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Biotechnological Aspects In The Development Of Functional Food Products.

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ABSTRACT

For a more complete use of blood as a raw material for the production of food, a method for reducing the intensity of blood color is proposed. This blood is used further for the production of blood-fat emulsions. The use of the proposed emulsions in food technology ensures the saving of meat resources, allows significantly reducing the cost of the final product and enriching the products with easily digestible home iron. The technology is simple, economical and environmentally friendly, provides a wide range of products with a pronounced functional orientation and excellent organoleptic and physic-chemical characteristics. The developed products are recommended for nutrition of adults and children requiring additional amounts of iron.

Keywords: functional food, an anemic products, amino acid composition, daily requirement, digestibility of proteins.

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INTRODUCTION

The transition to market relations and related complex economic processes led to an increase in prices for basic food products, including meat products. Therefore, the level of their consumption has decreased. And now the scientists of the industry face a difficult problem - to help enterprises develop the production of inexpensive, high-quality, delicious products.

Meat industry has considerable resources of inexpensive animal protein, contained in the blood of slaughter animals. There are many reasons why this blood is not used in factories for production. Among them - the considerable laboriousness of the processes of collection and processing of food, the low organoleptic characteristics of such products and low prices for them. To interest enterprises in the production of such products, the technological chain of collection - processing of food-grade blood should be freed as much as possible from labor-intensive, technologically unprofitable processes. In addition, it is necessary to improve the quality of the final product [6-12].

One of the serious limitations in the use of blood in the production of various types of meat products is the characteristic red color, due to the presence of heme in the protein hemoglobin. In order to create conditions for more complete involvement of blood as a raw material for food production, research has been conducted in several countries on the development of methods for its decolorization. It was proposed mainly chemical methods of processing, providing for the separation of heme from the protein globin, as well as the method of oxidation of iron ions contained in the heme. The application of these methods is associated not only with the complexity of implementation, but also with the deterioration of the quality of meat products, especially developed with the use of bleached blood by the oxidation of iron ions of heme [1, 5].

RESULTS AND DISCUSSION

The authors proposed a method for reducing the intensity of blood staining, due to the use of blood-fat emulsions. As a fat raw material, raw fat (mainly porcine) was used. The fraction of blood in the emulsion varied from 10 to 45%. To ensure the stability and stability of the emulsion, it was thoroughly homogenized. The resulting color emulsion is identical to the color of beef wursts on the cut (the proportion of blood in the emulsion should not exceed 30%), so introducing it into the stuffing does not impair the color of the finished product. It has a high emulsifying ability (100%) at a temperature of 0-4 ° C and does not separate for 48 hours. A comparative study of the chemical composition of the blood-fat emulsion and bold pork showed insignificant differences. The most noticeable were the content of iron ions, which is 1.6-2.6 times higher in blood-fat emulsions (depending on the content of the mass fraction of blood). The similarity of the chemical composition suggested the possibility of using blood-fat emulsions in place of meat raw materials in minced systems.

It should be noted that in this case the finished product is enriched with heme iron, which is important for consumers with a low hemoglobin level in the blood and creates conditions for the production of meat products having anti-anemic effects. The use of blood-fat emulsions simultaneously allows to significantly improve the structural and mechanical characteristics of the finished product. The characteristics of the minced meat of boiled sausages according to the structural-mechanical parameters are presented in Table 1.

Table 1: Results of studying the characteristics of minced meat boiled sausages

Samples of sausages	Moisture contents, %		Stickiness, Pa	Viscosity, Pa•s	Shearing stress, kPa
	a common	related			
With a blood-fat emulsion (30%)	65,8	86,5	22,41	283,4	37,1
Control	64,6	84,6	20,54	217,9	42,38

The obtained data indicate that the minced meat of boiled sausage with a blood-fat emulsion is characterized by an increased content of bound moisture, better adhesion characteristics and greater

tenderness. The yield and nutritional value of boiled sausages produced with the use of a blood-fat emulsion instead of meat raw materials practically do not have any appreciable differences from the control samples and are 120.6 and 122.3%, respectively. Selection of meat raw materials was carried out using computer simulation methods. In addition, the use of milk protein was provided, which makes it possible to ensure the rational use of meat raw materials and a high amino acid balance. In addition, biologically active components were introduced, which ensure the enrichment of the product with digestible iron. Considering the importance for healthy nutrition of ballast substances, various cereals were used in the composition of the product. In addition to the use of cooked sausages in the technology, the use of food blood for slaughter animals seems promising in the production of brawn. The result of our work is a product balanced by amino acid composition, obtained by means of methods of mathematical modeling [2]. Correction of the introduction of food in the formulation was carried out after studying the gel-forming ability of the suspension. The main indicators of the nutritional value of the finished products (sausages "Juicy", "Appetizing" and "Blood jelly ") with an optimally selected ratio of the mass fraction of the formulation components are presented in Table 2.

