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IMPORTANCE OF ACTUAL NUTRITION IN THE PREVENTION OF NON-INFECTIOUS DISEASES

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РОЛЬ ФАКТИЧЕСКОГО ПИТАНИЯ В ПРОФИЛАКТИКЕ НЕИНФЕКЦИОННЫХ ЗАБОЛЕВАНИЙ

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Healthy nutrition is a key factor in reducing the risk of chronic non-infectious disease development and progression. In the present review, we assessed the results of epidemiological and clinical studies reporting participants' nutritional features including unbalanced rations, excessive caloric intake, and a lack of food intake variety, as well as differences between male and female nutrition stereotypes and deficiencies in the intake of vitamins and microelements. The interrelation between fiber intake and obesity risk, insulin resistance, and type 2 diabetes was confirmed. This article addresses the role of insufficient intakes of micronutrients and dietary fiber in the development of non-infectious diseases, as well as the necessity of and suggestions for their correction to prevent pathologic conditions.

The research results justify the need for further longitudinal population-based epidemiological research aimed to study the associations among clinical, medical, and social indices and assess the contribution of nutrition-related risk factors to the development of non-infectious diseases. To increase the effectiveness of prophylaxis against chronic non-infectious diseases, it is appropriate to use an integrated strategy to increase awareness among the population and professionalism among primary health care providers regarding issues of healthy nutrition. Health care professionals should use a personalized approach to develop recommendations regarding nutritional behavior, taking into account patients' sex and age, taste preferences, presence of concomitant pathology, physical activity, and professional employment.

Keywords: chronic non-infectious diseases, risk factors, healthy nutrition, prophylaxis, review

Здоровое питание является одним из значимых факторов, влияющих на снижение риска развития хронических неинфекционных заболеваний. В обзоре представлены результаты эпидемиологических и клинических исследований, свидетельствующие об особенностях питания населения. Обсуждается роль микронутриентной недостаточности и пищевых волокон в развитии неинфекционных заболеваний, необходимость и возможность их коррекции с целью профилактики патологических состояний. Результаты исследований обосновывают перспективность дальнейших продольных популяционных эпидемиологических исследований с целью изучения ассоциаций с клиническими и медико-социальными показателями и оценки вклада факторов риска, обусловленных питанием, в развитие неинфекционных заболеваний.

Для повышения эффективности профилактики хронических неинфекционных заболеваний целесообразно применять комплексный подход: повышать информированность населения и профессионализм врачей первичного звена в вопросах здорового питания, которые должны при разработке рекомендаций по пищевому поведению применять персонализированный подход, учитывая пол и возраст пациентов, вкусовые предпочтения, наличие сопутствующей патологии, физическую активность, профессиональную занятость.

Ключевые слова: хронические неинфекционные заболевания, факторы риска, здоровое питание, профилактика, обзор

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BMI – body mass index
CND – chronic non-infectious disease
CVD – cardiovascular disease
IHD – ischemic heart disease

At the present time, chronic non-infectious diseases (CND) occupy a leading position among all causes of adult mortality in economically developed countries. In terms of morbidity and mortality from CNDs, Russia surpasses most European countries [1–3], a situation that causes a considerable social and economic burden. Male mortality from circulatory system diseases exceeds female mortality by 4.7 times, mortality from ischemic heart disease (IHD) by 7.4 times, that from myocardial infarction by 10.6 times, and mortality from cerebrovascular diseases by 3.5 times [4, 5].

