Current trends in the development of functional meat products to improve the nutritional status of the population

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Abstract. Among the many environmental factors, nutrition is an essential factor, regularly and exclusively multidisciplinary affecting the biological and social essence of the human body. A balanced diet is the essential condition for maintaining health, contributes to increasing the duration and quality of life of the population. The presence in meat products of such components as saturated fats, cholesterol, nitrites, salts hurts the health of consumers. In this regard, it is relevant to improve and improve the composition of processed meat products by developing products with a practical orientation with a healing effect.

1. Introduction
The meat products' market is developing rapidly. There is a growing trend in the production and consumption of meat products and semi-finished products, which is due to the modern way of life of consumers and the demand for ready-to-eat products. Despite the wide variety of food products, the range of products of therapeutic, prophylactic, and functional action is small, while the problem of unbalanced nutrition is relevant in modern society.

Reducing the content of fat, cholesterol, sodium chloride, and nitrites, as well as improving the profile of fatty acids and the inclusion of biologically active compounds – these are the main directions for creating enriched meat products.

Active research is underway to develop meat products with the desired properties; their positive effect on consumer health is being studied [1–6].

Introduction to the diet of meat products with a balanced composition can improve the nutritional status and health of children, adolescents, and gerontological groups of the population with special needs for nutrients.

2. Use of dietary fiber
In order to enrich meat products with dietary fiber, various dietary fibers are added to them. In particular, plant foods rich in fiber, secondary products of processing plant materials and purified preparations of dietary fiber are used [7].

The authors studied the consumer characteristics of chicken sausages with the addition of up to 3 % fiber obtained from sugar cane, which is a by-product of the processing of this culture.
Compared with the control sample, a sample with an addition of 3 % had a higher yield – up to 97.52 %, the total phenol content increased from 25.43 to 57.09 mg/100 g, antiradical activity – from 28.11 to 60, 72 %, while the degree of oxidation of lipids decreased from 0.535 to 0.428 mg of malondialdehyde.

It should be noted the increased nutritional value and high consumer properties of chicken sausages with the inclusion of sugarcane fiber [8].

The authors of the following work determined the possibility of partial replacement of beef meat in sausage technology with barley beta-glucan concentrate, carrot fiber, and their mixture.

The results showed that the addition of dietary fiber leads to a decrease in protein content and an increase in humidity, and does not significantly affect the color parameters.

Sausages made from a mixture of dietary fiber with a reduced content of beef can be classified as functional products [9].

The purpose of the following studies was to evaluate the quality of low-fat fermented sausages from buffalo meat supplemented with wheat fiber.

Semi-dry fermented sausage with the addition of 1.5 % wheat fiber is presented as a promising new product for the consumer market with microbiological stability (low pH), improved nutritional value (low fat, dietary fiber), high technological and sensory characteristics [7].

3. Use of berries, vegetables, fruits and products of their processing

Colorectal cancer is a common disease in Europe. In order to reduce the incidence of this disease, various preventive measures are being studied, one of which is food rich in anthocyanins.

Anthocyanins are powerful antioxidant flavonoids found in fruits and vegetables. These nutraceuticals have various biological functions in the human body, including immunomodulatory, anti-inflammatory, and anti-tumor functions. A colorectal cancer nutritional model has been developed and tested in animal nutrition. In this model, animals were injected with azoxymethane and sodium dextran sulfate.

For 20 weeks, they were fed typical food (control group) and functional sausages containing 0.1 % anthocyanins obtained from blackberries and strawberries.

After the level of antioxidants in the plasma and tissues of the digestive tract of animals was analyzed.

The results revealed a statistically significant decrease in the number of colon tumors and an increase in the total antioxidant activity in animals fed on functional sausages compared to control animals.

A study of the microbiota of the large intestine showed a significant reduction in the populations of Bilophila Wadsworth.

