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СРАВНИТЕЛЬНАЯ ОЦЕНКА ФАКТИЧЕСКОГО ПИТАНИЯ И ОБЕСПЕЧЕНИЯ МАКРО- И МИКРОНУТРИЕНТАМИ СПОРТСМЕНОВ РАЗЛИЧНЫХ ВИДОВ СПОРТА

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Проблема и цель. *Растущая популярность видов спорта на выносливость, различных стилей борьбы и игровых видов дает возможность спортсменам проявить свои физические качества. Успех спортсменов, участвующих в этих видах спорта, зависит от уровня развития аэробной, анаэробной и алактатной энергетических систем, которые обеспечивают работающие мышцы энергией. От того, как спортсмены питаются, зависит их здоровье, работоспособность, приспособление к различным факторам окружающей среды. В современной системе спортивной подготовки питание рассматривается как один из ведущих факторов, обусловливающий возможность достижения высокой работоспособности и эффективного протекания восстановительных процессов при напряженной мышечной деятельности.*

Обзор литературных источников показывает, что при подготовке спортсменов разных видов спорта к ответственным соревнованиям, стараясь избежать неблагоприятных последствий, изучение фактического питания является несомненно актуальным. Только оценив питание спортсменов, можно его согласовать с организованным тренировочным процессом и выступлением на соревнованиях.

В Казахстане результаты исследований питания спортсменов показали, что их питание не всегда соответствует требованиям, предъявляемым к рациональному питанию спортсменов. Актуальность этого вопроса определила цель исследования – оценить и сравнить фактическое питание спортсменов высокого спортивного мастерства различных видов спорта и их обеспечение необходимыми нутриентами.

Методология. *В оценке фактического питания в 2017 году приняли участие 15 триатлонистов национальной сборной Казахстана, 15 борцов дзюдо национальной сборной Казахстана и 15 волейболистов команды «Буревестник» г. Алматы. Возраст исследуемых спортсменов был 19–30 лет. Оценка диеты включала сбор информации о питании спортсменов в течение трех*

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дней за 24 часа в сутки методом опроса о фактическом питании. Регистрировались данные о потреблении продуктов и блюд исследуемых спортсменов.

Результаты. *Химический состав и энергетическая стоимость потребляемых продуктов оценены по таблице химического состава продуктов Казахстана. Систематический анализ состава пищевых веществ и их энергетической стоимости проводился при помощи программы «Статистический пакет для общественных наук» (SPSS, версия 16) и типового синтаксиса и алгоритмов табулирования, адаптированных для цели нашего исследования.*

Заключение*. Фактическое питание исследуемых спортсменов высокого спортивного мастерства почти удовлетворяет физиологические потребности в пищевых и биологически активных веществах. У исследуемых спортсменов в средних пищевых рационах основные пищевые вещества недостаточно сбалансированы. Часть энергетической стоимости, приходящей из жиров, завышена и составляет в среднем у триатлонистов 33,44 %, у дзюдоистов – 49,0 %, у волейболистов – 35,20 %, тогда как часть энергии, производимой из углеводов, занижена, и у дзюдоистов составляет лишь 31,70 %, что не соответствует рекомендуемой дневной норме. В пищевых рационах исследуемых спортстменов недостатка витаминов и минеральных веществ нет. При этом количество таких элементов, как натрий, калий, кальций, фосфор, магнй, железо, йод, значительно превышает рекомендуемые нормы. Содержание витаминов А, В3, В6, В12, Н и С значительно превышает рекомендуемую дневную норму. В литературных источниках полагается, что спортсменам, выполняющим большие физические нагрузки, требуется повышенное количество витаминов и минеральных веществ, но нет никаких доказательств пользы того, что их увеличение является необходимым.*

Ключевые слова: *спортсмены; фактическое питание; энергетическая стоимость пищи; углеводы; жиры; белки; витамины; микроэлементы; макроэлементы.*