To preserve the health of the population and prevent the development of CNDs, nutrition plays an important role, as a component of a healthy lifestyle and comprising factors that directly affect the human body during the life span. It should be emphasized that in the recent literature, there are different interpretations of definitions and various terms are used, but these do not always fully reflect the essential meaning of nutrition. Some of these terms include «rational nutrition», «healthy nutrition», «proper nutrition», and «optimal nutrition». It should be noted that healthy nutrition not only refers to balanced nutrition but also to safe dietary intake. Rational nutrition (from the Latin word *rationales*, which mean reasonable) is a complete diet that satisfies the physiological needs of the human body in terms of nutrients and energy in accordance with age, sex, physical activity, health state, and environmental factors. Rational nutrition serves as the basis for life quality and work capacity and is recognized as one of the key factors involved in a lower risk of the development and progression of a number of CNDs [6, 7]. Additionally, food products can be a source of various compounds as a result of water and soil pollution, agricultural production, as well as storage and cooking. Dependent upon tropism to the organs and tissues of the human body, these compounds can promote the development of various CNDs such as oncologic, bronchial, and pulmonary diseases.

Thus, «the development of a system of measures for reduction of public health risks and formation of a healthy lifestyle among citizens of the Russian Federation» has become a priority state task, formulated in the Development Strategy for Medical Science of the Russian Federation (RF) for the period through 2025. This concept covers not only the development of relevant branches of medicine but also «conscious stimulation and focused work among individuals to restore and develop vital resources and to take responsibility for their own health, so that a healthy lifestyle becomes an unconstrained need» [8].

Irrational nutrition promotes the formation of secondary nutritionally dependent risk factors, such as high blood pressure, hypercholesterolemia (dyslipidemia), hyperglycemia, and overweight [9]. The prevalence and combination of these conditions can lead to the development of circulatory diseases, type 2 diabetes, and obesity, which in turn are not only independent diseases but also risk factors for all noncommunicable diseases (NCDs). Obesity is a multifactorial disease, but nutrition plays an important role in its development and progression. The number of obese people has grown in recent years by nearly 30 %–50 % among both adults and children [10]. It is well known that overweight and obesity are risk factors for the development of diseases such as arterial hypertension, type 2 diabetes, dyslipidemia, atherosclerosis and its complications, and oncologic diseases [11]. A study by The Physician's Health found that with an increase in body mass index (BMI) of 1 kg/m^2, the risk of hypertension increases by 8 % [12]. It has been proven that among all modifiable risk factors affecting blood pressure, body weight modification plays a key role in reducing the risk of cardiovascular events [13]. It should be mentioned that in the past decade, the scientific literature has actively discussed «the obesity paradox», which refers to a protective role of adipose tissue [14–16]. However, studies that refute the existence of an obesity paradox currently prevail. We must emphasize that to minimize systematic errors, a balanced approach is important when designing studies to research this effect, as well as when interpreting their results.

The multicenter epidemiological study «Epidemiology of cardiovascular diseases and their risk factors in the regions of the Russian Federation» (ESSE-RF), performed by the Federal State Statistics Service, gives a complete picture of the nutrition characteristics and nutritional habits and behaviors among populations in 13 regions of the RF [17]. The study population (aged 25–64 years) included a male and female participants (n=22,258), with 8519 men and 13,698 women. It was revealed that only 40.2 % of Russians follow the recommended level of meat consumption as a part of a healthy diet, and consuming red meat is preferable; 34.9 % of respondents had low fish consumption. As for daily dietary habits, 22.5 % of respondents had high levels of sausage consumption, 10.1 % consumed pickled and marinated foods, and 47.5 % had an increased consumption of sweets and confectionery. Only a quarter of the study population (24.4 %) limited the consumption of sweets. A high percentage of dairy products was consumed by 49.7 % of participants, and 74 % preferred dairy products with a high fat content. More than half of those surveyed (59.7 %) did not include fresh vegetables and fruits in their daily diet. Vegetable oils were reported as used mostly for cooking meals (95.4 %) and butter only for a «morning sandwich» A high prevalence (40.5 %) of adding salt to cooked dishes while eating was also revealed [18].

The same study [18] described the diets of 102,000 individuals who were assessed to identify sex differences in eating behavior patterns. Men were characterized by excessive consumption of meat, sausages, a clear lack of fresh vegetables and fruits, and a tendency to add salt to cooked dishes. In women, the diet mostly included dairy products and fresh vegetables and fruits. A balanced diet was lacking in both groups. Although it is hypothetically possible to predict the taste and nutritional preferences of men and women when developing recommendations for personalized nutrition, it is nevertheless important to know and to take into account the characteristic features of nutritional preferences according to sex.

