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MORPHOFUNCTIONAL INDICATORS OF ORGANISM OF THE ATHLETES-WRESTLERS OF YAKUTIA

DOI 10.25789/YMJ.2019.65.07

ABSTRACT

The article is devoted to a comprehensive study of the physical development and physique of freestyle wrestlers, as well as functional parameters of the body. The indicators of cardiovascular system - dynamics of indicators of adaptive potential and coefficient of endurance of athletes in different seasons of the year are studied.

38 men of Yakut nationality, aged 18 to 29 years, athletes – freestyle wrestlers having high sports qualification were the **object** of our study. The comparison group was 20 male cadets of the police school. The compared groups were comparable in age. The study was conducted in different seasons: summer (June), autumn (October), winter (December), spring (March).

We revealed that, among highly qualified wrestlers Yakut nationality, dominated the brachymorphic somatotype, characterized by an average or low growth, relatively long torso, broad shoulders, a large breast, short lower limbs. Analysis of the data showed that 34.2% of the athletes surveyed by us were overweight, as well as high values of the Rohrer index. Low heart rate values are probably a sign of adaptation to intense physical activity. The increase in AP points indicates signs of CVS stress, which is associated with an increase in physical and psycho-emotional stress in the autumn due to the beginning of the annual cycle of training, and in winter and spring with participation in competitions of various levels. The increase in EC (> 16.e.) 10% -18% of the surveyed us freestyle wrestlers indicates the voltage of the myocardium, and decrease in EC (< 12 e.) 45% -55% may be a sign of exhaustion of the myocardium.

Keywords: athletes, cardiovascular system, blood pressure, adaptive potential, coefficient of endurance.

Adaptation is one of the basic concepts in physiology. In the Far North, the adaptation of the human body to the conditions of habitat in high latitudes takes a special place and is provided by the restructuring of all body systems. The harsh climate also affects anthropometric indicators. T.I. Alekseeva [1], describing the «Arctic» adaptive type, indicates such features of the physical constitution of the indigenous population as a small body length, relatively wide chest, muscular body type, high body density. G.K. Stepanova [12] notes that the comparative analysis of the study of the dynamics of anthropometric data for 20 years showed that the growth in the population of young Yakuts significantly increased, but was not accompanied by the addition of body weight. This is consistent with the data of S.P. Permyakova [5] and V.G. Starostin [8] who noted an increase in the dolichomorphy among the indigenous peoples of the North and a decrease in the prevalence of representatives of the brachymorphic somatotype over the same period of time.

The human circulatory system is responsible for the adaptation of the body to various environmental factors. In most cases, the cardiovascular system (CVS) can be considered as an indicator of the body's adaptation. The study of CVS reactions allows to measure the level of functioning of the circulatory system, such as minute and shock blood volume, pulse rate, blood pressure, as well as to calculate such integrative indicators as the adaptive potential (AP) and endurance coefficient (EC) of CVS. Under excessive physical exertion in extreme Northern conditions, there are adaptive changes in athletes CVS, change in hemodynamic parameters. Adaptation to physical activity is accompanied by an increase in the impulse of the heart. The increase in the impulse of the heart affects the pulse at rest, it becomes much less frequent [6, 9 -12].

The aim of the research was to study the morphometric parameters of physical development and evaluation of the functional state of the body of freestyle wrestlers of Yakutia.

Materials and methods of research. The object of our study were 38 men of Yakut nationality, aged 18 to 29 years, athletes – freestyle wrestlers of School of the highest sports skill of Yakutsk and students of the Institute of physical culture and sports M.K. Ammosov NEFU having high sports qualification: candidates for masters of sports, masters of sports, masters of sports of international class, honored masters of sports. The comparison group was composed from 20 male cadets of the Yakutsk police school attending classes in general physical training. The compared groups

were comparable in age. The study was conducted in different seasons: summer (June), autumn (October), winter (December), spring (March).

We calculated body mass index (BMI) or Quetelet index and Rohrer index, which is used as a group growth-weight index.

The main indicators of the functional state of the CVS, which determine the development of adaptation of the body, include heart rate (heart rate), all types of blood pressure (systolic (SBP), diastolic (DBP)) and pulse (PP) (the difference between the ratio of systolic and diastolic pressure).

