

NUTRITION IN THE NORTH

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ANALYSIS OF ACTUAL NUTRITION OF FREESTYLE WRESTLERS IN YAKUTIA CONDITIONS

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The purpose of the study. Assessment of dietary intake of freestyle wrestlers depending on the season, taking into account the daily energy expenditure.

Material and methods. 63 wrestlers from 20 to 25 years of Yakut State high school sports skills were investigated. Anthropometric measures were taken into account. Daily energy expenditure of the wrestlers was measured in kilocalories (kcal) based on the timekeeping of the training day. The actual nutrition was assessed using the questionnaire (24-hour food recall). Canteen menu where athletes ate was analyzed also.

Results of the study. Analysis of anthropometric data (height $1,67 \pm 0,03$ m, weight - $69,91 \pm 5,68$ kg) showed that among 63 surveyed athletes dominated the sportmen with brachymorphic somatotype. This somatotype is characterized by a mean (22% of those surveyed) or low (67% of those surveyed) growth, relatively long torso, broad shoulders, big chest circumference.

Total daily energy consumption of freestyle wrestlers during the training process amounted 5609.28 kcal / day, and during training camps - 5687.16 kcal / day. Daily caloric food ration of the wrestlers depended on food basket. In summer, the caloric intake was highest and amounted to 3571 kcal, in the autumn - 3065 kcal, in winter - 2359 kcal, in the spring - 2878 kcal. The actual weight ratio of proteins, fats, carbohydrates (Protein: Fat: Carbohydrates) in the daily diet of athletes was as follows: in the summer of the year - 1.1: 0.9: 3.7; in the fall - 0.9: 1.05: 4.4; in winter - 1.2: 0.8: 4.5; in the spring - 1: 1: 4.

Conclusions. The data obtained conclude that the daily food ration calorie does not reimburse the daily energy consumption of athletes. The chemical composition of nutrients in the daily diet of athletes quantitatively and qualitatively does not correspond to the standards recommended for freestyle wrestlers.

Keywords: Yakutia, wrestling, daily consumption of energy, proteins, fats, carbohydrates.

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Introduction. Modern sports with its extreme physical, mental and emotional loads, long and intensive training is one of the most pronounced stressful effects on the human body. With intense physical activity, the rate of metabolic processes increases sharply, and the need for vitamins, macro - and microelements increases. With the loss of a significant number of elements with sweat, saliva and products of the excretory system, their balance in the body is disrupted, causing certain physiological and pathological shifts. It should be noted that the body of athletes training in the North experiences additional loads, since the existence of a person in extreme climatogeographic conditions is associated with an increase in the basic metabolism, which requires additional energy costs, as a result, the role of fat increases and the so-called "polar metabolic type" is formed [15].

Climatic extremes of human living conditions in Yakutia are created by: the average annual negative temperature; the lack or complete absence (polar night) of solar radiation in winter; the low absolute content of water vapor in the atmosphere; the high level of perturbation of the natural geomagnetic field; the location in the zone of widespread development of permafrost. Studies by a number of authors have shown that micronutrient and electrolyte homeostasis is often disrupted in humans in the North [1,19]. In

this regard, the role of nutrition in improving athletic performance and eliminating fatigue in athletes who live and train in the North, increases significantly.

The purpose of this study was to evaluate the actual nutrition of freestyle wrestlers depending on the season of the year, taking into account the daily energy consumption.

Research problem:

1. Calculate the daily energy consumption of wrestlers.
2. To study the actual diet of the wrestlers.

Material and methods. A set of materials for the study was conducted among athletes- wrestlers of the state institution "School of higher sports skill" in Yakutsk. We examined a total of 63 athletes of Yakutia aged 20 to 25 years. Anthropometric indicators were taken into account: height (in meters), body weight (in kg), body mass index (calculated using the formula $BMI = \text{body weight in (kg)} / \text{height (m)}^2$), Rohrer index.

Daily energy consumption was determined in kilocalories (kcal) based on the timing of the training day with the calculation of energy consumption. At the same time, it was taken into account that the daily energy consumption consists of individual activities of athletes, the main exchange, the specific dynamic action of food and unaccounted energy expenditure [7].

Actual nutrition was assessed using

a questionnaire - based method of daily (24-hour) nutrition reproduction using the Atlas of food consumption developed by the Institute of nutrition of the Russian Academy of medical Sciences with a parallel analysis of the menu layouts of the Institute's canteen where students eat [8,9]. The calculation of the chemical composition of the individual daily diet was carried out using tables of the chemical composition of food, taking into account the loss of food substances, during the culinary processing of food, followed by statistical processing of research results [21].