Scientists from the National Medical Research Center for Preventive Medicine under the Ministry of Health of Russia have studied nutritional characteristics in a sample of men living in Moscow (aged 41–44 years) to identify risk factors for the development of cardiovascular diseases (CVDs) [19]. Nutrition among Russian men of this age is known to be unbalanced, with an excessive intake of saturated fats and sodium chloride and insufficient intake of omega-6 and omega-3 polyunsaturated fatty acids, complex carbohydrates, dietary fiber, vitamins, and minerals. This is a consequence of high consumption of animal fats and salt and insufficient consumption of vegetable oils, fish, grain products, vegetables, and fruits. Overweight and obesity were found in 67 % of respondents, dyslipidemia in 42.6 %, and increased blood pressure and use of antihypertensive drugs in 50 % of participants [19]. The findings showed that a preventive diet for individuals of a certain age will be effective in lowering the risk of fatal CVDs.

One of the tasks of a sociological study [20], conducted using a standardized telephone interview via a computer system, was to assess diet among residents of St. Petersburg, as an important component in the development of recommendations for rational nutritional intake. A total of 1200 St. Petersburg residents were included in this study (aged over 18 years, 56.2 % women). The obtained data indicated the lack of regularity in food intake both young and older people. Men were more often limited to two meals a day. On the contrary, women were more likely than men to eat five times a day. An orientation toward healthy nutrition with consumption of 3–4 meals a day was reported by more than half of respondents (67.0 %). Deviations in diet were recorded, especially among young people, who had excess caloric intake in the evening. This study revealed that the most common nutritional patterns among men increase the risk of obesity and the development of some oncologic diseases and CVDs. The identified differences in nutritional patterns between men and women allows for consideration of these differences when developing recommendations for dietary programs, to better target them to men and women.

Some common nutrition behavioral patterns have been identified in the Northern regions and Buryatia, characterized by insufficient consumption of meat, fish, seafood, milk and dairy products, and fresh vegetables and fruits and excessive consumption of fats, baked goods, and salt [21, 22]. Such dietary intake is characterized by deficiencies in dietary fiber, unsaturated fats, and a number of vitamins and minerals, as well as by a high energy value. Thus, for men, the average daily diet included 2891±43.6 kcal and 2407±38.4 kcal for women. These levels are owing to a high content of fats and carbohydrates and a low protein content (82.4–87.3 % of recommended levels). At the same time, recommendations on caloric values according to daily meals consumed were not taken into account in 91.6 % of cases [22]. In Buryatia, 47 % of men and 52 % of women are overweight.

In the Samara region, the diet among people with higher incomes consists of fatty foods, exceeding recommended intakes by 1.5 times; sugar and confectionery products exceed recommendations by 1.3 times against the background of insufficient consumption of fish, milk, potatoes, bread, fresh vegetables and fruits, and meat [23]. Researchers have also described sex-dependent differences in nutrition: the diet among men in the region primarily comprises fat-containing foods whereas women consume more sugar-containing and high-calorie confectionery products. These dietary patterns represent a risk factor for the development of obesity, CVDs and diabetes mellitus. Overweight was found in more than half of study participants, and more significantly in women. The correlation between BMI and concentrations of cholesterol and blood glucose was also revealed [24].