Among the numerous criteria proposed for assessing the functional state of compensatory-adaptive mechanisms that provide adaptation and homeostasis of the body under the effects, often having a stressful character, an important role belongs to the definition of AP of the circulatory system, reflecting in conventional units – points the degree of tension of adaptation mechanisms, manifested in changes in hemodynamic parameters. AP organism was calculated by the formula: AP=0,011PR+0,014SBP+0,008DBP+0,014A+0,009BW–0,009G–0,27, where PR – pulse rate; SBP – systolic blood pressure; DBP – diastolic blood pressure; G – growth; BW – body weight; A – age. Scale of assessments for the indicator AP: 4 points-2.10-satisfactory adaptation (characterizes sufficient functionality of the circulatory system); 3 points - 2,11-3,20 - functional stress adaptation mechanisms; 2 points - 3,21-4,30 - unsatisfactory adaptation (characterizes the decrease in the functionality of the circulatory system with insufficient, adaptable reaction to the loads); 1 point - more than 4.30 - destruction of adaptation (characterizes a sharp decrease in the functionality of the circulatory system with the phenomenon of failure of the mechanisms of adaptation of the whole organism) [2].

EC characterizes the functional state of the CVS and is an integral value that combines the heart rate with pulse pressure [3]: calculated by the Kvas formula: EC = HR x 10/PP. Normal EC from 12 to 16.e.

The data obtained were statistically processed using the SPSS 17.0 statistical software application package. For all indicators in each group, the arithmetic mean values (M) and the errors of the mean values (m) were calculated. The level of significance was considered significant at p≤0.05. The significance of the differences was determined using non-parametric Mann-Whitney criteria. The Spearman linear correlation coefficient was calculated to identify the conjugacy of the indicators.

Table 1

Anthropometric indicators of highly qualified freestyle wrestlers

Parameter	Freestyle wrestlers (n=38)	Control group (n=20)	p
Age, years	22,0 (22,0; 25,0)	24,0 (22,5; 25,5)	0,070
Height, m	1,7 (1,6; 1,7)	1,8 (1,7;1,8)	<0,001
Body weight, kg	62,5 (58,0; 72,0)	68,5 (66,0; 74,5)	0,010
The Rohrer's Index	14,7 (13,8; 17,2)	12,9 (12,0; 14,2)	<0,001
BMI, kg/m^2	23,7 (22,7; 26,0)	22,8 (21,3; 24,5)	0,062

Note. In the Tables 1-3 data are presented in the form of median and interquartile distribution in Me (Q1; Q3) format; p – achieved level of statistical significance of differences in comparison of groups (Mann-Whitney criterion).

Results and discussion. Body size (along with other indicators characterizing physical development) are important parameters of sports selection and sports orientation. Table 1 presents the results of anthropometric indicators of the men we examined.

When assessing the distribution of growth was considered undersized person with the growth of 167 cm and below average height – with the limits of growth 168-179 cm, and tall – 180 cm and above [12]. Analysis of the distribution of growth showed that there are significant differences between the groups (Figure 1). 61% of freestyle wrestlers were undersized athletes, while in the control group undersized was 5%. The share of tall was 13 and 30%, respectively. Thus, among the examined highly skilled freestyle wrestlers dominate undersized athletes, and among the persons constituting the control group was dominated by persons with a mesomorphic type.

Differences in BMI values did not reach the level of statistically significant, but in athletes both the median and the boundaries of quartiles were shifted towards larger values. The analysis of the data showed that 13 (34.2%) wrestlers were overweight, while in the control group the same figure was 4 (20%). This is probably due to the peculiarities of morphofunctional features (differences in the composition of the body, more muscle mass in athletes). Thus, the Rohrer index characterizing the body density was significantly higher in wrestlers than in the control group (p<0.001).

Indicators of the functional state of the CVS of the persons examined by us are given in the Tables 2 and 3.

