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MARKETING ASPECTS OF DEVELOPMENT AND PROMOTION OF PRODUCTS FOR ENTERAL NUTRITION FOR HERODIETICAL PURPOSES

ABSTRACT

The current global demographic structure of the population at the global and national levels indicates significant rates of aging. As a result of this process, gradual metabolic changes appear in the body, characterized by a slowdown in metabolic processes, the level of assimilation of oxygen and nutrients, and a decrease in the body's functional capabilities. Nutrition is one of the main factors that ensure the vital activity of the human body. The completeness and correspondence of the food ration to the metabolic needs makes it possible to significantly influence the level of health and physiological state. Adherence to nutrition is important for older people, and especially in emergency situations arising from psycho-emotional and physical stress, diseases and injuries, in the process of rehabilitation and recovery. In connection with this, the practice of consumption (use) of products for enteral nutrition, which according to international legislation are considered dietary food products for special medical purposes, has become widespread. The paper analyzes general approaches to ensuring the nutritional needs of representatives of older age groups. Based on this, it was established that for their full satisfaction, physiological processes due to changes in metabolism during aging should be taken into account. It has been established that the elderly, senile and long-lived people need a balance of the main nutrients, namely an increased amount of protein and lipid components and a reduced amount of carbohydrates, adequate supply of vitamins and minerals. As a result of the study of nutritional needs of representatives of older age groups in emergency situations, it was established that their full satisfaction largely determines the success of treatment and rehabilitation, requires taking into account the specifics of metabolism and dietary principles. The peculiarities of the needs of representatives of this category of people who additionally suffer from diabetes, which requires restriction of carbohydrate consumption, were also studied. It has been established that enteral nutrition products are used to meet their nutritional needs. The work describes the main and additional raw components used in the production of products for enteral nutrition. The existing approaches to the classification of the studied products were also investigated, a classification was developed that reflects technological and consumer characteristics and is aimed at satisfying the interests and preferences of the target category of their consumers.

KEYWORDS

Products for enteral nutrition, herodietetic purpose, emergency situations, older people, aging, metabolic activity, diabetes, raw components, approaches to classification.

Widespread trends observed today, both at the global and national levels, are the increase in the average age and the aging of the population. These facts are evidenced by the results of research by the United Nations (UN) [1] and the World Health Organization (WHO) [2] regarding the increase in the average age of the world's population. According to the forecasts of specialists of these organizations, the share of people belonging to older age groups (age 60 and over) in the total structure of the Earth's inhabitants in 2025 will reach the level of 20 %. It is also assumed that in 2050 it will increase even more and will amount to about 30 % (2 billion people). It is appropriate to note that Ukraine is one of the leading countries (among the top 10) in terms of the overall rate of population aging [3]. Thus, in this state, the number of people aged 60 and over in 2021 exceeded 10 million, which is more than 25 % of the overall age structure.

The natural physiological aging of the body is characterized by a number of metabolic changes, in particular, a gradual slowing down of metabolic processes, the level of absorption of oxygen and nutrients, a decrease in the functional capabilities of systems, organs, tissues and cells. It is a scientifically proven fact that aging processes largely cause degenerative changes and diseases of the cardiovascular, nervous, locomotor, digestive and other systems of the body. These processes take on a particularly negative character in emergency situations, in particular during physical and psycho-emotional overloads, stressful events, diseases, injuries, in the process of rehabilitation and recovery.

It is natural that food is rightfully considered one of the main factors that ensure the vital activity of the human body. The completeness and compliance of the food diet with metabolic needs makes it possible to significantly influence the level of health and condition of a certain person, to a certain extent to correct physiological disorders. Macro- and micronutrients that enter the body with food from the external environment actively affect the course of metabolic processes, the state of the immune, nervous, digestive systems, etc. Taking this into account, the consumption of food products for herodietic purposes has become widespread in modern practice, which, according to the wording developed by specialized specialists of the WHO, are defined as "products intended for consumption (consumption) by persons belonging to older age groups, which have been specially developed, processed and/or produced in accordance with the specific nutritional needs of the body of representatives of this category of people and take into account the specifics of their metabolic processes" [4].

The full value of providing nutrients, which in terms of qualitative and quantitative composition will correspond to the specifics of age-related changes and the nutritional needs of the body, in emergency situations becomes especially important for representatives of older groups. In view of

this, in order to ensure the nutritional needs of representatives of older age groups, in particular in emergency situations, the consumption (use) of products for enteral nutrition has become widespread in modern practice. According to the terminology developed by specialists of the European Society of Parenteral and Enteral Nutrition (ESPEN), enteral nutrition is defined as "a method of providing the nutritional needs of the body with optimal complete nutrition through the use of a specially defined and prepared food mixture through the gastrointestinal tract" [5]. Products for enteral nutrition, which according to international legislation belong to dietary food products for special medical purposes [6], are characterized by a specially selected, scientifically based composition of components. Thanks to this purposefully modeled to ensure the defined functions of the composition of nutrients, these products allow to better meet the needs of the body, contribute to the optimization of the physiological state, increase of immune and restorative properties.

Taking into account the significant number of older people, their vulnerability to diseases, injuries, increased stress levels, factors causing emergency situations, the urgent task is to provide products for enteral nutrition of herodietic purpose. It should also be noted that the products of this assortment group are presented on the modern market in a rather limited assortment. This, in turn, determines the prospect of conducting scientific developments to enable target consumers of these products, including on national markets, to choose from an expanded range of products of appropriate quality. Considering the above, it is necessary and important for development in this direction to study the merchandising principles of creation and marketing promotion of products for enteral nutrition of herodietic purpose. It is important to note that in order to effectively achieve the formulated result, a complex combination of the principles of a wide range of scientific fields is necessary – commodity science, nutritionology, in particular dietetics, medicine, food technology, gerontology, marketing.

The conducted research is aimed at the analysis of the main theoretical and applied aspects of the development of products for enteral nutrition of representatives of older age groups in emergency situations, the determination of the most promising raw materials for the production of these products.

The presented data reveal prospects for stimulating the production of both ingredients and products for enteral nutrition as a whole at domestic levels, developing their assortment and solving the problem of import dependence by drawing the attention of state bodies to solving conceptually important issues for ensuring the health of the population.

1.1 GENERAL APPROACHES TO ENSURING THE NUTRITIONAL NEEDS OF PERSONS BELONGING TO OLDER AGE GROUPS

According to generally accepted scientific principles, the physiological aging of the human body is defined as a systemic, hereditarily programmed natural phenomenon, during which there is a gradual degeneration and loss of basic functions, in particular, the ability to active regeneration [7, 8].

It is generally accepted that a person's physiological old age occurs when practically healthy people reach the elderly (60–74 years), senile (75–90 years), life period of long-lived people (90 years and older) [6, 7]. It is a scientifically proven fact that the process of physiological aging, uncomplicated by certain diseases, lesions and/or pathological processes, is characterized by a gradual slowing down of the intensity of metabolic processes, which determines the vital activity of the human body. It is worth noting that self-renewal of proteins, utilization of glucose, use of oxygen by cells and release of carbon dioxide, use of enzymes by tissues of the heart, liver, and kidneys are reduced in the body. Also, lipid complexes and components are observed in organs and tissues [7, 8]. Based on the analysis of scientific information [7, 9], a correlational interdependence between the aging of the human body and the reduction of its adaptive capabilities, functionality of systems and organs was established. mechanisms of biochemical and enzymatic activity.

One of the main needs of a person, the satisfaction of which directly determines the level of life and quality of life, is the need to provide adequate and complete nutrition.

