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COMPLEX USE OF RAW MATERIALS OF ANIMAL AND VEGETABLE ORIGIN FOR THE PRODUCTION OF NEW TYPES OF DESSERTS.

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Abstract:

This article presents the results of studying the chemical composition and physico-chemical properties of blood plasma to assess the feasibility of its use for the development of protein dessert product. It was established experimentally that the introduction of vegetable juices in a mass fraction of up to 40% allows for the structuring of a protein system on the basis of blood plasma. Evaluation of the quality of the obtained product showed that the protein-vegetable jelly has high organoleptic characteristics: dense elastic texture, original taste, attractive appearance. The product is a source of easily digestible protein, dietary fiber, mineral compounds and vitamins. Evaluation of the biological value of the product based on the study of amino acid composition showed that the protein of the product is complete and has a high degree of balance of essential amino acids, which indicates its good digestibility.

Keywords: *blood plasma of farm animals, vegetable juices, gelation, protein products.*

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INTRODUCTION:

Rational use of all food components of agricultural raw materials is the basis for creating a sustainable food base of the state, and the search for ways to maximize the use of all food protein sources in food is of particular importance. This is due to both the extreme importance of proteins and their structural units in the implementation of a number of biological processes in the human body, and the existing deficiency of protein in the diet of a significant part of the world's population. At the same time, an important aspect is the quality of the protein, which predetermines its digestibility and ability to maintain the homeostasis of the body [1]. One of the most important resources of complete animal protein is the blood plasma of farm animals. It is obtained by separating whole stabilized blood, dividing into bright red unformed elements and unpainted plasma, which contains on average 90% water, 7.5-8.0% protein, 0.9% inorganic compounds.

The use of products of slaughter of animals, especially blood, is extremely important, which is explained by the rich chemical composition, therapeutic and biological properties [4, 5, 7]. A number of researchers have established that blood plasma contains biologically active amines, enzymes, free amino acids, hormones, and hundreds of other various protein compounds [4, 8].

The quality of protein in the blood of slaughter animals and its fractions are not inferior to the proteins of meat, which are one of the main sources of essential amino acids in human nutrition. At the same time, it is important to take into account significant amounts of this secondary raw material, the potential for processing of which is not sufficiently realized [6, 8].

Giving an assessment of the functional properties of blood plasma, it is necessary to note the high gel-forming ability of its proteins, which surpasses soy isolate in this indicator. Plasma proteins form dense, but elastic and stable gels at a protein concentration of 8.0-8.5%, while for other globular proteins a concentration of about 9-10% is necessary.

While appreciating the experience of using plasma in food technology, it should be noted that their range is limited. In this regard, the creation of jelly-based products based on plasma is of practical interest. The purpose of the work is to study the conditions of gelation and offer a prescription composition to create new types of protein products.

MATERIAL AND METHODS:

Experimental studies were conducted on the basis of the department of production technology and processing of agricultural products, as well as in the accredited educational and scientific testing laboratory of the Stavropol State Agrarian University. The objects of research were: blood plasma of cattle, corresponding to GOST 33674-2015, carrot and pumpkin juices, jelly prototypes.

The mass fraction of the main components of the product - moisture, protein, ash - was determined by standard methods, the relative viscosity was measured on Engler viscometer [4]. Amino acid composition was determined on the AAA-400 amino acid analyzer by standard methods, mineral and vitamin composition - by calculation, according to reference data. A triple repetition of experiments, mathematical processing was carried out in the program Microsoft Office Excel 2007.

RESULTS AND DISCUSSION:

When studying the influence of various physicochemical factors, the relative viscosity was chosen as an estimated criterion for the intensity of gelation. Studying the effect of the pH of the medium on the gel-forming ability of plasma proteins showed that the values of the relative viscosity (E) of blood plasma have 2 optima, both in acidic medium (pH 3.2-3.8) and in alkaline (pH 13.8 14.6). At the same time, in the area of alkaline pH values, the viscosity of blood plasma has higher viscosity values (approximately by 20%) (Figure 1).

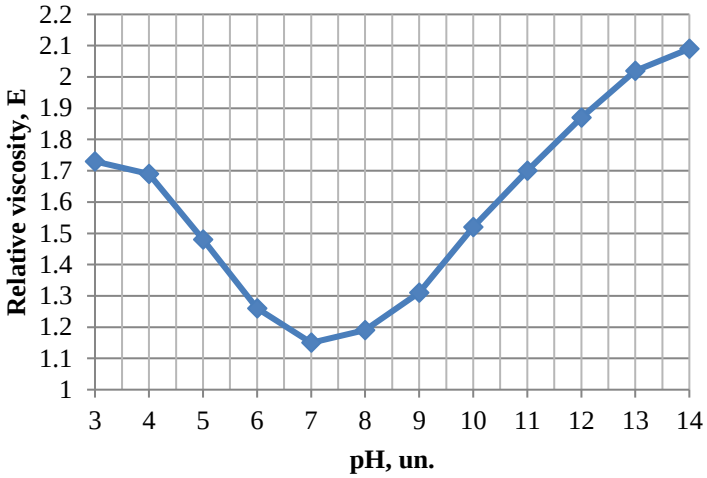

Figure 1: Effect of active acidity on the gel-forming ability of plasma proteins

It is known [1, 8] that when the pH is shifted from the isoelectric point of plasma proteins, its viscosity also changes. However, the use of this pattern in food technology seems inappropriate, since the use of products with an alkaline reaction can adversely affect human health. Therefore, at the next stage of the research, reagents were selected that lower the pH of the plasma to form a gel-like structure and at the same time impart taste. Organic acids were used for this: grape, lactic, succinic, malic.