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Comparative evaluation of actual nutrition practices and macro- and micronutrients consumption of athletes in a range of sport types

Abstract

Introduction. *The growing popularity of sports for endurance, various styles of wrestling and game types allows athletes to show their physical qualities. The success of athletes doing these sports depends on the level of development of aerobic, anaerobic and alaktate energy systems which provide muscle energy. Athletes' diets affect their health, performance, and adaptation to various environmental factors. Modern system of sports training recognizes nutrition as one of the leading factors contributing to enhanced sporting performance and increased regenerative processes during intense muscular activities. The literature review shows that study of actual nutrition practices of athletes in a range of sport types is significant during pre-competition training. Only after assessing athletes' nutrition practices, it is possible to develop a planned dietary strategy to satisfy the requirements of training process and to enhance sports performance at competitions. In Kazakhstan, the results of studies on athletes' nutrition practices showed that their actual diet did not always meet the requirements of rational nutrition for athletes. The relevance of this issue has determined the purpose of this study. The objective of the research is to study actual nutrition practices of elite-level athletes and to evaluate the provision of necessary nutrients.*

Materials and Methods. *The research was carried out in 2017 and involved 15 triathletes of Kazakhstan national team, 15 judo wrestlers of Kazakhstan national team and 15 players of Almaty volleyball team called Burevestnik. The participants were aged between 19 and 30 years. The data were collected via a survey on athletes' actual nutrition for 3 days (24 hours a day). The data on the consumed food and dishes were recorded.*

Results. *Chemical composition and energy value of consumed food products were estimated according to Dietary Reference Values for chemical composition of Kazakhstan's food products. A systematic analysis of the composition of nutrients and their energy values was carried out using the Statistical Package for Social Sciences software (SPSS, version 16), the typical syntax and tabulation algorithms modified for the purpose of the study.*

Conclusions. *The research has shown that actual nutrition practices of the elite-level athletes under study satisfy their physiological needs in food and biologically active substances. We observed*

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that basic nutrients are not sufficiently balanced in athletes' middle food rations. Part of the energy coming from fats is increased and makes up 33.44 per cent on average for triathletes, 49.00 per cent for judo wrestlers, and 35.20 per cent for volleyball players, while part of the energy produced from carbohydrates is understated, and is only 31.70 per cent for judo wrestlers, which does not correspond to the recommended daily rate. There is no shortage in vitamins and minerals detected. At the same time, the content of such elements as sodium, potassium, calcium, phosphorus, magnesium, iron, iodine, significantly exceeds the recommended standards. The content of vitamins A, B3, B6, B12, H and C also significantly exceed the recommended daily allowance. Literature sources believe that athletes performing high physical activity require an increased amount of vitamins and minerals, but there is no scientific evidence justifying it.

Keywords

Sportsmen; Actual diet; Energy value of food; Carbohydrates; Fats; Proteins; Vitamins; Micro elements; Macro elements.

Introduction

The growing popularity of sports for endurance, various styles of wrestling and game types allows athletes to show their physical qualities[1]. These sports make great demands on the muscles of the legs and upper body [1; 2][2]. The success of athletes participating in these sports depends on the level of development of aerobic, anaerobic and alaktate energy systems, which provide working muscles with energy. From the athletes eat affects their health, performance, adaptation to various environmental factors [3]. In the modern system of sports preparation of food is considered as one of the leading factors that contribute to the possibility of achieving a high performance and efficient flow of regenerative processes during intense muscular activity [3]. The nutrition of athletes covers the general principles of rational nutrition of people, but due to the constant great physical exertion, emotional stress, it acquires specific features[4].