Table 2: Chemical composition of the developed meat products

Index	Content, %		
	Sausages "Juicy"	Sausages "Appetizing"	«Blood jelly»
Moisture	57,89	62,37	59,84
Protein	15,53	13,71	21,34
Fat	17,10	18,59	13,70
Carbohydrates	7,19	5,53	0,42
Energy value, kcal	301,15	297,52	210,13

As can be seen from table 2, the ratio of protein and fat in the developed sausages is 0.83 -0.92. This corresponds to the medico-biological requirements for children's nutrition and allows recommending them for inclusion in the diet of children of preschool and school age [3]. The chemical composition of "Blood jelly" corresponds to the biomedical requirements for functional nutrition. Comparative characteristics of the amino acid composition of anti-anemic products and ideal protein showed that the developed products have a good amino acid balance. The minimum and maximum speedy sausages are "Juicy" and "Mouthwatering" are respectively of 0.46 and 0.96; of 0.41 and 0.86, "Blood jelly" - of 0.52 and 0.80. The main indicator of the biological value of a food product is its digestibility by digestive proteolytic enzymes. The study of the degree of protein digestibility in the developed products showed that the degree of digestibility of sausages "Juicy" and "Appetizing" is higher than the digestibility of milk protein by 1.3–4.1% and slightly lower (11.1–13.9 %) of egg white. The degree of digestibility of "Blood jelly" is 2.1% higher than the digestibility of milk protein and 13.1% lower than egg protein. This is due to the presence of a significant amount of ballast substances in jelly, which have a positive effect on digestion, although they reduce the digestibility of the product. Data of mineral, vitamin composition of sausages "Juicy", "Appetizing" and "Blood jelly", as well as the degree of satisfaction of daily needs in trace elements are presented in Table 3.

Table 3: Microelement composition of the developed products

Index	Content in 100 g of product / (degree of satisfaction of daily requirements, %)		
	Sausages "Juicy"	Sausages "Appetizing"	«Blood jelly»
Vitamins, mg			
A	0,0476 / (8,0)	0,065 / (13,0)	1,64 / (18,0)
B ₁	0,28 / (20,0)	0,28 / (20,0)	0,23 / (21,0)
B ₂	0,23 / (14,3)	0,16 / (10,0)	0,55 / (28,6)
PP	0,48 / (3,6)	1,83 / (3,6)	3,59 / (14,8)
Mineral substances, mg			
Potassium	310,35 / (12,3)	285,13 / (13,5)	231,82 / (10,3)
Sodium	307,70 / (8,9)	256,15 / (8,6)	265,92 / (7,9)
Calcium	140,85 / (9,6)	251,93 / (16,8)	240,85 / (15,9)
Magnesium	41,33 / (18,6)	34,15 / (15,4)	20,00 / (9,3)
Phosphorus	208,35 / (13,8)	211,36 / (14,0)	225,30 / (15,8)
Iron	28,17 / (61,2)	18,81 / (38,6)	20,09 / (57,2)

From the data in Table 3, it can be seen that the degree of satisfaction of the daily demand for basic microelements (100 g of product) does not exceed 20-30%, which corresponds to the requirements for functional foods. The exception is iron, the degree of satisfaction of the daily requirement for which is about 60%, which ensures rapid correction of iron deficiency states. To assess the consumer appeal, the color characteristics of the products were examined in comparison with the traditional products - sausage of boiled first class and jelly traditional. As a result, it has been established that the shades of the products and control samples are practically identical; therefore, the developed products have a traditional, attractive color to the consumer. And during the whole period of storage there are no significant changes in the color characteristics of the product. The results of the research made it possible to recommend storage times for "Blood jelly" and boiled sausages at a temperature of up to 8 ° C for no more than 5 days. During storage at -12 ° C there was no microbiological, as well as oxidative damage to the product, which allowed setting the period of their storage - 45 days.

The composition of the developed products includes the blood of slaughter animals, which determines the anti-anemic properties of the product. The anti-anemic properties of the products were studied on white male rats with an initial mass of 180-220 g, for which anemia was artificially induced (within 14 days the iron was completely excluded from the diet). After that the experimental group of animals received sausages and "Blood jelly" within the diet for 28 days, the vivarium diet served as the control.

CONCLUSION

The data of the carried out researches allow to attribute developed products to potentially effective products of anti-anemic purpose. The following mode of application of the created products is recommended: for the prevention of anemia - 50-100 g twice a week, for therapeutic nutrition - 100 g per week for 4-6 weeks.

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