Rational use of lupine flour for enrichment of coagulated melange and chopped semi-finished products from broiler chicken meat

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Abstract. The article is devoted to a review of the scientific literature on the nutritional value of eggs and their processed products; data is provided on the nutritional value of fortifying raw materials, which are used to increase the physiological value of the developed coagulated egg products - lupine bean flour. The practical part of the article presents the results of a study on the development of new types of coagulated egg products, additionally enriched with lupine flour. The fatty acid composition of such products has been established. The optimal level of lupine flour addition was determined using an organoleptic method. An improvement was established in the fatty acid composition of coagulated melange enriched with lupine flour compared to the control sample.

1 Introduction

Rational, nutritious nutrition is fundamental in the formation and preservation of public health. The Federal project "Strengthening Public Health" and the regional program for the Smolensk region "Strengthening Public Health" for 2020 - 2024 have been developed, one of the goals and objectives of which is to create a system of motivating citizens to lead a healthy lifestyle, including healthy eating and giving up bad habits. The topic of the article corresponds to the direction of state policy in the field of maintaining public health, including through the inclusion of fortified food products in the diet, noted in the order of the Government of the Russian Federation dated June 29, 2016 N 1364-r.

One of the most important macronutrients, the importance of which is difficult to overestimate for human health, is protein. Its biological role is diverse in the human body. Proteins perform plastic, catalytic, hormonal, transport and other functions in the body, and also provide specificity. The importance of the protein component of nutrition lies, first of all, in the fact that it serves as a source of amino acids. The source of complete protein is the chicken egg, which, in addition to its high nutritional value, is an affordable food product for all segments of the population. The production and processing of chicken eggs meets the doctrine of food safety of food products and the Strategy for improving the quality of food products in the Russian Federation until 2030. In accordance with these

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Eggs are a very important and underutilized source of high-quality protein, minerals and vitamins [1]. Cesar de Anda, Chairman of the IEC (International Egg Commission), said: “The egg is one of the world's most important foods and its importance cannot be overstated! Eggs are the most important source of high-quality protein and are produced sustainably; To feed the growing population of the Earth, the importance of eggs is incomparable to any other food product” [2-5]. From a nutritional point of view, egg products are unique. The egg contains all the nutrients necessary for human nutrition. But for food manufacturers, eggs not only have nutritional properties, their functional properties are no less important - the yolk for preparing emulsions and the white for whipping and gelling. Egg yolk contains 30-40% protein and is rich in choline. Choline is bound to phospholipids, and phospholipids are easily absorbed and used by the body. Certain nutrients found in large quantities in eggs, such as choline, can become valuable ingredients in highly nutritious foods and supplements. Thus, the production of egg products is promising for the production of functional foods today [6].

Plant raw materials are also a promising source of functional ingredients. A source of complete proteins of plant origin is lupine, the beans of which contain 33–47% protein. Unlike soybean, lupine contains less proteolytic enzyme inhibitors and does not cause allergic reactions. Lupine seeds contain from 5 to 12% oil, the main share of which is linolenic, linoleic and oleic acids [7-8].

The composition of macroelements is dominated by potassium, phosphorus and calcium, magnesium, microelements - manganese, iron, zinc and copper, vitamins: pantothenic acid, riboflavin, thiamine, niacin, β-carotene. Lupine fiber is a good prebiotic and a source of fiber.

The use of lupine processing products is promising. Lupine flour contains 34-36% protein, 3-10% fat, 10.6-18.2% dietary fiber, 15-22% carbohydrates. Lupine flour is free of gliadin and gluten, which is especially important for people with digestive disorders [9-10].

2 Materials and methods

The work carried out a study on the production of coagulated melange enriched with lupine bean flour. Coagulation and denaturation of proteins is carried out by increasing temperature, pressure, adding acids, salts, alcohols, alkalis, and denaturing agents. The technology of coagulated melange is based on its coagulation and aggregation using the method of limited acid-salt hydrolysis during heat treatment.

To enrich the coagulated melange, lupine bean flour was used, produced by Viola, Lipetsk region. The product is sold as a source of plant protein. According to the composition per 100 g of product: protein 40 – 48 g; fats 7 – 10 g, carbohydrates – 11 – 14 g, dietary fiber – 30 – 35 g, calorie content – 380 kcal, energy value – 1470 kJ.