Triathlon is a sport that requires great endurance and strength. Competitions for triathlonists last 3–4 hours. Consequently, this sport consists of three endurance sports, replacing each other in a continuous sequence, the methodology for building the triathlete training process includes methods for their preparation in the disciplines that make up the types of the triathlon program, taking into account the length of the distance segments[5]. The long-term training process in the form of sport triathlon causes peculiar physiological and psychological changes in the human body. The result adequately built athlete training, specializing in one form or another program on the selected distance, is to improve the body's functions to deliver oxygen and energy substances to the muscles that work, increase the ability to increase energy reserves (in muscles and liver), accelerate the excretion of metabolic byproducts from muscle tissues, improve motor performance [6]. The dominant

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energy system during a load of this duration is aerobic.

Judo is a sport that requires great physical strength, speed and agility. Duel in wrestlers lasts two halves of 5 minutes. During the fight, the energy demand wrestlers changing. The duel saturated with moments during which ATP-CF, glycolytic systems are involved in energy production, and aerobic systems help the fighter recover quickly during less active activities.

Volleyball is a game that requires energy, speed, strength and accuracy. Volleyball players during the game quickly overcome short distances, quickly come into motion, often jump and change the direction of movement. During the game, volleyball players are mainly involved in the anaerobic energy system, which gives about 90 % of the energy produced.

In the energy supply of triathletes, carbohydrates and fats make the main contribution. According to many authors, the energy expenditures of sports representatives developing aerobic capabilities range from 5000–6000 kcal and can depend on gender, age, training period, the complexity of the terrain crossing [4; 5] [7]. The need for triathlonists in basic food substances is about the same as for other athletes – 55–60 % should be carbohydrates, 25–30 % fats and 15–20 % proteins [8]. Recommendations E. Applegate (1991) [6] and E. Kolleman [9] diet for training triathlonists the following: 7–10 g carbohydrates kg-1 per day, 7 g • kg-1 for 1-hour classes per day, 8 g • kg-1 for 2 hours a day, 10 g • kg- 1 for 3-4 hours a day. L. Burke (2007)[10] determined that during the training sessions a triathlonist weighing 67.5 kg consumes 9 grams • kg-1 carbohydrates (60 % of the total energy consumption).

The dominant energy production system during judo wrestling is anaerobic. It assumed that for judo wrestlers 70–80 % of the energy produced by the ATP-KF system together with the glycolytic and 10–20 % – aerobic[11] [7]. The need for judo wrestlers in basic food substances is about the same as for other athletes – 55–60 % should be carbohydrates, 25–30 % fats and 15–20 % proteins[12].

The need for basic nutrients for volleyball players is slightly different from the general recommendations for athlete nutrition[13]. A diet rich in carbohydrates (60–65 %), moderate in fats (20–30 %) and proteins (12–20 %), should provide players with a balance of essential nutrients. A well-balanced diet based on carbohydrates will provide energy for training sessions and competitions, as well as explosive energy and glycogen for muscle nutrition.

As suggested A. Jeukendrup et al. (2005) [8], D. Bentley et al. (2007) [9] the amount of energy produced from fats in athletes participating in excessively long distances can be 36–45 % of the total energy produced.

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The need for fat in wrestlers of the style of judo varies depending on the nature of the fight. As E. Filaire et al., 2001; S. Proteau et al., 2006; D. Papandreou et al., 2007 [10; 11][14] the amount of energy produced from fats in them is 36–45 %.

The fat needs of volleyball players vary depending on the individual goals of each player. The energy requirement is determined based on the individual body weight of the athlete, and the average number of calories burned during exercise[15].

Protein supplements for long-term work on endurance, being an additional source of energy, justify themselves, since 5–10 % of energy during such work comes at the expense of protein catabolism [12]. The recommended protein norm for non-athletes per day is 0.8–1.0 g / kg body weight. However, for triathlonists, the need for a protein is greater, increasing to 1.4–1.7 g / kg body weight [13–15]. L. Burke, R. Reed (1987) [16] believe that triathlonists, during training sessions, should consume at least 2 g • kg-1 protein (13 % of energy consumption) and fats – 1.8 g • kg-1 (27 % of energy consumption). For wrestlers, the need for protein is even greater and increases to 1.6–1.8 g / kg body weight [13; 17; 18][16]. It is also important for a volleyball player to obtain a protein for growth and restoration of tissue[17].

