

NUTRITION IN THE NORTH

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ANALYSIS OF THE MACRO- AND MICRONUTRIENT DIET PROFILE OF YOUNG MALE INDIGENES IN THE NORTHEAST OF RUSSIA

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Each ecological region has individual characteristics of metabolism particularly because of the indefinite landscape zone that can be inhabited by people of different ethnic and racial origin. The environmental factor of nutrition has a great influence on the metabolism characteristics. What macro- and micronutrients are consumed with food becomes a prognostic sign of the development of alimentary-dependent deviations that directly affect functional parameters of the body systems. The diet of 17-21 year old male indigenous residents of Magadan region ($n = 38$) and Chukotka Autonomous District ($n = 52$) has been analyzed. All the examinees were full-time students having similar living conditions. The ASPON-Nutrition program (Russia) was used to evaluate the young subjects' nutritional profiles by analyzing their daily diets. The studied parameters were proteins, fats, carbohydrates, fiber, vitamins, and macro- and microelements. In addition, the energy value of the daily diet was assessed in kcal / day. Larger deviations from the current normative values of the body physiological needs in macro- and micronutrients have been found. The nutritional imbalance characterized by insufficient intake of proteins, fats, essential trace elements, and vitamins against the background of reduced energy value of daily calorie content has been shown. The revealed deficiency is much more typical at young men living in the city of Magadan. In general, the multilateral imbalance established in the diet of young indigenes indicates a violation of the basic principles of healthy eating (satisfying energy needs, balancing proteins, fats, carbohydrates) and can be associated with avoiding the traditional type of the diet by the indigenous population and turning to the classical Caucasian one which does not provide all the needs of the body of this ethnicity.

Keywords: young men, indigenes, diet, macro-, micronutrient diet profile.

Introduction. In contrast to all abiotic factors that constantly affect a person, food is transformed in the body into an internal factor as a source of energy and plastic material for building cells [1]. Being environmental factor nutrition has a great influence on the metabolism characteristics [8]. What macro- and micronutrients enter the body with food becomes a prognostic characteristics of the development of alimentary-dependent deviations that directly affect functional parameters of the body systems [15].

The youth are known to keep to a special pattern of eating behavior which is characterized by irrational, monotonous nutrition with the dominance of carbohydrates [16]. That can lead to nutritional deficiency and imbalance [18]. According to WHO avoiding a balanced diet is one of the main risk factors for the development of chronic diseases [25]. Such diet unbalanced by the consumption of micro-

and macronutrients is a very important component in the etiology of cardiovascular, oncological diseases as well as obesity [19].

It is obvious that even within one ecological region there are individual characteristics of metabolism particularly because of the considered landscape zone that can be inhabited by people of different ethnic and racial origin [14]. In this regard, the aim of our research was to identify regional characteristics of the macro- and micronutrient composition of the diet of young indigenous men born in the northeast of Russia.

Methodology. The diet assessment was carried out among young men from the indigenous population of the city of Magadan ($n = 38$) as well as representatives of the Chukotka Autonomous District (ChAD) aged 17-21 ($n = 52$). All the examinees were full-time students having similar living conditions. The ASPON-Nutrition program (Russia) was used to evaluate the young subjects' nutritional profiles by analyzing their daily diets. The studied parameters were proteins, fats, carbohydrates, fiber, vitamins, and macro- and microelements. In addition, the energy value of the daily diet was assessed in kcal / day. Besides, the frequency of deficiency or excess in macro- and micronutrients intake were recorded as compared to the normative ranges.

The study was carried out in accordance with the principles of the Helsinki Declaration (2008). The study protocol was approved by the Ethics Committee of Biomedical Research at the NESC, FEB RAS (No. 004/013 dated

12/10/2013). All the volunteers gave their written informed consent of being included in the study. The results underwent statistical processing using the software package of Statistica 7.0. The distribution of the measured variables was checked for normality based on the Shapiro-Wilk test. The processing parametric methods are presented as the average value (M) and the arithmetic mean error ($\pm m$). The statistical significance of differences was determined using the Student's t-test for independent samples. The critical level of significance (p) was taken equal to 0.05.

Results and discussion. Tables 1 and 2 show the diet macronutrition facts of young male natives from both the city of Magadan and Chukotka Autonomous District. Proteins are known to play a leading role in biological systems since they determine the plastic function of cellular and extracellular structures [24]. It ought to be noted that food should contain at least 140 g of protein per day for normal body functioning in the North [9]. We have found the protein content per day to be no more than 112.1 ± 9.9 g. The young men of Magadan were significantly lower in protein than the young men of the ChAD. The same picture has been observed for lipids as the indigenous residents of the city of Magadan demonstrated the smallest animal and vegetable fats in their diets. Of note that diets of residents of Magadan region have proved to be low in polyunsaturated fatty acids which are important nutrients and the lack of them can lead to significant consequences, in particular, a shift in the blood lipid spectrum - an increase

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in total cholesterol, triglycerides, and atherogenic fractions of lipoproteins [11]. No statistically significant differences in carbohydrates which are the main energy supplier to the body have been found.