Nutrition evaluation in an adult population from the Republic of Bashkortostan (RB) also demonstrated a mismatch with the modern requirements for healthy nutrition [25]. A total of 1328 people aged 25-60 years participated in the program (groups I–III of physical activity), with 821 women, and 507 men. The results showed that residents of the RB have bread and sugar consumption levels that are 1.4 and 1.9 times higher than the recommended daily consumption levels; vegetable consumption was 2.2 times lower, fruit consumption 2.6 times lower, and fish and seafood consumption 2.7 times lower than recommendations. This diet alters the composition of nutrient intake and increases the calorie content. Nearly 40 % of both urban and rural residents reported eating an irrational, unbalanced diet in terms of basic nutrients and tending toward high fat intake, added sugars, and a decrease in vegetable and fruit intakes by 28 % of the recommended rates. Owing to insufficient intake of fresh vegetables and fruits, the supply of dietary fiber to the body amounted to 79 % of the requirements. Among the total, 6.0 % of respondents were underweight, with overweight or degrees of obesity present in 36.3 % of men and 51.1 % of women. Obesity in the RB was increased by 3.3 times during the 5-year observation period. Studies have revealed a relationship between the prevalence of nutritionally dependent diseases and malnutrition among adult populations in the RB. As for diet energy value, 45 % was owing to the consumption of carbohydrates, 42 % from fat, and 13 % from protein, with an average 2812±196 kcal per day for men and 2229±136 kcal per day for women. Although that study took into account groups of physical activity in assessing energy consumption, it was unclear which group corresponded to the summarized daily calorie contents, which is important for drawing conclusions [25].

As part of the international HAPIEE project, a cross-sectional population study of Russian women's actual nutrition in the city of Novosibirsk was carried out and nutrient intake in this population with abdominal obesity was studied as a risk factor for the development of atherosclerosis [26]. The study involved 5074 women aged 45–69 years. Analysis of respondents' nutritional data showed a significant inverse relationship between the risk of developing abdominal obesity and carbohydrate intake. However, the results of this study regarding the relationship of individual nutrients with obesity risk were insufficient to assess the effect of nutrition on metabolic disorders and related diseases. When surveying the population, it was not specified which types of carbohydrate were taken into account; however, the researchers suggested that these were complex carbohydrates (vegetables, grains, fruits). In this case, the stated association may be owing to a decrease in caloric intake. The above results were confirmed in a number of international studies, in which it was found that a high intake of carbohydrates (cereals, vegetables, and fruits) was significantly associated with a decrease in BMI [27, 28].

The results of the epidemiological study NATION, conducted during 2013–2015 in the RF and including 26,620 people, indicated a lack of public awareness regarding the nutritional requirements to avoid the development of obesity and type 2 diabetes [29]. The study findings also demonstrated low levels of awareness concerning the risks of chronic diseases as well as low motivation and commitment among the population to adopt a healthy lifestyle. According to the latest recommendations of the American Heart Association and the European Society of Cardiology and Hypertension, all patients with hypertension should increase their intake

of fresh fruits, vegetables, low-fat dairy products, and fish while reducing sodium intake [30]. This can be an effective approach prior to prescribing drug therapy that can additionally contribute to decreasing blood pressure and reducing the number and dose of medications.

The results of studies conducted in different regions of the RF outline the general tendency toward an imbalance in the nutritional structure, with excess energy values in the daily diet of both men and women, high BMI, excessive consumption of animal fats, deficiency of polyunsaturated fatty acids, and excessive intakes of salt, sugar, and confectionery products. This nutritional pattern creates the conditions for obesity development or progression. It is advisable to highlight the critical deficiency in fresh vegetables, fruits, and other sources of dietary fiber in the diet of the population. The European Food Safety Authority (EFSA) considers dietary fiber as the sum of polysaccharides and lignin that are not digested by the secretions of the human gastrointestinal tract [31]. As for its physiological role, dietary fiber stimulates motor function of the intestine, contributes to the formation of feces, promotes water retention in the intestinal lumen and sorption of bile acids and cholesterol, slows down the absorption of carbohydrates, and regulates the intestinal microbiota, which are important processes in the prevention of CNDs [32]. The importance of dietary fiber in the normal functioning of the digestive system; prevention of overweight, obesity and hyperlipidemia; and reduction in the risk of cancer and CVDs has been proven. However, optimal dietary fiber intake is currently not clearly defined and recommended doses differ among different countries [32–34]. The population of our country consumes only 1/3 of the daily requirement for dietary fiber [35]. EFSA experts (2017) consider an adequate dose of dietary fiber in an adult's diet to be 25 g/day for normal intestinal functioning. Russian experts (in 2008) stated that 20 g/day was sufficient but that to reduce the risk of CVD, type 2 diabetes, and overweight, the consumption of more than 25 g/day is necessary [31]. This dose–dependent effect, which contributes to preventing CVDs, was confirmed in 7 prospective cohort studies identified in the MEDLINE database. A large-scale study in the United Kingdom demonstrated the relationship between whole grain fiber intake and obesity risk, insulin resistance, and type 2 diabetes [36, 37]. A positive effect of dietary fiber on maintaining normal body weight in adults was also observed. With an increase in dietary fiber, a decrease in insulinemia, postprandial glycemia, and cholesterolemia were noted as well as an association with an energy value decreased by 10 %. Long-term observations have demonstrated a decrease in the synthesis of atherogenic lipoproteins and body weight normalization [38]. An important condition for consuming more than 25 g/day of dietary fiber is consuming a diet that is balanced in vitamins and minerals to prevent their deficiency [39–41].