A diet rich in nutrients is very important during training sessions and competitions to ensure adequate consumption of vitamins and minerals. P. Clarkson (1996) [19] (2000) [18], S. Papadopoulou (2002) [20], A. Jeukendrup, M. Gleeson (2010)[3] found that mainly athletes consume an adequate amount of essential vitamins and minerals during training sessions and at the same time pay attention to the fact that over-hardy athletes can risk their status of vitamins and minerals. During long training sessions and competitions if the amount of vitamins and minerals obtained in the form of tablets and injections is significantly higher than their quantity, which came from food, which can have a negative effect on the body.

Good hydration is the main concern during long competitions, as an athlete who has adequate muscle glycogen stores and blood glucose level can still get a heat stroke. Athletes can achieve very high rates, if the fluid intake will make up for its loss with sweat. Dehydration, equal to 2 % of body weight, improves the function of the cardiovascular system and thermostatic. Good hydration improves stamina and protects against thermal shock[19].

The review of literature sources shows that when training sportsmen of different sports for responsible competitions, trying to avoid adverse consequences, the study of actual nutrition is

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undoubtedly relevant. Only after assessing the nutrition of athletes, it can be coordinated with the organized training process and performance at competitions[20].

In Kazakhstan, the results of studies on nutrition of athletes have shown that their actual nutrition does not always correspond to the requirements for rational nutrition of athletes[21,22,23]. Among scientific researches of nutrition of sportsmen, there are not enough data on the actual nutrition of athletes developing endurance and performing at long and long distances, including triathletes and representatives of speed-power sports. The relevance of this issue determined the purpose of this study.

Purpose of the work – evaluate and compare the actual nutrition of athletes high sports skills of various sports and provision of necessary nutrients.

Methods

The actual nutritional assessment in 2017 was attended by 15 triathletes of the national team of Kazakhstan, who are on training camps during their preparation for the national championship and 15 judo wrestlers of the national team of Kazakhstan of different weight categories, who are on training camps during their preparation for the World Championship and 15 volleyball players of the Burevestnik team in Almaty, playing in the national championship. The age of the triathletes studied was 21–30 years old, their average height was 180.0 ± 7.2 cm, body weight – on average 65.5 ± 7.1 kg, body mass index (BMI) averaged 20.2. The age of judoists was 20–28 years old; their average height was 174.3 ± 8.3 cm, body weight – on the average 78.0 ± 18.9 kg, BMI was on average 25.74. The age of volleyball players was 19–22 years, their growth averaged 188.0 ± 8.38 cm, body weight – on the average 78.11 ± 7.68 kg, and BMI averaged 22.1.

Evaluation of the diet included collecting information on athlete nutrition for 3 days for 24 hours a day by questioning the actual nutrition. The data on the consumption of products and dishes of the athletes under study recorded.

The chemical composition and energy cost of consumed products estimated from the table of the chemical composition of Kazakhstan's products. When compiling the database, the product loss factors for cold and thermal processing taken into account (an individual computer program created by the programmer Kan E.). In order to determine the Recommended Daily Allowance (RDA) were used recommendations D. Bernardot (2000) [24], S. Portugalov (2001) [25]. A systematic analysis of the composition of nutrients and their energy costs carried out using the Statistical Package for Social Sciences program (SPSS, version 16), the typical syntax and tabulation algorithms adapted for the purpose of this study. To analyze the

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research data, traditional methods of mathematical statistics are applied – the arithmetic mean (X) and their standard deviations (SD) are calculated.

