



## **Development of Scientifically-based Approaches to the Design of Food Products for Herodietic Purposes**

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### **Authors' contributions**

*This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.*

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### **ABSTRACT**

The study conducted a detailed analysis and provides data on the demographic situation in the world, as well as in the Russian Federation, concluded that the trend of rapid aging. Nutrition refers to the most important factors of the influence of the external environment on the state of health, working capacity and life expectancy of a person. For this reason, every person needs high-quality and specialized nutrition that will fill all the needs of the body in nutrients, namely proteins, lipids, carbohydrates, vitamins and mineral elements. This scientific article analyzes and systematizes approaches to ensuring the nutritional needs of people of older age groups and recommends ratios in the composition of diets according to gender and age characteristics. The standards of energy

and nutritional requirements for various groups of the population are analyzed. The problems associated with the development of the production of products for the elderly are investigated and promising directions of their production are established. It is determined that the most social problem for the elderly is providing the body with biologically and physiologically valuable substances, in particular macro - and microelements, vitamins, essential amino acids, the presence and ratio of which has a significant impact on the processes of metabolism and assimilation by the body.

*Keywords: elderly and senile people; centenarians; metabolism; energy metabolism; macro - and micronutrients.*

## 1. INTRODUCTION

The current demographic situation in the world as a whole and in Russia in particular is characterized by a pronounced rate of population aging. According to WHO forecasts, in 2025 the number of representatives of older age groups will increase by 6 times compared to 1950 and will amount to almost 20% of the total population, and in 2050 this figure will reach 30%, which will correspond to 2 billion people [1]. This situation is especially relevant for Russia, which, in terms of the aging of the population and the number of people aged 60 and older, although it ranks 44th in the world, but only because of the high mortality rate among people of retirement age [2].

Physiological aging is characterized by gradual changes in the state of organs and body systems, a decrease in the activity of the metabolic process. Especially noticeable and negative for a person are changes and disorders in the digestive system. They determine the importance of the geriatric problem, the negative consequences of which provoke degenerative diseases of the heart, blood vessels, kidneys, digestive organs, musculoskeletal system, including joints and the like [3-7]. Axiomatic is the fact that it is advisable to influence the nature, pace and direction of such changes in metabolism, adaptive and compensatory processes by rationally providing optimal nutrition that will meet the specific needs of natural aging [8,9].

To date, a significant amount of theoretical and experimental data has been accumulated, which make it possible to state that it is the discrepancy of nutrition in terms of its energy value, the content of amino and fatty acids, vitamins and minerals that are the causes of imbalances and, as a consequence, the occurrence of pathologies. Optimal and scientifically based in accordance with the specifics of the needs of the

body, products of herodietic purpose, allow to prevent the development of disorders in the body of people of older age groups and contribute to improving their quality of life.

### 1.1 The Purpose of the Work

A detailed analysis and systematization of data on the specifics of metabolic processes and the definition of modern scientifically-based principles and approaches to ensuring the nutritional needs of practically healthy people of older age groups.

## 2. MATERIALS AND METHODS

Methods of scientific cognition, analysis and synthesis, comparison and generalization, induction and deduction, systematization of methodological approaches of leading scientists from different countries are used for the methodological base.

## 3. RESULTS AND DISCUSSION

According to scientific data, the aging of the human body is considered as a complex, hereditarily programmed phenomenon [3,4]. It is generally recognized that physiologically normal old age, uncomplicated by a certain disease, lesion or pathological process, is the achievement by practically healthy people of advanced (60-74 years old), senile (75-90 years old) age and the age of centenarians (90 years or more).

The nutritional status of the population of older age groups is largely determined by the age of a person, his financial capabilities, the ability to self-service, problems with the dental apparatus, changes in taste sensitivity, the presence of various pathologies.

With increasing age, it becomes more difficult for a person to receive and assimilate the necessary

nutrients, because the processes of metabolism and energy exchange slow down, the appetite and the body's ability to regenerate tissues deteriorates, the body's resistance to the negative effects of the environment and various kinds of infections decreases [4].

The discrepancy between the nature of nutrition and the level of metabolic processes of the body can be one of the causes of metabolic disorders and deterioration of the health of an aging person. By changing the alimentary composition of food products, it is possible to optimize metabolic processes in the body, thus affecting the life expectancy of a person.

The saying of the ancient Greek philosopher and physician Hippocrates is world-famous: "Our food should be our medicine and our medicine should be our food." That is, the intake of food substrates into the human body is an important factor in ensuring health.

According to Academician A. A. Pokrovsky, food should be considered not only as a substrate that ensures the performance of plastic and energy functions, but also a complex biologically active complex that performs immuno- and bioregulatory, rehabilitation, motivational-signaling and other effects on the vital activity of the body.