The obtained data were statistically processed using the SPSS 17.0 statistical software package. Arithmetic mean values (M) and errors of mean values (m) were calculated for all indicators in each group. The significance level was considered reliable at $p \leq 0.05$. The reliability of differences was determined using nonparametric Mann-Whitney criteria. Spearman's linear correlation coefficient was calculated to identify the conjugacy of indicators.

Results and discussion. It is known that anatomical and anthropological features of athletes depend on ethnicity, physical activity and functional systems of the body. Adaptation of the body to various environmental factors is a long process aimed at forming an ecological type that ensures the integrity of the body and optimal conditions for its life. Long-term adaptation of a person to extreme climatogeographic conditions of the North affected his morphometric indicators. Thus, the anthropometric feature of the Northern ecotype is shortness [23].

Analysis of anthropometric data (height 1.67 ± 0.03 m, body weight 69.91 ± 5.68 kg) showed that among the 63 athletes examined by us, persons with brachymorphic somatotype predominate. This type of somatotype is characterized by medium (22% of the surveyed) or low (67% of the surveyed) height, relatively long torso, broad shoulders, large chest circumference.

Relatively high values of the body mass index ($BMI - 24.65 \pm 1.18$) and the Rohrer index (14.71 ± 0.58) indicate a large body density, which is associated with high indicators of muscle strength - the flexors of the forearm, the extensors of the hip and trunk of the highly qualified freestyle wrestlers we examined. It was found that wrestlers with large girth sizes and body weight are more effective [10]. The value of body weight (both your own and your opponent's) in wrestling is so great that weight categories are introduced to equalize the chances of winning in this sport.

Wrestling refers to acyclic sports and is characterized by complex motor activity performed in conditions of space and time deficit, often with limited vision and difficult breathing. In the process of intensive muscle activity, athletes spend a large amount of energy, which requires optimal and timely replenishment of energy costs. Freestyle wrestling is an acyclic sport characterized by a large amount of physical activity. According to the standards, the energy consumption of wrestlers should be 4500-5500 kcal (70 kcal/kg of body weight) [17]. In table 1 data reflecting the daily energy consumption of freestyle wrestlers in various types of

activities are presented.

From the data presented in the table, it can be seen that the largest percentage of daily energy consumption is accounted for by improving sports skills - about 40% (table 1). Taking into account the main exchange and specific dynamic action of food, the total total daily energy consumption during the training process was 5609,28 kcal/day, and during training camps - 5687,16 kcal/day. Some increase in the total daily energy consumption of athletes in June-August is due to an increase in energy consumption during passive and active recreation, which is the specifics of summer training camps. The conversion per 1 kg of body weight averaged 80 kcal. Our results do not contradict the literature data. According to Grigorieva O.V. (2003), the level of daily energy consumption for martial arts students was $4310,2 + 62,1$ kcal, and the conversion per 1 kg of body weight was $59,04 + 7,12$ kcal [5]. But for highly qualified athletes, they can be higher [11,20].

High energy costs associated with the specifics of training highly qualified martial artists should be compensated by optimal nutrition. Rational nutrition is one of the most important directions in improving the physical performance of athletes and their achievement of high results in competitive activities. The athletes we examined were on an organized four-day meal in the School of higher sports skill canteen. However, some wrestlers, in addition to eating in the dining room, had an additional snack, usually 2-3 hours after dinner (late dinner at 21-22 hours). The daily diet of athletes included basic food items: meat and meat products, fish,

Table 1

Daily time budget (per hour) and energy consumption (kcal/hour) for various types of athletes activities

Type of activity	Daily time budget	Energy consumption (kcal)	In % of daily energy consumption	Daily time budget	Energy consumption (kcal)	In % of daily energy consumption
	Training process (September-May)			Training camps (June-August)		
Sleep, lying down	9 hour	581.65	17.13	8 hour	517.02	14.91
The meal	60 minute	90.26	2.66	60 minute	90.26	2.61
Personal hygiene (washing, shower, sauna)	40 minute	97.65	2.87	50 minute	122.06	3.52
Passive recreation (conversation, reading, preparation for classes, TV, Internet)	3 hour 20 minute	307.91	9.06	5 hour 10 minute	477.26	13.76
Household work (washing, cleaning)	1 hour	130.01	3.83	1 hour	130.01	3.75
Active recreation (indoor walking, walking, driving)	3 hour	478.15	14.08	5 hour	796.92	22.99
Study	3 hour	377.12	11.10	-	-	-
Intense physical activity	3 hour	1333.62	39.27	3 hour	1333.62	38.46
TOTAL:	24 hour	3396.35	100%	24 hour	3467.15	100%