It is generally accepted that food is considered not only a substrate that performs plastic and energy functions, but also a complex biologically active factor of immune, bioregulatory, rehabilitation, motivational and signaling influence on the life support of the organism. Based on this statement, to ensure proper nutritional support of representatives of older age groups, specialists in the field of herodietics formulated the following basic principles of nutrition for the specified category of persons [7, 10, 11]:

– balanced energy value of the food ration in accordance with the actual energy expenditure of the person;

– the maximum possible variety of ingredients presented in the diet, which will contribute to ensuring the balance of all indispensable metabolic components;

– easy digestibility and digestibility;

– the presence of substances that will provide moderate stimulation of the digestion process and ensure the activity of enzyme systems;

– reasonable distribution of the nutritional value of food components between individual meals;

– food should be fractional, i.e. 4–5 times a day. The last meal should be consumed 2.5–3 hours before bedtime;

– the use in food of products and dishes that are characterized by a rather light enzymatic action;

– cooking technologies for the elderly must be gentle (easy to digest based on the ingredient composition);

– full supply of the body with a sufficient amount of drinking water for its necessary hydration, especially in the hot season;

– antisclerotic focus of the diet, which should be provided through the use and presence of sources of antisclerotic substances;

– maximum individualization of diets based on the specifics of metabolism, the state of individual physiological systems, organs and tissues of representatives of older age groups.

Based on the results of the analysis of sources [7, 11, 12], it was investigated that the results of aging processes are most significantly reflected in the digestive system of older people. Thus, as a result of the gradual processes of atrophy of the intestinal mucosa, in particular its destruction and decrease in the activity of glandular cells, there is a deterioration of its motility, a decrease in the level of secretion, the acidity of gastric juice, and the concentration of enzymatic substances. These disturbances, in turn, cause deterioration of the work of the gastrointestinal tract, the digestion process, the development of the initiators and pathogens of putrefactive processes in the intestine, and an increase in the need for pre- and probiotics [7, 11].

It was analyzed that the prevalence of gastrointestinal dysfunctions in people belonging to this group is associated with disorders of the membrane digestion process [13]. Based on this, it was investigated that the increase in the level of membrane hydrolytic splitting almost proportionally depends on the decrease in the level of entero-gastric digestion. This, in turn, allows to state that in the process of age-related changes in the human body, the rate of starch assimilation when consuming food products that contain it in moderate amounts practically does not change.

Based on scientifically proven data [7–9], the actual decrease in the level of basic metabolism in people belonging to older age groups was analyzed. This is due, first of all, to the physiological processes of aging, as well as, in most cases, low physical activity of the representatives of these persons. Considering this, the energy value of the daily rations of elderly, elderly and senile people should be moderately limited.

The analysis of the results of the studies of many scientists and researchers [7, 8, 14, 15] allows to state that the average level of energy metabolism, and accordingly energy needs, decreases with aging. In particular, it decreases by 16–20 % in the elderly, and by 30 % in the elderly, relative to this indicator of people aged 18–35. Depending on body weight, age and level of physical activity in men aged 61–74, it is on average 1800–2100 kcal/day, for women – 1600–2000 kcal/day. After reaching the age of 75 in men, this indicator is on average 1600–1900 kcal/day, in women – 1400–1700 kcal/day [7, 10, 12, 16].

It is worth noting that in many cases, excessive consumption of food products by representatives of older age groups can be dangerous due to the risk of obesity, the appearance of many diseases. In particular, they are varicose veins, type II diabetes, atherosclerosis, gallstone and urolithiasis, coronary disease heart attack, stroke, and others [7, 9, 10]. The frequency and severity of the course of these diseases increases with age. In this regard, one of the key requirements is a gradual decrease in the energy value of the daily rations of people who belong to the older age categories, as the body ages. Taking this into account, to reduce the energy value of food rations of people who belong to the elderly, elderly and long-lived people, it is recommended to reduce the content of lipid and carbohydrate components of food [8, 10, 14, 16].

In order to systematize scientific approaches to meeting the needs of people belonging to older age groups, the results of research into the main energy substrates were analyzed [7–10, 16]. It has been studied that the optimal ratio between macronutrients (%) for representatives of older age groups with normal metabolism from a scientific point of view is proteins : lipids : carbohydrates –

16–20 : 25–30 : 55–59. Quantitative norms of the main energy substrates presented in **Table 1.1** are recommended for consumption by representatives of older age groups. In addition, elderly people who lead a sedentary lifestyle are recommended to limit the consumption of carbohydrates.

● **Table 1.1** Recommended rates of consumption of macronutrients by representatives of older age groups with normal metabolism

Age and gender groups	Recommended consumption rates, g/day		
	proteins	lipids	carbohydrates
60–74 years			
men	72–105	50–70	240–310
women	64–100	44–67	220–295
74–90 years			
men	64–72	44–50	220–240
women	56–68	39–57	193–112

Recommendations regarding the composition of the main macronutrients deserve special attention in the analysis and systematization of data on ensuring the nutritional needs of the elderly, senile and long-lived people with normal metabolism [7, 10, 12, 16]. In particular, in addition to ensuring compliance with the amino acid score of food rations in accordance with the recommendations of FAO/WHO specialists, it is also necessary to ensure the share of essential amino acids within at least 40 % of the total amount of protein [7, 8, 10, 15]. Taking into account the need to ensure the proper level of digestibility, it is more appropriate to represent the protein component of rations at the expense of dairy, egg and fish products.

The analysis and systematization of scientific data on the lipid component of rations for herodietic purposes [7, 10, 16] allow to state that the optimal ratio of vegetable and animal fats is 1:2, omega-3 and omega-6 fatty acids – 4:1. It is also necessary note that the optimal amount of dietary fiber consumption in the daily diet should be about 30–40 g [14, 16].

Vitamins and mineral elements, and especially those characterized by antioxidant properties, play an important role in maintaining the physiological processes of people of older age groups. According to the results of the analysis and generalization of scientific literature and experimental data [6–8, 10, 15–17], it was established that the optimal daily intake of vitamins for the elderly, senile and long-lived people is indicated in **Tables 1.2** and **1.3**.

Based on the analyzed scientific information on the consumption of nutrients, approaches to ensuring the nutritional needs of people of older age groups, the recommended consumption rates of the main nutrients were studied. It has been established that it is recommended for older people to consume dairy products, seafood, fish, eggs, oils, poultry, vegetables, fruits, berries, seeds, nuts, whole grain products, and biologically active supplements. One of the options for enriching the diets of people of older age groups is the consumption of special food products of increased nutritional, in particular, biological value, which will take into account the herodietic features of the metabolic process.

● **Table 1.2** Recommended rates of consumption of basic vitamins by representatives of older age groups with normal metabolism

Vitamins	Unit of measurement	Men	Women
Ascorbic acid	mg	90–120	90–110
Retinol		0.9–1.1	0.9–1.1
Tocopherol		15–25	15–20
Thiamine		1.6–1.7	1.5–1.6
Riboflavin		1.7–2.2	1.6–2.0
Niacin		1.5–2.0	1.5–1.8
Pantothenic acid		5.0	5.0
Pyridoxine		2.5–3.5	2.5–3.5
Cyanocobalamin	μg	3.0	3.0
Biotin		45–50	43–45
Folic acid		250–400	250–400
Calciferol		7–15	5–12
Phylloquinone		100–120	90–110

● **Table 1.3** Recommended rates of consumption of the main mineral elements by representatives of older age groups with normal metabolism

Mineral elements	Unit of measurement	Men	Women
Potassium	mg	2200–2500	2200–2500
Sodium		1200–1400	1200–1400
Calcium		900–1200	800–1100
Phosphorus		900–1200	800–1100
Magnesium		450–600	400–550
Ferum		12–18	10–16
Zinc		12–15	12–15
Fluorine		2–4	2–4
Manganese		2	2
Kuprum		1	1
Iodine	μg	120–150	110–140
Molybdenum		60–70	60–70
Selenium		60–70	55–65
Chrome		50	50

1.2 THE CONCEPT OF PROVIDING NUTRITIONAL NEEDS OF REPRESENTATIVES OF OLDER AGE GROUPS IN EMERGENCY SITUATIONS

It is generally accepted that a balanced and rational diet is the basis of any person's life. Its completeness and compliance with the specificity of metabolic processes are especially important for people with somatic diseases and injuries during treatment and rehabilitation periods, in particular, representatives of older age groups. Optimum nutritional status largely determines the ability of victims to better tolerate illness and critical conditions, overcome them with less loss of health and fuller and faster rehabilitation.