The concept of balanced nutrition combines the complete provision of energy, macro- and micronutrients, and minor vital components of food. Under modern social conditions, energy consumption is reduced in human populations. The diet of most people is highly caloric, characterized by a loss of variety and consumption of refined or canned foods that are subjected to intensive technological processing and depleted in essential vitamins and minerals. Consumption of such nutritional products leads to metabolic disorders and obesity [42]. Analysis of the current situation in terms of actual nutrition in the RF shows that there is a mismatch between nutrition in the population and healthy nutrition principles. There is also convincing evidence that an increased risk of obesity is a significant factor in the development of some NCDs.

Despite nutritional problems and health being addressed at state level via the formation and implementation of national programs and projects, the health status of the Russian population is still inadequate, which highlights the need to optimize and actively introduce preventive nutritional measures [43]. Additionally, physicians' recommendations often do not meet modern dietary requirements. Therefore, it is important that scientific publications focus attention on the importance of this problem so as to increase awareness and raise competency in the area of healthy nutrition among specialists who communicate recommendations for a healthy lifestyle. This approach can help to reduce the risk factors for the development of nutrition-related diseases and improve the quality of preventive measures.

Conclusions. The analysis of the current literature assessing the actual nutrition in the RF revealed an excess of caloric intake; excessive intake of fats, carbohydrates, salt, and sugar; deficiency in polyunsaturated fats; insufficient consumption of vegetables and fruits and other sources of dietary fiber; a decrease in certain vitamins and microelements, and an imbalance in food variety. These findings highlight an increasing risk of developing circulatory system diseases, metabolic diseases, and obesity owing to nutrition.

The study results in this review highlight the need for further longitudinal population-based epidemiologic research to identify the associations between clinical and medical-social indicators and assess the contribution of nutrition-related risk factors to the development of CNDs.

To increase the effectiveness of CND prophylaxis, it is advisable to use an integrated approach to increase awareness in the population and professionalism among primary healthcare physicians on issues concerning healthy nutrition. A personalized approach should be used when developing recommendations for nutritional behaviors, taking into account patients' sex and age, taste preferences, presence of concomitant pathologies, physical activity, and professional employment. It is necessary to consider possible vitamin–microelement deficiencies, to make timely diagnoses and corrections for the purpose of enriching nutritional intake with vitamin–microelement complexes.

Training physicians within the framework of continuing education is necessary to inform them regarding issues of healthy and therapeutic nutrition and modern approaches to dietetics. In this way, the competencies of primary health care specialists in nutrition will be enhanced.

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NEW OPPORTUNITIES FOR IMMUNOLOGICAL CONTROL OF THE EFFECTIVENESS OF VACCINATION AGAINST COVID-19

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НОВЫЕ ВОЗМОЖНОСТИ ИММУНОЛОГИЧЕСКОГО КОНТРОЛЯ ЭФФЕКТИВНОСТИ ВАКЦИНАЦИИ ПРОТИВ COVID-19

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