Table 2

**Actual and recommended daily grocery set
freestyle wrestlers of School of higher sports skill**

Products	Summer (n=18)	Autumn (n=11)	Winter (n=14)	Spring (n=20)	Norm *
Meat (beef, foal, venison, pork, chicken)	211.4 (40.3)	132.3 (20.5)	160 (18.3)	191.4 (37.4)	300
Meat products (jelly, cutlets, sausages)	100 (13.1)	78.6 (16.5)	81.1 (18.1)	113.2 (9.4)	50
Beef offal (tongue, liver, giblets)	20.9 (2.4)	20 (3.5)	20.8 (3.7)	18.7 (2.8)	100
Fish	100 (8.8)	100 (12.0)	150 (12.5)	97.7 (5.2)	90
Egg	47 (15.5)	47 (11.5)	47 (14.3)	47 (10.2)	47
Butter	20.6 (1.7)	15.5 (1.5)	40 (1.4)	35 (2.5)	80
Vegetable oil	20 (0.8)	20 (1.2)	20 (1.4)	20 (1.1)	-
Dairy products (milk, kefir)	300 (30.0)	300 (27.5)	300 (10.1)	300 (18.8)	600
Sour cream	26.7 (2.2)	16.4 (3.0)	20.8 (2.1)	30.5 (1.3)	30
Cream (whipped with berries)	-	100±27.45	-	-	-
Cheeses	9.8 (1.6)	18.6 (3.0)	10 (2.0)	10 (1.5)	30
Cereals	208.9 (28.2)	284.5 (16.2)	175.0 (14.2)	238.4 (11.4)	90
Vegetables	94.4 (9.7)	160.9 (15.2)	100 (13.5)	65.2 (5.2)	400
Potato	97.8 (8.7)	100 (6.5)	88.4 (7.1)	150.0 (10.9)	300
Fresh fruit	262.8 (11.6)	300 (10.7)	67.2 (3.9)	73.3 (6.1)	500
Sweet (sugar, sweets, etc.)	29.8 (5.1)	29.2 (4.9)	38.2 (3.4)	27.9 (4.2)	100
Flour confectionery products (bun, cupcake, cake, etc.)	110.3 (6.5)	125.5 (3.4)	132.2 (6.5)	65.4 (5.0)	130
Pasta	96.1 (5.5)	183.6 (7.9)	186.1 (4.8)	150 (9.1)	-
Bread	237.2 (5.8)	189.1 (7.6)	105.0 (4.2)	154.2 (3.9)	350
Juices (natural, canned, mors, compote from agricultural products)	200 (17.0)	200 (21.3)	125.0 (7.2)	164.5 (6.5)	400
Drinks (black tea, green tea, coffee)	1275.0 (51.5)	1304.5 (72.1)	1019.4 (90.4)	1027.4 (47.0)	-
Water	1750.0 (46.4)	1150.0 (30.1)	3800.00	5600.00	2000
Coca-Cola	100.0 (18.9)	18.2 (1.8)	58.3 (5.5)	45.2 (3.6)	-
Honey	10 (0.8)	10 (1.2)	10 (1.4)	10 (1.3)	-
Nuts	70 (6.0)	70 (6.5)	70 (8.8)	70 (5.7)	-
KCAL	4234.3	4359.6	3999.3	3993.0	

Note - the data is presented in the form of average and standard deviation in the format M (SD);* - recommended food set for freestyle wrestlers (Appendix No. 10), order No. 325 of 21.10.12 of the Ministry of sports of the Russian Federation.

milk and dairy products, bread and flour confectionery, various types of cereals, pasta, fruits and vegetables. In table 2 presents the main daily set of food products examined by us freestyle wrestlers depending on the season of the year.

Data presented in table 2, indicate that all products of the daily set in all seasons of the year did not meet the recommended standards. Thus, the greatest amount of meat (211,38 (40,3) g) athletes consumed in the summer. However, its content in the summer diet was 1,4 times less than the recommended values. The greatest consumption of dairy products by athletes was noted in the autumn period of the year, however, it was 6,2 times

less than the recommended amount per day. It should be noted that dairy products present in the diet of athletes did not differ in diversity. The main dairy products were milk and kefir. Butter, sour cream, cheeses, and fish were consumed by athletes in very low amounts throughout the year. Eggs in sufficient quantities in the daily diet were present only in the spring season.

