



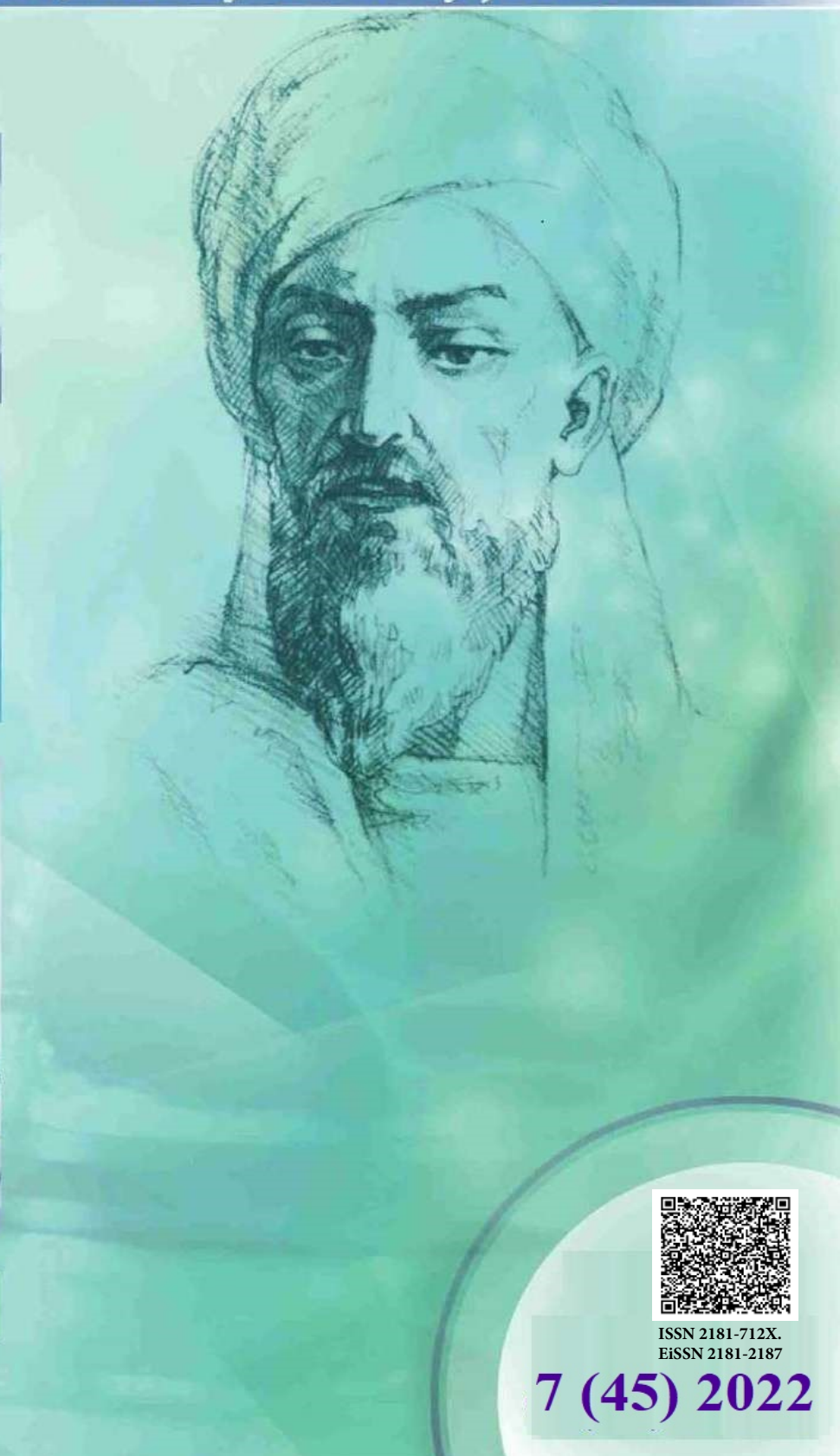
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## HYGIENIC ASSESSMENT OF MICRONUTRIENT CONSUMPTION IN THE DIET OF MILITARY ATHLETES