Lupine flour was added to the coagulated melange after it was cooled to a temperature of 25 - 27°C. The following samples of coagulated melange were studied:

- Sample 1: coagulated melange (control).
- Sample 2: melange coagulated with 5% lupine flour.
- Sample 3: melange coagulated with 10% lupine flour.

The developed samples of coagulated products were evaluated for organoleptic indicators using the profile method. The main organoleptic indicators and their characteristics were selected - descriptors: taste - egg, lupine, mixed; aroma – egg, lupine, mixed; consistency – hard, crumbly, pasty, color – pronounced egg, pronounced lupine, mixed.
Chopped semi-finished products (cutlets) with the addition of 10% coagulated melange have been developed. Additionally, lupine flour was added to the test sample instead of 10% broiler chicken meat; the control sample did not contain lupine flour.

To determine the effectiveness of introducing plant raw materials, the fatty acid composition of the control and experimental sample of semi-finished products was determined.

3 Results and Discussion

The introduction of a new type of raw material is always associated with a change in the rational organoleptic characteristics of the enriched product. Since lupine flour has a characteristic aroma and a slight bitter taste, the level of introduction of lupine flour was determined, which does not significantly change the usual taste of coagulated egg melange.

Figure 1 shows lupine bean flour.

![Lupine bean flour](image)

Fig. 1. Lupine bean flour.

The organoleptic characteristics of the developed coagulated egg products were determined. The results are presented in Table 1.

<table>
<thead>
<tr>
<th>Indicator name</th>
<th>Sample 1 (control)</th>
<th>Sample 2</th>
<th>Sample 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Color</td>
<td>Light yellow</td>
<td>Bright yellow</td>
<td>Bright yellow</td>
</tr>
<tr>
<td>Taste</td>
<td>Egg</td>
<td>Eggy with a slight taste of flour</td>
<td>The taste of lupine bean flour is more pronounced, slightly bitter</td>
</tr>
<tr>
<td>Smell</td>
<td>Pronounced egg aroma</td>
<td>Pronounced egg aroma with slight flour aroma</td>
<td>Pronounced flour aroma, slightly eggy aroma</td>
</tr>
<tr>
<td>Consistency</td>
<td>Loose</td>
<td>Loose before grinding, pasty after grinding</td>
<td>Loose before grinding, pasty after grinding</td>
</tr>
</tbody>
</table>

Egg products enriched with lupine flour had a rich yellow color and a denser consistency compared to the control sample. When adding 10% melange, a more pronounced taste and aroma of lupine flour was felt, while it did not interrupt the aroma and taste of melange.
To determine the effect of lupine flour on the fatty acid composition of meat products, enriched semi-finished products from broiler chicken meat with the addition of lupine flour have been developed. The fatty acid composition of enriched semi-finished products (test sample) and a control sample without lupine flour was determined. Figures 2 and 3 show the content of fatty acids and fat in the experimental enriched sample and the control sample, respectively.

![Prototype](image)

**Fig. 2.** Content of fatty acids and fat in the experimental enriched sample.

![Control sample](image)

**Fig. 3.** Content of fatty acids and fat in the control sample.

It can be noted that the addition of lupine flour slightly increased the fat content in the enriched semi-finished products. The control sample contained 5.2% of it, and the
experimental sample contained 5.8%. The fatty acid composition has changed: the amount of polyunsaturated fatty acids, in particular omega-3, has increased.

The addition of lupine flour changed the organoleptic characteristics of the finished semi-finished products. A more delicate taste of the samples and a slight taste of lupine when chewed were noted. The prototype was rated higher in organoleptic indicators compared to semi-finished products without the addition of plant materials.

4 Conclusion

As a final conclusion based on the results of the research, it can be noted that eggs and their processed products are promising raw materials for providing the planet's population with complete, easily digestible protein. It is also necessary to note its accessibility from an economic point of view.

The production of coagulated egg products allows us to expand the range and improve the technological properties of valuable raw materials. Coagulated egg products can be added in larger quantities to enrich semi-finished meat products and confectionery products; they are more convenient to transport.

The inclusion of plant raw materials, in particular lupine flour, makes it possible to produce food products enriched with dietary fiber and unsaturated fatty acids. As noted in the study, the addition of 10% lupine flour increased the content of polyunsaturated fatty acids, in particular Omega-3, making the fatty acid composition more balanced. The combination of animal and plant proteins has a positive effect on the biological value of the product.

Acknowledgement

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