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MARE'S MILK AS A FUNCTIONAL FOOD

Abstract. The article is devoted to topical issues of the application of functional nutrition and its role in preserving and improving the health of the population. A literature review on the creation, production and improvement of functional food products, as well as their further development using modern innovative technologies, was conducted. The development of functional nutrition in Kazakhstan with the use of the freeze-dried form of mare's milk is shown with the aim of increasing the average life expectancy and active longevity.

Key words: functional nutrition, life expectancy, mare's milk.

Year by year, the desire of most people for a healthy lifestyle and nutritious products is gaining higher popularity and recognition in the world. In order to maintain health and stay always in shape, it is necessary to have an active lifestyle, do exercise and monitor diet, and it should be as functional as possible.

Functional nutrition (FF) is a food that serves not only to meet human needs in proteins, fats, carbohydrates, micro- and macroelements, but also to realize other goals such as improving immunity and the functioning of the intestine, heart, reducing or increasing the body mass etc. [1, 2].

Serious changes in our diet have been requested for a long time. Functional nutrition is defined as a nutrition, which contributes to the improvement of the functioning of individual organs, as a result of the whole organism. It has a regulating effect on physiological functions, biochemical reactions and psychosocial behavior of a person.

FN is a new enriched natural special-purpose product with predetermined properties, which, with daily use, maintains physical health and reduces the risk of various diseases [3-6].

We again return to the old entrenched postulates that "food should be medicine, and medicines food," as Hippocrates said [7].

The end of the twentieth century was marked by a large number of scientific discoveries and developments, including the creation of a scientific concept of functional nutrition. The concept of functional nutrition includes:

– Functional food - healthy food, positive nutrition, nutrition with healthy effects.

– Functional nutrition products (FNP) - natural or artificial products, additionally enriched with any biologically active component.

– Functional nutrition ingredients (FNI) - essential food components, ingredients with protective properties, regulatory food substances.

The idea of functional nutrition initially arose in Japan. There, along with existing specific products for pregnant, lactating, infants, and elderly, the concept of "Nutrition for specified health use" (NFSHU) was introduced at the legislative level [8-11].

This concept involves the inclusion in the composition of traditional diets of special functional nutrition that, in addition to satisfying their energy and plastic needs, are able to modulate (optimize) specific physiological functions, biochemical and behavioral reactions of a person, as well as its symbiotic microflora [3].

Throughout the entire period of human civilization, food was considered primarily as a means designed to satisfy feelings of hunger, appetite and taste. Correspondingly, inadequate eating habits became rooted, the diet of the main layer of the modern population became unbalanced, excessively fat, mainly due to saturated solid fats (40% of the ration at a rate of 25%), carbohydrate (over the last 100 years, sugar consumption increased 100 times), mainly due to liquid sugars, products made from fine flour, carbohydrate "dummies", purified, homogenized products [12]. Ecological problems of the twentieth century, "fascination" with pesticides, antibiotics and hormones in agriculture and animal husbandry, preservatives, nitrates in the production of products - all this led to a change in the properties of food. As a result, the epidemic began not infectious, but exchange-alimentary diseases. During the foreseeable past, the frequency of cardiovascular pathologies increased 10-12 times, endocrine disorders 5 times, autoimmune, allergic diseases, diabetes mellitus, atherosclerosis, arterial hypertension and other diseases of civilization began to occur. It has become quite obvious that official medicine and pharmacological science can not create effective methods for curing these diseases. Moreover, they can not even stop their growth. One of the pioneers who offered food and some of their components to replace pharmaceuticals is the Nobel Prize winner Linus Pauling, who in the middle of the last century founded the theory and practice that physical illness and mental illness can be cured not by medication, but by careful selection, constant use of optimal quantities of certain macro-microelements not synthesized by man [13].

The leader in the development of functional nutrition is Japan. This is the only country that legally defined the list of functional products, and the Japanese market of functional products is now one of the most advanced in the world. Therefore, the achievements of this country are often taken as a basis in Europe and the United States. This is the direction of preventive medicine and food biotechnology, which in the 21st century will create real prerequisites for an increase in the average life expectancy, long-term preservation of physical health, social and moral satisfaction, active life and the birth of a healthy generation.

