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Research Article

Functional State of Athletes-Wrestlers in Yakutia

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ABSTRACT.

This is a comparative analysis of the features of physical development and a constitution of wrestlers of free style that result in functional indicators of an organism. The results of the study of the dynamics of the indicators of the blood circulation system adaptive potential in athletes in different seasons of the year are presented.

Among highly qualified wrestlers of the Yakut nationality, the brachymorphic somatotype, which is characterized by the predominance of a short stature, dominate. Probably, lower values of the heart rate in athletes-martial artists, in comparison with people engaged in physical culture within the general program, indicate the adaptation of the athlets' orhanism to the intense physical activity. The increase in the points of adaptation of the potential in the athletes examined by the authors revealed the signs of the stress that had an impact on the cardiovascular system, which was associated with an increase in physical and psycho-emotional loads in the autumn due to the beginning of the annual cycle of training, and in winter and spring – with the participation in competitions of different levels.

Keyword: athletes, cardiovascular system, blood pressure, adaptive potential.

INTRODUCTION:

In the Far North, a special place is occupied by the adaptation of the human body to environmental conditions. Adaptation of the person to the conditions of high latitudes is provided by the restructuring of all systems of the body. The harsh climate also affects anthropometric indicators. T. I. Alekseeva (1989), describing the "Arctic" adaptive type, points to 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 (2005) notes that a 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 the Permyakova, S. P. (2002), celebrated during the same time period the increase among the indigenous peoples of the North of dolichomorphic and the reduction in the prevalence of representatives brachymorphic somatotype.

The human circulatory system is responsible for the adaptation of the body to various environmental factors. In most cases, the cardiovascular system (SVS) can be considered as an indicator of the body's adaptation. The study of SVS reactions allows to measure the level of functioning of the circulatory system, such as minute and shock blood volume, pulse rate, blood pressure. Under excessive physical exertion in extreme Northern conditions, there are adaptive changes in athletes SVS, change in hemodynamic parameters.

Adaptive potential (AP) – an indicator of the level of adaptability of the human body to a variety of changing environmental factors. This is the most important physiological indicator of life, the formation of the level of which is carried out by the whole complex of changes in the physiological systems of the body (pituitary and adrenal hormones, the state of the nervous, cardiovascular, respiratory and other systems), occurring under the influence of stress factors (physical and mental work, shifts in atmospheric pressure, temperature, etc.). In this case, a new adaptive behavior of the individual is formed, which provides the most favorable adaptation of the organism to these factors.

AP - the integrated indicator constructed on the basis of regression relations of heart rate (HR), systolic (SBP) and diastolic blood pressure (DBP) blood pressure, age, body mass (MT) and growth (R). All these indicators, according to numerous data, play a significant role in the formation, consolidation of the adaptation of the organism to numerous environmental influences, and the levels of their regression relations can characterize the level of adaptation in General, especially in the evaluation and dynamic observation in anthropoecological systems (Vovk, 2009).

Purpose: the research was the study of morphometric indicators of physical development and evaluation of the functional state of the body of wrestlers of the free style of Yakutia.

aterials and methods of research.

The object of our study were 38 men of Yakut nationality, aged 18 to 29 years, athletes – wrestlers free style shvsm Yakutsk and students of the Institute of physical culture and sports (IFKIS) NEFU. M. K. Ammosova having high sports qualification: candidates for master of sports, master of sports, master of sports of international class, honored master of sports. The comparison group was 20 male cadets of the Yakutsk police school attending classes in General physical training. The study was conducted in different seasons: summer (June), autumn (October), winter (December), spring (March).

Body mass index (BMI) or Quetelet index was determined by dividing body mass (kg) by the square of body length (m2): I = MT (kg) / DT (m2).

The Rohrer index is used as a group growth-weight indicator and was calculated by the formula: I = MT (kg) / DT (m3).

As indicators of the state of CVC used blood pressure (SAD and DAP), heart rate, AP.

Blood pressure was measured on the right hand in a sitting position after a 5-minute rest with an accuracy of 2 mm Hg. art. according to the who standard procedure. Used mercury sphygmomanometer and a stethoscope with a membrane. The first phase of Korotkov's tones was recorded as systolic blood pressure, the fifth as diastolic blood pressure, 3 blood pressure

measurements were performed and the mean VALUE was used.

