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Development of anti-anemic products based on local raw materials of animal origin for therapeutic and preventive nutrition of women and children"

Khalilova Saidakhon Usmanzhanovna
Mobile phone +998 94-4316986
PhD Tashkent State Agrarian University
(Department of "Technology of storage and processing
of agricultural products)

Abstract - The article introduces waste-free technology, production of food products of antianemic action by the method of thermoplastic extrusion, food blood of slaughtered animals. The technology of development of these products and the results of their clinical trials are presented. New proposals for the production of an antianemic drug based on raw materials of animal origin for the therapeutic and preventive nutrition of women and children are given.

Keywords - Component, plasma separation, globin, oxidation, hemoglobin, protein. extrusion

Today, a significant part of the adult population and children in the republic are susceptible to diseases caused by iron deficiency anemia. In this regard, the development of new foods of therapeutic and preventive action enriched with iron is an urgent issue.

The main factor determining the therapeutic effectiveness of such a product is its iron-containing component. Today, the food industry has a sufficient amount of raw materials containing such a component, which is highly digestible by the human body.

A protein product as the edible blood of slaughtered animals, in which an average of 0.040% iron is in heme form as part of the hemoglobin protein. Since hemoglobin is the main protein of the shaped elements, the stabilized food blood is subjected to separation for separation into plasma and shaped elements. The latter in the dry residue contain 0.15% iron, which is concentrated in the prostatic group of this complex protein - heme.

The presence of hemoglobin in the blood causes the red color, which makes it difficult to use it as a valuable protein raw material for the production of meat products. In this regard, the developers of new technologies face a difficult task to discolor blood or its shaped elements, which can ultimately be achieved by separating heme from globin or its oxidation. Separated heme can be used as a source of heme iron in the production of therapeutic and prophylactic products of antianemic action [1].

A number of methods are known to solve this problem. The traditional method is the chemical separation of hemoglobin into heme and globin according to the Tibor method. Its implementation involves hemolysis of shaped elements with water, treatment with chloroform, the addition of ascorbic acid to weaken the bond between globin and heme, as well as treatment with acidified acetone to extract the heme group.

However, this method is associated not only with a significant consumption of acetone, but also with the fact that the resulting globin acquires an unpleasant taste. The use of another solvent, butane, does not have such a strong effect on globin. At the same time, it is impossible to completely remove the solvent, which has a negative impact on the health of people whose food products have been developed with the protein globin. Such a method cannot be called safe, taking into account only toxicity, but also fire hazard [2].

Another well-known method involves enzymatic hydrolysis of hemoglobin in an acidic medium for 10-24 hours, subsequent neutralization with calcium hydroxide, separation of the non-hydrolyzed part by filtration or centrifugation.

As a result of hydrolysis, instead of globin protein, its cleavage products are obtained in the form of peptides and amino acids separated from heme and having a bitter taste and low functional properties. Their water-binding and emulsifying ability is on average 30% lower than that of the original hemoglobin.

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Methods based on the oxidation of heme with strong oxidants provide for the further use of the resulting insoluble protein product as components of raw materials for the production of certain types of meat products as a substitute for 10% meat protein.

It should be noted that the strong oxidizer remaining in the product (for example, hydrogen peroxide) negatively affects other components of the raw material, changing, in particular, their color and oxidizing the fats contained. So, when storing sausages with the use of blood discolored by strong oxidants, its color on the section changes and becomes yellow.

These technologies indicate their complexity, multi-stage nature, duration, and the presence of significant shortcomings in the quality of products. All this explains why they are not adopted by industrial enterprises.

It is also necessary to take into account the potential volume of sales of manufactured products, since the use of technologies involving chemical long-term processing of raw materials can become an obstacle to their introduction into production.

This requires fairly simple and labor-intensive methods of processing raw materials, affordable and cost-effective equipment, high yield and quality of the products produced, which ensures the effectiveness of their use.

Such requirements are met by the production of black food albumin from stabilized blood and its shaped elements as a source of heme iron. The improvement of this process is based on a new principle of drying raw materials, which provides for the use of low-pressure steam, the possibility of placing drying plants in a single-storey room, the absence of a tendency for the finished product to be tracked during storage and the presence of a high content of soluble protein substances with bacterial safety.

These requirements are implemented in drying plants with a vibrating boiling layer of inert material of type A1-FMU, A1-FMYA and A1-FMB. In installations of this type, steam with a pressure of 0.5 MPa is used, their height does not exceed 4.5 m, the content of soluble protein substances in the finished product is at least 90% (for the highest grade), the presence of scales and films prevents traceability.

