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Macronutrients composition of dry soluble gerodietetic products for enteral nutrition

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Abstract. In emergencies, including increased stress, injuries, diseases, traumas, and during the recovery period, the compliance of nutrition with the special metabolic body needs is critical. Considering this, the use of foods for special medical purposes, particularly enteral nutrition, has become quite widespread in modern dietary practice. The purpose of this study was to develop the suitable macronutrient composition of dry soluble gerodietetic products for enteral nutrition, which would meet consumer preferences with its organoleptic properties. For this, the study found that specialists in nutritional support for the emergency needs of representatives of older age groups recommend the ratio of protein, fats, and carbohydrate components in the total energy value (%) within 17-21/28-34/45-55, respectively. For people with type 2 diabetes, these values were 26-51/31-35/14-43. Based on this, the corresponding mass ratios of macronutrients were determined. This provided the base for dry soluble products for enteral nutrition development. Based on their organoleptic evaluation in the ready-to-consume liquid state, the most optimum were defined: 24.5/14.5/61.0 wt. % for representatives of older age groups without any metabolic complications, 61.0/16.0/23.0 wt. % for patients with type 2 diabetes. These products were selected for further use and enrichment with a specially designed functional composition in the further products development. The study also developed mathematical models to describe the relationship between the complex organoleptic quality indicators of macronutrient compositions for enteral nutrition and their protein, fat, and carbohydrate content. The practical value of this study lies in improving the methodological principles of dry soluble gerodietetic products for enteral nutrition development and in the possibility of using the developed mathematical models to optimise their macronutrient composition

Keywords: enteral nutrition products; assortment; metabolic needs; composition of macronutrients; organoleptic properties; mathematical modelling

Introduction

It is axiomatic that nutrition is one of the key factors determining the vital functions of the organism. For people in emergencies (with increased loads, lesions, diseases, injuries, during the recovery period), the alignment of nutrition with special metabolic needs becomes crucial. Considering this, the use of foods for special medical purposes, particularly for enteral nutrition, has become quite widespread in modern dietary practice (Prytul'ska & Antiushko, 2024).

The provided analysis of information on the state of the market for enteral nutrition products at both the global (Global enteral feeding formulas..., 2024) and European regional (Europe enteral nutrition market, 2024) levels revealed quite a dynamic development. At the same time, despite the war in Ukraine, almost all products presented on Ukrainian market were foreign-made. Ukrainian products of this assortment group were represented to a rather insignificant extent

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(The list of notifications about the intention..., 2025). This indicated the relevance of scientifically sound development and improvement of the existing assortment of products for enteral nutrition, including ensuring their Ukrainian production.

The author J. Doley (2022) analysed the benefits of using the studied products, the main cases in which their consumption (use) occurs. This researcher also provided recommendations for choosing these products based on their component differences, their complementarity with other different formulas, duration, and place of consumption (usage), measures to reduce possible risks. A. Church & S. Zoeller (2023) analysed the available products of this assortment group. Specifically, the key differences in composition of components, priority areas of application, results, and efficacy of usage were investigated. C. Compher *et al.* (2022) analysed the clinical results of using various types of products for enteral nutrition, which differed in energy value, protein content, and the presence of other macronutrients in the products content. The benefits of consumption (usage) of these products in combination with parenteral nutrition products were also explored.

Scientists A. Weimann *et al.* (2021) presented practical recommendations aimed at ensuring the nutritional aspects of the concept of postoperative recovery and care, preventing the occurrence of complications. Specifically, practical algorithms for using enteral nutrition were proposed to optimise blood glucose levels, reduce catabolic processes under the influence of stress, provide the suitable amount of protein components, and restore muscle functions.

