The effect of protein hydrolysate on the functional and technological indicators of pate

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Abstract. It is advisable to study the effect of new protein additives on the functional and technological properties of food systems, taking into account a wide range of food and technological additives used in the production of meat products. The purpose of the research is to determine the effect of protein hydrolysate on the functional and technological indicators of pate. Optipep protein hydrolysate was used. Research methods. The functional and technological indicators of the protein hydrolysate were determined; the physico-chemical indicators of the pate samples were determined, and the obtained values were compared with the requirements of the state standard. The yield of the product after heat treatment was also determined. Results. It has been established that protein hydrolysate has high functional and technological indicators, which affect the increase in the yield of the product, as well as the increase in moisture, which contributes to a more spreadable consistency of the product. Samples of pate with the introduction of protein hydrolysate have a higher nutritional value. Based on the results, concluded that it is advisable to use protein hydrolysate in the pate recipe to improve its quality indicators.

1 Introduction

Currently, it is almost impossible to imagine the work of meat processing plants without the use of food additives. Food additives and protein preparations help not only to diversify the range of meat products but also significantly simplify and reduce the cost of production processes. In addition, food additives are used to increase the shelf life of final products due to their antioxidant and antimicrobial properties, improve sensory characteristics, and increase the nutritional and biological value of the final product.

Today, emulsified meat products are gaining popularity in the food industry due to their versatility and ease of use. They can be used to prepare various dishes, such as sausages, pates, and other meat products [1].

Emulsified products also have a long shelf life and can be easily transported, making them popular among producers and consumers. Moreover, they can be tailored to suit the different tastes and preferences of consumers, making them competitive in the market.

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In this context, food additives are used to improve water and fat-holding capacity. The water and fat holding capacity of meat products is a very important quality attribute that affects product yield, which in turn has economic consequences [2].

Pate is a homogenized food product with a predominant content of meat or liver. This is a dense, high-calorie meat delicacy. The principle of making pates is based on a combination of different types of products as well as methods of processing them, depending on the recipe [3]. Pate is a meat product that is ready to eat without pre-processing. It can be applied to bread or used as an addition to main dishes [4].

The composition of meat pates can have a significant impact on their nutritional characteristics. There are a large number of different recipes for meat pates using different types of meat [5]. In the meat pate market, chicken pates are becoming increasingly popular due to the increase in global poultry meat production. This helps meet the demand for healthier and more dietary products since chicken meat is generally considered lighter and less fatty compared to other types of meat [6].

A variety of meat pâtés, including reduced-fat diet options, reflect changing consumer needs and demand for healthier options [7].

Scientists and food manufacturers are actively working to develop new formulations that will preserve the taste and texture of pates while reducing the fat content and adding protein additives and dietary fiber. This opens up new opportunities for innovation in the food industry and contributes to the development of the market for dietary meat products [8].

The use of protein additives in pates is an important way to optimize their functional properties. Protein additives, being surfactants, can improve the texture and viscosity of a product, making it more attractive to consumers. In addition, they have high thermal stability and the ability to form gel structures, which also improves the quality of the pate. Both animal- and plant-based preparations can be used as protein additives. The use of animal protein additives in the production of meat products has a number of advantages. They help retain moisture in the product during heat treatment and storage, which improves the economic efficiency of production. In addition, the high functionality of animal proteins allows the creation of a variety of meat products and semi-finished products, such as gels, oleogels, emulsions, and granules. They can also be used in dry form, added directly to minced meat or brine, which makes the production process more convenient and efficient [9]. A promising area of use as a technological additive is the use of protein hydrolysates obtained by enzymatic hydrolysis of various protein raw materials. Protein hydrolysate is a mixture of individual protein substances (peptides and free amino acids) resulting from the protein hydrolysis reaction. Protein hydrolysates are obtained by enzymatic hydrolysis using proteolytic enzymes or microorganisms actively produced by these enzymes. Protein hydrolysate is capable of increasing the shelf life of products due to its antimicrobial and antioxidant properties, as well as increasing the functional and technological properties of finished products [8].