The Japanese government established a certification system for functional food products in 1991. The new system was aimed at helping to promote the production of food products aimed at addressing serious health problems. The Japanese government recognizes functional nutrition as an alternative to drug therapy and defines it as a product of special use for maintaining health (NFSHU) and food products of special use for maintaining health [8-11]. Functional nutrition product is a food product with a purposefully changed chemical composition, which has a positive effect on one or several physiological functions of the body from the position of evidence-based medicine in the systematic daily use. The chemical composition of the food product is altered by additional enrichment determined by the functional food ingredient or by the removal (substitution) of the product component of the beneficial effect product on the body [12].

According to the Scientific Concept of Functional Nutrition in Europe, developed in 1995-1998, food products can only be assigned to FN if it is possible to demonstrate their positive effect on one or another key function human (in addition to traditional nutritional effects) and obtain strong objective evidence supporting these relationships [8-11, 14, 15].

In this respect, the products of FN should also be distinguished from biologically active supplements (dietary supplements) to food. The fundamental difference between FN from dietary supplements to food is the form in which the human body lacks functional ingredients and is delivered to human organs. If in the form of a drug or an additive similar to a drug for oral administration (tablets, capsules, powders, etc.), then it should be said about dietary supplements. If the functional ingredient enters the body in the form of a traditional nutritional product, then it is an FN. In addition, the concentration of the active functional principle in dietary supplements can generally be absent or significantly (sometimes tens of times) higher than the physiological requirements required, so they are usually administered by courses and taken for a certain time.

The concentrations of functional ingredients present in the products of FN and having a regulating effect on human functions and reactions are close to optimal, physiological, and therefore such products can be taken indefinitely, by all age groups of a healthy population [16].

A component of a product, a biologically active substance or a complex of biologically active substances derived from a food source or an identical live culture of probiotic microorganisms with a proven beneficial effect on one or more functions of the human body is defined as a food functional ingredient [17].

Enrichment of a food product with a functional nutrition ingredient should provide the claimed beneficial effect, and make up at least 15%, but not exceed the physiological requirement, with the manufacturer's recommended daily intake of this product. If the manufacturer positions the product as a health product, the content of the functional ingredient must match the declared parameters. To produce the product of FN, high-tech production, ecological clean and genetically unmodified material is used [18]. Cereals represent another alternative for the production of FN products. They can be used as enzymatic substrates for the growth of probiotic microorganisms as a source of non-digestible carbohydrates, contributing to the selective stimulation of the growth of lactobacilli and bifidobacteria. Cereals contain a water-soluble fiber, such as β-glucan and arabinoxylan, as well as oligosaccharides such as galacto- and fructo-oligosaccharides, and resistant starch. Starch can be used as a material for encapsulating probiotics in order to improve their storage stability and increase their viability when passing through unfavorable conditions of the gastrointestinal tract. Thus, cereals actually fulfill the function of prebiotics [19].

Recommendations for the use of FN products include the following list: regulation of immunity, lipid and carbohydrate metabolism, blood pressure, preventing the development of senile syndrome, improving sleep, memory, growth, development and sexual activity, as well as preventing and improving anemic conditions associated with nutritional deficiencies, protection of the liver from chemical damage, protection from radiation and mutagenic effects in order to enhance antitumor protection, etc.

Positive results from the use of enriched food products activated and created an entire industry of "healthy" FN in Japan and the United States. In the European Union each person can choose products not only to taste, but also specialized, aimed at solving certain health problems, such as juices for hypertensive people, chocolate for diabetics, cookies for myopic, etc. [20.3].

The development of this direction should be a priority task of modern preventive and restorative medicine, the implementation of which will allow to increase the average duration of active life in the 21st century with minimal economic costs, with a high level of physical and spiritual health. Already, 40% of North Americans and almost 32% of Western Europeans use the products of FN instead of traditional medicines. Although, currently, FN products constitute no more than 5% of all known food products, but according to forecasts, in the next 15 years their share will reach 30% of the total product market. At the same time, according to calculations of Japanese analysts in the most developed countries, they are replacing many official medications by 35-50% [21].

Probably the most probable part of the FN is probiotics. WHO defines probiotics as safe for humans live bacteria that inhibit the activity of pathogenic microorganisms and ensure the restoration of normal intestinal microflora. Normal human microflora - normoflora (symbiotic, resident, saprophytic, obligate anaerobes) performs a number of important functions in maintaining the vital activity of the body. The protective function is carried out primarily by bifido- and lactobacilli, due to their ability to suppress pathogenic bacteria and compete with them [22].

