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MODERN FOOD BIOTECHNOLOGY: MAIN PROBLEMS AND PROSPECTS

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Abstract: The article provides an analysis of the current state and prospects for the development of food biotechnology in the field of production and processing of livestock products and their importance in ensuring food security and health of the population in Ukraine and the world. It was determined that the following priority areas in this area are: increasing food safety; development of the theory and practice of personalized nutrition; creation of specialized food products with increased biological value and accessibility of components. In biotechnology today, microbial synthesis of biologically active substances is actively developing, the potential of any biological raw material, including secondary, is being used more fully. The steady development of food biotechnology is due to modern global challenges and is aimed at improving health through nutrition, the most efficient use of available natural resources and environmental protection.

Keywords: food biotechnology, technology of production and processing of livestock products, processing of livestock waste, meat industry, dairy industry, rational nutrition.

Introduction. In our country, intensive development of biotechnology began in the 1980s, when the first nationwide program on biotechnology was developed, qualified personnel were trained, and specialized laboratories and departments were organized. In 1985, the USSR ranked 2nd after the USA in terms of the level of development of biotechnology. However, in the 1990s, attention to biotechnology in

the country weakened, and research funding was reduced [13, 14].

The priorities in food biotechnology today are the production of food protein, in particular from low-value raw materials; enzyme preparations; prebiotics, probiotics and synbiotics; functional food products; therapeutic and preventive nutrition; food ingredients, biologically active substances, including vitamins and functional mixtures [2, 6].

Modern food biotechnology uses not only its traditional but also new forms, including genetic engineering, nanotechnology, bioinformatics, molecular biology, etc. Despite the presence of opponents, genetic engineering methods continue to create new biological species, and with their application new products, including vital ones, necessary for the treatment of serious diseases [2].

The importance of biotechnology in the development of the Ukrainian economy is difficult to overestimate. Modernization of the technological base of modern food production is impossible without the mass introduction of biotechnology. Biotechnology methods allow for the complete processing of waste from the agro-industrial complex, in a number of countries the very concept of "waste" has already ceased to exist [13].

Purpose of the study: Analysis of the current state and prospects for the development of food biotechnology in the field of production and processing of livestock products and their importance in ensuring food security and health of the population in Ukraine and the world.

Results and discussion. Let us consider the main tasks that determine the challenges of modern food biotechnology in the field of production and processing livestock products and their importance in ensuring food security and public health in Ukraine and the world.

Reducing the spread of nutritionally dependent (non-communicable) diseases associated with inadequate nutrition. The global nutritional community sets the main goals to stop the growth of obesity, diabetes incidence, and reduce mortality from cardiovascular diseases, which can be achieved through joint efforts of specialists in the field of nutrition and education, food production and the media with the support

of government authorities. According to WHO, since 1980 the number of people suffering from obesity has more than doubled and reached over 2 billion people. With an increase in body mass index by 5 units, the risk of stomach cancer increases by 52%, rectal cancer by 24%, and gallbladder cancer by 59%. The cost of medical care for overweight people is 25% higher than for people of normal weight [2, 6, 8].

The need for strict control of food safety, especially that obtained with the use of new biotechnologies [1, 3]. Unsafe foods cause more than 200 diseases, from diarrhea to cancer. 600 million people fall ill after eating contaminated food; 420 thousand people die every year; 40% of foodborne diseases occur in children under five years of age, with 12 thousand deaths annually. Every year, 550 million people fall ill from diarrheal diseases, and 230 thousand people die. With the introduction of new packaging materials, the globalization of the food market, and the use of new additives, new pollutants are discovered. Today, there is almost no assessment of the cumulative effect of pollutants. Special attention is paid to the safety of genetically modified products.

Development of technology for personalizing nutrition depending on the characteristics of metabolism or health status of a person [11]. Currently, personalization is carried out using both proteomic and metabolomic data and genetic studies. Creating a personalized diet is necessary for a healthy person to compensate for existing features genotype and the associated risks of disease development, as well as to provide tasty food to meet all physiological needs depending on its activity, age and other factors.

Creation of specialized food products for therapeutic, dietary, preventive, functional nutrition [2, 9]. Specialized products are intended for different categories of the population (athletes, lactating and pregnant women, the elderly, children, etc.) and are able to reduce the deficiency of various macro- and micronutrients, reducing the costs of treating socially significant diseases. These should be products for patients with phenylketonuria, homocystinuria, glutaric and isovaleric acidemia, tyrosinemia, products with a reduced protein content.

Increasing the objectivity of the assessment of sensory characteristics,

especially new types of food products. Research is being conducted in this area to "digitize" the sensations of taste, smell and consistency. They can be useful for people who are prescribed special diets. Such methods can improve control over the components entering the body, help reduce the amount of sugar and table salt consumed. Creation of a wide range of functional food products in a traditional form. The composition of, first of all, socially significant products should include food concentrates of BAS, which normalize metabolism, activate the work of individual body systems, fill the deficiency of nutrients, reduce the risk of developing diseases related to nutrition. The search is underway for plant antioxidants that normalize the body's ability to counteract free radicals caused by stress. The range of products is expanding with the replacement of milk proteins with plant proteins, with an increased concentration of unsaturated fatty acids. Products are needed for impaired swallowing, products for sensory stimulation as the most important component of restoring brain functions, for example, after a coma. Deciphering the mechanisms of molecular action of biologically active substances. New capabilities of analytical technology and chemistry should contribute to the growth of knowledge about molecular mechanisms of action of biologically active substances. Currently, experimental studies of various aspects of the interaction between biologically active natural small molecules and target proteins associated with specific diseases are being developed and optimized [3, 5, 9].