It has been established that in emergency situations, in particular diseases and injuries, as a result of stress and physiological changes that occur during the inflammatory process, metabolic metabolism accelerates. This process of a complex metabolic response of the human body to a generalized inflammatory reaction, accompanied by increased energy needs and a decrease in the ability to utilize endogenous substrates, received the scientific definition of "hypermetabolism-hypercatabolism syndrome" [18–20].

As a result of the action of any etiological factor, it is recommended to carry out nutritional support, which is defined as the process of providing the body with optimal nutrition using special products, methods different from the usual eating [12, 21, 22]. In particular, this factor can be increased mental and physical stress, in particular emotional stress, mechanical injuries of tissues and organs, blood loss, sepsis, polytrauma, inflammatory process of various degrees of severity, thermal injuries, etc. The development of products that will provide nutritional support is based on modern scientific research on the balance of the nutrient composition and its compliance with the needs of people in emergency situations. In particular, the use of such specially modeled and directed products is considered particularly relevant for nutritional support of persons belonging to older age groups.

Numerous studies in the field of providing nutritional needs of representatives of older age groups in emergency situations [7, 12, 14, 15, 20, 22] make it possible to investigate and reveal the specifics of physiological processes. Also, they, in turn, are the basis for the development of the basic principles of their nutrition for this category of persons in the specified condition.

The scientific basis for the development of modern principles of human nutrition in emergency situations, in particular under the influence of stress caused by nervous and physical overloads, diseases, and injuries, are the fundamental provisions on the specificity of the resulting metabolic needs of the body [23–25]. Particular attention should be paid to the fact that, in emergency situations, compliance with the fundamental principles of the theories of balanced and adequate nutrition is of primary importance in ensuring the nutrition of people, particularly the elderly.

According to this concept, developed on the basis of the concepts of differentiated, directed (targeted) and individual provision of nutrients, the needs of victims for the recovery of the body depend to a large extent on many factors. First of all, they are the type and severity of damage to the body due to stress and physical injuries and diseases, body constitution, age, gender, energy

expenditure, level of neuropsychological stress, etc. [23, 26, 27]. This, in turn, determines the need for a detailed analysis of the peculiarities of physiological processes and states of people, which were caused as a result of the psycho-emotional and physical impact of emergency situations.

The basic scientific basis for this was the theory of metabolic reactions developed by the Scottish scientist D. Cuthbertson, caused by various influencing factors [23, 27, 28]. This theory is based on 2 phases of the body's metabolic response to the transferred loads and damage identified by the researcher:

– decline in metabolic activity (EBB) – observed during the first 12–24 hours. This phase is characterized by a short-term decrease in the activity of physiological processes, the transfer of oxygen to the affected areas of the human body, the synthesis of energy necessary to support the metabolism of the human body at rest;

– increase in metabolic activity (FLOW) – occurs after the end of the decline during the next 5–7 days. This phase is characterized by an increase in the activity of physiological metabolic processes, in particular, an acceleration of catabolism (especially active in peripheral affected tissues and organs) and anabolism (as a result of which acute-phase proteins are produced in the body) [23, 26, 27].

In turn, the analyzed theory was refined and improved by the American clinician F. D. Moore. Scientists have proven and substantiated that the cause of the decay of affected cells and tissues, as a result of the loss of the victim's body weight, is primarily the lack of nutrients for the restoration of the affected areas [27, 29, 30].

As a result of a significant physical injury, the victims have a sharp violation of the water balance, which, in turn, is associated with a significant loss of intercellular fluid, a change in its pressure; tissue hyperventilation; hyperdynamic mode of blood circulation. Because of this, during the EVV phase, the stabilization of the hydrobalance becomes important, which causes in the first 12–24 hours. the need to provide the body with an adequate amount of liquid, Na^+ and Cl^- electrolytes, vitamins and mineral elements [27, 29]. In particular, according to the recommendations developed by specialists in the field of nutritional support [18], meeting the increased needs for certain vitamins and mineral elements is mandatory during this phase. In particular, such vitamins are fat-soluble retinol, tocopherol and water-soluble ascorbic acid, thiamine, riboflavin, pyridoxine, cyanocobalamin, folic acid; mineral elements Magnesium and Zinc. This, in turn, is explained both by the ability of these nutrients to act on the nervous system, somewhat suppressing active excitement, and by their antioxidant properties.

It has been established that the primary reaction of the body to the action of any etiological factor is stress, which also affects the body of representatives of older age groups under the influence of emergency factors. Under the influence of this factor, substrates are mobilized, which can quickly release a significant amount of energy when split under the condition of a reduced level or complete absence of oxygen [24, 25]. Thus, under these conditions, carbohydrates become the main source of energy for the body. At the same time, the body's carbohydrate reserve is quite limited, which leads to its rather rapid exhaustion and the need to find new resources (**Table 1.4**) [24, 25, 31].

Table 1.4 Carbohydrate reserves in the body of a person with an average body weight of 74 kg

Body substrate	Mass of the substrate, kg	Potential energy value, kcal
Muscle glycogen	0.5	2000
Liver glycogen	0.2	800
Glucose (extracellular fluid)	0.02	80

It has been studied and established that as a result of the physiological effect of stress, the speed of glycogen breakdown and consumption by the affected parts of the body increases approximately 4 times [24, 31, 32]. Scientists have also researched that with the beginning of the FLOW phase, glycogen reserves in the body are depleted in approximately 2–6 hours. Because of this, the process of gluconeogenesis is activated in the body, which is defined as the process of glucose formation from other available energy substrates: lipids, amino acids of skeletal muscles (especially glutamine and arginine), glycerol, and triglycerides [25, 32].

It has also been scientifically established that a feature of the FLOW phase is an increase in the level of adrenocorticotropic hormone, adrenaline and norepinephrine in the blood of the affected person. Their high concentration, in turn, increases the consumption of glucose by the body, causes the beginning of proteolysis and lipolysis, which ultimately causes the occurrence of negative protein and lipid balances, and, as a result, nutritional deficiency [25, 31, 32]. In modern scientific and special literature [1], this term is defined as a state of the body characterized by a deficiency and/or imbalance of macro- and micronutrients, causing functional and morphological disorders and/or homeostasis disturbances. In order to minimize the negative effect and eliminate these metabolic disorders, to normalize the state of the body, products for nutritional support of a person are actively used in modern practice.

In order to ensure the optimal energy balance of the body of persons affected by emergency situations, it is recommended to start nutritional support with the appropriate amount of macro- and micronutrients immediately after the onset of the FLOW phase [25, 27–29, 31].

According to the formulation developed by specialists of the American Society of Parenteral and Enteral Nutrition (ASPEN) [33], nutritional support is defined as the process of providing the body with optimal complete nutrition through the use of certain products and a number of methods different from the usual eating. It, in turn, includes additional food fortification, partial and/or full enteral (in the form of oral administration and/or tube administration) or parenteral nutrition [27–30] (**Fig. 1.1**). It is also appropriate to note that in certain cases they are combined. At the same time, the consumption (use) of special food products is considered to be the optimal way to meet the needs of the injured person in these conditions.

Food fortification of the diet involves the necessary additional enrichment of the diet due to the protein component, micronutrients, biologically active substances or their complexes. Such additional food components can be consumed both separately and when added to certain dishes and products, including in the process of their manufacture and preparation [31, 33].