The authors P.E. Wischmeyer *et al.* (2023) found that nutrition during periods of treatment and rehabilitation should meet the concrete needs of consumers and specific target groups representatives. Practical recommendations were provided on the proper satisfaction of needs and elimination of protein and microelement deficiencies, the use of definite special anabolic nutrients for this purpose. C. Compher *et al.* (2022) also presented recommendations on the proper provision of adult population representatives nutritional needs. The researchers established that the primary significance in eliminating physiological dysfunctions ensured the proper supply of energy and protein substrates, the amount of which should be determined based on individual anthropometric, gender-age, and metabolic characteristics.

Researchers D. Volkert *et al.* (2022) investigated the problem of insufficient provision of energy substrates and hydroresources in the treatment of older age groups representatives, the imbalance of the presented nutrients with the humans of mentioned target group's metabolism. S. Ekmekcioglu (2020) examined the materials on the specific features of metabolic needs in representatives of the older age groups, including in emergencies.

The researcher explored the specific features of metabolism and needs of this group of people. In addition, practical recommendations for ensuring their content in food rations, including during increased loads, diseases, and injuries were proposed.

Scientists T.A.F. Wylie *et al.* (2022) analysed the data on the specific features of needs in this group of people and developed practical recommendations for quantitative macronutrient content in their diets, particularly in emergencies. At the same time, on the modern market, specifically in Ukraine, there were practically no specially developed products for enteral nutrition of older age groups, including for patients suffering from type 2 diabetes.

The purpose of this study was to investigate and model the optimum macronutrient composition of dry soluble gerodietetic products for enteral nutrition. To fulfil this purpose, the following tasks were set:

- to analyse data and recommendations of specialists on ensuring the nutritional needs of older age groups' representatives in emergencies;
- to evaluate the organoleptic characteristics of the primary variants of the macronutrient basis of dry soluble products for enteral nutrition, which would meet the established recommendations;
- to determine the optimum macronutrient composition of dry soluble gerodietetic products for enteral nutrition of gerodietetic purpose based on previously established data.

The scientific originality of this study lies in the systematisation of data on the recommended ratio of basic macronutrients in the general diet of older age groups, including patients with type 2 diabetes. Additionally, it improves the methodological principles of mathematical modelling of the complex quality index of organoleptic properties based on information regarding macronutrient content.

Materials and Methods

The study employed the methods of scientific research, analysis, comparison, establishment of correlations and systematisation to establish recommendations for the optimum ratio of proteins, fats, and carbohydrates in the diet of people belonging to older age categories. While converting the recommended ratio of macronutrients in the total energy value of the diet into the corresponding indicator per 100 g of a balanced food product, the following coefficients were used, kcal/100 g: proteins – 4.1, fats – 9.3, carbohydrates – 4.0 (considering the different energy value of their groups and types). The maximum, average, and minimum recommended values of the quantitative content of protein, fats, and carbohydrate components were used to develop the experimental samples of the macronutrient composition of dry soluble products for enteral nutrition. The raw materials that are most widely used in the manufacturing of dry soluble

products for enteral nutrition (whey protein concentrate (proteins – 80%, fats – 10%, carbohydrates – 5%), polyunsaturated fatty acids in a casein-starch matrix, maltodextrin, glucose (except for the product intended for people with type 2 diabetes), fructose were chosen to provide macronutrients in researched samples.

Sample preparation for organoleptic evaluation was performed by dissolving a portion of the dry mixture (50 g) in 200 cm³ of boiled water at 15-40°C. The organoleptic properties of the test samples were evaluated by 5 qualified experts using a specially developed scale. The evaluation criteria were presented in Table 1.