Thus, functional meat products enriched in anthocyanins can be an effective strategy for the prevention of inflammatory diseases of the digestive system and colorectal cancer in humans [10].

The grape squeeze is a source of food coloring, as well as substances with a preservative effect, contains dietary fiber, unsaturated fatty acids, antioxidants, and minerals. The authors propose the use of oilcake preparations in the technology of meat products to increase nutritional value and improve technological properties [11].

Powdered extract of sea buckthorn fruit and pumpkin seeds can be used for producing a new functional product from horse meat. The need to include these plants is associated with the natural biologically active substances contained in them, which have the potential to improve the oxidative stability of pigments and lipids.

This article aimed to study the effect of extracts in two concentrations (0.5 and 1.0 %) in the technology of gourmet cooked smoked products from horse meat on the quality and oxidative stability during storage.

It was found that the addition of extracts in an amount of 1 % improves the stability to oxidation of the functional delicacy of horse meat and allows saving sensory and color characteristics [12].
Due to its nutritional composition, algae are a valuable resource for expanding the range of food products. They are rich in protein, vitamins, minerals, and dietary fiber, and especially soluble fiber [5, 13].

The possibility of correcting iodine deficiency by introducing functional meat products containing various sources of organic and mineral iodine into the diet was studied.

One of the most accessible sources of organic iodine is algae, which also contains a molecular iodine synergist – selenium, which is actively involved in the production of thyroid hormones. In algae, the ratio of iodine: selenium is 1.0: 0.7, which is optimal for the synthesis of the hormone thyroxine and triiodothyronine. The authors of the article developed the technology of meat products using algae to reduce the risk of goiter diseases [13].

The article presents the production technology of cooked sausages using emulsion based on a pumpkin puree.

Calculation of amino acid scores showed that the experimental samples were as balanced as possible in terms of amino acid composition, while in the control sample, valine, threonine, and lysine were limiting.

Studies have confirmed that the emulsion in the formulation of a meat product can reduce its cost and at the same time, preserve the nutritional properties and biological value of the finished product [14].

The authors' study included an assessment of the effect of chopped raw carrots and mashed sweet potatoes, used as functional ingredients, on the consumer characteristics of chicken products (nuggets). Products were evaluated by physicochemical, sensory indicators, and nutritional value.

It was found that the addition of carrots and sweet potatoes leads to improved nutritional value and gives the products a practical orientation due to the presence of dietary fiber and β-carotene.

It was found that the additive is useful for obtaining products with high yield and stable emulsion.

There were differences between product samples in terms of sensory qualities; samples supplemented with 10% carrots / sweet potatoes had higher acceptability rates [15].

In the next study, carrot powder, which was included in sausages, was used as a functional ingredient.

A high content of fiber, chlorogenic acid, carotenoids in the ingredient used was found. The additive studied demonstrated adequate sensory acceptability, and the content of carotenoids and phenols remained stable during storage. The research results showed that carrot powder could be used as a functional ingredient in sausage recipes to increase the content of nutraceuticals [16].

The study was conducted to assess the potential of three plant ingredients, namely cabbage powder, red bean powder, and orange pulp. These herbal ingredients have been the source of natural antioxidants and dietary fiber for the preparation of functional meat products from mutton.

Herbal ingredients were included by replacing meat in product formulations. It was found that mutton products with additives are characterized by a long shelf life without noticeable deterioration in physicochemical, microbiological, and sensory qualities. Products were distinguished by a high content of fiber and mineral components [17].

4. Use of bean, grain groups, and products of their processing

Cereal polysaccharides, as a source of dietary fiber, are essential for the prevention of various diseases.

The use of grain processing products in the technology of combined meat products allows creating a product of stable quality. This result is based on increasing the nutritional and biological value of products, and technology that promotes a stable and even distribution of ingredients.

This study examined the effect of rye bran and collagen, used as a partial replacement for fat on the quality of sausages.