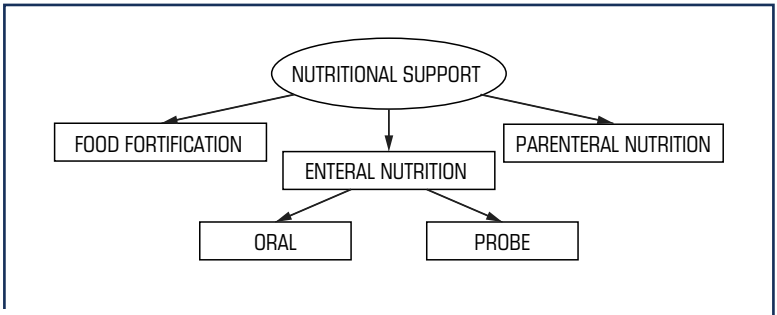

Fig. 1.1 Methods of nutritional support

Enteral nutrition involves ensuring the nutritional needs of the body in nutrients due to the consumption (use) of specially developed products orally and/or through a nasogastric tube in severe conditions of the victims. This method of nutritional support allows to provide the energy and plastic needs of the body while preserving the functions of the gastrointestinal tract [21, 29, 33].

Parenteral nutrition involves the introduction of the necessary nutritional mixtures of nutrients or individual nutrients without contact with the gastrointestinal tract directly into the blood through the main vessels and peripheral veins. Modern international experience in the treatment of patients with a high degree of severity of lesions, injuries and diseases indicates the need to use products for parenteral nutrition almost immediately after the elimination of acute disorders. In particular, these can be dysfunctions of hemodynamics and respiratory functions, and the use of this method is largely due to the need for rapid restoration of energy and plastic resources of the affected body [28, 29, 31, 33].

Based on the results of the given information, it can be summarized that in emergency situations, enteral and parenteral nutritional support become especially relevant. It is also worth stating that for people in severe critical conditions, the enteral method is considered the most physiologically successful compared to the parenteral method, which is due to the following factors:

– ensuring the supply of the necessary nutrients through its oral and tube administration (introduction) makes atrophy of the mucous membrane of the gastrointestinal tract impossible;

– the risk of infectious complications and the development of multiple organ failure syndrome is reduced;

– it is possible to reduce the severity of the stress reaction;

– the possibility of protein synthesis and regulation of metabolism in internal organs, especially in the liver, is assumed;

– more favorable conditions are created for the implementation of biochemical processes that occur in the walls of the intestine, which is impossible with parenteral administration of nutrients;

– there is no need to observe sterile conditions;

– lower level of necessary economic costs [19, 23, 27, 31].

According to world practice, an integral part of the nutritional support of victims in emergency situations is the provision of specialized nutrition, developed in accordance with the specifics of the body's metabolic processes. Thus, it is scientifically established that there is a direct correlation between the severity of the course of the disease and the trophic supply of the victims: the lower the nutrient deficiency, the less often multiple organ failure and complications are observed [29, 31, 33].

Based on the above, it was analyzed that in most cases the most successful and convenient method of providing nutritional support is enteral nutrition (both oral and tube feeding). This is due to the fact that in critical conditions, the gastrointestinal tract is a potentially dangerous source of endogenous infection, and the presence of a food substrate in it prevents the appearance of dystrophy and atrophy of the mucous membrane, disruption of its barrier functions [27, 29]. Additional advantages of enteral nutrition in comparison with parenteral nutrition are simpler requirements for the sterility of the conditions of preparation and use (introduction), a much smaller number of side effects, and a cheaper cost (by 3–6 times) [27, 29, 32].

In the case of insufficient provision of the victim's organism with energetic and plastic substrates, first of all, there is a failure of their mass transfer to areas and cells of the body [26, 34]. In order to restore and properly function the body of a person affected by emergency situations, it is of great importance to observe the principle of balance in the diet of the main macronutrients. Most specialists in the field of clinical dietetics and the development of special products for nutritional support of the elderly recommend the following norms of the optimal ratio of the total energy value between the main macronutrients, %: proteins : fats : carbohydrates – 20–25 : 25–32 : 43–55 [7, 11, 18, 19, 34].

Carbohydrates are the main metabolic substrate for people, particularly the elderly, in emergency situations, including physical illnesses and injuries. Their splitting can occur with the release of energy, including in the absence of oxygen, which is defined as glycolysis. In conditions of partial or complete impossibility of mitochondrial respiration of cells, these macronutrients can be absorbed in damaged areas of the body [24, 25, 29]. The minimum physiological need necessary to meet the basic metabolic needs of persons of older age groups in the studied conditions in carbohydrates is considered to be 200 g/day, the optimal amount is 320–390 g/day [27, 29, 31, 34]. The optimal carbohydrate substrate for meeting the needs of the injured, including the elderly, is glucose, which is the initial energy substrate for glycolysis. Under these conditions, the maximum rate of utilization of glucose with exogenous administration is considered to be within the range of 0.5–0.7 g/kg/day [27, 29, 34]. At the same time, it was established that the digestibility of glucose under these conditions depends, first of all, on the adequacy of blood flow and the ability of cells to utilize it [25, 27, 29]. At the same time, it has been investigated that the excess supply of carbohydrates to the body of the affected person is characterized by an increase in resistance to endogenous insulin [23, 25, 26].

As a result of disruption of normal physiological metabolism and redistribution of proteins in the body of the affected persons, special importance is attached to protein metabolism in the diet of the affected persons.

Under these conditions, the basic indicator of this metabolic process is the nitrogen balance, which is the difference in the amount of nitrogen that enters the body with proteins, amino acids, and that is removed from it in various ways [26, 29, 34]. At the same time, it should be noted that nitrogen losses indicate a loss of protein in the body and lead to a decrease in body weight (1 g of nitrogen corresponds to 6.25 g of protein or 25 g of muscle mass) [30–32].

When researching the protein needs of older people who have suffered from emergency situations, it is appropriate to note the presence of somewhat different approaches among certain scientists. In particular, on the basis of some studies, it was established that the protein needs of victims of somatic lesions are in the range of 1.5–2.0 g/kg/day, at the same time, there is a statement according to which protein should enter the body of victims in the amount of 2.5–2.8 g/kg/day [29, 32].

At the same time, the exact determination of protein substrate needs is individual for each victim in accordance with the specifics of the injuries received and requires the implementation of individual nitrogen balance studies [28, 29, 32, 34]. The fact that in the diet of persons affected by emergency situations, including people of older age categories, the ratio of the number of calories from the non-protein component to nitrogen should be 90–110:1 [27, 29, 33, 34]. For persons with a total area of somatic lesions of more than 30 % – 80–90:1 [31, 34].

When analyzing protein needs, it should be noted that the amino acid L-glutamine acquires special importance in meeting the nutritional needs of people with somatic diseases and injuries. It has been studied that due to the generalized inflammatory process occurring in the body due to the effects of emergency factors (sepsis, blood loss, injuries), the consumption of this amino acid increases significantly (almost by 65–75 %) [25, 29, 31]. This fact is due to the fact that the amino acid L-glutamine becomes indispensable for the restoration of somatic parts of the body in case of injuries and injuries due to emergency situations. It should be noted that this nutrient becomes the basic substrate for the gastrointestinal tract due to the possibility of utilization by enterocytes and colonocytes to a greater extent than glucose). Also, its consumption reduces the possible level of purulent complications, increases the level of protein utilization by muscles and the general tone of blood vessels by reducing their permeability and promoting the restoration of structural integrity, stimulates the synthesis of hormonal drugs necessary for recovery and has pronounced antioxidant properties [32, 34].

Due to their high energy value (9.3 kcal/g), when meeting the needs of people in emergency situations, lipids are of particular importance and are considered the most beneficial source of energy [27–29, 31]. It has been studied that one of the main processes occurring in the human body as a result of emergency factors is lipolysis, as a result of which fatty acids and glycerol are formed from these macronutrients [28, 29, 31]. Fatty acids become the most important energy source for muscles and the liver, and also contribute to the acceleration of neutralization of microbial harmful cells by the liver [26, 28, 29]. It is appropriate to note that glycerol under these conditions becomes one of the basic substrates for gluconeogenesis [27, 29]. Based on the recommendations of experts in the field of nutritional support in emergency situations [26, 29, 31, 34], the needs

of the body in the studied conditions in lipids are within the range of 0.7–1.2 g/kg/day, depending on the severity of the lesion.