Table 1. Point-scale for evaluating the organoleptic properties of products for enteral nutrition macronutrient compositions' samples in a ready-to-consume liquid state

Indices	Importance coefficient	Points	Characteristics
Consistency and external appearance	0.2	5	Homogeneous, without sediment or delamination, not viscous, slightly viscous
		4	Homogeneous, a small amount of undissolved particles is acceptable, not chewy, slightly viscous
		3	Homogeneous, with a small amount of sediment and delamination, viscous
		2	Homogeneous, with a small amount of sediment and a significant amount of delamination, viscous
		1	Heterogeneous, with a significant amount of delamination and sediment, viscous
Colour	0.1	5	Light-yellow to light-brown, uniform
		4	Light-yellow to light-brown, homogeneous, with a small amount of white inclusions
		3	Light-yellow to light-brown, heterogeneous
		2	Light-brown to brown, heterogeneous
		1	Brown to dark-brown, heterogeneous
Scent	0.15	5	Clean, pleasant, without foreign shades, with faint characteristic hints of additives
		4	Subtle, with faint characteristic hints of additives
		3	Empty, faint scent of fatty acids
		2	Unpleasant, distinct scent of fatty acids, foreign shades are felt
		1	Sharp, unpleasant, quite expressed scent of fatty acids with rich foreign shades
Taste	0.3	5	Pleasant, balanced, pronounced, sugary, with a faint aftertaste of the additives
		4	Pleasant, inadequately expressed, sugary, with a faint aftertaste of additives
		3	Empty, sugary, with faint notes of bitterness, a pronounced aftertaste of the additives
		2	Unpleasant, uncharacteristic, bitter, with pronounced aftertaste of fatty acids
		1	Unpleasant, bitter, with pronounced aftertaste of fatty acids
Aftertaste	0.25	5	Pleasant, balanced, sugary, lingering, without any foreign aftertaste
		4	Pleasant, unbalanced, sugary, brief, without any foreign aftertaste
		3	Empty, subtle, faintly felt, without any foreign aftertaste
		2	Unpleasant, weakly expressed, brief, with a slight foreign aftertaste
		1	Sharp, unpleasant, bitter, persistent, with a significant foreign aftertaste

Source: developed by the author

The complex quality index of the organoleptic properties of macronutrient composition in gerodietetic products for enteral nutrition was calculated based on expert assessments, factoring in rejected and reference values, according to the following formula:

$$I_{CQI} = \sum_{i=1}^n a_i \frac{P_i - P_i^{ref}}{P_i^{ref} - P_i^{rej}}, \quad (1)$$

where P_i – i -point index in natural form; P_i^{ref} – reference (best acceptable) point value of i -index; P_i^{rej} – rejected (worst acceptable) point value of i -index; a_i – importance coefficient of i -index, identified by range method; n – quantity of evaluated indices.

Using the results of the provided organoleptic research of the main samples of raw material component compositions that correspond with the mentioned ranges of protein, fats, and carbohydrate content, the optimum ones were determined. In addition,

mathematical models for forecasting the complex quality index of the macronutrient compositions' organoleptic properties were developed using MS Excel 2016 software. The study was conducted following the standards of The Declaration of Helsinki (2013).

Results and Discussion

It was found that due to aging processes, which largely manifest after a person reaches 60-65 years old, the intensity of protein self-renewal, glucose utilisation, oxygen consumption, and biological enzyme oxidation decrease in the body. In addition, the accumulation of fats in tissues increases, and significant carbohydrate imbalances emerge (Kemoun *et al.*, 2022). As a result, the nutrition of people belonging to this category should accommodate age characteristics and be used not only to provide energy and compensatory effects, but also to perform plastic, protective, and rehabilitating functions, to exert

immuno- and bioregulatory effects on vital activity (Torres-Quesada *et al.*, 2022; Schippinger, 2022). Considering this, ensuring a high content of protein, specifically, presented by dairy and egg origin, poly- and monounsaturated fatty acids in the diet of older age groups becomes of increased significance for restoring and minimising the results of age-related changes (Antiushko, 2020).

The adequacy of nutritional substrate intake, supplied with food, becomes particularly significant in cases of increased stress, diseases, and injuries. Based on the findings of the analysis of scientific sources by S. Ekmekcioglu (2020), it was estimated that most specialists in the field of nutritional support for the needs of older age groups in emergencies recommend the following ratio of protein, fats, and carbohydrate components in the total food rations energy value, % – 17-21/28-34/45-55, respectively.