Results

Results of the study of energy value of the diet of athletes of different sports showed that the resulting energy triathletes high sportsmanship averaged 4967 ± 1009 kcal, judo, members of the national team of Kazakhstan – an average of 6845 ± 605 kcal, and volleyball on average 4033 ± 456 kcal (Table 1). It should note that for 1 kg of body weight, triathletes received on average 75.83 kcal, judoists on average – 87.76 kcal, and volleyball players – on average, only 51.64 kcal. Judoist obtained energy significantly greater than the recommended daily allowance. Evaluating the provision of sportsmen one of the main nutrients is protein; it should note that all of us studied athletes received a sufficient amount of the substance. If the intake of protein by triathlonists and volleyball players was within the norm and averaged 163.62 ± 29.96 g and 162.2 ± 48.2 g, respectively, the number of consumed proteins by judoists was significantly higher than the RDN and was 281.75 ± 45.89 g (3.61 kg / kg). Protein calories in the diet of triathlonists of high sportsmanship amounted to 13.18 ± 2.97 % of the total amount of energy received, in judoists – 16.5 ± 2.5 %, in volleyball players – 16.07 ± 3.8 % (Table 1).

The amount of fat in the food ration consumed by members of the national triathlon team averaged 184.51 ± 43.50 g, which is slightly higher than the recommended daily rate, whereas in judoists the amount of this component of the diet was significantly higher than the RDA and averaged 372.91 ± 55.99 g. In the diet of volleyball players, the amount of fat was within the RDN. The amount of fat per 1 kg. body weight was as follows: y triathletes – 2.82 g / kg, in judo – 4.78 g / kg, whereas the recommended norm for them should be 1.5–2.6 g / kg. From the total amount of energy produced in the body, the share of fats in triathlonists is 33.4 ± 4.02 %, in judoists 49.0 ± 4.20 %, for volleyball players 35.2 ± 8.2 %. In nutrition of athletes important, not energy, but fulfilling many important functions, the substance is cholesterol. In the ration of athletes, its quantity usually should not exceed 500 mg. In our surveyed triathlonists and volleyball players, the amount of this substance was slightly above the norm and averaged 675.12 ± 288.17 mg and 648.0 ± 250 mg, in judoists the amount of this substance exceeded the RDN more than twice and amounted to 1273.0 ± 814 mg (Table 1).

The results of our study showed that in the diet of the triathlonists studied, the total amount of carbohydrates averaged 646.20 ± 172.11 g, in judo – 542.81 ± 42.55 g, in volleyball players – 472.04 ± 101.02 g, which is an average of 9.87, 6.96 and 6.04 g / kg, respectively. The contribution to the total amount of energy produced by triathletes was on the average 52.04 ± 4.9 %, in judoists – 57.88 ± 2.99 %, and for volleyball players – 47.09 ± 8.56 %.

The average number of dietary fibers in triathlonists and volleyball players was within the norm (33.42 ± 5.53 g and 32.62 ± 5.94 g), whereas in judoists in food rations the amount of this substance was much higher than the RDN and amounted to an average of 95,07 ± 13.82 g. They also participate in the production of energy, but their contribution to the total amount of energy in our studied triathlonists is relatively small and amounted to 1.34 ± 0.22 %, for judoists – 2.8 ± 0.5 %, for volleyball players – 1.64 ± 0.37 % (Table 1).

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Table 1

Characteristics of the chemical composition and energy cost of food rations for athletes in different sports (X ± SD)