With the use of black food albumin, anti-anemic food products have been created. The most famous is the children's hematogen. It contains 4% black food albumin as a source of heme iron, as well as condensed milk with sugar, molasses, vanillin.

In the laboratory of the department "Technology of storage and processing of agricultural products" of TASHGAU, a technology for obtaining products for therapeutic and preventive nutrition of antianemic action was developed. Which includes black food albumin, powdered milk sugar, wheat flour, starch.

The technology provides for single-stage and short-term (1-2 minutes) processing of a mixture of raw materials by the method of cooking extrusion. As a result, an extrudate of the following chemical composition is obtained in %; moisture -5, protein -12, fat -2.5, carbohydrates -80, mineral salts -1, iron -5.

High solubility indicates a deep destruction of starch, which determines the good digestibility of the finished product.

Studies have shown that this technology ensures the death of microorganisms contained in the raw mixture, and allows you to get a sanitary product.

A clinical study of the product on women 25-35 years old suffering from iron deficiency showed that after 20 days of regular intake, which ensures the intake of 5 mg of iron per day, the concentration of hemoglobin in their blood increased by 14.0 g / dm3, ferritin in the blood serum - by 4.5 ng / cm3, iron in the blood serum by 1.49 mmol / dm3, the saturation coefficient of transferrin increased by 0.9.

These data indicate that the inclusion of an antianimic product in the diet of people suffering from iron deficiency contributes to the improvement of biological indicators characterizing iron metabolism in the body.

It should be emphasized that this technology is simple, allows for complex and waste-free processing of a mixture of raw materials in one apparatus, guarantees the receipt of a sanitary product of high biological value.

The same technology is used to develop a therapeutic and prophylactic food product for a multidisciplinary purpose, which also contains black food albumin as part of its raw materials. This product has proven itself positively in the treatment of hypertension, diabetes and gastric diseases.

The use of shaped elements and stabilized blood for the production of sausage products and minced semi-finished products opens up great opportunities for the production of anti-anemic food products (Table 1). A

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large assortment of boiled, smoked blood sausages and cold cuts has been developed. No special equipment is required for their manufacture. The production of these products, as well as minced semi-finished products using blood, is carried out on the traditional equipment of sausage shops of any capacity [3].
Also noteworthy is the manufacture of sausages, sausages and sausages with protein-blood-fat emulsions, which allows you to replace part of the meat raw materials in the recipe of sausage products, enriches them with iron and reduces the cost.

Raw fat can be used to obtain protein-blood-fat emulsions. This significantly reduces heat consumption compared to the production of ghee from it, and also makes it possible to use the protein part of raw fat as a food raw material [4].

In the laboratory of the department "Technology of storage and processing of agricultural products" TASHGAU developed regulatory documentation for the production of boiled sausages, sausages and sausages with the introduction of protein-carbohydrate-fat emulsions, where enriched wheat flour of local production was used as a carbohydrate component.

For the introduction into production, the development of new anti-anemic food products based on raw materials of animal origin, it is necessary to convincingly and competently demonstrate its harmlessness, high digestibility and effectiveness of use in daily diets for the prevention and treatment of anemic diseases.

Table 1

The results of the experiments on the use of stabilized blood in minced meat

Indicators	5% stable blood		10% stable blood	
	with exposure	without exposure	with exposure	without exposure
Raw minced meat				
Moisture content, %	76	76	76	76
Viscosity, $10\text{-}5^{-5}$ *pz*	0.85	0.87	0.77	0.78
Shear modulus, $10\text{-}3^{-3}$ *din/*^{cm2}	1.37	1.40	1.27	1.29
Stickiness, *g /*^{cm2}	48	48	51	50
Finished product				
Compression ratio, %	32	32	30	30
Elasticity, %	38	39	40	41
Ductility, %	49	48	46	45
Cutting force, *g / cm*	460	460	530	550
Moisture loss during heat treatment, % of initial content	16.0	16.3	15.4	15.1

The organization of the production of therapeutic and prophylactic antianemic food products will help prevent the growth of the disease of women and children with iron deficiency anemia.

Thus, a technology has been developed for the production of therapeutic and prophylactic, anti-anemic food products, which are distinguished by their usefulness to the human body, and can be introduced into production at food industry enterprises of various capacities, using raw materials of animal origin.

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