It was also found that one of the most common non-communicable diseases, which was also significantly prevalent among older age groups, was type 2 diabetes mellitus (Diabetes, 2024). Considering this, information on professional recommendations regarding the optimum ratio of the main macronutrients in their diet was also analysed (Holdoway, 2022; Dove *et al.*, 2024). It was found that for this group of target consumers, specialists recommend the following ratio, % – 26-51/31-35/14-43, respectively. Based on the established and analysed recommendations of specialists on the recommended ratios of protein, fats, and carbohydrate components in the total energy value of diets and using the energy coefficients of their oxidation, the recommended content per 100 g of a balanced food product for the mentioned consumers was calculated (Table 2).

Table 2. Results of calculation of recommended macronutrient content in the diet of older age groups representatives in emergencies

Macronutrients	Recommended content in total energy value, %		Recommended content, wt. %	
	for individuals without metabolic complications	for individuals with type 2 diabetes	for individuals without metabolic complications	for individuals with type 2 diabetes
Proteins	17.0-21.0	26.0-51.0	19.5-24.5	31.0-61.0
Fats	28.0-34.0	31.0-35.0	14.5-17.5	16.0-18.0
Carbohydrates	45.0-55.0	14.0-43.0	58.0-66.0	21.0-53.0

Source: developed by the author

Analysis of established data on the mass ratio of basic macronutrients recommended for older age groups representatives in emergencies revealed that to ensure the necessary body recovery, an increased content of easily digestible protein and fats should be ensured. Specifically, for older age groups without metabolic complications, this was 19.5-24.5 and 14.5-17.5 wt. %, respectively. For people with type 2 diabetes in this age group, this was 31.0-61.0 and 16.0-18.0 wt. %, respectively. Notably, it was vital to provide people with problems with carbohydrate metabolism with a low glycaemic load in their diet and the products under study.

Based on the established data on the mass ratio of basic macronutrients recommended for older age groups in emergencies, 9 experimental samples were developed. They were characterised by the maximum, average, and minimum content of each analysed

macronutrient. The findings of the organoleptic assessment of the proposed samples of the macronutrient composition of products in a liquid ready-to-consume state, which was conducted by representatives of the expert group using a specially developed scale (Table 1), were presented in Table 3. The organoleptic assessment of modelled enteral nutrition products found that the fat component had the most significant influence on their macronutrient composition. Specifically, the study found that samples with lower content had higher scores on taste, aftertaste, and scent indices. In addition, it was found that samples with a higher protein content had more balanced organoleptic properties. Summarising the findings of the provided organoleptic evaluation of the modelled samples of products for enteral nutrition macronutrient composition, the results, presented in Table 4, were obtained.

Table 3. Results of organoleptic evaluation of modelled samples of products for enteral nutrition macronutrient composition in liquid ready-to-consume state

Samples	Composition			Assessments by indices, points																								
				Consistency and external appearance					Colour					Scent					Taste					Aftertaste				
	proteins	fats	carbo- hydrates	expert 1	expert 2	expert 3	expert 4	expert 5	expert 1	expert 2	expert 3	expert 4	expert 5	expert 1	expert 2	expert 3	expert 4	expert 5	expert 1	expert 2	expert 3	expert 4	expert 5	expert 1	expert 2	expert 3	expert 4	expert 5
for older age groups without metabolic complications																												
1	19.5	14.5	66.0	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	5	4	4	4	4	4	