It is advisable to use protein hydrolysates in the production of meat products, in particular pates, due to their technological properties.

The purpose of the research is to develop a pate recipe containing protein hydrolysate and evaluate its quality indicators.

2 Materials and methods

2.1 Preparation of pate samples

Mechanically separated chicken mince, chicken by-products (liver, heart, gizzard), protein hydrolysate, chicken fat, vegetables (onions, carrots), broth, and flavoring components were used to make pate. The chicken by-products were boiled and then ground in a meat grinder. Next, the stuffing was carried out, during which fried vegetables, spices, and broth were added. Then secondary grinding, molding, and heat treatment (baking) were carried out. Baking was carried out at a temperature of 180 °C for 10-15 minutes.

Protein hydrolysate was added as a component of meat pate in amounts of 0.5 and 1.5%. The main recipe for the pate is presented in Table 1. The choice of ingredients is justified by the widespread use of mechanically separated meat and poultry by-products in the production of both meat and meat-vegetable pates.

Table 1. Summary table of pate recipes

Recipe component	Component content, %		
	Formulation 1	Formulation 2	Formulation 3
Minced chicken of mechanical deboning	15.9	15.8	15.0
Chicken liver	11.9	11.9	11.9
Chicken hearts	12.0	12.0	12.0
Chicken gizzard	12.0	12.0	12.0
Protein Hydrolysate	0	0.5	1.5
Chicken fat	2.0	2.0	4.0
Carrot	19.4	19.2	18.5
Onion	18.0	17.9	17.2
Chicken broth	6.4	6.3	5.5
Salt	2.0	2.0	2.0
Sugar	0.01	0.01	0.01
Ground black pepper	0.07	0.07	0.07
Coriander	0.05	0.05	0.05

2.2 Determination of functional and technological properties of protein hydrolysate

To preliminary assess the impact of the used protein additive on the food emulsion system, studies of its functional and technological properties, such as fat- and water-holding and fat-emulsifying abilities, were carried out. To measure fat-holding capacity, 2.5 g of the protein hydrolysate was taken and placed in a graduated centrifuge tube, pre-weighed. Then 15 ml of sunflower oil was added, and the resulting mixture was stirred on a homogenizer for 1 minute, after which it was left alone for 30 minutes. The tubes were then placed in a centrifuge for 15 minutes at 4000 rpm. After this, the test tube was weighed, and the volume of the mixture and the volume of the remaining unadsorbed oil were measured. Then the remaining oil was drained, the test tube was placed in an inclined position to remove residual oil, and it was weighed again. The determination of water-holding capacity was carried out similarly to the method for determining fat-holding capacity, but using water instead of oil. To measure the fat emulsifying ability, 25 ml of distilled water was added to 1.75 g of protein hydrolysate, then mixed in a homogenizer for 1 minute. Then added 25 ml of sunflower oil and stirred again for 5 minutes. The resulting emulsion was centrifuged for 5 minutes at a rotation speed of 2000 rpm. Then the volume of the mixture,

the volume of remaining unadsorbed oil, and the test tube were measured. The remaining oil was drained, the test tube was placed in an inclined position to remove residual oil, and it was weighed again.

2.3 Determination of physicochemical parameters of finished pate samples

Physico-chemical indicators, such as the mass fraction of moisture, the mass fraction of fat, and the mass fraction of table salt, were determined experimentally in accordance with GOST 9793-2016 “Meat and meat products. Methods for determining moisture", GOST 23042-86. “Meat and meat products. Methods for determining fat" and GOST 9957-2015. “Meat and meat products. Methods for determining sodium chloride content."

2.4 Determination of the yield of finished pate samples

For finished pate samples, the yield was determined by the difference in mass before and after heat treatment - by the calculation method.

