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Using Emulsions Based On Animal Blood For Enrichment Meat Products With Organic Iron.

Anna Alexandrovna Khramchenko[1]*, Anastasia Vasilevna Strizhenko[2], Olga Viktorovna Kosenko[2], and Larisa Nikolaevna Shubina[2].

[1]Kuban State Agrarian University named after I.T. Trubilin, 13 Kalinina str., Krasnodar 350044, Russia.
[2]Russian university of cooperation, Krasnodar Cooperative Institute (branch), Mitrofana Sedina str., 168/1, Krasnodar 350015, Russia.

ABSTRACT

Iron lacking into the human body causes a violation of vital functions and leads to various diseases. Presence into animal blood significant quantities an organic iron determines the prospects its use in preventive food for people with iron deficiency anemia diseases. Serious restriction of using blood into production various meat products is a characteristic red color associated with presence in hemoglobin the protein the iron-containing component - heme. Authors proposes using an emulsions based on food blood into meat products, which provides a wide range of products with a pronounced functional orientation and excellent organoleptic and physicochemical characteristics. Experiments were carried out in the research laboratories of the department of technology of production and processing of agricultural products, as well as in the accredited educational and scientific testing laboratory of the Stavropol State Agrarian University and the department of technology of animal products of the Voronezh State University of Engineering Technologies. Research objects were pig blood stabilized by sodium pyrophosphate, cattle blood, and sausages. Quality of finished products was assessed by physicochemical, organoleptic and microbiological indicators according to generally accepted methods. Proportion of blood into emulsion ranged from 10 to 45%. Careful homogenization ensured stability and durability of the resulting emulsion. Emulsifying ability of the developed emulsion is 100% by temperature of 0-4 °C and stable for 48 hours. This technological solution will make it possible to enrich finished product with heme iron, which is important for consumers with a low level of hemoglobin in the blood and creates conditions for production the meat products with antianemic effect.

Keywords: antianemic products, functional nutrition, amino acid composition, protein digestibility.

Corresponding author

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INTRODUCTION

The meat industry has substantial resources for high-quality, low-cost protein, including that contained in the blood of farm animals. However, there are a number of reasons why blood is practically not used for food production. The main one is the high labor intensity of the process of collection and processing, the specific organoleptic characteristics of blood products and, as a result, low prices. Thus, in order for enterprises to be interested in the production of products using blood, the technological chain should be simplified as much as possible at the expense of liberation from technologically unprofitable processes. In this case, a separate task is the need to improve the quality of the final product [1, 3, 6, 11].

A serious restriction on the use of blood in the production of various meat products is the characteristic red color associated with the presence in the hemoglobin protein of the iron-containing component - heme. For a greater involvement of the slaughter blood as a food raw material, research has been conducted in various countries to find ways to bleach it [7, 8, 10]. The proposed methods of treatment are mainly chemical, and in their essence provide for the separation of heme and globin protein, as well as the oxidation of iron ions contained in heme. However, the application of these methods will not only complicate the process, but also lead to a deterioration in the quality of meat products, especially in bleaching blood by oxidizing heme iron [1, 4, 5, 12].

MATERIAL AND METHODS

The quality of finished products was assessed by physico-chemical, organoleptic and microbiological indicators according to generally accepted methods.

The objects of research were pig blood, stabilized by sodium pyrophosphate, cattle blood and sausages.

Mass fractions of vitamins and minerals were determined according to the procedure [7, 9] using an AAS-703 atomic absorption spectrophotometer.

The hemolysis of uniform elements was carried out by adding 1 cm^3 of chemical reagent to 1 cm^3 of PE. Then, 0.25 cm^3 of the mixture was taken and diluted with physiological solution 84 times. After mixing, the optical density was measured on a photo-electrocolorimeter at a wavelength of 670 nm.

RESULTS AND DISCUSSION

A method is proposed for reducing the intensity of blood color due to its use in a blood emulsion. Pork fat raw was used as a fat base. The proportion of blood in the emulsion ranged from 10 to 45%. Careful homogenization ensured stability and durability of the resulting emulsion. The color of the emulsion is identical to the color on the cut of beef sausages. At the same time to prevent deterioration of the color of the finished product, the mass fraction of blood in the emulsion should not exceed 30%. The emulsifying capacity of the developed emulsion is 100% at a temperature of 0-4 ° C and is stable for 48 hours. The chemical composition of the blood emulsion differs insignificantly from that of bold pork. Most noticeably, they differed in the content of iron, which is 1.6-2.6 times more in blood emulsions (with different mass fractions of blood). The similarity of the chemical composition suggested the possibility of replacing part of the raw meat in stuffing systems with blood emulsions.