Table 3. Continued

for older age groups without metabolic complications																														
2	19.5	16.0	64.5	4	4	4	4	4	4	4	4	4	4	4	4	3	4	4	4	4	4	4	4	4	3	4				
3	19.5	17.5	63.0	4	4	4	4	4	4	3	4	4	4	4	3	4	3	4	4	3	4	4	4	4	3	3	4			
4	22.0	14.5	63.5	4	4	4	4	4	4	4	5	4	4	4	4	5	4	4	4	4	5	4	4	4	4	4	4			
5	22.0	16.0	62.0	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	3	4	4			
6	22.0	17.5	60.5	4	4	4	4	4	4	3	4	4	4	4	3	4	4	4	4	3	4	4	4	4	3	3	4	4		
7	24.5	14.5	61.0	4	4	4	4	4	4	4	5	4	4	4	4	5	4	4	4	4	4	4	5	4	4	4	5	4		
8	24.5	16.0	59.5	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4		
9	24.5	17.5	58.0	4	4	4	4	4	3	4	4	4	4	3	4	4	4	4	3	4	4	4	4	3	3	4	4	4		
for older age groups with type 2 diabetes																														
1	31.0	16.0	53.0	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4		
2	31.0	17.0	52.0	4	3	4	4	4	4	4	3	4	4	4	4	3	4	4	4	4	4	4	4	4	3	4	4	4	4	
3	31.0	18.0	51.0	4	3	3	4	4	4	4	3	4	4	4	3	3	4	4	4	4	4	3	4	4	4	3	3	4	4	
4	46.0	16.0	38.0	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	5	4	4	4	4	4	4	5	4	
5	46.0	17.0	37.0	4	4	4	4	4	4	4	3	4	4	4	4	3	4	4	4	4	4	4	4	4	4	4	4	4	4	
6	46.0	18.0	36.0	4	4	3	4	4	4	4	3	4	4	4	4	3	3	4	4	4	4	3	4	4	4	4	4	3	4	
7	61.0	16.0	23.0	4	4	4	5	4	4	4	4	4	4	4	4	4	5	4	4	5	4	4	4	4	4	4	5	4	4	
8	61.0	17.0	22.0	4	4	4	4	4	4	4	4	4	3	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	
9	61.0	18.0	21.0	4	4	4	4	4	4	4	3	4	3	4	4	3	4	4	4	3	4	4	4	4	4	3	4	4	4	4

Source: developed by the author

Table 4. Summary data on the results of organoleptic properties evaluation of the researched gerodietetic products for enteral nutrition macronutrient compositions in a liquid ready-to-consume state

Samples	Composition			Average value of scores by indices, considering their importance coefficients, points					Complex quality index of organoleptic properties, conventional units
				Consistency and external appearance	Colour	Scent	Taste	Aftertaste	
	proteins	fats	carbo-hydrates						
for older age groups without metabolic complications									
1	19.5	14.5	66.0	0.80	0.40	0.60	1.26	1.00	0.7650
2	19.5	16.0	64.5	0.80	0.40	0.57	1.20	0.95	0.7300
3	19.5	17.5	63.0	0.80	0.38	0.54	1.14	0.90	0.6900
4	22.0	14.5	63.5	0.80	0.42	0.63	1.26	1.00	0.7775
5	22.0	16.0	62.0	0.80	0.40	0.60	1.20	0.95	0.7375
6	22.0	17.5	60.5	0.80	0.38	0.57	1.14	0.90	0.6975
7	24.5	14.5	61.0	0.80	0.42	0.63	1.26	1.05	0.7900
8	24.5	16.0	59.5	0.80	0.40	0.60	1.20	1.00	0.7500
9	24.5	17.5	58.0	0.80	0.38	0.57	1.14	0.90	0.6975
for older age groups with type 2 diabetes									
1	31.0	16.0	53.0	0.80	0.40	0.60	1.20	1.00	0.7500
2	31.0	17.0	52.0	0.76	0.38	0.57	1.20	0.95	0.7150
3	31.0	18.0	51.0	0.72	0.38	0.54	1.14	0.90	0.6700
4	46.0	16.0	38.0	0.80	0.40	0.60	1.26	1.05	0.7775
5	46.0	17.0	37.0	0.80	0.38	0.57	1.20	1.00	0.7375
6	46.0	18.0	36.0	0.76	0.36	0.54	1.14	0.95	0.6875
7	61.0	16.0	23.0	0.80	0.40	0.63	1.26	1.05	0.7850
8	61.0	17.0	22.0	0.80	0.38	0.60	1.20	1.00	0.7450
9	61.0	18.0	21.0	0.80	0.36	0.57	1.14	0.95	0.7050