The protein-lipid type of nutrition of the indigenous population, which evolved as man started developing the Arctic, was a natural basis for a fairly quick adaptation of the ethnic group to a cold climate [10, 12]. According to the researchers, the type of aboriginal diet focused on high intake of protein and animal fats is the only way to maintain the energy balance of the body in the North even with low carbohydrate content in food [22].

The previously conducted research on nutrition features typical for the native population in the European and Far North showed nearly complete absence of traditional dishes in the diet of younger people of these regions [4, 5]. Our data also indicate transition from the traditional protein-lipid to the urbanized diet of younger representatives of indigenes of northeast Russia, which is more frequent among young male residents of Magadan region. In the future that can lead to significant metabolic disorders significantly worsening health and reducing quality of life of the indigenous population of Russia's northeast [13].

There should be also noted the extreme lack of fiber consumption (both among residents of Magadan and among young men from ChAD), which is considered a risk factor for the development of a number of non-infectious diseases [7]. That indicates a low variety of food consumed and may be associated with the high cost of them especially fresh fruit and vegetables.

The analysis of macro- and microelement composition of the diet of young men is presented in Table 3, and Table 4 shows the frequency of deficit, excess and normal values of the studied indicators. It can be seen that only the copper and nickel values demonstrated no statistically significant differences. The values of manganese and fluorine were higher among young men from the city of Magadan. The indicators of the rest 12 macro- and microelements were significantly higher among the inhabitants of ChAD, and in some cases this difference had multiple values. Such an essential element in maintaining the optimal level of bone mineralization [6] as calcium was found in the diet of Magadan subjects almost two times less than among the inhabitants of Chukotka. Analysis of deviations from normative indicators revealed that calcium deficiency was found in 100% of Magadan subjects and 90% of Chukchi. The examinees from Magadan were also lower in potassium and sodium which are the most important intra- and intercellular cations playing a key role in maintaining a stable volume of cells [21]. It must be emphasized that, 61% of them from Magadan Region were very deficient in sodium while the great majority (86%) of those from ChAD had an excess of it in their diet being two times higher than the daily norm recommended by WHO for adults [26]. Chlorine which regulates (along with calcium and sodium) the water-electrolyte balance in the body and is of importance in the development of neuromuscular inhibition had an even more pronounced excess in the subjects of that group, its intake with food exceeded the normal values in almost

all examinees and was 4.5 times higher than that of Magadan subjects. The latter were totally deficit in the intake of iodine while in Chukotka such a shortage was found only in half the cases. Apparently such a low intake of this important trace element is associated with shortage in seafood in the diet especially fish. Of note is the pronounced deficiency of selenium which is a cofactor for iodine and therefore influences the functioning of the thyroid gland [17]. In our studies, 94% of Magadan subjects have proved to be low in this microelement as well as 100% of the inhabitants of Chukotka.

Tables 5 and 6 present data on the vitamin profile in the diet of the examined young men. Vitamins are one of the most important micronutrients that play a key role in many biochemical reactions of the functional state of cells [23]. We could observe significant differences in almost all indicators. It should be noted that most of the highest values were demonstrated by residents of the ChAD. Only vitamin C tended to increase among residents of Magadan, but that deviation did not have a statistically significant difference. At the same time, the lowest values for all water-soluble and three fat-soluble vitamins A, D, and K were recorded for male indigenes of Magadan. It is known that almost all vitamins that are water-soluble, unlike fat-soluble vitamins, cannot accumulate in the body, therefore their insufficient daily intake with food leads to disorganization of redox processes and disruption of the body functional systems [3]. Vitamin deficiency is one of the causes of metabolic disorders, reduced physical and mental activity, and rapid fatigue [2]. Moreover, even a perfectly designed adult diet, calculated at 2500 kcal per day, is deficient in most vitamins by at least 20% [20]. According to our studies, the energy value of the daily diet of Magadan residents did not reach that value (and was significantly lower than that of residents of the city of Anadyr), which again indicates the pronounced depletion of the vitamin profile characteristic of people living in the city of Magadan (Table 1).