To assess the functional state of the circulatory system used AP, reflecting in conventional units-points the degree of stress adaptation mechanisms, manifested in changes in hemodynamic parameters. AP the body was calculated by the formula (Baevsky and Berseneva, 1997): AP=0,011 PE+0,014 GARDEN+0,008 DBP+0,014+MT 0,009–0,009 R–0,27, where PE – heart rate; GARDEN – systolic blood pressure; DBP – diastolic blood pressure; R – rising; MT – body weight; – 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 voltage 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 - failure 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).

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 $p \leq 0.05$. 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.

RESULTS AND DISCUSSION.

Table 1 presents the results of anthropometric indicators of the athletes we examined. The compared groups were comparable in age. Statistically significant differences in the values of growth, body weight and Rohrer index were established. The athletes had lower growth and body weight, higher values of Rohrer's index than those in the control group.

Table 1-Anthropometric indicators of highly skilled wrestlers freestyle

	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/m2	23,7 (22,7; 26,0)	22,8 (21,3; 24,5)	0,062
Note - 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).			

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 (Stepanova, 2005).

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.

Body size (along with other indicators characterizing physical development) are important parameters of sports selection and sports orientation.

For example, to achieve high sports results in basketball is of great importance high growth and long limbs.

However, not so rarely achieve great success and those athletes somatotype which differs from the best for the sport.

In such cases, the impact of many factors, especially such as the level of physical, technical, tactical and volitional training of athletes.

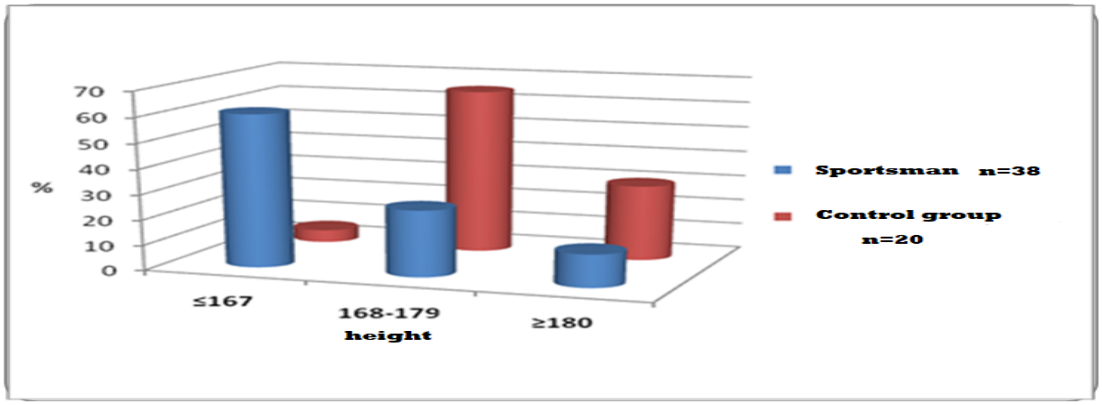

Figure 1-growth Distribution in the compared groups

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 ($p<0.001$) (table 1). The results obtained by us do not contradict the information given in the literature. In studies S. P. Permyakova (2002) and G. K. Stepanova (2005) data craniometric indicators in combination with other morphological indicators, such as body length, Rohrer index, the surface area of the body, in boys of indigenous nationality marked higher values relative to the Stanovoy forces, indicating a sufficiently high level of Stanovoy muscle strength, muscle development and can be considered as an ethnic trait. Probably, therefore, among the highly skilled wrestlers of free style surveyed by us short athletes prevail.

It should be noted that all wrestlers examined by us are highly skilled athletes, masters of sports, masters of sports of the international class. They are participants of many competitions of the Russian and international level.

Yakut wrestling school has trained 3 Olympic Champions. It probably cannot be called accidental, as, in addition, one of the oldest national sport is wrestling hapsagay, anthropometric ecotype is characterized by short stature and chunky (Avtsyn and Zhavoronkov, 1985).