The basic principles of nutrition of elderly, senile and long-lived people were developed and formulated [3,10]:

- the combination of products in the proposed products and diets should take into account the availability and peculiarities of assimilation of nutrients;
- the use of dietary supplements balanced by basic nutrients and energy value;
- exclusion from the diet of foods with a high glycemic index containing refined carbohydrates;
- specialized focus of nutrition for the prevention of various common diseases;
- compliance of the diet with age-related changes and metabolism of the human body;
- enrichment of diets with bifido-, lacto-, pro- and prebiotics capable of normalizing the intestinal microflora of an aging organism;
- enrichment of food with substances that have geroprotective properties;

- correction of the diet for the purpose of its rapid digestibility and digestibility.

Researches has established that the greatest results of aging processes affect the digestive system [11-13]. Through the gradual processes of atrophy of the intestinal mucosa, namely its thinning and a decrease in the activity of glandular cells, there is a decrease in its motility, the level of secretion and acidity of gastric juice, the concentration of enzymes. This, in turn, is the cause of poor digestion, the development of pathogens of putrefaction processes in the intestine and an increase in the need for pro- and prebiotics [11,14].

Developing the scientific foundations of optimal provision of the nutritional needs of people of older age groups, developed by A. A. Pokrovsky, A.M. Ugolev linked the prevalence of gastrointestinal disorders with disorders of membrane digestion. In particular, scientists have found that the increase in the level of membrane hydrolysis is almost proportional to the decrease in the level of digestion, and, consequently, the starch digestibility index remains almost constant [15].

Therefore, today it is urgent to develop scientific approaches to the creation of functional products that, by their composition and effect on the body of an aging person, should have a significant biological effect - provide nutrients and perform a preventive function [16-19].

Based on the scientifically established information about the decrease in the level of basal metabolism in older people due to the physiological processes of aging and low physical activity, the energy value of the daily diets of elderly and senile people should be moderately limited.

A detailed analysis of the results of the achievements of some domestic and foreign scientists suggests that the average level of energy metabolism, and, consequently, energy needs in elderly people decreases by 16-20%, senile - by 30% relative to this indicator in 18-35 years. Depending on body weight, age and level of physical activity in 61-74 years, it is 1800-2100 kcal/day for men, 1600-2000 for women; after 75 years, 1600-1900 kcal/day for men, 1400- 1700 for women [20]. Excessive consumption of food for people of older age groups can be dangerous because of the risk of obesity, varicose veins, type II diabetes mellitus, atherosclerosis, bile and

urolithiasis, coronary heart disease, heart attack [15,21-24].

In order to reduce the energy value of the diets of elderly, senile and long-lived people, it is recommended to reduce the content of lipid and carbohydrate components [5,6,10,25].

In accordance with the methodological recommendations, the norm of energy needs is, kcal / day: for men aged 60-74 years – 2000; 75 years and older - 1800; women 55-74 years - 1800; 75 years and older-1600. In addition, norms of physiological needs for basic nutrients have been established for elderly and senile people (Table 1).

The analysis of literary and statistical data gives the right to assert that there are no finished products for people of older age groups that correspond to the physiological norms of consumption of basic macro- and micronutrients. In this regard, in order to systematize scientific approaches to meeting the needs of older age groups in basic energy substances, the results of research have been analyzed [4-10]. It has been established that the optimal, from a scientific point of view, the ratio between the main substances (%) is - proteins: fats : carbohydrates – (16-20) : (25-30) : (55-59).

Recommended for consumption by representatives of older age groups are the quantitative norms of basic energy substances presented in Table 2. People who lead a sedentary lifestyle are additionally recommended to limit their carbohydrate intake.

Special attention should be paid to the analysis and systematization of data on ensuring the nutritional needs of elderly, senile people and centenarians [5; 6; 21-24]. Information on the composition of basic substances deserves special attention. So, in addition to bringing the amino acid score of diets in line with the recommendations of FAO/WHO specialists, it is necessary to ensure the proportion of essential amino acids at the level of at least 40% of total protein [2]. Given the need to form an appropriate level of digestibility, it is more appropriate to represent the protein component of diets at the expense of dairy, egg and fish products.

Analysis and systematization of scientific information on the lipid component of the diets of gerodietetic function gives grounds to summarize that the optimal ratio of plants and animal fats is 1 : 2, omega-3 and omega-6 fatty acids – 4 : 1 [11,13,14,26].