From a biomedical point of view, high concentrations of acids are undesirable for the human body; therefore, their content in the solution for gel formation was sought to be minimal. The study of the effect of organic acids of various concentrations on the gelation of blood plasma showed that when 7–10% of lactic acid was added, an elastic gel was formed, the remaining acids used were ineffective.

One of the scarce components in the human diet, along with high-grade protein, are dietary fibers that positively affect human digestion, as well as help cleanse the body of heavy metals and toxins, thereby preventing the development of a number of diseases. Thanks to the research of V.B. Tolstoguzov known that mixtures of polysaccharides and protein solutions when converting them to a gel-like state more quickly form a spatial network and are characterized by a lower value of the indicator of the critical concentration of gelation [1]. This led to further research directions related to the study of the feasibility of the joint use of blood plasma and natural juices to obtain a stable gel-like protein product. As a juice component, carrot and pumpkin juices with pulp, rich in dietary fiber, vitamins, micro- and macroelements were selected. The results of the effectiveness of the formation of gelatinized systems when making juices with pulp are shown in Figure 2.

Figure 2: Effect of vegetable juices with pulp on the gel-forming ability of plasma proteins

The positive results obtained when carrot and pumpkin juice with pulp are added to the plasma are obviously associated with the interaction of plasma proteins with cellulose macromolecules, which account for 1.2-1.4% in the juices used.

The strength of the structure of the obtained gels is directly dependent on the content of juices in the composition of the product, however, with an increase in the mass fraction of juice (over 40%), the biological value of the product decreases due to the dilution of the primary medium - blood plasma. A block diagram of the production of jelly based on blood plasma and vegetable juices is shown in Figure 3.

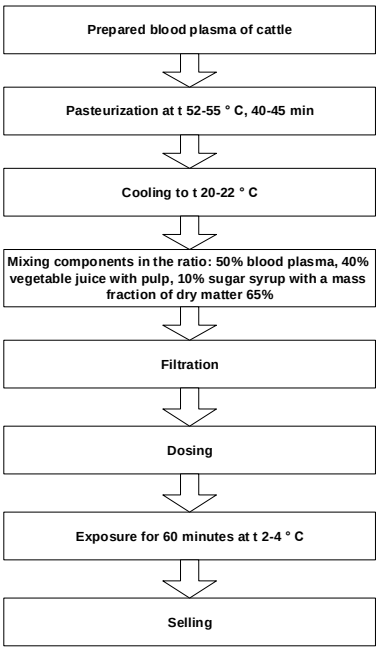

Figure 3: Flowchart of jelly production

Ready-to-eat protein-vegetable jelly has good organoleptic characteristics: dense elastic texture, original taste, attractive appearance. The product has a relatively long shelf life, is a valuable source of easily digestible protein, carbohydrates (table 1), mineral compounds and vitamins (table 2).

Table 1: The results of the study of the quality characteristics of protein-vegetable jelly products

Indicator	Jelly product with	
	carrot juice	pumpkin juice
Content, %:		
moisture	80,65	84,78
squirrel	5,60	5,30
reducing sugars	7,12	4,10
ashes	1,66	1,47
dietary fiber	0,89	0,95
Organoleptic characteristics		
Consistency	Dense, elastic, resilient	
Appearance	Homogeneous jelly mass	
Colour	Light orange	Light yellow
Taste	Sweet, without a specific taste	
Smell	Characteristic for a particular type of juice	

Table 2: Results of the analysis of the mineral and vitamin composition of the protein-vegetable jelly products

Content	Jelly product with	
	carrot juice	pumpkin juice
Minerals, %:		
sodium	0,451	0,434
potassium	0,230	0,034
calcium	0,069	0,037
magnesium	0,059	0,018
Vitamins, mg%;		
β- carotene	9,00	1,50
B_1	0,07	0,05
B_2	0,08	0,06
C	1,00	0,05
nicotinic acid	8,00	12,00

To assess the biological value of the obtained product, the content and balance of essential amino acids were studied.

Table 3: The content of essential amino acids in protein-vegetable jelly products

The name of the amino acid	Content g / 100 g carrot jelly protein	Amino acid score,%	Content g / 100 g pumpkin jelly protein	Amino acid score,%
Lysine	5,6	101,8	5,5	100,0
Methionine + cystine	3,6	94,7	3,4	97,1
Threonine	4,5	112,5	4,6	115,0
Isoleucine	3,9	92,5	3,8	95,0
Leucine	7,2	102,9	7,5	107,1
Tryptophan	1,2	120,0	1,1	110,0
Valin	4,8	96,0	4,9	98,0
Phenylalanine + tyrosine	6,2	103,3	6,4	106,7
Utility ratio of amino acid composition (U), the proportion of units	97,3	-	96,8	-

As a result, it was established that the protein of the product contains all the essential amino acids and has a high degree of balance, which suggests its good digestibility.

The study of the storage capacity of the product showed that when storing jelly in a refrigerator (at a temperature of 2-4 °C), the total microbial number after 3 days does not exceed 1×10^3-1×10^4 CFU per 1 g of the product recommended for similar products.

CONCLUSION:

Thus, the developed protein-vegetable jelly products are characterized by high quality indicators, are a source of high-grade animal protein, vitamins, micro- and macronutrients, which allows us to recommend them to a wide range of consumers as a source of essential nutrients and for the prevention of various forms of protein deficiency.

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