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### ✓ *Resume*

*The study analyzed the level of micronutrient intake in the diet of military athletes (after competitions at home) aged 20 to 40 years, participating in international competitions as part of various teams of the Ministry of Defense. Determination of the chemical composition of the daily diet was carried out using the programs "Chemical composition of food products" and "Health diet". The daily diet of military athletes at home does not meet the hygienic standards for the content of trace elements, and the level of consumption of thiamin acid in the diet is 75%, ascorbic acid – 61,3%, vitamin A – 61,0 %, retinol – 80,0%, beta-carotene - 60%, riboflavin – 68,0%, cyanocobalamin – 36,0 %. The intake of potassium from micronutrients in the diet is 64,4 %, calcium – 75,2 %, magnesium – 81,9 %, iron – 90,1%, iodine - 61%, selenium – 90,4%, and the level of phosphorus intake is 77,3%. Insufficient consumption of trace elements adversely affects the performance of military athletes, and incomplete satisfaction of the need for vitamins adversely affects the body's mobility and leads to rapid fatigue.*

*Key words: vitamins, minerals, military athletes, chemical composition of the diet.*

## ҲАРБИЙ СПОРТЧИЛАРНИНГ ОВҚАТЛАНИШ РАЦИОНИ ТАРКИБИДАГИ МИКРОНУТРИЕНТЛАР ИСТЕЪМОЛИНИ ГИГИЕНИК БАҲОЛАШ

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### ✓ *Резюме*

*Тадқиқотда Мудофаа вазирлиги тасарруфидаги ҳалқаро мусобақаларда турли жамолар таркибида иштирок этувчи 20 ёшдан 40 ёшгача бўлган ҳарбий спортчиларнинг мусобақалардан кейинги даврда уй шароитидаги овқатланиш рациони таркибидаги микронутриентларнинг истеъмол даражаси таҳлил қилинди. Уларнинг кун давомидаги овқат рационнинг кимёвий таркибининг миқдори «Озиқ-овқат маҳсулотларининг кимёвий таркиби» ва «Health diet» дастурий таъминоти ёрдамида амалга оширилди. Ҳарбий спортчиларининг уй шароитидаги кунлик овқатланиш рациони микроэлементлар таркиби жиҳатдан гигиеник меъёрларга тўғри келмайди ва рациони таркибидаги тиамин кислотаси истеъмол даражаси меъёрга нисбатан 75% ни, аскорбин кислотаси 61,3% ни А витамин 61,0% ни, ретинол 80,0% ни, бета каротин 60% ни, рибофлавин 68,0% ни цианкоболамин 36,0% ни ташиқ қилди. Овқатланиш рациони таркибидаги микроэлементлардан калийнинг истеъмол даражаси меъёрга нисбатан 64,4% ни, кальций 75,2% ни, мағний 81,9% ни, темир моддаси 90,1% ни, йод 61% ни, селен 90,4 % ни ва фосфор истеъмол даражаси 77,3% ни ташиқ қилди. Озиқ-овқатлар таркибидаги микроэлементларнинг етарли миқдорда истеъмол қилинмаслиги ҳарбий спортчиларнинг фаолият самарадорлигига салбий таъсир кўрсатиб, витамин ва микроэлементларга бўлган талабнинг тўлиқ қондирилмаслиги натижасида организмнинг тетиклиги ва чарчоқнинг тез энгилишига салбий таъсир кўрсатади.*

*Калит сўзлар: витаминлар, минераллар, ҳарбий спортчилар, рационнинг кимёвий таркиби, озиқ-овқатлар.*

# ГИГИЕНИЧЕСКАЯ ОЦЕНКА ПОТРЕБЛЕНИЯ МИКРОНУТРИЕНТОВ В РАЦИОНЕ ВОЕННЫХ СПОРТСМЕНОВ

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## ✓ Резюме

*В исследовании проанализирован уровень потребления микронутриентов в рационе питания военных спортсменов (после соревнований в домашних условиях) в возрасте от 20 до 40 лет, участвующих на международных соревнованиях в составе различных команд Министерства обороны. Определение химического состава суточного рациона питания проводили с помощью программ «Химический состав пищевых продуктов» и «Health diet». Суточный рацион питания военных спортсменов в домашних условиях не соответствует гигиеническим нормативам по содержанию микроэлементов, а уровень потребления в рационе тиаминовой кислоты составляет 75 %, аскорбиновой кислоты - 61,3 %, витамина А - 61,0 %, ретинола - 80,0 %, бета-каротин - 60%, рибофлавин - 68,0%, цианокобаламин - 36,0%. Уровень потребления калия из микронутриентов в рационе составляет 64,4 %, кальция - 75,2 %, магния - 81,9 %, железа - 90,1 %, йода - 61 %, селена - 90,4 %, и уровень потребления фосфора составляет 77,3 %. Недостаточное потребление микроэлементов отрицательно сказывается на работоспособности военных спортсменов, а неполное удовлетворение потребности в витаминах отрицательно сказывается на мобильность организма и приводит к быстрому утомлению.*