One of the most important functions of microorganisms of human normoflora is stimulation of the immune system. The most convincing evidence of the effectiveness of probiotics is related specifically to their use to improve bowel function and affect the immune system [23]. More than 80% of the functioning immune system is located in the human abdominal cavity in the form of an intestinal microflora. It forms the "second brain" of the body, having the competence to organize and confirm its comprehensive protection, including from pathogenic origins. It has been established that probiotic bacteria stimulate the immune system by increasing the number and increasing the activity of phagocytes, lymphocytes, production of immunoglobulins, interferon and bacteriocins. They increase the production of cytokines that unite the human immune system into a single whole. The totality of all populations of microorganisms inhabiting different biotopes of the body number about 1014 cells more than 1000 (thousand) trillions of symbiotic bacteria. This is 10-20 times more than the number of cells of the human body itself and weighs

about 3 kilograms. A significant part (more than 60%) of microflora inhabits different parts of the gastrointestinal tract (GIT): oropharyngeal 15-16%, skin-12%, vagina-9%, urogenital tract-2% [24].

Microecological aspects of the etiopathogenesis of modern diseases are based on the recognition that the symbiotic microflora is an integral part of the organism, its peculiar extracorporeal organ, which includes billions of microorganisms and fulfills a regulatory function [25, 3].

An analysis of the literature indicates that under natural habitats there is not a single biochemical process, not a single function of living organisms that would be carried out without direct or indirect involvement of symbiotic microorganisms, bacteria possessing the properties of probiotics [26, 27].

Probiotic from Greek - "pro" - "facilitating" and "bios" - "life" - "for life" or this concept was defined as an antonym of antibiotics, i.e. "Promoter of life."

Various kinds of bifidobacteria (Bifidobacterium longum, B. breve, B. infantis, B. bifidum, B. adolescentis, B. animalis), lactobacilli (L. acidophilus, L. casei, L. bulgaricus, L. gasseri) are used as probiotics. and other microorganisms (Lactococcus cremoris, L. lactis, Streptococcus thermophilus, Enterococcus faecium, Saccaharomyces boulardi - yeast antibiotic) [25, 28].

The mechanisms of action of probiotics are manifested on three levels of the organism: at the first level, probiotic bacteria inhibit the vital activity of pathogenic strains as a result of competition for nutrients.

On the second, probiotic bacteria interfere with adhesion or displace pathogenic microflora from adhesion receptors, preventing the translocation of intestinal pathogenic bacteria to the internal environment of the macroorganism.

An extremely important mechanism of action of probiotics is the third level involved in the activation of local and general immune responses [20, 28, 30].

Bifidobacteria and lactobacilli are the basic parietal and luminal intestinal microflora, they lining the intestinal mucosa in the form of a protective biofilm. This polysaccharide skeleton consists of polysaccharides of microbial cells and mucin. The thickness of the biofilm is 0.1-0.5 mm. It contains from several hundred to several thousand microcolonies.

Probiotics are most commonly used in gastroenterology, since intestinal microflora disorders are primarily associated with diseases of the digestive system.

Along with probiotics, there are two more terms - "symbiotics" and "prebiotics."

Symbiotics are combinations of several probiotics. It is considered effective at the expense of the total effect of the components.

Prebiotics are substrates stimulating the natural microflora that enter the body as part of the diet. They are not digested and not absorbed in the stomach and small intestine, and getting into the thick intestine are used as a nutrient medium for normoflora, contribute to the improvement of human normoflora due to selective stimulation of growth or active life of probiotic intestinal microflora [28, 31]. Biological effects of prebiotics are an increase in the number of useful anaerobic bacteria, an increase in calcium absorption, fecal volume, a decrease in the time of intestinal transit, and, probably, a decrease in the level of blood lipids.

The main prebiotics are: lactose of breast milk, inulin - polysaccharide contained in flower beds of dahlias, artichokes, dandelions, elements of cell membranes of plants of beets, carrots, pectins, bran, dietary fiber. Jerusalem artichoke flour contains fructooligosaccharides, which are not digested by digestive tract enzymes. In addition, prebiotics include monosaccharides (xylitol, sorbitol, raffinose), oligosaccharides (lactulose, soy oligosaccharide, fructo-oligosaccharide) and polysaccharides (pectins, dextrin, insulin).