This technological solution will make it possible to enrich the finished product with heme iron, which is important for consumers with a low level of hemoglobin in the blood and creates conditions for the production of meat products with antianemic effect. The use of blood emulsions also has a positive effect on the structural and mechanical characteristics of the finished product. The results of studies of structural-mechanical parameters of model samples of minced meat are shown in Table 1.

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Table 1: The results of the study of the characteristics of minced boiled sausages

Samples of sausages	Moisture contents, %		Stickiness, Pa	Viscosity, Pa • s	Cutting force, kPa
	general	related			
With blood emulsion (30%)	65,8	86,5	22,41	283,4	37,1
Checklists	64,6	84,6	20,54	217,9	42,38

The data obtained indicate that the prototype of the stuffing system (with the introduction of blood emulsion) was characterized by better indicators of adhesion, a high moisture content and a more delicate consistency. The yield and nutritional value of experienced boiled sausages, using a blood emulsion instead of a part of raw meat, have practically no significant differences from the control samples and constitute, respectively, 120.6 and 122.3%. The selection of raw meat was carried out using computer simulation methods. Additionally, the use of milk protein was foreseen, which allows for the rational use of raw meat and high amino acid balance. In addition, biologically active components were introduced to ensure the enrichment of the product with easily digestible iron. Given the importance for healthy nutrition of ballast substances, various cereals were used as part of the product. In addition to the use of boiled sausages in technology, it seems promising to use the food blood of slaughter animals in the production of brawn. The result of our work is an amino-acid balanced product obtained using mathematical modeling methods [2]. Correction of the introduction of food blood into the formulation was carried out after the study of the gel-forming ability of the suspension. The main indicators of the nutritional value of the finished products (sausages "Sochnyye", "Appetitnyye" and "Zel'ts krovyanoy") with the optimally selected ratio of the mass fraction of the recipe components are presented in Table 2.

Table 2: Chemical composition of developed meat products

Indicator	Content, %		
	Sausages «Sochnyye»	Sausages «Appetitnyye»	«Zel'ts krovyanoy»
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

The data in table 2 show that the ratio of protein and fat in developed sausages is 0.83-0.92. This meets the medical and biological requirements for baby food and allows them to be recommended for inclusion in the diet of children of preschool and school age [3]. The chemical composition of Zel'ts krovyanoy meets the medical and biological requirements for functional nutrition. Comparative characteristics of the amino acid composition of antianemic products and the ideal protein showed that the products developed are characterized by good amino acid balance. The minimum and maximum speed Sausages "Sochnyye" and "Appetitnyye" are respectively 0.46 and 0.96; 0.41 and 0.86, "Zel'ts krovyanoy" - 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 digestibility of proteins in the developed products showed that the degree of digestibility of the Sochnyye and Appetitnyye sausages 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 the “Blood-stuffed corn” is higher than the digestibility of milk protein by 2.1% and 13.1% lower than egg protein. This is explained by the presence of a significant amount of ballast substances in the brawn, which have a positive effect on digestion, although they reduce the digestibility of the product. The data of the mineral, vitamin composition of the “Sochnyye”, “Appetitnyye” and “Zel'ts krovyanoy” sausages, as well as the degree of satisfaction of the daily need for trace elements are presented in Table. 3

Table 3: The micronutrient composition of the developed products

Indicator	Content per 100 g of product / (degree of satisfaction of daily needs,%)		
	Sochnyye	Appetitnyye	Zel'ts krovyanoy
Vitamins			
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			
Fe	28,17 / (61,2)	18,81 / (38,6)	20,09 / (57,2)
Na	307,70 / (8,9)	256,15 / (8,6)	265,92 / (7,9)
K	310,35 / (12,3)	285,13 / (13,5)	231,82 / (10,3)
P	208,35 / (13,8)	211,36 / (14,0)	225,30 / (15,8)
Mg	41,33 / (18,6)	34,15 / (15,4)	20,00 / (9,3)
Ca	140,85 / (9,6)	251,93 / (16,8)	240,85 / (15,9)

From the data of table 3 it can be seen that the degree of satisfaction of the daily need for basic microelements (100 g of the product) does not exceed 20–30%, which meets the requirements for functional foods. The exception is iron, the degree of satisfaction of the daily need for which is about 60%, which ensures a rapid correction of iron deficiency states. For a comparative assessment of the consumer attractiveness of sausages, their color characteristics were studied with control meat products - first-grade boiled sausage and traditional brawn. As a result, it was found that the color spectra of the products offered and control samples are almost identical, which allows us to conclude that the products developed have a traditional, attractive color. In this case, the color characteristics of the product do not undergo significant changes during the entire shelf life.

CONCLUSION

The data of the conducted studies allow us to relate the developed products to the potentially effective meat products for anti-anemic use. The following regimen of the use of the products created is recommended: in order to prevent anemia, 50–100 g twice a week, for clinical nutrition — 100 g per week for 4-6 weeks.

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