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Development Of Food Products Enriched With Biologically Active Form Of Iron.

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ABSTRACT

In the article the method of hemolysis formed elements (FE) of blood with ascorbic acid with a molar concentration of 0.75 mol / l is proposed. When studying the dynamics of hemolysis, it was established that the degree of hemolysis on the 10th minute is 99.8%. Hemolysate is a brown liquid without a blood smell with a content of up to 19.5% protein, about 75.5%, moisture and about 0.09% iron. The results of the hemolysate color estimation showed its similarity with cocoa powder, which indicates the possibility of their use for the production of imitated chocolate products enriched with heme iron. Also, a dye was developed to correct the color of minced systems characterized by a low content of myoglobin. The range of concentrations of sodium nitrite is based on the calculated hemoglobin content in the solution and also taking into account preliminary studies showing optimal color formation at a pigment to sodium nitrite ratio of 1: 5.
Keywords: blood, heme iron, hemolysate, anti-anemic products, secondary raw materials.

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INTRODUCTION

In the life of virtually all known life forms, iron plays a huge role. In particular, iron-containing proteins transport electrons in the respiratory chain, supplying energy for the functional activity of the cells. Iron is also necessary for DNA synthesis, growth and multiplication of cells.

Iron deficiency is one of the most common pathologies of modern mankind. According to the WHO, iron deficiency is noted in more than 1.5 billion people, including about 500 million people with iron deficiency anemia [1].

The lack of iron in the human body causes disruption of vital functions and leads to various diseases, increases the risk of death. In children, iron deficiency anemia can lead to developmental delay and behavioral abnormalities such as decreased motor activity, social interaction and attention concentration, pregnant women are at increased risk of premature birth and low birth weight, and in adults often exhibit decreased performance. In the treatment of iron deficiency anemia, first of all, salts of this metal are used, which, however, can cause a number of side effects that worsen the functioning of the body systems [2, 6]. An alternative to medical prophylaxis and treatment of iron deficiency anemia can be offered prophylactic foods with increased content of organic iron.

The presence in the blood of animals of significant amounts of organic iron determines the promise of its use for the production of preventive foods for people with iron deficiency anemia [3]

The effectiveness of the use of blood of slaughter animals for the development of this category of products is due, first of all, to the fact that iron is in the heme form, which is the most digestible in comparison with similar preparations.

In accordance with the standards of slaughter of pigs and cattle, the production of edible blood is 2.6% and 3.5%, respectively, of processed meat. High content of high-grade proteins and biologically active substances, allows long to call blood "liquid meat", emphasizing its importance as an important food raw material. However, traditional technologies do not allow the wide use of this raw material for food production, restricting its use to only certain types of sausages, the production of light and black food albumin, and the production of medical products. Therefore, a significant part of the selected blood is sent to the production of fodder (meat-and-bone meal), or simply merges into production sewage, causing damage to the environment [4, 5].

We carried out research for several years aimed at creating technologies that enable the fuller use of food blood and its fractions for the development of new products and product groups.

MATERIAL AND METHODS

The quality of the finished product was assessed by physicochemical, organoleptic and microbiological indicators according to generally accepted methods.

The subjects of the study were pork blood stabilized with sodium pyrophosphate, blood of cattle and sausages.

Mass fractions of vitamins and minerals were determined according to the procedure [7, 8] using the AAS-703 atomic absorption spectrophotometer.

Hemolysis of the formed elements was carried out as follows: 1 cm^3 of the chemical reagent was added to 1 cm^3 of the elemental elements. Then 0.25 cm^3 of the mixture was taken and diluted 84 times with physiological saline. After mixing, the optical density was measured on a photo-electrocolorimeter at a wavelength of 670 nm.

RESULTS AND DISCUSSION

The development of effective methods and methods for the use of animal blood or its formed elements (PEA) is inherently associated with the operation of cell wall destruction. This is necessary both from a functional-technological and from a biological point of view. Particularly important detail is the reduction in the content of cell membranes, which are not easily affected by human gastrointestinal enzymes.

We suggested hemolysis of the FE of blood with ascorbic acid with a molar concentration of 0.75 mol / dm^3. When studying the dynamics of hemolysis, it was established that the degree of hemolysis on the 10th minute is 99.8%. The implementation of hemolysis with ascorbic acid is a new approach, allowing to obtain an enriched functional basis for the production of food products.