It is generally accepted that one of the best ways to adequately provide the affected person with fatty acids is to use omega-3 and omega-6 polyunsaturated fatty acid complexes in their diet. The use and combination of these substances, which make it possible to provide the body not only with a source of energy, but also make it possible to timely and effectively regulate inflammatory processes in injured parts of the body [27, 30]. Due to the properties of interacting with transmembrane signaling molecules, these fatty acids have properties to reduce the level of inflammatory processes. In addition, they are able to inhibit the uncontrolled release of active leukocytes, stimulate the body's defenses by restoring the cell membranes of the affected areas of the body, and normalize the functioning of the endocrine and nervous systems [27, 28].

It is also appropriate to note that dietary fiber plays an important role in the diet of the nutritional needs of older people who have been negatively affected by emergency situations. The use of these nutrients in nutritional support is due to their ability to favorably affect the gastrointestinal tract due to the absorption of bile acids, cholesterol, and promote the increase of intestinal motility [26, 27]. In this regard, it is considered expedient and favorable to ensure the presence of non-starch polysaccharides, fructo-oligosaccharides, pectin and lignin in the nutrition of this group of affected people [12, 21, 32]. 15–25 g/day is considered the most recommended daily intake for people of older age groups, in particular in the state of damage due to emergency situations [6].

It should also be noted that quite a lot of attention is paid to vitamin therapy when providing the nutritional needs of representatives of older age groups in emergency situations. In particular, specialized specialists of the international organizations ESPEN (European Society of Parenteral and Enteral Nutrition) and ASPEN (American Society of Parenteral and Enteral Nutrition) have developed recommendations on optimal norms for meeting the needs of the studied category of persons in the mentioned states [31, 33, 34]. In particular, according to them, optimal provision of needs for retinol, thiamin, riboflavin, niacin, pyridoxine, cyanocobalamin, ascorbic acid, calciferol, tocopherol, phylloquinone becomes especially important (**Table 1.5**).

In the process of conducting research by many specialists in the field of nutritional support of people, especially the elderly, in emergency situations, it was investigated [14, 15, 19, 23] and it was established that providing an adequate amount of vitamins is important. In particular, the level of satisfaction of vitamin needs determines the nature of optimization of protein, carbohydrate, and lipid exchanges, reduction of the activity of pain syndrome, free radical oxidation process in tissues and organs, increase of the level of tissue respiration. Ensuring the proper exchange of thiamine, riboflavin, pyridoxine, and tocopherol is especially important.

It is also appropriate to note that ascorbic acid plays a rather important role among vitamins, the metabolic exchange of which is in a complex relationship with protein exchange. Thus, the results of scientific research [30] show that an increased amount of ascorbic acid (from 50 to 200 mg) helps to optimize the protein status of the body. This, in turn, is caused by the fact that

tissue regeneration of dehydroascorbic acid into ascorbic acid is disrupted with significant protein losses. The latter, being a fairly effective natural antioxidant, takes an active part in the body's redox reactions, forming a hydrogen atom transport system with dihydroascorbic acid. During this process, a complex of enzymes is activated, the valency of some metals changes (in particular, $Cu^{2+} \rightarrow Cu^{+}$). It is worth noting that thanks to this, ascorbic acid is characterized by an effective stimulating effect on recovery, promotes the activation of the endocrine glands, facilitates the process of converting ferrum into ferrite [27, 28].

● **Table 1.5** Recommended norms of daily consumption of individual vitamins by representatives of older age in emergency situations

Vitamins	Unit of measurement	Recommended usage rates	
		Minimal	Maximum
Retinol (A)	μg	1000	3500
Thiamin (B1)	mg	1.8	3.0
Riboflavin (B2)	mg	2.5	6.0
Niacin (B3)	mg	1.5	5.0
Pyridoxine (B6)	mg	2.5	6.5
Cyanocobalamin (B12)	μg	3.0	9.0
Ascorbic acid (C)	mg	90	250
Calciferol (D3)	μg	10	35
Tocopherol (E)	mg	15	60
Phylloquinone (K)	μg	120	400

An important factor that determines the success of the process of treatment and rehabilitation of injured persons, including the elderly, is the satisfaction of needs in mineral elements. Based on this, according to the recommendations of specialists [21, 23, 27, 31, 33], it is quite important to increase the level of meeting the needs of trace elements (**Table 1.6**), in particular Ferrum, Manganese, Cuprum, Zinc, Selenium, Chromium, Molybdenum, Iodine.

Thus, on the basis of the given information, it is possible to summarize the rather important role of proper supply of mineral elements in the process of treatment and rehabilitation, including representatives of older age, from adverse emergency situations.

In the course of the conducted analytical research, it was also established that many scientists [22, 23, 26, 28, 32, 33] noted the importance of using a rationally planned strategy of saturating the body of victims with liquid. This, in turn, makes it possible to improve the thermoregulatory ability of the body, to improve the level of pressure in the body. It has been studied that the optimal amount of fluid intake enriched with electrolytes Na^{+}, K^{+} and glucose for the studied

group of people is within 1.5–2.5 l/day [28, 30, 32]. It has been established that the use of liquid mixtures saturated with all necessary macro- and micronutrients is the best way to ensure proper nutritional support.

● **Table 1.6** Recommended norms of daily consumption of certain trace elements by representatives of older age in emergency situations, μg

Microelement	Unit of measurement	Recommended limits of norms of use	
		Minimal	Maximum
Ferrum	mg	12	30
Zinc	mg	12	25
Cuprum	mg	1.5	5.0
Manganese	mg	2	5
Iodine	mg	0.15	0.50
Molybdenum	μg	70	120
Selenium	μg	70	130
Chrome	μg	50	100

1.3 FEATURES OF ENSURING THE NUTRITIONAL NEEDS OF REPRESENTATIVES OF OLDER AGE GROUPS SUFFERING FROM DIABETES IN EMERGENCY SITUATIONS

Diabetes mellitus is considered one of the most common diseases in our time. In particular, this fact is confirmed by the information that almost 415 million people around the world suffer from this disease, and the share of these people in different countries ranges from 4 to 7 % of the total population [34, 35]. There is information that this disease has a constant tendency to increase, showing a special increase in economically developed countries after 65, and in developing countries – between 45–64 years [34, 35]. These data confirm the wide prevalence of this disease among people who belong to older age groups, especially with regard to type II diabetes. It is worth noting that this type of disease is characterized by the fact that the patient's body does not produce the required amount of insulin or does not use it to the full extent [35].

It is worth noting that diabetes is a very common disease among people belonging to older age groups. In particular, it was established that, according to statistical data, more than 25 % of these representatives suffer from the specified disease, about 50 % have prediabetes [35]. It was also studied that representatives of older age groups suffering from diabetes are characterized by a higher level of other diseases, in particular, stroke, hypertension, and somatic lesions [35]. Based on the above information, it is relevant to study the specifics of ensuring the nutritional needs of older people suffering from diabetes, particularly type II.

The fact that diabetes is widespread in modern society, the development of which is caused by a significant level of stress, deserves increased attention [34, 35]. This phenomenon is especially relevant for the population of Ukraine, which is characterized by increased psycho-emotional stress due to the military attack of the russian federation, its missile strikes. It is worth noting that during stress, human glands produce an increased amount of adrenaline, norepinephrine, and cortisol hormones. The latter in a normal concentration contributes to the healing of wounds, regulation of the immune system, maintenance of normal blood pressure, however, with prolonged release, it increases the level of glucose, increasing the level of sugar in the blood [36]. As a result, the level of development of type II diabetes mellitus increases in the affected person's body.