Source: developed by the author

Based on the established complex quality indices of the organoleptic properties of the researched samples of products macronutrient compositions, it was found that among those intended for older age

groups without metabolic complications, the best value (0.7900 conventional units) was characterised by the ratio of protein, fats, and carbohydrate components 24.5/14.5/61.0 wt. %. For older age groups with

type 2 diabetes mellitus, the best value (0.7850 conventional units) was found in the sample with the ratio 61.0/16.0/23.0 wt. %, respectively. This was explained by the lower content of polyunsaturated fatty acids in these samples, which gave a fishy taste, aftertaste, and scent.

In addition, using the results of organoleptic properties evaluation of the main samples of raw components compositions and corresponding to the mentioned ranges of protein, fats, and carbohydrate content, mathematical models of the dependence of the complex quality indicator of organoleptic properties on the content of the specified components were developed using MS Excel 2016 software:

- for enteral nutrition products aimed at older age groups without metabolic complications:

$$y = 0.031 \cdot x_1 + 0.0014 \cdot x_2 + 0.0275 \cdot x_3 - 1.65278; \quad (2)$$

- for enteral nutrition products aimed at older age groups with carbohydrate metabolism dysfunctions (particularly type 2 diabetes):

$$y = 0.0001086 \cdot x_1 - 0.0445386 \cdot x_2 - 0.0012164 \cdot x_3 + 1.527482, \quad (3)$$

where y – complex quality index of macronutrient composition's organoleptic properties, conventional units; x_1 – content of protein component, g/100 g; x_2 – content of lipid component, g/100 g; x_3 – content of carbohydrate component, g/100 g.

The reliability of the obtained findings of mathematical modelling was above 97%. Notably, such developments in enteral nutrition products were the property of private companies and protected by patent law. Therefore, information about their manufacturing formula was not widely available. At the same time, A.K. Jansen *et al.* (2017) examined the principles of enteral nutrition development, prescribed by doctors, nurses, dietitians, pharmacists, and other providers of home enteral nutrition. Based on comparable ranges of macronutrient content of the studied products, recommendations for the combination of the most common ingredients in home use were provided. J.J. Patel *et al.* (2024) analysed modern tendencies of products for enteral nutrition usage, especially for patients with septic shock, risk factors for enteral feeding intolerance. It was found that using this type of nutrition provides benefits of introducing enteral nutrition on preserving gut barrier function. At the same time, the main risks connected with its usage should be carefully analysed. V. Kumari & A. Jayadeep (2019) analysed the composition of general or special products for enteral nutrition, and the effects of products with different macronutrient content on physical recovery in patients. H.J. Coelho-Júnior *et al.* (2022) noted that no clear relationship was found between protein distribution or sources and physical function.

C.L. Nelms (2018) analysed the compositional features of enteral nutrition for children with chronic kidney disease, specifically those related to macronutrient content. The researcher highlighted the primary ways of optimisation and criteria for selecting products with the most suitable composition for these children. K. Jones *et al.* (2017) found that to provide patients in critical conditions with enteral nutrition, it was most suitable to use standard formulas at the first stage. Then, based on the needs diagnosed by doctors, the mixtures should be enriched with additional specific nutrients. C.E. Mazur *et al.* (2021) analysed the level of energy and protein needs of patients after stroke based on the consumption of the most common commercial formulas (CF) for enteral nutrition, home-made products, and mixed diets. The researchers also studied, how these nutritional options allow meeting the needs of victims in macronutrients. In addition, within the development of enteral nutrition, the study of food processing mechanisms that reduced the risk of microbial contamination was significant (Pyatkovskyy, 2023). Thus, the analysis of enteral nutrition development highlighted key principles prescribed by medical professionals, emphasising the value of selecting common ingredients for home use.