*Ключевые слова: витамины, минеральные вещества, военные спортсмены, химический состав рациона, пищевые продукты.*

## Relevance

In heavy and power sports that require intense physical activity, strength, speed and endurance, there is an increase in oxidative processes in the athlete's body, an increase in energy consumption, as a result of increased sweating, a lot of fluid and mineral salts are removed from the body [6,8,9]. This leads to an increase in the need for macro- and microelements, antioxidants and biologically active substances in the body of athletes. Maintaining a balance of vitamins and minerals in the diet is important to ensure a high level of performance and improve the body's adaptation to intense training [10,19,20,14]. Minerals and vitamins in the diet of military athletes differ sharply from the needs of different segments of the population [3,4,5,11,18]. At the same time, the body of military athletes must replenish the expended energy not only at the expense of proteins, fats and carbohydrates, but also at the expense of vitamins, minerals, dietary fiber and other physiologically active substances and compounds to meet the needs of the body [1,2,7,12,14,17].

## Material and methods

In the course of a scientific study, the amount of micronutrients in the diet of military athletes of various national teams of the Ministry of Defense at home was studied using the "Chemical composition of food products" and special program "Health diet" [15,16,] as well as, the requirements of sanitary norms and rules [13], the chemical composition of the daily diet.

## Result and discussion

In the course of this study, we decided to study the amount of vitamins and microelements in the nutrition of military athletes (at home). The diet of military personnel outside the competition, i.e. at home, differed from each other in different months of the winter season. In December, the amount of meat and sausage products as a share of the total amount of food consumed was lower than in other months of the winter season. In particular, it was found that in the winter season, the daily level of meat consumption averaged 44%, and the volume of consumption was 2,2 times less than the established norm. In some sports associated with high physical activity and overwork, the need for micronutrients in the body of athletes, unlike other segments of the population, is constantly increasing.

Tables 1, 2 and 3 show the daily diet of military athletes at home in the winter season, the amount of vitamins and microelements in the diet.

**Table №1**

**Quantitative indicators of daily food consumed by military athletes at home**

№	Name of products	Norm №4	Actual consumption	%	Deviation from the norm, g
1.	Bread and flour products	750	840±9,6	112	+90
2.	Rice and various cereals	87	163±4,7	187	+76
3.	Macaron (Pasta)	55	67±2,3	122	+12
4.	Sausage	0	24±1,6	-	+24
5.	Beef 1st category	250	110±3,4	44	-140
6.	Poultry meat	0	52	-	+52
7.	Fish	100	23±1,5	23	-77
8.	Vegetable oil	60	48±2,0	80	-12
9.	82.5% butter	50	38±1,7	76	-12
10.	Animal fat	20	12±1,0	60	-8
11.	Sterilized 2% milk.	200	63±2,2	32	-137
12.	Half smoked sausage	25	12±0,9	48	-13
13.	45% cheese	25	8±0,7	32	-17
14.	Egg 1-category (pcs)	1	1±0,05	100	0
15.	Sugar	60	65±1,1	108	+5
16.	Natural honey	30	6±0,04	20	-24
17.	Food salt	10	18±0,9	180	+8
18.	Tea	2	3±0,03	150	+1
19.	Spices, bay leaf	0,9	10,2±0,6	1133	+9,3
20.	3% acetic acid	2	1±0,03	50	-1
21.	30% tomato paste	10	8±0,6	80	-2
22.	Potato	600	238±6,2	39,7	-362
23.	Vegetables	400	255±6,7	63,7	-145
24.	Fruit (apple)	100	48±2,0	48	-52
25.	Apple juice	100	51±1,3	51	-49
26.	Kefir	0	28	-	+28
27.	Margarine	0	12	-	+12
28.	Yeast	0	1	-	+1
29.	Chocolate	0	8	-	+8
30.	pear, grape	0	18	-	+18
31.	Seedless raisins	0	10	-	+10
32.	Almond, pistachios, walnut	0	20	-	+20
33.	Banana, orange and lemon	0	41	-	+41

*Note: the reliability of the difference in the ratio of the obtained indicators compared to the established norm is  $P > 0,05$*

According to the content of macronutrients of the diet, it was found that the consumption of rice and cereal products in the winter season amounted to 187% of the norm, which is 1,8 times more. The level of consumption of vegetables in the diet in the winter season was 64% and amounted to 143,0 g, or 1,5 times less than the norm.