It is appropriate to note that a mandatory condition for the treatment and rehabilitation of persons belonging to the older age categories, exposed to emergency situations and additionally suffering from diabetes, is the rational provision of the food ration. This is caused primarily by the fact that the most significant fluctuations in the level of sugar in the blood occur after eating [34, 35]. Full satisfaction of the energy and plastic needs of this category of victims, taking into account the need to normalize glucose homeostasis, is possible only under the condition of maximum compliance with modern principles of clinical diabetology.

Modern scientific data [7, 12, 33, 36] indicate that the problem of providing the necessary macro- and micronutrients to people suffering from diabetes requires a special approach to this process. Thus, the following principles for their diet therapy were developed by scientists who are specialists in the field of nutritional support for this category of people [7, 12, 31, 33, 36]:

– ensuring the ratio in the total energy value of food, %: proteins : lipids : carbohydrates – 30 and less : 27–35 : 40 and more. The increased content of proteins and lipids in the diet is due to the process of gluconeogenesis in emergency situations and the critical functioning of the Corey cycle. It was established that as a result of these processes under the influence of a stress factor, glucose synthesis occurs from these substrates;

– ensuring preference in favor of vegetable oils in the lipid component, as they contain mainly polyunsaturated fatty acids;

– the inclusion of carbohydrates in the diet should be based on scientifically based data, based on information about their glycemic index, the degree of digestibility and refinement, the recommended daily rate of their consumption, their share in the total diet;

– ensuring the presence of dietary fibers in the diet, which will slow down the increase in motility of the stomach, its emptying and shorten the period of movement of nutritional substrates through the intestine and, as a result, will prevent sharp fluctuations in the blood sugar level of the affected person;

– stability of the regime of nutritional support – obtaining nutritional substrates should involve 5–6 receptions (administrations) per day with a clearly defined isocaloric distribution of energy value.

Thus, on the basis of the analyzed and researched material, it can be concluded that one of the conditions for the successful treatment and rehabilitation of representatives of the older age groups suffering from diabetes in emergency situations is a complete diet developed on the

basis of scientifically based data on the specifics of physiological processes their body. Adequate provision of the nutritional needs of this category of people should be ensured taking into account the peculiarities of their physiological needs and increased sensitivity to the carbohydrate component of the diet.

1.4 CHARACTERISTICS OF THE MAIN TYPES OF RAW MATERIALS THAT CAN BE USED IN THE PRODUCTION OF PRODUCTS FOR ENTERAL NUTRITION

The modern dynamic rates of scientific research in the field of nutrition and medicine, supported by the rapid development of production capabilities, cause the spread of the practice of producing special products for nutritional support of a targeted effect on the human body [29, 32]. This determines the need to find and use high-quality raw materials for production, which will meet the ever-growing demands of consumers, in particular representatives of the older age group, regarding the nutritional and biological value of ready-made products.

The main requirements for raw materials for the production of products for nutritional support are: the presence of documents confirming safety, proper quality, registration by the relevant executive authority, a high degree of purification, dispersion, solubility in solutions. For physiologically active components, additional requirements are set for the availability of information on the confirmed effectiveness of the action [28, 29, 32, 34]. It should also be noted that the cost of raw materials in the production of this type of product is the main factor that determines its cost price and determines the need for the development of the raw material base [29, 34].

In the practice of production of products for nutritional support of persons belonging to older age groups in emergency situations, in particular with the additional disease of type II diabetes, basic and additional raw materials are used. The main raw materials used are: purified and prepared water; glucose, fructose, sweeteners; omega-3, omega-6, omega-9 polyunsaturated fatty acids, vegetable oils and extracts; proteins, peptides, amino acids and their concentrates. To increase the biological value of this type of product, food fibers, vitamins and minerals, as well as food premixes containing them, are added [7, 14, 16, 29, 33].

The main raw material used in the production of products for the nutritional support of the human body are carbohydrates. Among them, glucose is the most common [7, 28, 29]. This is explained by the fact that it is one of the main energy substrates during the stress reaction. Since glucose can be broken down with the release of energy in the absence of oxygen (glycolysis), it is absorbed by organs and tissues for which mitochondrial respiration is partially or completely unavailable. These include tissues in the areas of lesions, when lipids cannot be a source of nutrition due to impaired blood circulation [28, 31]. Thus, glucose is the only energy substrate that provides nutrition for cells and tissue for their recovery. In addition, this carbohydrate enhances redox processes, improves the antitoxic function of the liver, stimulates the contractility of the myocardium, and prevents excess water loss by the body. At the same time, it should be noted that

the digestibility of glucose in a critical state depends on the adequacy of perfusion (blood flow), the ability to utilize it by cells (insulin resistance) [23, 27, 29].

Another component of the carbohydrate group that is quite actively used in the production of special products for nutritional support is fructose. It is absorbed by the body after being converted into glucose, which is why it is a timely source of energy. In addition, fructose is not absorbed by insulin-dependent tissues, stabilizes the blood sugar level, which determines the possibility of its use in products for nutritional support of the body of people suffering from diabetes [27, 34, 35]. Research by a number of scientists [31, 36] has proven that when using fructose in products for enteral nutrition of victims in an emergency, particularly critical condition, an increase in the ability of cells to stimulate the immune system is observed. In particular, fructose promotes the release of substrates that inhibit the action of infectious agents.

One of the sugar substitutes that is widely used as a raw material in the manufacture of products for the nutritional support of people suffering from diabetes is sorbitol [34–36]. This component practically does not lead to an increase in the level of sugar in the blood, being slowly absorbed from the gastrointestinal tract [34]. The recommended dose of its daily use is up to 45–50 g/day. There are scientific data [34, 35] that sorbitol is characterized by a detoxifying effect.

Protein components deserve special attention when analyzing raw materials for the production of products for enteral nutrition. A mandatory condition for the protein component of these products is the content of all essential amino acids [27, 29, 31]. Protein concentrates (of both animal and vegetable origin), isolates, peptides, amino acids and their mixtures are used to meet protein needs [27, 29, 31–33]. The main purpose of their use is to ensure the rapid recovery of protein losses under the influence of gluconeogenesis and to create favorable conditions for the metabolic processes of the body's energy and plastic exchange. It should be noted that the main criteria for the selection of raw materials for providing the protein component of products for nutritional support are its biological value, high solubility, and the ability to stabilize dispersed systems [29, 31, 32]. Considering this, in the production of products for the nutritional support of people with somatic diseases and injuries, it is advisable to use whey protein concentrates characterized by a high content of protein, vitamins (retinol, ascorbic acid, thiamine, riboflavin, niacin, pantothenic acid, pyridoxine, cyanocobalamin), minerals elements (calcium, sodium, potassium and others). In particular, the ratio of calcium/phosphorus and calcium/magnesium is close to optimal (1:2 and 1:7, respectively), which indicates high assimilation by the body [32].

Amino acids require special attention when characterizing the raw materials used in the production of products for enteral nutrition. The value of their use is due to the simplified process of assimilation and the possibility to balance the amino acid composition according to the specific needs of the body [6, 15, 23, 32]. Studies conducted by clinical nutritionists [23, 32] show that due to generalized inflammation, the content of glutamine in the blood decreases by 50–60 % and remains at a reduced level for a significant period of time (up to 30 days). Due to the fact that the stress reaction is accompanied by a significant increase in its consumption, in emergency situations,

in particular critical conditions, glutamine is considered an irreplaceable amino acid [25, 27, 32]. In addition, it is necessary for the restoration of damaged areas of the body, has an anti-inflammatory effect, increases the tone of blood vessels, contributes to the restoration of the structural integrity and activity of the intestine, stimulates the synthesis of growth hormone, reduces the number of purulent complications and has a pronounced antioxidant capacity [18, 23, 27, 32].