Recently in Europe and Kazakhstan special attention is paid to mare's milk as a food product with therapeutic and prophylactic activity. In Europe, many farms have been created for the production of mare's milk. The leading of them is the German horse farm "Kurgestüt Hoher Odenwald" (Hans Zollmann), where not only sublimated (dried) milk is produced, but also various food products (milk porridge, drinks, baby food, ice cream, etc.) based on mare's milk. These food products are essentially functional, as mare's milk has a variety of therapeutic and prophylactic properties. The uniqueness of this product lies in the chemical composition of mare's milk. It contains about 40 biologically active components, the most important of them are vitamins A, C, B1, B2, B6, B12, amino acids, enzymes and trace elements [32], there are low molecular weight peptides, lactoalbumins and globulins. The mare's milk contains a high

level of polyunsaturated fatty acids and linolenic acid of the omega-3 family and has an immunostimulating effect [33].

Milk is recommended as a medical and dietary product, normalizing metabolism and improving health, slowing down the aging process. Milk is recommended for diseases of the immune system, the entire digestive system, including liver and peptic ulcer diseases, as well as oncological pathologies [34-36]. The therapeutic and dietary potential of mare's milk is not exhausted, and is being studied by our national scientists.

The main disadvantage of mare's milk was its instability, as it is rapidly oxidized under the influence of the environment and becomes unsuitable for use 2-3 hours after milking. It can not be boiled, but it loses all useful properties. Therefore, the mare's milk could not be used as a functional food, although in terms of its chemical composition and therapeutic and prophylactic properties it exceeds all other functional foods based on cow's milk.

Thankfully, because of modern high technology in the production of dairy products by the method of freeze-drying at a low temperature (down to -35 °C), it has become possible to store mare's milk for a long time without any preservatives. At the same time, all its useful therapeutic and dietary properties are preserved, repeating up to 80-85% the quality of freshly harvested mare's milk. In addition, the milk is simultaneously subjected to pasteurization and such mare's milk becomes safe for consumption.

Now in Kazakhstan, with the participation of the German company Kurgestüt Hoher Odenwald, a large-scale program for the production of freeze-dried mare's milk by entrepreneurs of Eurasia Invest Ltd LLP with a design capacity of up to 10 tons of freeze-dried mare's milk per year is being implemented. This fact is the main driver of development of production of functional food products in Kazakhstan with therapeutic and dietary and preventive properties.

Thus, at present, using modern innovative technologies, we can use the therapeutic and dietary potentials of mare's milk in the production of functional foods for the purpose of treating and preventing various diseases of internal organs. This direction can contribute to an increase in the average life expectancy, long-term preservation of physical health, active longevity and the birth of a healthy generation, as it was introduced in Japan at the end of the twentieth century - in a country that occupies a leading position on life expectancy in the world.

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БИЕ СҮТІ – ФУНКЦИОНАЛДЫҚ ТАҒАМ

Аннотация. Мақала функционалдық тағамды пайдаланудың негізгі мәселелері мен оның адам денсаулығын сақтау мен жақсартудағы ролі жайында жазылған. Функционалдық тағамдарды жасап шығару, оны өнеркәсіптік жолға қою және заманауи технологияларды пайдалана отырып одан әрі өркендету мақсатында әдеби шолу жасалған. Қазақстанда орта жасты және белсенді өмір сүру ұзақтығын ұзарту мақсатында бие сүтінің сублимацияланған ұнтақ түрін пайдалана отырып функционалдық тағам өндіруді дамыту жолдары көрсетілген.

Түйін сөздер: функционалдық тағам, өмір сүру ұзақтығы, бие сүті.

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КОБЫЛЬЕ МОЛОКО КАК ФУНКЦИОНАЛЬНОЕ ПИТАНИЕ

Аннотация. Статья посвящена актуальным вопросам применения функционального питания и его роли в сохранении и улучшении здоровья населения. Проведен литературный обзор по вопросам создания, производства и совершенствования функциональных продуктов питания, а также их дальнейшего развития с использованием современных инновационных технологий. Показано развитие функционального питания в Казахстане с использованием сублимированной формы кобыльего молока с целью увеличения средней продолжительности жизни и активного долголетия.

Ключевые слова: функциональное питание, продолжительность жизни, кобылье молоко.

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