOLLEYBALL PLAYERS OF THE MESOMORPHIC SOMATOTYPE

Abstract. *The peculiarities of the amplitude of the diastolic wave, the dicrotic and diastolic indices of the thigh and shin in the youth volleyball players of the mesomorphic constitutional type are presented in the paper. The lower values of the diastolic wave amplitude and hemodynamic indices in mesomorphic volleyball players were established in compare with non-athletes, that means and improve good venous outflow of blood. The lower values of the diastolic wave amplitude and hemodynamic indices in mesomorphic volleyball players and non-athletes were established, results indicated good venous outflow of blood in volleyball players.*

Key words: *reovasogram of thigh and shin, venous outflow, youth volleyball players, mesomorphic somatotype.*

Sports is a special kind of activity, which is combined with regular high (often extreme) physical and emotional stresses, high standards of health of an athlete. Assessment of the functional state of the body during sports is important for optimal construction of the training process, a kind of "outlet" of athletes to the highest level of functional readiness, which, together with other factors, ensures the achievement of the maximum possible sports results [1, 2]. Adaptation mechanisms of muscles blood supply are very important for the growth of sports achievements. It is known that the weight of the muscles is about 36% for women, 42% for men. Athletes - 50% or more. The largest range of changes in blood supply is a characteristic feature of the skeletal muscle's blood supply. In a state of rest, skeletal muscle receives 18-20 % of the total volume of oxygen consumed, which is 50-60 ml min^{-1}. During the physical trainings the blood supply of skeletal muscles can increase by 10-20 times in comparison with the state of rest, and consequently, the proportion of oxygen, which enters to the active muscles is increased to 2.8-3.3 l min^{-1} [3, 4]. In the process of intensive work of the muscles are appear adaptive changes in the activity of the cardiovascular system, the nature and tension of which depend not only on the power and duration of loading, but also to a lesser extent on the action that was used [5]. A sufficiently large factual material has been accumulated concerning the physiological processes associated with the exercise of physical activity and, above all, dynamic loads. But a number of issues of muscular work adaptation remains inadequate. Considering the above facts, it is obvious that the system of peripheral vessels, in particular the state of venous outflow of blood, is of great importance for the proper performance of training and competitive loads.

The purpose of the study was to determine the state of venous blood outflow in athletes of the mesomorphic somatotype, who are engaged in volleyball, by determining the reovosographic indexes of the thigh and shin.

Materials and methods. We conducted a comprehensive survey of youth volleyball players (boys from 17 to 21 years old and girls from 16 to 20 years) with high level of athletic skill (from the first adult level to sports master). They conducted an

anthropometric study using Bunak's technique [6], and somatotypological investigation according to the estimated modification of the Heath-Carter method [7]. It was found that 32 male volleyball players and 29 female volleyball players belonged to the mesomorphic constitutional type. The control group was consist of individuals of the same somatotype (23 boys and 33 girls) who were not engaged in sports, and were practically healthy at the time of the survey. A statement on their health was made after a clinical and laboratory study, which included echocardiography, sonography of the thyroid gland, kidney, urinary bladder, liver, gall bladder and spleen, chest X-rays; spirography, tetrapolar rheography. The research was conducted on the base of the Scientific Laboratory of Functional Morphology and Genetics of the Scientific-Research Center of the E. Pirogov Vinnitsa National Medical University. The reovasographic parameters of the thigh and shin were determined using tetrapolar rheography on a computer diagnostic complex. The estimation of quantitative parameters was carried out according to time, amplitude and other parameters according to Ronkin and Ivanov's method [8]. Reliability of difference values between independent quantitative variables were determined using the U-Mann-Whitney criterion and programme STATISTICA 5.5 (license number AXXR910A374605FA)

Results. Firstly, the state of venous blood outflow is characterized by such indices to reovazograms, as amplitude of diastolic wave, dicrotic and diastolic indices. We have found that the amplitude of the diastolic wave on the thigh in the volleyball players of the mesomorphic somatotype (0.006 ± 0.002) Ohm, compared to those of the same constitutional type who were not engaged in sports (0.007 ± 0.002) Ohm, was slightly lower (p> 0.05). At the shin of the volleyball players, this indicator had a value (0.019 ± 0.005) Ohm, in the control group - (0,021 ± 0,007) Ohm, the difference in comparison of these values is not reliable.