According to our data, the heart rate in the group of athletes, depending on the season, did not change statistically significantly. However, athletes heart rate in all seasons was lower than in the control group. Thus, in comparison with the control group, athletes ' heart rate at rest in autumn was lower by 16% (p<0.01), in winter it did not change, and in spring it was lower by 14% (p<0.05). In the control group, depending on the season of the year, statistically significant differences in heart rate were revealed. Thus, there was a decrease in heart rate in winter and spring by 11% (p<0.05) and 8%, respectively, in comparison with the autumn season. Slowing of heart rate or bradycardia (45-60 beats per minute) was observed in summer in 33% of wrestlers, in autumn – in 54%, in winter – in 64% and in spring – in 40% (Table 2). Bradycardia, stated in some highly qualified athletes in all seasons of the year, may be a sign of heart hypertrophy under the influence of intense physical activity.

Due to the fact that the annual training cycle is divided into different stages, we analyzed the AP depending on the season of the year (Table 3). The analysis of AP revealed that the average AP scores in athletes during the year

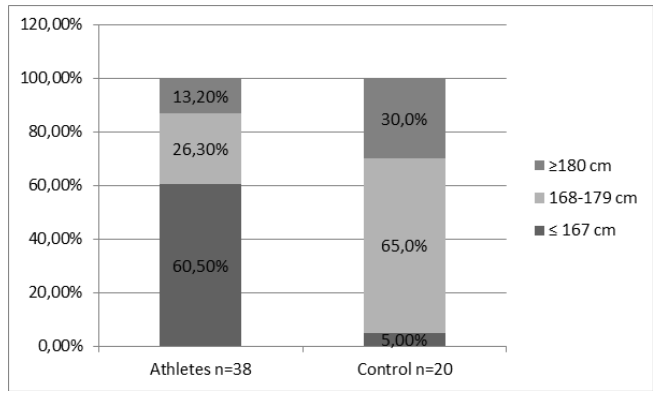

Fig. 1. Growth distribution in the compared groups

exceed 2.1 points, which indicates the stress of adaptation mechanisms, which is probably due to a decrease in heart rate. Since adaptation to physical activity is associated with an increase in the shock volume of the heart. While in the control group signs of stress adaptation mechanisms appear only in the spring.

In a more detailed analysis revealed that in the summer 39% of athletes AP was at the level of satisfactory adaptation, 61% - corresponded to the level of stress adaptation mechanisms. In autumn, the number of athletes with AP at the level of satisfactory adaptation decreased to 27%, while in the control group at this time of the year the level of satisfactory adaptation was noted in 87%. That is, the tension of adaptation mechanisms was observed in 73% of athletes, and in the control group only in 13%. In winter, satisfactory adaptation among athletes was observed in 43%, and among the control group – in 71%. In other words, the tension of adaptation mechanisms was observed in 57% of wrestlers, while in the control group – in 29%. In spring, both among athletes and among the control group, 40% were at the level of satisfactory adaptation, and 60% experienced tension of adaptation mechanisms.

Study EC in athletes depending on the season of the year showed that the highest average rates were observed in the summer of 13.32±2,89.e. and the lowest of 10.09±1,67.e. in the spring, indicating that the fatigue of the CVS (Figure 2).

The most favorable indicators of EC were noted in the spring, the greatest overvoltage of CVS was noted in the autumn, the greatest fatigue of CVS – in the summer. Our data indicate that intense physical and psychoemotional load, experiencing highly skilled athletes, affect the functional state of compensatory-adaptive mechanisms for adaptation and the degree of fitness of the CVS. At the same time, the greatest stress of adaptation mechanisms athletes experience in the autumn. Probably, this is due not only to the beginning of the annual cycle of training, but also the influence of climatic factors.

The increase in the number of wrestlers with signs of CVS stress to 73% is in the autumn due to the beginning of more intense physical activity after the summer period. In addition, the state of CVS athletes affected by climatic factors (in October, set a negative temperature to -20°C), reduced insolation (shortening of daylight hours), changes in atmospheric pressure. The increase in the number of athletes with satisfactory adaptation in winter (up to 43%), in spring – up to 40%, is likely due to the fact that athletes are gradually entering a certain training regime. However, the fact that 57% (AP 2,13 points) of wrestlers in the winter and 60% (AP 2,21 points) of wrestlers in the spring, have signs of tension of CVS that testifies that in these seasons of year they experience the greatest physical and psychoemotional loadings. Since the greatest number of different competitions falls on these periods.