The use of omega-3 and omega-6 polyunsaturated fatty acids in products for nutritional support is due to the need to optimize lipid metabolism [19, 23]. In the modern production practice of the studied products, omega-3 and omega-6 essential fatty acids of plant origin are mainly used, which is due to their higher organoleptic properties compared to similar animal origin [18]. It is known that additional advantages of their use in products for nutritional support of people with somatic diseases and injuries are the recovery and growth of muscle tissue, improvement of the rheological properties of blood by reducing its viscosity [18, 23].

Lecithin, consisting of choline, phosphoric and fatty acids, and glycerin, is also used in the production of nutritional support products [18, 19]. This component promotes the transport of nutrients from the blood to the cells, improves blood circulation by removing excess cholesterol, and helps restore immunity [18, 25].

Natural dietary fibers are widely used in the production of food products for nutritional support [27, 29], which is due to their prebiotic properties and ability to have a beneficial effect on the gastrointestinal tract due to the absorption of bile acids, cholesterol, and improve gastric motility [29].

An important factor determining the biological value of food products for people in an emergency, including the elderly, and trauma, is their vitamin and mineral value. To meet the metabolic needs of these consumers in micronutrients, individual artificially synthesized vitamins, their complexes, vitamin, vitamin-mineral and mineral premixes, mineral salts of a high degree of purification are most often purposefully added to nutritional support products [22, 25, 29]. Considerable attention in this process is paid to micronutrients characterized by antioxidant properties. In particular, vitamins retinol, ascorbic acid, calciferol, and tocopherol are most often used in the production of products for nutritional support of people in an emergency. Phylloquinone, thiamin, riboflavin, niacin, pantothenic acid, pyridoxine, cyanocobalamin are also used. In the production of products for enteral nutrition, mineral salts are also used, which are intended to meet needs. First of all, these are compounds that include Sodium, Potassium, Calcium, Magnesium, Ferrum, Copper, Zinc, Manganese, Chlorine, Phosphorus, Iodine [22, 28, 29, 32].

In view of the increased need for vitamins and mineral elements that contribute to the healing and restoration of the affected areas of the body, the trend of using raw materials containing nutrients in their native form – protein concentrates of milk whey, dry milk, egg white – has become widespread in modern practice [7, 18, 28, 29]. This is explained by the better degree of assimilation of nutrients by the body of affected people.

In the production of products for nutritional support, the vitamin-like coenzyme Q_{10} of natural and synthetic origin is often used, which is a natural antioxidant, provides energy to body cells,

protects fatty acids from oxidation by free radicals, stabilizes cell membranes and stimulates the immune system [18, 28].

It is appropriate to note one more group of raw materials for the production of the researched products – plant extracts. The most widely used are extracts of green tea, rose hips, chamomile, sage, and mint [25, 27, 29]. Such enrichment of products is explained by their properties – anti-inflammatory, healing, tonic, increased antioxidant capacity [27, 29]. In addition, in the modern practice of the production of special products, an extract of the Tribulus Terrestris plant is used, which contains mostly steroidal saponins of the furostanol type, among which protodioscin prevails, which is metabolized in the human body to dehydroepiandrosterone. It has been scientifically proven that this substance significantly contributes to the acceleration of muscle growth, activation of protein metabolism, increasing the level of permeability of cell membranes and immunity; improving cholesterol metabolism [29].

1.5 ANALYSIS OF EXISTING APPROACHES TO THE CLASSIFICATION OF PRODUCTS FOR ENTERAL NUTRITION

Nowadays, more than 250 names of products for enteral nutrition are produced in the world, which differ in a significant number of consumer characteristics and properties. The main ones are the specificity of the functional purpose, composition, energy value, the degree of decomposition of the constituent macronutrients, protein content, peculiarities of preparation for use (administration), physicochemical properties, and other characteristics.

An effective preventive means of protecting the rights of consumers, expanding and diversifying the range of products for enteral nutrition is the analysis of the existing classification bases and their comprehensive improvement due to the adaptation of modern world requirements and approaches. This will make it possible to study, evaluate and more fully satisfy the needs and expectations of target consumers; eliminate ambiguities, inaccuracies; ensure the industrial efficiency of manufacturing enterprises. It will also contribute to the intensification of international trade by eliminating technical barriers caused by the difference in approaches in global and national standardization systems.

According to the Law of Ukraine "On Basic Principles and Requirements for the Safety and Quality of Food Products" [37] enteral nutrition products are food products for special medical purposes. According to the mentioned document [37], they are defined as "food products specially designed and produced for feeding patients (including those who are infants and young children) to be consumed on the prescription of a doctor in a health care facility and/or outside its limits". At the same time, there is no classification of enteral nutrition approved at the legislative level in Ukraine.

Analysis of the experience of the European Union in the field of legislative regulation of the production and circulation of products for enteral nutrition makes it possible to define these products as a category of food products for targeted food use, developed and intended for dietary

nutrition of patients during treatment and recovery periods. European Union Directive 2016/128 "On specific requirements for the composition and information on food products for special medical purposes" [38] established the classification of enteral nutrition products according to their composition, according to which they are divided into 3 categories:

– with a standard composition, which, if used according to the manufacturer's instructions, can be the only source of nutrition;

– with a composition adapted to certain specific diseases, disorders or conditions of treatment, which, if used according to the manufacturer's instructions, can be the only source of nutrition;

– with a standard or adapted composition for specific diseases, disorders or treatment conditions that, when used according to the manufacturer's instructions, cannot be the sole source of nutrition.

In modern practice, the classification of products for enteral nutrition according to their chemical composition is considered the main one [29]. According to this classification feature, which is widely used in medical practice, the mentioned food products can be conditionally divided into 5 groups:

– *standard (polymeric)* – balanced in terms of their nutrient composition; to be used as both the only and additional source of nutrition. The main distinguishing feature of such products is that all macronutrients (proteins, lipids, carbohydrates) are in a single, unbroken form. Such enteral nutrition is prescribed in most uncomplicated cases, with the exception of pronounced disorders of digestion and assimilation of nutrients. In turn, the products of this group are divided into those that do not contain dietary fibers and those that do;

– *semi-elemental (oligomeric)* – balanced in composition and containing proteins hydrolyzed to peptides and/or amino acids; lipids to medium-chain triglycerides; carbohydrates to highly hydrolyzed dextrins. The products of this group are a good alternative to parenteral (intravenous) nutrition and are prescribed for disorders of intracavitary and parietal digestion caused by diseases or operations;

– *modular* – contain only one of the macronutrients or individual amino acids (for example, L-glutamine or L-arginine), fatty acid complexes (omega-3, omega-6), dietary fibers (pectin), regulators of the metabolic process (L-carnitine). They are used to supplement a special diet and meet the individual needs of each person;

– *special (metabolically directed)* – contain a composition of nutrients specially developed taking into account the most common physiological needs of specific physiological conditions or diseases (for example, hypermetacatabolism, diabetes, liver, kidney and severe respiratory insufficiency). The use of products of this group is aimed at correcting metabolic disorders;

– *immunomodulating* – intended for correction of immune disorders of victims with significant injuries and burns, severe infections, immunodeficiency. The composition of these products is enriched with special nutrients that strengthen immunity – L-glutamine, L-arginine, omega-3 and omega-6 polyunsaturated fatty acids, nucleotides.

Such classification of products for enteral nutrition, in our opinion, will help consumers (both victims and their doctors) to understand the wide range of similar food products sold in pharmacies

and specialized stores. At the same time, not all information about the properties and mechanism of ensuring the special metabolic needs of the human body is clear and available. In particular, this classification combines the direction of action (standard or special), and the degree of breakdown of the constituent macronutrients (polymeric, oligomeric, monomeric) and the composition of the components.

Specialists of the American Society of Parenteral and Enteral Nutrition [5] proposed a classification based on the energy content of 1 ml of enteral nutrition. According to it, such products are divided into:

– hypocaloric (1 ml < 1 kcal);

– isocaloric (1 ml – 1 kcal);

– hypercaloric (1 ml > 1 kcal).