Development of food products without an expiration date with preservation of nutrients [7]. Preservation of nutrients for a long time is a request from the space industry and the army. These studies are mainly in the field of working with packaging material and new methods of processing products. It should be noted that some traditional foods, such as honey, sugar and starch, also have such qualities. However, nutrition that provides the full range of nutrients necessary for humans, while not losing its properties over time, has not yet been created.

Development of nutrigenomics as a tool for the influence of nutrition on genes [6]. Nutrigenomics will allow us to find explanations for how genetic differences affect different responses to nutrients. This area has great potential in preventing,

mitigating and even treating chronic diseases and some types of cancer through small changes in diet. The data obtained will allow preventing their development by identifying early markers of metabolic disorders and drawing up an individual nutrition plan.

Innovative approaches to ensuring food quality [1]. Today, at the genetic level, it is possible to sequence new generation products and create their "Molecular Fingerprints". New developments in the field of isothermal amplification will allow for more accurate determination of product types. At the protein level, specific biomarkers and peptides can be used. Breakthroughs in molecular biology have made it possible to form effective omics tools for determining the origin of food products and their path to the counter. One of the areas is the use of the so-called DNA barcoding. In the field of quality assessment, metabolomic analytical strategies based on nuclear magnetic resonance and mass spectrometry are promising. Production and use of peptides in food products. Increased interest in peptides (short protein fragments of 2–10 amino acids) in food biotechnology is caused by their important functions in the body, including as hormones, neurotransmitters, growth factors, ion channel ligands or anti-infective agents. Peptides are selective signaling molecules that bind to specific cell surface receptors, thereby triggering intracellular reactions. Given their attractive pharmacological profile, safety, good tolerability and efficacy, it is promising to use peptides as a basis for the development of new biologically active additives, functional food products and pharmaceuticals. Peptides can be used as geroprotectors, antioxidants, immunomodulators, prebiotics, antitumor agents, gene expression regulators.

World experience in obtaining bioactive peptides shows two main methods of their production: enzymatic and chemical hydrolysis. The high-temperature method of protein hydrolysis to obtain short peptides has proven its effectiveness. A new method is the synthesis of peptides in vitro in the presence of a catalyst (enzyme).

A promising source of peptides is milk proteins and fermented milk products, including whey proteins. Food products based on milk peptides have antioxidant, prebiotic and immunomodulatory properties, effective for the prevention of

oncological, cardiovascular and endocrine diseases [2, 3, 9].

Obtaining artificial meat (cellular meat). Traditional technologies in animal husbandry allow obtaining high-quality organic products, but they require high costs for keeping animals, long-term research aimed at improving economically valuable qualities, increasing their productivity, ensuring welfare, and creating stress-resistant animals suitable for industrial technology [4, 15-17].

An alternative is a new science-intensive direction, which consists in creating artificial meat in vitro based on stem cells from animals, without their cultivation and slaughter. This direction is relatively young, which supports an ethical attitude towards animals. An alternative to cultured meat is developments based on plant cell materials, which is largely due to the popularization of vegetarian diets. In the first case, meat is “grown in a test tube” using a nutrient medium, and in the second, “plants are turned into meat”. The technologies have some problems, the solutions of which should be worked on comprehensively. The main problem is the cost of production, which prevents scaling. The development of these technologies will free up huge areas adapted for pastures and forage crops, eliminate the production of compound feed, vaccines for animals, etc. [12].

Expansion of the range and improvement of the quality of dietary supplements for food [2, 10]. Dietary supplements have entered our lives relatively recently, giving rise to a new field of knowledge - pharmaconutrition. They are used to optimize carbohydrate, fat, protein, vitamin and other types of metabolism in various functional states of the body; to normalize and/or improve the functional state of organs and systems of the human body, including independently or as part of products that have a general strengthening, mild diuretic, tonic, sedative and other types of action in various functional states; to reduce the risk of diseases, normalize the microflora of the gastrointestinal tract, as enterosorbents, etc. Today, it is relevant to analyze the use of dietary supplements, the impact of their action on the human body, expand the range and increase the safety of their use.

Complex processing of secondary food raw materials [3, 8, 11]. These are large resources that remain after obtaining food products from primary raw materials. In

Ukraine, a large amount of waste from the processing of livestock products is generated annually in the food industry, from which important products can be obtained for further use. Dairy industry (skimmed milk, buttermilk, whey, etc.) - you can get dry protein, biologically active additives, lactose, lactic acid starters, condensed and food concentrates. Meat industry (blood plasma, skin, bones, internal organs of slaughter animals) - this is collagen, bioactive peptides, food and feed additives, nutrient media for microorganisms, fertilizers.

Conclusions. Research on the current state and prospects for the development of food biotechnology in the field of production and processing of livestock products has shown their important role in ensuring food security and health of the population in Ukraine and the world. Priority areas in this area are improving food safety, creating specialized food products with increased biological value and accessibility of components. It has been established that for new types and forms of food products it is rational to apply innovative approaches to quality assurance, to create mechanisms of increased objectivity for assessing sensory characteristics.

In the future, it is necessary to continue research into the human microbiome and its connection with the molecular mechanism of action of biologically active substances and nutrigenomics.

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