The results of our research do not contradict the information given in the literature. In the few publications relating to structural and functional features of CVS athletes of Yakutia shows that intense professional sports can contribute to decompensatory changes of AP from individual athletes (group risk). This is manifested by an increase in the mass of the left ventricular myocardium, violations of hemodynamic parameters: higher blood pressure, bradycardia, while a higher total peripheral resistance, which indicates a violation of intrasystem interactions and the transition to myocardial hypertrophy (4, 6, 7, 9- 14].

Thus, in highly qualified wrestlers of the Yakut nationality, the brachymorphic somatotype dominated, characterized by an average or low growth, relatively long torso, broad shoulders, a large breast, short lower limbs. Analysis of the data showed that 34.2% of the athletes surveyed by us were overweight, as well as high values of the Rohrer index. Low heart rate values are probably a sign of adaptation to intense physical activity. The increase in AP points indicates signs of CVS stress, which is associated with an increase in physical and psycho-emotional stress in the autumn due to the beginning of the annual cycle of training, and in winter and spring with participation in competitions of various levels. The increase in EC (> 16.e.) 10% -18% of the surveyed us freestyle wrestlers indicates the voltage of the myocardium, and decrease in EC (< 12 e.) 45% -55% may be a sign of exhaustion of the myocardium.

Table 2

Indicators of the functional state of the cardiovascular system in freestyle wrestlers

Parameter	Freestyle wrestlers (n=38)	Control group (n=20)	p
SBP, mm	124,0 (119,0; 127,0)	122,5 (115,0; 128,0)	0,763
DBP, mm	73,0 (66,0; 79,0)	74,0 (67,0; 81,5)	0,587
HR, min	61,0 (54,0; 66,0)	69,0 (56,5; 74,0)	0,029
AP (N up to 2.1 points)	2,0 (1,7; 2,3)	2,2 (2,0; 2,4)	0,048
EC (N 12-16 e)	12,0 (10,4; 15,6)	14,2 (12,9; 15,6)	0,091

Table 3

IIIndicators of the functional state of the cardiovascular system in freestyle wrestlers in different seasons of the year

	Summer n=18	Autumn n=10	Winter n=17	Spring n=32	p
SBP, mm	125,5 (121,3; 130,5)	126,5 (121,8; 133,0)	122,0 (118,0; 128,0)	124,5 (115,0; 134,0)	0,058
DBP, mm	71,0 (63,5; 77,5)	74,0 (67,8; 83,5)	73,0 (66,5; 80,0)	74,5 (68,0; 82,0)	0,691
HR, min	62,5 (53,5; 67,5)	58,5 (51,3; 68,8)	59,0 (56,5; 63,0)	62,0 (52,0; 67,0)	0,308
AP	2,2 (2,0; 2,4)	2,2 (2,1; 2,4)	1,6 (1,5; 1,8)	1,7 (1,5; 1,9)	0,013
EC	11,4 (8,9; 15,3)	10,7 (7,6; 16,8)	12,6 (10,6; 14,9)	12,7 (10,2; 15,7)	0,308

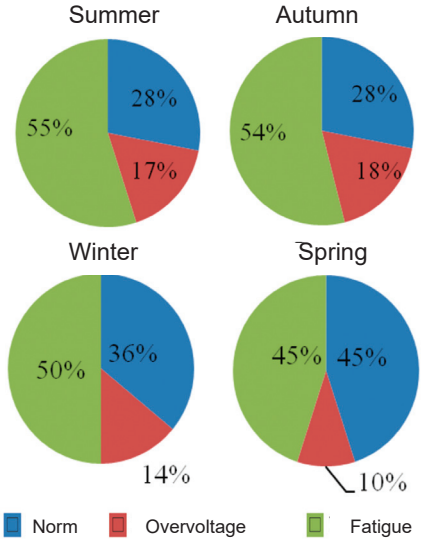

Fig. 2. Frequency of overvoltage and fatigue of CVS on EC in wrestlers depending on the season of the year (%)

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