Conclusions

Based on the analysis of information and recommendations of specialists in the field of ensuring the nutritional needs of older age groups representatives in emergencies, the study found that for people without metabolic complications, the following ratio of protein, fats, and carbohydrate components in the total energy value of food rations was recommended, % – 17-21/28-34/45-55, respectively. The study also found that for people of this age category with type 2 diabetes, the recommended ratio was 26-51/31-35/14-43, respectively.

While establishing the recommended mass ratio of macronutrients, it was found that to ensure the necessary recovery of older age category representatives in emergencies, increased content of protein and fats should be ensured. Thus, according to the analysed recommendations, their content for older age groups without metabolic complications should be 19.5-24.5 and 14.5-17.5 wt. %. At the same time, for people of the same age group with type 2 diabetes, the content should be 31.0-61.0 and 16.0-18.0 wt. %, respectively. Notably, for people with carbohydrate metabolism problems, low glycaemic load of diet should be provided. Therefore, 9 samples of macronutrient compositions were modelled and assessed for organoleptic properties, which were characterised by the maximum, average, and minimum content of each macronutrient in the established range of values.

Based on the findings of the provided assessment of analysed samples of macronutrient com-

positions' organoleptic properties, it was found that among those intended for older age groups additional metabolic complications, the best value of this index (0.7900 conventional units) was characterised by the ratio of protein, fats, and carbohydrate components of 24.5/14.5/61.0 wt. %; for those with type 2 diabetes mellitus (0.7850 conventional units) – 61.0/16.0/23.0 wt. %, respectively. This was explained by the lower content of polyunsaturated fatty acids in these samples, which provide a fishy taste, aftertaste, and scent. The prospect of further research is the selection and modelling of

the components content of functional compositions for enteral nutrition products under development.

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Conflict of Interest

None.

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Макронутрієнтний склад сухих розчинних геродієтичних продуктів для ентерального харчування

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Анотація. В умовах надзвичайних ситуацій, включаючи підвищений стрес, травми, захворювання, травматичні ушкодження та під час періоду відновлення, відповідність харчування особливим метаболічним потребам організму є критично важливою. З огляду на це, використання продуктів для спеціального медичного призначення, зокрема ентерального харчування, стало широко поширеним у сучасній дієтичній практиці. Метою цього дослідження було розробити відповідний макронутрієнтний склад сухих розчинних геродієтичних продуктів для ентерального харчування, який би відповідав споживчим перевагам завдяки своїм органолептичним властивостям. Для цього було виявлено, що спеціалісти з харчової підтримки для надзвичайних потреб представників старших вікових груп рекомендують співвідношення білків, жирів і вуглеводів у загальній енергетичній цінності (%) у межах 17-21/28-34/45-55 відповідно. Для осіб з цукровим діабетом 2 типу ці значення становлять 26-51/31-35/14-43. На основі цього були визначені відповідні масові співвідношення макронутрієнтів. Це стало основою для розробки сухих розчинних продуктів для ентерального харчування. На основі їх органолептичної оцінки в готовому до вживання рідкому вигляді були визначені найоптимальніші: 24,5/14,5/61,0 мас. % для представників старших вікових груп без метаболічних порушень, 61,0/16,0/23,0 мас. % для пацієнтів з цукровим діабетом 2 типу. Ці продукти були обрані для подальшого використання та збагачення спеціально розробленим функціональним складом при подальшій розробці продуктів. У дослідженні також були розроблені математичні моделі для опису залежності між комплексними органолептичними показниками якості макронутрієнтних складів для ентерального харчування та їхнім вмістом білків, жирів і вуглеводів. Практична цінність цього дослідження полягає в удосконаленні методичних принципів розробки сухих розчинних геродієтичних продуктів для ентерального харчування та в можливості використання розроблених математичних моделей для оптимізації їхнього макронутрієнтного складу.

Ключові слова: продукти ентерального харчування; асортимент; метаболічні потреби; склад макронутрієнтів; органолептичні властивості; математичне моделювання