Fruit during the year, athletes consumed less than the recommended norms. The highest fruit consumption was observed in the summer and amounted to 262,78 (11,6) g, which was 1,9 times less than the norm. Athletes consumed vegetables 5,5 times less than the norm

during the year. The total amount of carbohydrates was replenished mainly by cereals, bread and flour confectionery products. Dried fruits, nuts, and honey were consumed by athletes in very small quantities. The daily caloric content of the food ration of wrestlers depended on the food set. In summer, the caloric content of the diet was the highest and amounted to 4234,3 kcal, in autumn-4359,6 kcal, in winter-3999,3 kcal, in spring-3993,0 kcal. According to our data, the average energy value of the daily diet of wrestlers in all seasons of the year was 4146,53 kcal, which is 13% lower than the calculated average for these athletes. Analysis of the seasonal dynamics of the energy value of athletes' diets showed that the energy value of the actual nutrition of athletes covered the main exchange and energy spent on intensive physical activity only in summer and autumn, and in winter and spring did not correspond to energy consumption. However, it should be noted that using the time-table method, the daily energy consumption can only be obtained approximately. The energy consumption shown in the tables is of relative importance, since the energy consumption when performing even one type of work can fluctuate for various reasons, depending on the state of the body, the level of training and other factors.

The calculation of the chemical composition of the main nutrients showed that the daily intake of their athletes significantly differed from the recommended norms. We found insufficient intake of proteins, lipids and carbohydrates in all seasons of the year. The content of the main food substances in the daily diet of freestyle wrestlers is shown in fig. 1. The training process and participation in competitions (national, national and international) in School of higher sports skill requires significant muscle work, which is accompanied by increased protein breakdown. Therefore, the diet of athletes should contain a sufficient amount of easily digestible high-grade protein. At the same time, animal proteins should make up 55-70% of their total amount in the diet [4.13]. According to the standards for wrestlers per 1 kg of weight per day, it is recommended to use 2,4-2,5 g of protein, 2,0-2,1 g of fat and 9-10 g of carbohydrates. Our athletes' body weight averaged 69,91±5,68 kg, so they should consume 168 g of protein per day. The data shown in fig. 1, show that the lowest amounts of the main components of food fall during the winter period. Thus, the protein deficit in the daily diet of athletes (compared to the recommended values) was 53%. Even in the summer, when the

daily diet included the largest number of food components, the need for protein was met only by 78% (fig.1).

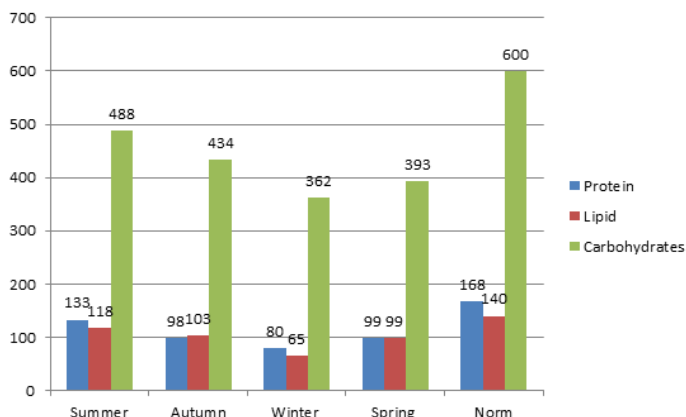


Fig. 1. The content of basic nutrients in the daily diet of freestyle wrestlers (g)

It is known, that protein metabolism is closely related to the exchange of other nutrients, in particular potassium, calcium and some vitamins. When the protein content in the diet is low, the loss of potassium and calcium increases in the body, and the daily urinary excretion of some water-soluble vitamins increases, despite their adequate intake with food [16]. In isolated studies on sports biochemistry, it is shown that the level of magnesium and ascorbic acid in the blood serum of athletes in the Far North is reduced [12].

Insufficient carbohydrate content in the diet is a factor that limits the physical performance of athletes, since muscle fatigue can be associated with depletion of glycogen stores in the muscles. With the body weight of the athletes we examined ($69,91 \pm 5,68$ kg), the amount of carbohydrates in their daily diet should be at least 630 g, but even in the summer, the need for carbohydrates was met only by 78% (Fig.1). The need for lipids in these athletes in winter was met by 46%, in spring and autumn - by 70%, in summer - by 84%, if we consider that the daily need for them at the rate of 2 g per 1 kg of weight is 140 g.

The lack of macro- and micronutrients negatively affects the health of athletes and their sports results. In this regard, it is necessary to use special sports nutrition products and vitamin and mineral preparations, depending on the intensity of physical activity, the stage of the training process and the season of the year.