Food substances	Triathletes		Judoists		Volleyball players		Recommended daily allowance
	Total	Ratio kg^{-1}	Total	Ratio, kg^{-1}	Total	Ratio, kg^{-1}	
Proteins, total g	163.62 ± 29.96	2.50	281.75 ± 45.89	3.61	162.20 ± 48.2	2.08	96–176
Protein calories,%	13.18 ± 2.97		16.50 ± 2.50		16.07 ± 3.80		12–20
Proteins, animal, g	105.40 ± 24.13	1.61	151.00 ± 49.43	1.94	99.84 ± 12.63	7.90	75–100
Proteins of animals to total proteins,%	64.20 ± 7.02		53.95 ± 8.84		59.38 ± 12.63		65
Fats, g	184.51 ± 43.50	2.82	372.91 ± 55.99	4.78	158.97 ± 46.31	2.04	144–176
Fat calories,%	33.44 ± 4.02		49.00 ± 4.20		35.20 ± 8.12		20–30
Vegetable fats, g	76.80 ± 22.08	1.17	84.85 ± 9.49	1.09	52.80 ± 18.54	0.67	48–58
Calories of vegetable fats,%	42.52 ± 12.12		22.80 ± 4.22		33.91 ± 10.27		–
Saturated fatty acids (NLC), g	65.74 ± 26.98	1.00	131.83 ± 28.21	1.69	63.88 ± 24.65	0.82	–
Monounsaturated fatty acids (MLSFA), g	62.68 ± 21.23	0.96	95.96 ± 21.53	1.23	54.77 ± 18.77	0.70	–
Polyunsaturated fatty acids (PUFA), g	37.94 ± 12.58	0.58	50.28 ± 6.03	0.64	25.41 ± 9.55	0.33	–
The ratio of PUFA / NLC	0.65 ± 0.26		0.38 ± 0.08		0.40 ± 0.19		–
Cholesterol, mg	675.12 ± 288.17	10.31	1273.00 ± 814	16.32	648.00 ± 250	8.30	300–600
Carbohydrates, g	646.20 ± 172.11	9.87	542.81 ± 42.55	6.96	472.04 ± 101.02	6.04	400–560
Carbohydrate calories,%	52.04 ± 4.90		31.70 ± 2.90		47.09 ± 8.56		60–65
Mono-disaccharides, g	352.21 ± 161.99	5.38	313.57 ± 22.29	4.02	142.26 ± 27.60	1.82	–
Percentage of mono-di-saccharides to all carbohydrates, %	52.90 ± 11.98		57.88 ± 2.99		30.50 ± 4.49		–
Dietary fiber, g	33.42 ± 5.53	0.51	95.07 ± 13.82	1.22	32.62 ± 5.94	0.42	25–50
Calories of dietary fiber, %	1.34 ± 0.22		2.80 ± 0.50		1.64 ± 0.37		–
Energy cost, kcal	4 967 ± 1 009	75.83	6 845 ± 605	87.76	4 033 ± 546.1	51.64	3 500–4 000

Vitamins and minerals are involved in many metabolic processes occurring in the body. The main minerals are sodium, potassium, calcium, phosphorus, magnesium, sulfur. It should be noted that we studied athletes consumed quantities of sodium, potassium, phosphorus and magnesium significantly exceeded the recommended rate. The most significant excess of RDN of these elements was noted in judoists, for example, the amount of sodium averaged 12930 ± 1004 mg, the amount of potassium – on average 15880 ± 2774 mg, calcium – 4025 ± 612 mg, phosphorus – 6102 ± 900 mg, iron – 32.46 ± 6.7 mg (Table 2). In triathlonists and volleyball players, the amount of these minerals also exceeded the RDN, but less than in judo. The amount of mineral substances of copper, zinc, manganese, selenium was within the limits of the norm or insignificantly it exceeded in all sportsmen of the sports we studied. The amount of iodine in the diet of all study also exceeded the norm.

Our research has shown that all the investigated athlete dietary vitamin deficiency was not (Table 3), and some of them, such as vitamins A,

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D, B3, B5, B6, B12, H – higher than normal. Comparatively much studied volleyball consumed vitamin C, in which the average number of daily diet was investigated 86.45 ± 32.05 mg, whereas diet in triathletes found 386.1 ± 43.5 mg, which is significantly higher than recommended norm. It should be noted that in the diet of athletes we studied, representatives of speed-power sport – judo, found significantly higher than RDA amounts of vitamin E, is an average of 44,65 ± 3,79 mg. A similar situation found with the vitamin B2.