At the same time, specialists of the European Society of Parenteral and Enteral Nutrition [39] proposed a classification based on the energy content of 1 ml of enteral nutrition, which differs in its numerical values:

– hypocaloric (up to 0.9 kcal/ml);

– isocaloric (0.9–1.2 kcal/ml);

– hypercaloric (more than 1.2 kcal/ml).

This organization also proposed a classification based on the degree of cleavage of the main amount of the protein component. According to it, products for enteral nutrition are divided into:

– polymeric – the protein is presented in an uncleaved form;

– oligomeric (semi-elemental) – the protein component is represented by peptides;

– monomeric – the protein component is represented by amino acids [40].

Also, specialized scientists in the field of medicine [40] developed another classification, according to which products for enteral nutrition were divided into 3 groups depending on the protein content:

– hyponitrogenous (up to 35 g of protein per 1 liter of product);

– isonitrogenous (35–50 g of protein per 1 liter of product);

– hypernitrogenous (more than 50 g of protein per 1 liter of product).

Another classification feature proposed by scientists is physical properties. Thus, products for enteral nutrition were divided into powdered and liquid (ready-to-use). In addition, emulsions and suspensions were singled out among the last group [27].

The analysis of existing approaches to the classification of enteral nutrition products from the point of view of commodity science allows to summarize that they are not always scientifically based and take into account the current trends of market development, the specifics of many scientific principles of consumer and technological features. Thus, the existing classifications of the studied products need to be revised.

The need for adequate provision of the nutritional needs of each of the individual categories of victims, which is aimed at restoring the body and minimizing metabolic process disturbances, requires a differentiated approach in order to achieve the expected physiological effect.

Based on the analysis, systematization of existing features and selection of new ones, which are important for conveying the information necessary for target consumers, in particular representatives of older age groups in emergency situations (both victims and their doctors), about the properties of products for enteral nutrition, we developed a classification. It was based on faceted distribution, which provides for the parallel differentiation of products for enteral nutrition into independent classification groups. This allows it to be flexible, easily expand and deepen its representativeness.

Systematicity was chosen as the main indicator when choosing classification features, which will allow more precisely to reveal the properties and peculiarities of the physiological effect of products for enteral nutrition on the metabolic processes of the human body. This, in turn, will make it possible to use it both in the scientific and theoretical sphere, and in the practical one.

The methodological basis for the classification of products for enteral nutrition identified 2 main groups of features:

– consumption (method of consumption (use), ability to be the only source of nutrition, direction of action, nature of impact on the body, energy value, content of the protein component, degree of splitting of its main mass, regularity of product use, age of consumers);

– technological (physical properties of the product (form of sale), origin of the protein component, packaging dosage, type and material of packaging) (**Table 1.7**).

● **Table 1.7** Classification of products for enteral nutrition

Group of classification features	Classification features	Categories of products for enteral nutrition
1	**2**	**3**
CONSUMABLES	Method of consumption (use)	– for oral consumption (sip feeding); – for tube feeding; – for combined consumption (use)
	The ability to be the only source of nutrition	– capable of being the only source of nutrition; – an additional source of nutrition is necessary
	Direction of action and associated diseases and/or lesions	– standard; – special: 1) for patients with diabetes; 2) for patients with damage to the cardiovascular system; 3) for patients with respiratory failure; 4) for patients with neurological diseases; 5) for patients with diseases of the gastrointestinal tract and/or dysbacteriosis; 6) for patients with endocrine diseases; 7) for patients with kidney failure; 8) for patients with liver failure; 9) immunomodulating

Continuation of Table 1.7

1	2	3
	Nature of influence	– indirect influence; – complex action; – direct impact; – monoaction
	Energetic value	– hypocaloric (up to 0.9 kcal/ml); – isocaloric (0.9–1.2 kcal/ml); – hypercaloric (more than 1.2 kcal/ml)
	Content of the protein component	– hyponitrogenous (up to 35 g/l of product); – isonitrogenous (35–50 g/l of product); – hypernitrogenous (more than 50 g/l of product)
	The degree of cleavage of the main amount of the protein component	– polymeric; – oligomeric (semi-elemental); – monomeric
	Regularity of use	– for regular use; – for long-term use; – for short-term use; – for one-time use (quick satisfaction of nutritional needs at a specific stage)
	Age of consumers	– for children aged 1–3 years; – for children aged 4–6 years; – for teenagers (ages 7–18); – for adults (18–60 years old); – for older age groups (over 60 years old)
TECHNOLOGICAL	Physical properties (form of implementation)	– liquid ready for consumption (use); – liquid concentrates; – powdered
	The origin of the protein component	– based on milk proteins (casein and/or whey proteins); – based on milk proteins (casein and/or whey proteins) and isolated soy proteins; – based on isolated soy proteins; – based on amino acids and peptides
	Packaging dosage	– for a single reception during the day; – for 3–5 receptions during the day; – for multiple (more than 5) receptions per day
	Type of packaging	– bottles, cans, bags, containers, stacks, etc.
	Packaging material	– glass, polymer and paper materials, plastic, metal, metallized foil, their combination, other

The proposed classification of products for enteral nutrition is based on the requirements established by specialized organizations in world practice (in particular, ASPEN and ESPEN),

advertising information of manufacturers, distributors and sellers, modern merchandising approaches to the classification of food products.

Thus, the proposed classification of products for enteral nutrition reflects the main approaches to their production and consumption, taking into account the interests and preferences of the target category of consumers and medical professionals. In turn, as the range of researched products in Ukraine and the world is updated and expanded, this classification can be supplemented and updated.

CONCLUSIONS

1. Based on the analysis of general approaches to meeting the nutritional needs of older age groups, it was established that for their full satisfaction, physiological processes caused by changes in metabolism during aging should be taken into account. It has been established that elderly, senile and long-lived people need a balance of the main nutrients, namely an increased amount of protein and lipid components and a reduced amount of carbohydrates. The diets of the studied group of people should have an increased content of dietary fiber, ascorbic acid, retinol, calciferol, tocopherol, thiamine, pantothenic acid, pyridoxine, calcium, phosphorus, magnesium, zinc, copper, selenium and chromium. This, in turn, is due to their ability to improve the digestion process, antioxidant properties and antisclerotic effect.

2. As a result of the analysis of the nutritional needs of representatives of older age groups in emergency situations, it was found that their full satisfaction largely determines the success of treatment and rehabilitation, it is necessary to take into account the specifics of metabolism and dietary principles. It was analyzed that in modern practice, specially developed food products, in particular products for enteral nutrition, are used for successful nutritional support of this category of persons.

3. Based on the results of the analysis of the peculiarities of meeting the nutritional needs of representatives of older age groups suffering from diabetes, in emergency situations it was determined that this process should be carried out taking into account the metabolic specificity. At the same time, taking into account the increased sensitivity to the carbohydrate component of the diet is of considerable importance, in connection with which the use of these components is limited. It is carried out using information about their glycemic index to prevent a significant increase in blood sugar.

4. It was established that the main raw materials appropriate for the production of enteral nutrition products are glucose, fructose, sorbitol, and other sugar substitutes; omega-3, omega-6 fatty acids, vegetable oils and extracts; proteins, peptides, amino acids, their concentrates. To increase the biological value of this product, the use of synthetic vitamins, their complexes, vitamin, vitamin-mineral, mineral premixes, mineral salts of a high degree of purification, taking into account their availability on the market, is also common.

5. Based on the analysis of existing approaches to the classification of products for enteral nutrition, the main characteristics by which these products are divided on the market were studied. Based on existing production and consumption approaches, a classification of products for enteral nutrition was developed, taking into account the specifics of commodity science. The proposed classification reflects the main approaches to their production and consumption, taking into account the interests and preferences of target consumers. In turn, as the range of researched products in Ukraine and the world is updated and expanded, this classification can be supplemented and updated.

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