Quantitative indicators of vitamins in daily food consumed by military athletes at home are shown in table №. 2

**Table № 2**

**Quantitative indicators of vitamins in daily food consumed  
by military athletes at home**

Vitamins	Amount of vitamins (mg, mcg)		
	Norm	Actual consumption	Difference %
Vit A, RE (mcg)	2480	1501±13,6	61
Retinol (mg)	0,5	0,4±0,013	80
Alpha carotene (mcg)	1,8	47,7±0,81	2650
beta carotene (mg)	11,6	6,9±0,06	60
Vit B1, thiamine (mg)	3,2	2,4±0,011	75
Vit B2, riboflavin (mg)	2,8	1,9±0,010	68
Vit B4, choline (mg)	1035	943±3,02	91,1
Vit B5, pantothen (mg)	9,9	7,6±0,05	76,7
Vit B6, pyridoxine (mg)	6,7	4±0,05	59,7
Vit B9, folate (mcg)	518,5	514±2,1	99,2
Vit B12, cobalamin (mcg)	11,6	4,2±0,08	36
Vit C, ascorbic acid (mg)	234,8	144±1,6	61,3
Vit D, calciferol (mcg)	2,52	3,6±0,05	143
Vit E, tocopherol, (mg)	44,7	37,6±0,07	84,1
Vit H Biotin (mcg)	52,8	44,5±1,1	84
Vit K, phyloquinone (mcg)	134,5	119±4,01	88
Vit PP (mg)	72,4	60±0,06	82,8

*Note: the reliability of the difference in the ratio of the obtained indicators compared to the established norm is  $P > 0,05$*

This, in turn, causes dietary deficiencies in nutrients such as beta-carotene, vitamin B6, ascorbic acid, and vitamin A found in vegetables. In the winter season, the absolute consumption of bread products at home by military athletes amounted to 112%, which is 1,12 times higher than the norm. Excessive consumption of flour products destroys the intestinal microflora, makes it difficult to digest nutrients and produce good cholesterol, and negatively affects the functioning of the gastrointestinal system. There is very little evidence to support the effectiveness or safety of many nutritional supplements, and most researchers confirm that drugs such as caffeine and creatine monohydrate are safe and effective for athletes. To maintain glycogen stores in the liver and muscles, military athletes require varying amounts of vitamins, carbohydrates and trace elements depending on the amount of exercise. Please be aware that some organizations (WADA, IOC, etc.) prohibit the use of certain nutritional supplements.

Analyzing the level of vitamin intake in the nutrition of military athletes, the intake of vitamin A was 1501 mcg or 61% of the norm, retinol – 0,4 mg or 80%, alpha-carotene – 47,7 mcg, beta-carotene - 6 mg or 60% of the norm. Analyzing the amount of intake of B group vitamins in the diet, vitamin B1 accounted for 2,4 mg or 75%, vitamin B2 for 1,9 mg or 68%, vitamin B4 for 943 mg or 91,1%, vitamin B5 by 7,6 mg or 76,7%, the intake of vitamin B6, the most important of the B vitamins, was 4

mg or 59,7%, as well as vitamin B9 by 514 mcg or 99,2%, vitamin B12 by 4,2 mcg or it was found that it was 36% compared with the norm. In addition, ascorbic acid, which is considered the leading antioxidant in the body, is also important for athletes. Considering that ascorbic acid biochemically reduces the level of glutathione, which protects against free radicals, toxins and heavy metals, one can understand how important the role of this vitamin is in the nutrition of athletes.

Analyzing the consumption of ascorbic acid in the home diet of military athletes, it was found that the level of consumption of this substance was 144 mg or 61,3% compared to the established norm. The second table shows that the consumption of vitamin D in the diet of athletes at home is 3,6 mcg or 143%, that is, almost 1,5 times the amount indicated in the norm, it was determined that it was due to the content of animal fat, chicken eggs and dairy products in the diet.