The ratio of the main components of nutrition – proteins, fats and carbohydrates – is of great importance for adaptation to physical activity. Since even full

provision of energy needs of the body due to one or two components (mainly fats or carbohydrates), with insufficient

intake of other, for example, proteins, can cause changes in the body's metabolism. Modern research has established that the optimal ratio of protein, lipids and carbohydrates in the diet of athletes should be 1:0.8:4, in percentage terms it corresponds to 15:24:61 (in terms of calories) [2, 6, 18, 22, 26]. The actual weight ratio of proteins,

lipids, carbohydrates (Proteins: Lipids: Carbohydrates) of the daily diet of the athletes we examined by season was: in the summer period of the year 1,1:0,9:3,7; in the autumn period – 0,9:1,05:4,4; in the winter period – 1,2:0,8:4,5; in the spring period – 1:1:4. The distribution as a percentage of the daily caloric intake of athletes, depending on the season of the year, was as follows: in the summer – 15:30:55; in the autumn – 13:30:57; in the winter – 14:25:61; in the spring – 14:31:55. These data indicate that the actual nutrition of athletes in terms of quantitative and qualitative composition of food substances (proteins, lipids, carbohydrates) does not meet the standards recommended for wrestlers. The results of our research are consistent with the literature data [20, 23, 24].

Quantitative and qualitative analysis of daily diets indicates an excess of fat consumption, and at the expense of animal fats, and creates prerequisites for the violation of lipid metabolism in athletes and the occurrence of pathological conditions, such as diseases of the cardiovascular and digestive systems. A relative increase in the proportion of lipid, especially in the autumn period of the year, with a low content of carbohydrates in the daily diets of athletes is associated with a large consumption of oxygen and can lead to the accumulation of ketone bodies in the blood [25]. In addition, physical activity in a cold climate increases the level of oxygen consumption, which leads to an acceleration of oxidative processes. Excessive activation of lipid peroxidation when eating fatty foods is the most important maladaptation factor, reduces the body's motor capabilities, its endurance,

reduces physical performance, and, consequently, negatively affects sports performance. In a few studies, it has been shown that the decrease in performance among athletes in Yakutia is associated with the accumulation of peroxidation products in the body of athletes [14].

Conclusion. Among highly qualified freestyle wrestlers of yakut nationality, persons with a brachymorphic somatotype predominate. This type of somatotype is characterized by medium or low growth, a relatively long body, broad shoulders, and a large chest circumference. Relatively high values of the body mass index and the Rohrer index of freestyle wrestlers indicate a large body density, which is associated with high indicators of muscle strength – the flexors of the forearm, the extensors of the hip and trunk.

The total daily energy consumption of freestyle wrestlers corresponds to the standards calculated for wrestlers. The daily caloric content of the diet of freestyle wrestlers was lower than the recommended norms and did not correspond to energy costs in all seasons of the year. The ratio of the main food nutrients: proteins, lipids and carbohydrates is also violated. When analyzing the quantitative and qualitative nutritional value of athletes, a decrease in protein consumption was found, especially in winter, and a relative excess of fat consumption, and at the expense of animal fats, which is unacceptable, since it worsens sports results, and creates prerequisites for a violation of lipid metabolism. At the same time, carbohydrates in the diets were not enough, which is a factor that significantly limits physical performance, since carbohydrates are the main source of energy for the body of athletes. Thus, the basic diets of freestyle wrestlers of the School of higher sports skill in Yakutsk did not correspond to the principles of rationality and balance, which can lead to a decrease in performance and speed of recovery processes and, as a result, to a deterioration in the effectiveness of training sessions, if no correction is made.

When organizing the rational nutrition of athletes engaged in sports in the North, it is necessary to take into account the general principles of nutrition, the specifics of the sport, the season of the year, the intensity of physical activity and the stage of the training process.

The development of nutrition standards for athletes in the Far North should be carried out at the level of Ministries and Departments, which include the School of higher sports skill in Yakutsk, and the approved standards for energy and food

consumption should correspond to the costs of freestyle wrestlers.

In nutrition in the School of higher sports skill of Yakutsk requires the use of special sports nutrition products and vitamin-mineral preparations to optimise the power depending on intensity of physical activity, stage of the training process and season. The use of special sports nutrition products, vitamin and mineral preparations and monitoring the effectiveness of their use should be carried out by a sports doctor. Questions concerning the use of special sports nutrition products and vitamin and mineral preparations should be included in the general educational program for the education of cultural and hygienic skills of healthy nutrition.

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