3 Results and discussion

The results of determining the fat-holding, water-holding and fat-emulsifying capacity are presented in Table 2. The obtained high values of the studied indicators confirmed the literature data on the good technological properties of protein hydrolysates using the example of comparison with the hydrolysate obtained by microbiological fermentation of the broiler chickens gizzard [10].

Table 2. Functional and technological parameters of protein hydrolysate

Indicators	Value, %	
	Test sample of hydrolysate Optipep	Hydrolysate obtained by microbiological fermentation of the broiler chickens gizzard [10]
Fat-holding capacity, %	202.4	139.5
Water-holding capacity, %	282.0	170.3
Fat-emulsifying ability, %	52.5	47.0

The values of physical-chemical indicators, as well as their standardized values according to GOST R 55334-2012 “Meat and meat-containing pates. Technical specifications” are presented in Table 3.

Table 3. Physico-chemical indicators of pates

Indicator	Value, %			
	GOST R 55334-2012	Sample 1	Sample 2	Sample 3
Mass fraction of fat	не более 19	6.0	6.0	7.9
Mass fraction of table salt	1.5	1.5	1.6	1.6
Mass fraction of moisture	not standardized	78.1	82.1	79.8

Based on the results of physic-chemical indicators, the fat content ranges from 6.0 to 7.9%, which is less than 18% as stated in GOST R 55334-2012, therefore these pate samples can be classified as dietary products. There is also a high content of mass fraction of moisture, which in turn affects the consistency of the pate, which becomes more spreadable and plastic.

The results of determining the yield of pate after heat treatment are presented in Figure 1.

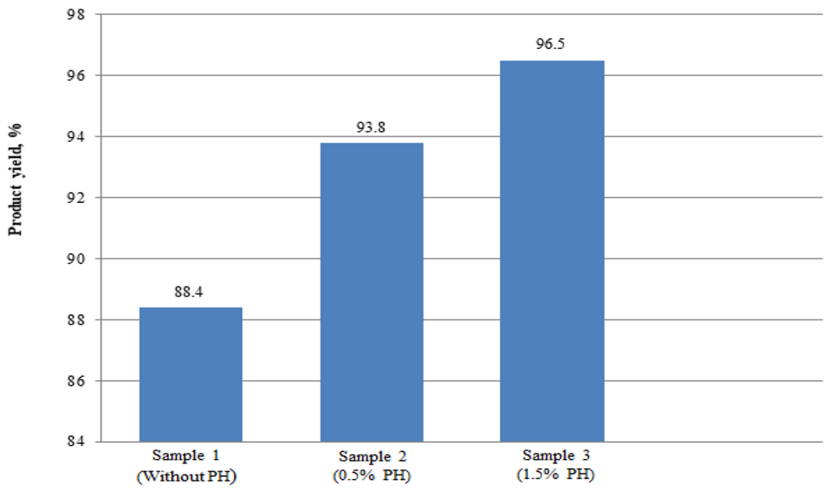

Fig. 1. The results of the pate yield

The results show an increase in product yield: in samples 2 and 3 with the introduction of protein hydrolysate, the yield was 93.8 and 96.5%, respectively, in sample 1 without protein hydrolysate – 88.4%.

A comparison of the results of studies of the indicators of pates with the introduction of protein hydrolysate with the results of the indicators of pates using a protein-oil emulsion showed that the moisture content in the pate decreases with increasing emulsion content. The fat content in pate samples ranged from 13.6 to 14.0% [7].

4 Conclusion

The results of studies of the functional and technological properties of the protein supplement – protein hydrolysate Optipep allow us to conclude about its high functional and technological characteristics. This confirms the feasibility of using this additive in the production of emulsified meat products, such as pates. Physico-chemical evaluation of the pate showed that the resulting samples have a low fat content, therefore these pate samples can be classified as dietary products. It has been determined that protein hydrolysate affects the increase in the yield of finished products (with hydrolysate 93.8 and 96.5%, without hydrolysate 88.4%). The authors recommend adding protein hydrolysate in an amount of 0.5 or 1.5%.

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