Conclusion. The conducted studies allowed us to establish that the diet of young male residents of northeast Russia is characterized by the large deviations from the current normative values of the body physiological needs for macro- and micronutrients. The current nutrition of young residents from the indigenous population of Magadan Region and Chukotka Autonomous District is characterized by the low proportion of proteins and fats, the shortage of polyunsaturated fatty acids, and the complete lack of fiber

Table 1

Macronutrient composition of the diet in young male indigenes of Magadan region and ChAD

Indicators	Cohort		Difference Significance between Cohorts
	Indigenes, Magadan	Indigenes, Chukotka	
Proteins, g	74.2±1.9	112.1±9.9	p<0.001
Fats, g	35.2±1.6	58.7±4.6	p<0.001
Arachidonic Acid, g	0.3±0.0	0.5±0.0	p<0.001
Docosahexaenoic Acid, g	0.04±0.01	2.36±1.75	p<0.001
Linoleic Acid, g	8.9±0.5	8.5±1.3	p=0.79
Linolenic Acid, g	0.22±0.01	0.31±0.04	p<0.05
Carbohydrates, g	327.2±8.2	351.0±14.6	p=0.15
Fiber, g	3.9±0.2	6.1±0.8	p<0.01
Energy Value, kcal	2310.5±44.3	2807.2±89.1	p<0.001

Note. Table 1-3 the significance of differences between groups is indicated at p<0.05, p<0.01, p<0.001.

Table2

Microelement profile of the diet in young male indigenes of Magadan Region and ChAD

Indicators	Cohort		Difference Significance between Cohorts
	Indigenes, Magadan	Indigenes, Chukotka	
Iron, mg	14.9±0.5	24.1±4.5	p<0.05
Potassium, mg	2013±82.2	3346.4±142.4	p<0.001
Calcium, mg	355.5±19.0	670.7±58.0	p<0.001
Magnesium, mg	278.9±13.4	340.8±27.0	p<0.05
Manganese, mg	4.1±0.2	3.3±0.2	p<0.05
Sodium, mg	1433.4±89.8	4274.7±240.8	p<0.001
Phosphorus, mg	1043.8±29.9	1542.7±114.5	p<0.001
Fluorine, mg	22.3±4.9	10.8±1.9	p<0.05
Chlorine, mg	1342.3±84.1	6213.7±396.8	p<0.001
Zinc, mg	9.5±0.4	12.5±0.6	p<0.001
Iodine, mcg	45.4±2.9	116.2±9.6	p<0.001
Cobalt, mcg	22.8±1.1	51.2±4.1	p<0.001
Copper, mcg	1900±70	5145±2640	p=0.22
Molybdenum, mcg	74.1±3	87.7±4.0	p<0.05
Nickel, mcg	47.1±3.5	49.1±6.3	p=0.77
Selenium, mcg	21.1±1.9	28.7±2.9	p<0.05
Chromium, mcg	46.6±2.9	146.0±13	p<0.001

intake against the background of the relatively high proportion of carbohydrates. It should be noted the reduced energy value of the daily calorie intake necessary for young men at this age who tend to follow active lifestyle. The macro- and microelement nutritional profile is also characterized by the obvious deficit in the most essential elements and lacks in vitamin composition of consumed food products. The indicated deviations have high prevalence among male indigenes resid-

ing in Magadan Region. The imbalances of their nutrition profile in macro- and micronutrient composition have proved to reach the highest values among all the examined men, in some cases demonstrating a 100 percent deficit.

In general, the multilateral imbalance established in the diet of young indigenes indicates the violation of the basic principles of healthy eating (satisfying energy needs, balancing proteins, fats, carbohydrates) and can be associated with avoid-

ing by the Indigenous population the traditional type of the diet and turning to the classical Caucasian one which does not provide all the needs of the body of this ethnicity.

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Table3

Vitamin profile of the diet in young male indigenes of Magadan Region and ChAD

Indicators	Cohort		Difference Significance between Cohorts
	Indigenes, Magadan	Indigenes, Chukotka	
Biotin, mcg	29.3±2.1	42.5±6.5	p<0.05
Vitamin B1, mg	0.82±0.03	8.59±4.27	p<0.05
Vitamin B12, mcg	2.9±0.1	17.1±4.0	p<0.01
Vitamin B6, mg	1.5±0.0	2.5±0.1	p<0.01
Vitamin C, mg	61.9±9.5	55.8±14.5	p=0.72
Vitamin D, mcg	5.5±0.8	21.5±2.8	p<0.001
Vitamin E, mg	15.7±0.7	17.2±1.4	p=0.35
Vitamin PP, mg	12.4±0.4	17.9±1.0	p<0.001
Vitamin A, mcg	359.8±28.0	870.25±80.2	p<0.01
Vitamin B2, mg	0.76±0.04	1.38±0.13	p<0.001
Vitamin K, mcg	13.3±2.2	49.1±5.7	p<0.001
Pantothenic Acid, mg	3.1±0.1	5.5±0.5	p<0.001
Folacin, mcg	102.2±3.4	174.8±17.9	p<0.001

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