Hemolysate contains unbound forms of hemoglobin, and it also lacks cell walls that lower the nutritional value of the product. Hemolysate is a brown liquid without a blood smell with a content of up to 19.5% protein, about 75.5%, moisture and about 0.09% iron.

In their color characteristics, hemolysates are similar to cocoa powder, which indicates the possibility of their use for the production of imitation chocolate products that will favorably differ from the traditional contents of heme iron and animal proteins, which are important in the prevention of anemia of different etiologies.

The results of the instrumental color assessment carried out in the CIE Lab colorimetric system indicate that with the same color of the cocoa powder and hemolysate formed elements, the latter differs in a darker tone.

For the basis of imitation antianemic products, recipes of such confectionery products as chocolate paste, iris, waffles (filling), fondant sweets in which cocoa powder was replaced with hemolyzate of PE were adopted. The technology of these products further includes the collection and fractionation of blood, hemolysis, formulation, cooking, flavoring, pasteurization, cooling and packaging. During the cooling process, antioxidants (tocopherols) and flavors were added. This prevented the oxidative deterioration of the fat component, provoked by iron ions, and also allowed to enrich the products with vitamins - vitamin E and ascorbic acid. The necessary smell of products (fruit, chocolate) provided flavors.

The finished product contained (per 100 g) 3.75 g of ascorbic acid, 0.3 g of tocopherol (vitamin E), 135-180 mg of digestible organic iron and about 8.5 g of folic acid, while having the characteristic taste, color and odor for each type of product. The safety indicators of the developed confectionery products met the requirements of SanPiN. Thus, formulas for imitating confectionery products based on hemolyzate of PE for the prophylaxis of iron deficiency anemia have been proposed.

We have also studied the possibility of using the blood of blood of slaughter animals to give the desired color in the production of meat products, which is especially important with a high proportion of the replacement of meat raw materials with protein preparations in sausage production, and also in the case of raw materials with low color characteristics. Color correction in this case is a technologically necessary action, because otherwise the finished product will have a pale color. One of the ways to achieve the desired color characteristics can be the use of a natural dye based on the hemolysate of the PE of the blood.

The condition for obtaining nitrosohemoglobin, which gives a persistent reddish-pink coloration of the meat system, is the presence of hemoglobin in a reduced form, which will ensure its reaction with sodium nitrite to form a colored complex. To this end, ascorbic acid was added to distilled water in an amount of 0.2% of the mass of the PE of the blood, which ultimately also improved the hemolysis process.

The range of concentrations of sodium nitrite was established based on the calculated hemoglobin content in the solution and also taking into account preliminary studies showing optimal color formation at a pigment to sodium nitrite ratio of 1: 5 [5].

The developed dye can be used to correct the color of minced systems characterized by a low content of myoglobin.

We also developed a layered product based on the liver of farm animals with the replacement of a portion of the raw materials on the PV of the blood of slaughter animals.

The ratio of the formulation components was adjusted after studying the effect of the amount of added PE on the color of the product. Reflection spectra of $R = f(\lambda)$ samples with the addition of different amounts of PF showed that samples made with a higher FE content had a darker color, which adversely affected the organoleptic characteristics. The introduction of FE at the level of 15-20% of the initial content of the liver slightly changed the color characteristics of the finished product.

The technology of product preparation includes the following operations: grinding and mixing components according to the recipe, filling molds, baking at a temperature of 140-150 ° C for 20-25 minutes, alternating the obtained crusts with carrots and onions, cooling to 0-4 ° C. Additional introduction of the product in the form of carrots and onions allows to enrich the product with ballast substances and eliminate the specific taste caused by the liver and blood.

Amino acid balance of the proposed products indicates a sufficiently high values of the coefficient of rationality of the amino acid composition. A comprehensive quality assessment showed that 100 g of the product contain 100 mg of easily digestible organic iron, 17.5 g of protein, 18.8 g of fat, 4.4 g of carbohydrates.

CONCLUSION

Thus, the inclusion in the diet of blood formed elements is an instrument of non-drug prevention of anemia and improvement of the health status of the population. In addition, deep processing of blood of slaughter animals will help to solve the problem of rational use of this strategic raw material of animal origin.

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