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FUNCTIONAL MODULAR COMPOSITION FOR THE USE OF MEAT PRODUCTS FROM INULIN-CONTAINING RAW MATERIALS
ФУНКЦІОНАЛЬНА МОДУЛЬНА КОМПОЗИЦІЯ ДЛЯ ВИКОРИСТАННЯ М'ЯСНИХ ПРОДУКТІВ З ІНУЛІНВМІСТИМОЮ СИРОВИНОЮ

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Abstract. *The shortage and high cost of high-quality meat raw materials, on the one hand, and the lack of animal protein in diets, on the other, initiated the emergence and rapid development of a new direction in food production. It consists of a combination of potential food resources of plant and animal origin, formed on the basis of the processing industries of the agro-industrial complex, and is aimed at developing a new generation of food products with the implementation of the principles of food combinatorics. The developed functional composite mixture can be successfully used in the technology of a wide range of minced products, including enriched and preventive products for the general population, including children, the elderly, etc. The conducted economic calculations confirm the effectiveness and expediency of the proposed technological solutions at the level of profitability of the production of new products of 22.18%.*

Key words: *inulin, Jerusalem artichoke, hawthorn flour, animal protein, modular compositions, single minced meat, meat loaves.*

Currently, the development of multifunctional additives, including prebiotic ones, based on modular composites enriched with physiologically active ingredients in the composition of various types of phytoraw materials is relevant. In this aspect, special attention is paid to Jerusalem artichoke processing products.

The purpose of the work is to develop recommendations for expanding the range of enriched emulsified meat products using modular compositions based on plant and animal raw materials. Dried Jerusalem artichoke concentrate is a high-tech form for complex enrichment of products with inulin concentrate in a complex with proteins, macro- and microelements, including biogenic ones - potassium, phosphorus, silicon, magnesium, as well as vitamins B1, B2, C [1]. The protein composition of the product is characterized by a variety of amino acids, including essential ones: arginine, valine, histidine, isoleucine, leucine, lysine, methionine, threonine, tryptophan, phenylalanine.



Jerusalem artichoke concentrate is a dry product of the processing of Jerusalem artichoke tubers according to patent protection technologies while maintaining the properties of physiologically active components of the original plant material. The product is recommended for patients with diabetes mellitus, people with diseases of the cardiovascular system, with lipid metabolism disorders and to ensure the immune status of the body.

Hawthorn fruit powder was chosen as another phytoproduct for the complex enrichment of meat products. It enhances blood circulation in the vessels of the brain, dilates the vessels of internal organs, thereby lowering blood pressure, normalizes sleep, calms, normalizes sleep, and also normalizes the work of the most important organ in the human body - the heart. The healing qualities of hawthorn are used in the treatment of heart failure (especially in older people with impaired blood circulation of the coronary vessels). The impact of hawthorn is expressed in the improvement of the general condition, especially in elderly patients, the disappearance of fear of a heart attack and a decrease in irritability. In addition, hawthorn fruits contain selenium, which has anti-cancer properties and enhances the body's immunity, hawthorn is also useful for people suffering from myopia, as it acts as a source of carotene, as well as vitamin C. There is a positive experience of using whole-ground hawthorn flour for the production of enriched bakery and confectionery [2-4].

TIPRO 601 from Scanflavour AS (Denmark) was used as a functional animal protein in the development of a modular composition with phyto raw materials, as it has proven itself in the production of a wide range of emulsified products (boiled sausages, sausages, sausages, meat loaves, pates); semi-smoked, boiled-smoked sausages; whole-muscle products from pork, beef and poultry; chopped semi-finished products. The protein preparation was obtained from pork skin by successive implementation of thermal (degassing, dehydration) and mechanical (grinding) processes; helps to improve the consistency, juiciness and presentation of meat products; stabilizing and increasing the stability of minced emulsions; reducing the formation of broth-fat edema in combination with low-grade meat raw materials in order to improve the structure and functional and technological properties of meat emulsions, increase the biological value of finished products; in combination with fat-containing raw materials (raw fat, bacon and others) to stabilize the functional and quality characteristics of meat raw materials; increase the yield of finished products [5].

Within the framework of this goal, the following tasks were solved:

- selection of ratios of vegetable and animal ingredients to create a functional composite mixture in relation to the technology of emulsified meat products;
- assessment of the functional and technological properties of functional mixtures based on plant composites and animal protein;
- substantiation of rational recipe decisions for production emulsified products on the example of meat loaves using functional modular composition.

We have conducted research on the effect of the ratio of prescription ingredients in the composition of functional mixtures on their functional technological indicators. The ratios of Jerusalem artichoke powder (PT) : animal protein "TIPRO 601" (ZHB) : hawthorn flour were used (MB) equal 1:1:0,3; 0,5:2:0,5, 1,5:1,5:1, 2:0,5:1,5.