The value of the dicrotic index in the thigh of the mesomorphic somatotype volleyball players was (58.76 ± 13.34) %, in the control group - (59.66 ± 16.97); at the shin of the athletes, the average values of this indicator were within (30.28 ± 12.67) %, in non-athletes - (36.21 ± 11.79)%. Thus, it was found that on the thigh the magnitude of this indicator did not reveal statistically significant differences between volleyball players and non-sportspersons, and the dicrotic index was less ($p < 0.05$) than in the control group.

The diastolic index, determined by the ratio of the amplitude and parameters of time of the thigh rheogram, in the mesomorphs volleyball players (50.56 ± 12.76) % were significantly lower ($p < 0.05$) than in the control group (57.88 ± 13.32) %. The value of this index on the shin did not differ statistically significantly between athletes (37.50 ± 8.73) % and those not engaged in sports (40.32 ± 8.894) %, but although it is necessary to note the lower values of the diastolic index for volleyball players.

Discussion. Under the influence of sports training, the functional capabilities of athletes are increased, the parameters of aerobic performance of the organism increase, the efficiency of the functioning of the cardiovascular and respiratory system increases [9], longer load increases the significance of the aerobic system [10].

The amplitude of the diastolic wave, which reflects the ratio of arterial and venous blood flow, at a young age, under conditions of high elasticity of the arterial bed, it is mainly a wave of reflection from the smallest arteries and arterioles [11]. Because the degree of this reaction is functionally associated thought the venular-arteriolar reflex with a state of venous organ perfusion, it indirectly depends on the state of venous outflow. With the loss of the elastic properties of the arterial bed, which may be due to age or different pathological states, the amplitude of the diastolic wave increases due to overlapping reflection waves in the more central artery regions [12].

The dicrotic index characterizes the state of tone of contractive elements of small arteries and arterioles and allows to assess the state of microcirculation and depends on the state of peripheral vascular resistance. Significant changes in the dicrotic index (in the direction of increase) indicate a violation of the correlation between arterial flow and venous outflow in small vessels, the growth of peripheral resistance and the appearance of signs of venous congestion in the vessels of the precapillary bed [13].

The diastolic index reflects, basically, the state of blood outflow from the arteries to the veins [11]. Diastolic index - is the ratio of the magnitude of the amplitude at the level of the dicrotic to the

maximum amplitude of the rheographic wave [12]. It is known that this parameter reflects the state of the vessels of the postcapillary bed, the venules and venous tone, venous blood flow (the ratio of outflow and blood flow) and is an indirect parameter of the elasticity of the vascular wall [13, 14].

The smaller values of the diastolic wave amplitude, the dicrotic and diastolic indexes that we observed in the volleyball players of the mesomorphic somatotype, indicate the best venous outflow, which formed under the influence of systematic physical activity. An improved venous outflow of volleyball players of this constitutional type can be considered as a compensatory adaptation of peripheral hemodynamics to the needs of this kind of sport. In previous studies, we revealed the negative changes in regional circulation in volleyball players of the general group (without division into somatotypes). They showed the most pronounced slowing of the blood flow on the shin and thigh, reducing the elasticity of the vascular walls of the arteries of medium and small diameters, high peripheral resistance, and increasing the tone of arteries of different diameters [15, 16].

Conclusion: in volleyball players of the mesomorphic somatotype compared to non-athletes, improved venous outflow of blood was established, as evidenced by lower values of the amplitude of the diastolic wave, of the dicrotic ($p < 0.05$ on the tibia) and of the diastolic ($p < 0.05$ on the hip) indices.

Prospects for further research. The results of this study can be used in predicting the parameters of the reavasograms of the thigh and shin in volleyball players to achieve their high results.

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