**Table 1. Norms of physiological requirements for basic nutrients [15]**

Food substances	Units of measurement	Male		Female	
		age, years old			
		60-74	75 and older	60-74	75 and older
proteins		65	53	58	52
fats	g	60	54	54	48
carbohydrates		300	270	270	240
calcium		800	800	1000	1000
phosphorus		1200	1200	1200	1200
magnesium		400	400	400	400
ferrum		15	15	15	15
zinc		15	15	15	15
iodine		0,15	0,15	0,15	0,15
ascorbic acid		100	90	100	90
retinol	mg	0,25	0,22	0,25	0,22
tocopherol		25	20	20	20
thiamine		1,7	1,5	1,5	1,5
riboflavin		1,7	1,5	1,5	1,5
niacin		15	13	13	13
pyridoxine		3,3	3,0	3,0	3,0
cyanocobalamin	µg	3,0	3,0	3,0	3,0

**Table 2. Quantitative norms of basic energy substances [15]**

Gender and age groups	Recommended consumption rates, g/day		
	proteins	lipids	carbohydrates
60-74 years old:			
Male	72-105	50-70	240-310
Female	64-100	44-67	220-295
74-90 лет:			
Male	64-72	44 -50	220-240
Female	56-68	39-57	193-112

Should also note that the optimal intake of dietary fiber should be 30 to 40 g [12;27].

Vitamins and mineral elements, and especially those characterized by antioxidant properties, play an important role in ensuring the physiological processes of people of older age groups. Based on the results of the analysis and generalization of scientific literature and experimental data it was found that the optimal daily doses of vitamins consumed by elderly, senile and long-lived people, mg: retinol-0.9-1.1, thiamine - 1.5-1.7, riboflavin - 1.5-2.0, niacin - 13.0-20.0, pantothenic acid - 5.0, pyridoxine - 2.0-3.5, ascorbic acid - 90-110, tocopherol - 15-25; mcg: biotin - 50, folic acid - 230-400, cyanocobalamin - 3, calciferol - 2,5-15, phyloquinone - 120 [7; 21-23]. The recommended daily norms for the use of mineral elements are also systematized, mg: potassium - 2500, sodium - 1300, calcium - 800-1200, phosphorus-800-1200, magnesium-400-500, iron-10-18, zinc - 12-15, fluorine - 0.75-4, magnesium-2, copper-1; mcg: iodine-150, molybdenum-70, selenium - 50-70, chromium-50 [24-26].

Based on the considered scientific norms of nutrient consumption and approaches to ensuring the nutritional needs of older age groups, it is recommended that they consume dairy products, seafood, fish, eggs, butter, poultry meat, vegetables, fruits, berries, seeds, nuts, whole grain products, biologically active additives. One of the options for enriching the diets of people of older age groups is the use of special products for herodietic nutrition.

Based on the basic provisions of the science of rational and healthy nutrition, taking into account the metabolic processes in the body of an aging person, specialists have developed recipes and technologies of food products that, in terms of qualitative composition and ratios of prescription components, meet the requirements for food products of herodietic purpose.

Technologies of milk drinks for the elderly based on secondary dairy raw materials: whey and skim milk have been developed. For the production of dairy-grain drinks for herodietic purposes, different types of dairy-grain base have been developed, which includes skimmed milk, whey, flour for dietary nutrition (rice, buckwheat or oatmeal), soy and olive refined and deodorized oil, vitamins C and E and minerals [16].

Fermented milk drinks have been developed using a bacterial culture that normalizes the composition of the beneficial intestinal microflora. They contain vitamins and mineral elements, as well as animal fat replaced with vegetable [19,28].

The technology of bakery products for herodietic purposes has been developed, which eliminates the negative impact of functional ingredients. The composition of these bakery products differs in the use of dietary flour and various functional additives [29].

An assortment of meat and vegetable, fish and vegetable products of herodietic orientation with a balanced composition of proteins, fats and carbohydrates enriched with vitamins and macro- and microelements, fat products with a balanced composition of unsaturated fatty acids, low-calorie confectionery products using sweeteners, etc. is being developed [30].

Today, the range of herodietic products with therapeutic and prophylactic properties is very small [31]. It is necessary to expand the range of preventive products of herodietic orientation in accordance with the physiological needs and health status of the aging population.

#### 4. CONCLUSION

Based on the data obtained by the calculation method on the ratio of the main nutrients in the developed products for herodietic nutrition, it is possible to state with confidence about their

compliance with the needs of people of older age groups. Elderly, senile people and centenarians need a balance of basic nutrients, namely, an increased amount of protein and complex carbohydrates and a reduced fat content, especially animals. The diets of the studied group of people should have an increased content of proteins, PUFA, deficient micronutrients (magnesium, iron, iodine, selenium, folic acid, tocopherol, carotenoids) to improve the quality of nutrition, protect the body from the effects of a disturbed environmental environment, a positive effect on health, due to the ability to improve the digestive process, antioxidant properties and anti-sclerotic effect.

## CONSENT

It is not applicable.

## ETHICAL APPROVAL

It is not applicable.

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## COMPETING INTERESTS

Authors have declared that no competing interests exist.

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