In the technology of meat products, the most significant parameters are the so-called functional and technological indicators: moisture-binding and water-retaining and fat-retaining capacity of meat systems. Therefore, we studied the effect of the mass fraction of the composite mixture on the FCS of model minced meat.

Table 1 - Effect of ingredient ratios on moisture and fat retention ability of functional compositions. Provocative testing of small pieces of wheat bread($n=3, p \leq 0,05$)

Correlation of ingredients (PT):(ZHB):(MB)	VSS, gramme of water / gramme of composition	ZHUS, gramme of butter / gramme of composition
0,5:2,0:0,5	5,15 5,36	5,15 5,36
1,0:1,0:0,3	1,95	4,12
1,5:1,5:1,0	2,34	3,24
2:0,5:1,5	3,48	

At the first stage, the functional and technological properties of model minced meats of the composition were studied: beef - pork of a single-grade trimming in a ratio of 1:1 with a mass fraction of composite mixtures in an amount from 0 to 20% with a degree of hydration of 1:1 - 1:10. Minced meat of a similar composition without the use of functional additives acted as a control object. Based on a series of preliminary experiments, functional composition 1 was chosen with a ratio of components (0.5:2.0:0.5) and a hydromodule of 1:3.

When the hydromodulus exceeds 1:3, excessive dilution of minced meat occurs, which affects the decrease in all functional and technological indicators of meat systems. The maximum values are achieved with the introduction of a functional composition in an amount of 10-15% in minced meat instead of the main raw material and are 70.6-71.5%, 64.7-66.1%, respectively.

To study the interaction of various prescription components that affect the functional and technological properties of minced meat, mathematical planning of the experiment was applied.

Taking into account the results of the conducted studies of a technological nature, as well as the development trends of the regional industry base for production of livestock products, in particular, the prospects for the use of rabbit meat in the formulations of products of mass consumer demand [6, 7], as factors affecting the functional and technological properties of minced meat, the following are selected: X1 – mass fraction of mechanically deboned rabbit meat, % of masses of the main meat raw materials; X2 – mass fraction of the introduced hydrated composite mixture, % from the mass of raw meat.

When processing the results of the experiment, the following statistical criteria were applied: checking the homogeneity of variances - the Cochran test, the significance of the coefficients of the regression equations - Student's test, the adequacy of the regression equations - Fisher's test. The following output parameters were chosen as the criterion for evaluating the effect of various amounts of prescription components on the quality of the finished product: Y1 - VSS, %; Y2 - ZHUS, %.



As a result of statistical processing of experimental data, regression equations were obtained that adequately describe the influence of the studied factors on the selected output parameters: $Y1 = 80,407 + 5,262X1 - 2,096X2 - 0,9X1X2 + 24,828 X1 - 18,189 X2$; $Y2 = 75,25 + 2,802X1 - 0,396X2 + 11,158 X1 - 8,140 X2$

Rational values of parameters of input factors for minced meat correspond to the following values: $X1 = 5,96 \%$; $X2 = 10,2 \%$.

The development of experimental batches of meat loaves using a functional composite mixture was carried out in the technological laboratory of the department of grub technologies for the production and standardization of grub products of the ZVO "PDU". Experimental products were produced in accordance with the traditional technological scheme for the production of meat loaves [8].

The results obtained make it possible to positively evaluate the prospects for using a composite mixture based on ingredients of plant and animal origin in the composition of minced meat for meat loaves. The output of sausage products increased up to 115%. Protein quality assessment indicates the high biological value of the developed products, since they are characterized by a balanced amino acid composition and are close to the ideal protein according to the scale recommended by FAO/WHO.

Conclusions.

Thus, the developed functional composite mixture can be successfully used in the technology of a wide range of minced products, including enriched and preventive products for the general population, including children, the elderly, etc. The conducted economic calculations confirm the effectiveness and feasibility of the proposed technological solutions at the level of profitability of production of new products of 22.18%.

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Дефіцит та висока вартість високоякісної м'ясної сировини, з одного боку, та дефіцит тваринного білка у харчових раціонах, з іншого, тиніціювали виникнення та швидкий розвиток нового напрямку у виробництві їжі. Воно складається з комбінування потенційних харчових ресурсів рослинного та тваринного походження, що формуються на базі переробних галузей АПК, і спрямоване на розробку продуктів харчування нового покоління з реалізацією принципів харчової комбінаторики. Розроблена функціональна композитна суміш може бути успішно використана у технології фаршових виробів широкого асортименту, включаючи збагачені та профілактичні продукти для широких верств населення, у тому числі дітей, людей похилого віку тощо. Проведені економічні розрахунки підтверджують ефективність та доцільність пропонованих технологічних рішень при рівні рентабельності виробництва нових продуктів 22,18%.

Ключові слова: інулін, топінамбур, борошно глоду, тваринний білок, модульні композиції, єдиний фарш, м'ясні хліби.