Table 2

The average amount of mineral substances in food rations of athletes in different sports (X ± SD)

Minerals	Triathletes	Judoists	Volleyball players	Recommended daily allowance
Sodium, mg	10 983 ± 3 666	12 930 ± 1 004	8 089 ± 1 771	1 500–4 500
Potassium, mg	5 515 ± 818	15 880 ± 2 774	5 159 ± 922	2 000–3 500
Calcium, mg	1 064 ± 173	4 025 ± 612	918 ± 224	800–1 200
Phosphorus, mg	2 117 ± 320	6 102 ± 900	2 013 ± 422	800–1 200
Magnesium, mg	560 ± 92	2 905 ± 515	478 ± 61.2	300–400
Iron, mg	23.96 ± 6.82	32.46 ± 6.7	19.59 ± 2.31	10–15
Copper, mg	1.87 ± 0.48	3.26 ± 2.45	2.49 ± 1.86	1,5–3,0
Zinc, mg	16.48 ± 2.25	17.92 ± 4.66	17.77 ± 3.29	10–15
Manganese, mg	13.62 ± 9.69	7.18 ± 1.93	6.18 ± 1.30	5–10
Selenium, μg	89.57 ± 30.20	66.55 ± 23.77	112.08 ± 32.15	50–100
Iodine, μg	503 ± 232	400 ± 41	358 ± 89.8	100–200

Table 3

The average amount of mineral substances in food rations of athletes in different sports (X ± SD)

Vitamins	Triathletes	Judoists	Volleyball players	Recommended daily allowance
Vitamin A, μg	1 106 ± 290	2 649 ± 1 620	1 663 ± 563	700–900
Vitamin D, μg	2.72 ± 1.80	2.34 ± 1.01	2.90 ± 1.09	1–5
Vitamin E, mg	18.30 ± 7.82	44.65 ± 3.79	15.07 ± 2.91	5–15
Vitamin B1, mg	1.81 ± 0.41	2.58 ± 0.29	1.69 ± 0.35	1.5–2.5
Vitamin B2, mg	2.16 ± 0.32	6.84 ± 1.28	2.17 ± 0.50	1.5–2.0
Vitamin B3, mg	30.91 ± 8.57	71.92 ± 9.44	29.75 ± 15.86	10–18
Vitamin B6, mg	3.59 ± 0.48	3.26 ± 0.66	4.03 ± 1.56	1.6–2.0
Vitamin B12, mg	5.49 ± 1.45	8.46 ± 6.23	8.85 ± 7.56	2–3
Folate, μg	256.40± 37.60	210.8 ± 31.2	286.11 ± 43.07	300–400
Pantoic Acid B5 mg	7.73 ± 1.29	7.49 ± 1.46	7.62 ± 1.73	2–4
Biotin H, μg	49.74 ± 8.82	59.41 ± 9.95	48.40 ± 10.15	6–30
Vitamin C, mg	386.10 ± 43.50	192.6 ± 21.31	86.45 ± 32.05	75–90

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Discussion

Athletes of different sports consumption of energy should brought into line with its costs during the training sessions. To satisfy the energy needs of athletes, acting on long distances, often need to eat constantly all day [21]. As many authors point out, in 1/3 of the sportsmen of different sports studied in the diet of their actual nutrition, fats usually exceed the norm and are 36–45 %, whereas the recommended daily rate is 20–30 % [10; (Filaire et al., 2001; Finaud et al., 2006; Papandreou et al., 2007)[26,27] [21; 30; 35; 40; 41]. It should be noted that in the diet of triathletes we studied the recommended amount of fat daily rate slightly exceeded, but in judo this excess was significant and exceeded the norm by more than two times.