At the same time, the level of vitamin E consumption in the diet of military athletes was 37,6 mg or 84.1%, vitamin H – 44,5 mg or 84%, vitamin K - 119 mcg or 88%, and the level - 60 mg or 82,8 % compared to the established norm. The results obtained show that a statistical analysis of the nutritional and biological value of products in the home diet of military athletes shows that the ratio of proteins, fats and carbohydrates in their composition is 1:1,1:4.7, respectively, which is relevant for the physical condition of army athletes can have a negative impact and affect the endurance and speed of the body. Trace elements play an important role in the metabolism of proteins, fats, carbohydrates, protein synthesis in the body, heat transfer, hematopoiesis, bone formation, the activity of the reproductive and immune systems.

Quantitative indicators of trace elements in everyday food consumed by military athletes at home are given in Table. 3.

### Quantitative indicators of micronutrients in daily foods consumed by military athletes at home

Microelements	Amount of trace elements (mg, mcg)		
	Norm	Actual consumption	Difference %
Potassium, K (mg)	8160	5262±15,1	64,4
Calcium, Ca (mg)	1167	878,6±7,6	75,2
Silicon, Si (mg)	513,4	355,9±2,8	69,3
Magnesium, Mg (mg)	809,5	663±2,1	81,9
Sodium, Na (mg)	7727	10341±13,0	133,8
Sulfur, S (mg)	2075	1454±1,4	70
Phosphorus, P (mg)	2822	2183±4,6	77,3
Aluminium, Al (mg)	8632	5763±2,7	67
Boron, B (mg)	2092	1611±0,7	77
Vanadium, V (mcg)	1655	1110±0,8	67
Iron, Fe (mg)	40,1	36,4±0,09	90,1
Iodine, I (mg)	119,8	72,12±0,07	61
Cobalt, Co (mg)	90,6	67,2±0,06	73
Lithium, Li (mg)	497,7	204,7±1,01	41
Manganese, Mn (mg)	11,2	9,4±0,09	84
Cuprum, Cu (mcg)	4039	3387±8,05	83,5
Molybdenum, Mo (mg)	270,5	207,9±1,8	74
Nickel, Ni (mg)	126,8	135,3±1,10	107
Tin, Sn (mg)	224,3	96,15±0,06	43
Rubidium, Rb (mg)	3673	1670±2,01	45
Selenium, Se (mcg)	124	112,1±0,09	90,4
Strontium, Sr (mg)	147,8	295,7±0,05	200

The inclusion in the diet of athletes of food products containing iodine, magnesium, iron, zinc, calcium, potassium, phosphorus, selenium and fluorine from the main microelements necessary for the body, increases their performance, increases the vitality of the body and resistance to diseases.

From the third table it can be seen that the consumption of micronutrients in the home diet of athletes is: potassium - 5262 mg or 64,4%, calcium – 878,6 mg or 75,2%, silicon – 355,9 mg or 69,3%, magnesium 663 mg or 81,9%, and the level of sodium intake with food was 10341 mg or 133,8% compared to the established norm.

It has been established that the excess of sodium intake in the diet of athletes by 33,8% compared to the established norm is associated with a high salt content in their diet, as well as in sausages, pickled cucumbers and smoked sausages and similar products.



The obtained results show that the level of phosphorus intake in the home diet of military athletes is 2183 mg or 77,3%, the content of iron is 36,4 mg or 90,1%, copper is 3387 mcg or 83,5%, tin is 96,15 mcg or 43 %, the content of selenium is 112.1 mcg or 90,4%, and the intake of strontium is 295,7 mcg or 200% compared with the established norm.

Such a deficiency of microelements in the nutrition of military athletes will certainly cause a decrease in their performance, the development of fatigue in the body, and a decrease in resistance to various diseases.

### Conclusions:

1. Due to deficiencies in the daily diet of vitamins and microelements, the diet does not meet the requirements of a healthy diet, and the amount of potassium, sulfur, lithium, tin and iodine in food products in the diet is provided by 43-64% compared to the established norm.

2. The number of vegetables in the daily diet was 63,7% or 1,5 times less than the norm, and the level of potato consumption by 39,7% or 2,5 times less than the norm was the reason for the lack of ascorbic acid and group B vitamins in these products.

3. The level of consumption of micronutrients in daily diet of military athletes does not meet the requirements of the established norm. Due to insufficient consumption of micronutrients with food, this negatively affects the recovery and high performance of military athletes, creates conditions for the development of diseases associated with various metabolic disorders

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