It is proved that the inclusion of collagen and rye bran allows changing the technological and sensory characteristics of products, and is promising as a fat substitute in the technology of processed meat products [18].
The work aimed to study the possibility of replacing starch cassava (tapioca) in meatballs technology with rice bran to improve functional qualities.

Rice bran has antioxidant activity, which depends on the variety and growing conditions. The authors of the study determined the antioxidant activity of the extract obtained from untreated rice bran and studied the effectiveness of using bran to improve the functional qualities of meat products.

The results of the study showed that the best substitute is Serang rice bran at a concentration of 50 %. Excellent organoleptic characteristics distinguished products.

The use of rice bran led to an increase in antioxidant activity up to 35.78 %, total phenol – up to 90.81 mg / 100 g [19].

The increasing importance of legumes and oilseeds in the production of functional foods is associated with high protein content in them.

The authors’ article discusses the possibility of solving the problem of deficiency of essential amino acids, iodine, and selenium by creating products enriched with these components.

The technology of sausages has been developed, which contains a special additive, which is a mixture of chickpeas and wheat.

The article presents the results of the organoleptic evaluation, the content of nutrient components, including iodine, selenium, and the calculation of the amino acid composition.

It was established that the developed products have a more balanced amino acid composition, an increased content of dietary fiber, and mineral components.

As a result of the study, the optimal dose of the supplement was determined. The best biological values of the products were achieved by adding 15 % of the plant component, containing extruded chickpeas and wheat in a 2: 1 ratio, previously germinated in solutions of potassium iodide and sodium selenite [20].

In the next work, oat and barley flour, potatoes, textured soy protein, and whey protein concentrate were used replacing meat in chicken products.

The experimental samples showed a high content of dietary fiber, iron, copper, zinc, and lower cholesterol, compared with the control. Based on the results, a product with an additive of two types of flour was recognized as the most acceptable and accepted as a functional product [21].

Wheat is a valuable crop. The use of germinated wheat grain is due to the high content of essential amino acids, high extractives, enzymatic, and vitamin activity, as well as the presence of dietary fiber.

A group of authors researched the creation of new types of meat and vegetable semi-finished products based on cereal crops. At the initial stage, the kinetics of the germination of cereal crops was studied.

A comparative analysis of the amino acid composition of grains and wheat germ showed that the average amino acid content in sprouts is 25 % higher than in grains. The results obtained allow recommending the use of such plant materials in the production technology of functional meat and vegetable products.

When designing and developing a new formulation, the principle of obtaining a finished product balanced in amino acid composition was used. Based on these results, a composition was developed that was as balanced as possible in terms of amino acid composition [22].

In the next work, the authors considered the possibility of developing semi-finished meat products adapted for hero-diet based on meat and vegetable mincemeats, in which germinated wheat grain and dairy wheat flour were used as vegetable additives.

As a result of the analyzes, cutlets containing germinated wheat grain – 30 % and cutlets containing wallpaper wheat flour – 26 % were selected.

The developed semi-finished products had high consumer properties, contained proteins of animal and vegetable origin, valuable for the elderly and the elderly. At the same time, the proportion of animal protein in experimental samples with the addition of germinated wheat grain and wheat flour is lower than in the control sample and is closer to the requirement for the ratio of different proteins in the diet of this population category. Developed semi-finished products contain minerals, including calcium, which is necessary for the prevention of osteoporosis [23].
5. Conclusion
Nutrition is a complex and multifaceted problem. Its main goal is to ensure the growth and development of the child's body, maximum performance, and well-being in adulthood, health, and longevity in the elderly and senile. At the same time, nutrition is a source of aesthetic pleasure and a significant healing factor.

This article provides an overview of studies published in recent years on the enrichment of meat products, discusses current trends aimed at the development and production of functional meat products.

In the presented works, key functional components were selected: dietary fiber, minerals, vitamins, plant antioxidants. Principal components were selected depending on the quality characteristics of the finished product. When choosing, special attention was paid to the effect of substances on human health.

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