N. Boisseau at al. (2005)[12] indicates that the athletes in the proportion of polyunsaturated acids for 5–10 % of the energy produced, while in our study the representatives of judo at a fraction of the substance is necessary 13,5 % of the energy produced.

In the modern diet of athletes, one of the basic requirements in their diet is the optimal supply of carbohydrates. It proved that a sufficient amount of carbohydrates has a positive effect on performance, helps to alleviate fatigue (Jeukendrup et al., 2010)[2]. It should note that in our surveyed athletes the amount of carbohydrates did not correspond to the RDN. According to L. Burke et al. (2011) [23], S. Phillips, L. van Loon (2011) [24] the recommended norm of carbohydrates should be 60–70 % of the total amount of energy received from food, whereas in our study triatlonists the total amount of energy obtained from carbohydrates, averaged 52.04 %, volleyball players – 47.09 %, and in judo – only 31.70 %. J. Nogueira, H. DaKosta (2004) [25] surveyed nutrition of 38 Brazilian triathletes for 24 hours using a questionnaire survey and found that men weighing an average of 71.2 kg per 1 kg of body weight consumed 7.3 g of carbohydrates, 2,0 g of proteins and 1.6 g of fat, and women weighing an average of 55.8 kg – 5.9, 1.6 and 1.3 g, respectively. At the same time, the authors noticed that the amount of food and intake of certain groups of food was inadequate, which led to an inadequate intake of carbohydrates and some microelements. The literature presented data indicate that more than half of the studied representatives of sports of biathlon as there is a lack of carbohydrates in the diet [26–28][28,29]. Summarizing the data on the actual nutrition of athletes of various sports, you can see that among them there are more jobs, where it is noted that to increase aerobic capacity, athletes consume more carbohydrates, their meals are more appropriate for RDNs, while representatives of game sports, different types of wrestling – does not match [29].

In the diet, we studied athletes found significantly RDN exceeding the amount of sodium, potassium, calcium, phosphorus. Such a large amount of sodium can have a toxic effect on the athletes' body [20; 30–32]. In sports activities, an important trace element is iron. Athletes more often manifest iron deficiency in endurance sports; it has an ergolic effect on athletic

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performance [33]. Among our study of iron deficiency athletes noted.

Vitamins are involved in many biochemical reactions occurring in the body, but also in reactions associated with exercise and physical activity. Literature data research carried out in recent years show that the food of athletes often manifested a lack of vitamins A, D, folate, at least – of vitamins B6, C [34–36].

Our research has shown that for many of the vitamins in our surveyed athletes there was an excess of RDN. Noteworthy large amounts of vitamins A, E, B3, B6, B12, B5, C. However, according to E. Van der Beck, (1991) [37], athletes with food should receive more vitamins, 2–3 times higher than the recommended level for non-athletes. However, other authors [30] believe that consumption of vitamins should balance, since too much consumption of some of them increases the need for other vitamins. Dissatisfaction with this requirement may lead to vitamin deficiency. However, many authors suggest that increasing the amount of one of the vitamins listed above is necessary, since this increases the efficiency of the organism.

Conclusions

1. The actual nutrition of the athletes of high sportsmanship studied satisfies physiological needs in food and biologically active substances.

2. We investigated the athletes in the middle of food rations basic nutrients are not sufficiently balanced. Part of the energy cost coming from fats is overestimated and makes up 33.44 % on average for triathletes, 49.00 % for judoists, 35.20 % for volleyball players, while part of the energy produced from carbohydrates is understated, and for judoists is only 31.70 %, which does not correspond to the recommended daily rate.

3. In food rations, there is no shortage of vitamins and minerals. The number of such elements as sodium, potassium, calcium, phosphorus, magnesium, iron, iodine significantly higher than recommended rates. The content of vitamins A, B3, B6, B12, H and C also significantly exceed the recommended daily allowance. Literature sources believe that athletes performing high physical activity require an increased amount of vitamins and minerals, but there is no evidence that an increase is necessary.

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