At the same time, socio-economic factors can cause morphological changes in the body. S. P. Permyakova (2002), G. K. Stepanova (2005), V. G. Starostin (2008) noted an increase in the dolichomorphism among the indigenous peoples of the North and a decrease in the prevalence of the brachymorphic somatotype in recent years. Thus, among the surveyed persons who make up the control group engaged in physical culture under the program of the University, the persons with mesomorphic type prevailed.

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

Table 2 – The indicators of the functional status cardiovascular system in freestyle wrestlers

Indicator	Freestyle wrestlers (n=38)	Control group (n=20)	p
SAD, mm s.st.	124,0 (119,0; 127,0)	122,5 (115,0; 128,0)	0,763
DAD, mm s.st.	73,0 (66,0; 79,0)	74,0 (67,0; 81,5)	0,587
HSS, in minute	61,0 (54,0; 66,0)	69,0 (56,5; 74,0)	0,029
АП (N before 2,1 Points)	2,0 (1,7; 2,3)	2,2 (2,0; 2,4)	0,048
Note - 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).			

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 of the year was lower than

in the control group of untrained men. 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).

A major element of the limiting physical performance of the athlete, is CVC, which is the most integral reflects functional capacity of the organism. Adequate physical activity increases the efficiency of the CVC. Excessive loads, as well as insufficient motor activity, especially in combination with psycho-emotional factors, lead to the development of overvoltage of the CVC. It is known that the heart can cope with exercise or by increasing the pulse or by increasing the systolic volume. Adaptation to physical activity is accompanied by an increase in the shock volume of the heart. The increase in stroke volume of the heart affects the heart rate at rest, it becomes much less (Stepanova, Ustinova, 2002, 2003, 2004; Stepanova, 2005; Makarova et al, 2007; Pinigina, Makarova, Krivoshchekov, 2010).

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.

Among the many criteria proposed to assess the functional state of the compensatory-adaptive mechanisms that provide adaptation and homeostasis of the body under the effects, often having a stressful nature, an important role belongs to the definition of AP of the circulatory system. When choosing this indicator, we were guided: first, the simplicity of its definition, and secondly, the fact that it indirectly characterizes the degree of stress of the CVC, which is usually a sign of myocardial quenching.

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 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.

Table 3-Indicators of the functional state of the cardiovascular system in freestyle wrestlers in different seasons of the year

Summer n=18	Autum n=10	Winter n=17	Spring n=32	p
SAD, mm 639 s.st.				
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
DAD, mm 639s.st.				
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
HCC, imp. In minute				
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, y.e.				
2,2 (2,0; 2,4)	2,2 (2,1; 2,4)	2,1 (1,5; 2,4)	2,2 (1,7; 2,4)	0,013
Note - 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 (Friedman criterion).				

In a more detailed analysis revealed that in the summer, 39% of athletes AP it was at the level of satisfactory adaptation, at 61% - corresponded to the level of tension of 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.

The increase in the number of fighters with signs of stress CVC to 73% in the autumn due to the beginning of more intense physical activity after the summer period. In addition, the state of CCC 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 CVC 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 CVC athletes of Yakutia shows that intense professional sports can contribute to decompensatory changes of AP from individual athletes (group risk). This is manifested by the increase of myocardial mass of left ventricle, disorders of hemodynamic parameters: higher blood pressure, bradycardia, while higher total peripheral resistance, which indicates the violation of the internal interactions and the transition to myocardial hypertrophy (Stepanova, Ustinova, 2002, 2003, 2004; Stepanova, 2005; Makarova et al, 2007; Krivoshchekov et al, 2009; Pinigina et al. 2010; Semenov, 2011).

Thus, among highly skilled hog freestyle Yakut nationality, dominated the brachymorphic somatotype, characterized by an average or low growth, relatively long torso, broad shoulders, a large breast, short lower limbs. And among the persons of the control group, persons with mesomorphic somatotype predominate. The analysis of the data showed that 13 wrestlers (34.2%) from among the athletes examined by us had excess body weight, whereas in the control group BMI exceeded the norm only in 4 (20%) people. 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 ($p<0.001$).

Lower values of heart rate in athletes-martial artists, in comparison with persons engaged in physical culture on the General program, probably, are a sign of adaptation to intense physical activity.

The increase in AP scores in the athletes examined by us indicates signs of stress of CVC, 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.

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