Research of the effect of spinach on the quality indicators of chopped poultry semi-finished products

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Abstract. According to experts and scientists of the processing industry, the production of chicken products is a promising direction, as it allows you to expand the product range. So, in the last few years, along with the classic ones, new technologies for the production of dietary products have been used. The article presents data on the effect of spinach on the organoleptic, physical and chemical properties of minced chicken. The positive effect of spinach and a mixture of proteins on the value of moisture-retaining (MRA) and moisture-binding (MBA) abilities, as well as the nutritional value of semi-finished poultry products, has been proved.

1. Introduction

Today, the organization of production of high-quality meat semi-finished products is one of the most urgent tasks in the meat industry. The use of various types of vegetable additives in the development of semi-finished products can significantly reduce their caloric content and recommend them as "healthy food" products, which are currently becoming increasingly popular with customers [1,2].

One of the most actively developing industries is considered to be poultry. Starting in 2019, annual production is above 5 million tons of poultry meat, and by 2024 it may increase to 5.3 million tons [1]. This growth in the industry contributes to the development, optimization and creation of new technologies for processing chicken meat, which contribute to obtaining high-quality products that meet consumer demand. At the same time, such products should have improved organoleptic characteristics – taste, aroma and consistency. In addition, meat and meat-growing products should be produced in a sufficiently wide range so that each buyer can choose the types of high-quality minced products that they prefer.

As noted by some authors in their research on preferences in the market of semi-finished products [3, 4], consumers in recent years, when choosing frozen meat semi-finished products, are increasingly paying attention to the price-quality ratio, preferring a higher-quality product. A few years ago, frozen semi-finished products were not in demand and their range was extremely narrow, but now the situation has changed dramatically. Experts estimate the level of well-being of the population by the intensity of consumption of semi-finished products, in particular frozen ones.

An additional source of raw materials for the production of meat products are plant crops, including soy proteins, wheat, pumpkin, chickpeas, oat fibers, etc. are widely used in the production of semi-
finished products [5, 6]. At the same time, more and more meat raw materials in recipes are replaced with vegetable ones, in an effort to reduce the cost as much as possible.

The purpose of this work was to study the effect of spinach and animal protein on the quality of chopped semi-finished poultry products. At the same time, it should be noted that in the recipe of semi-finished products developed by us, the minimum possible amount of meat raw materials is replaced with vegetable ones.

Spinach – *Spinacia oleracea* (garden spinach) – a dioecious annual herbaceous plant of the family amaranth. This crop is precocious, cold-resistant and quite high-yielding, and spinach is grown in the open ground in many parts of the country [7]. The chemical composition of the plant is insufficiently studied. Spinach leaves contain a large amount of proteins, sugars, vitamins C, B1, B2, B3, K, E, D, carotenes, folic acid. Spinach leaves contain flavonoids, carotenoids (up to 11607 micrograms per 100 g), and it also contains Fe, Mg, K, P, Na, and I salts [8, 9].

Spinach leaves are widely used in the production of various useful and healthy food products, beverages, bakery products, as well as some types of meat products as a food additive, structure-forming agent or dye [10, 11].

### 2. Materials and methods

Experimental studies were carried out on the basis of comprehensive analytical laboratory of Federal state budgetary institution "Volga research Institute of production and processing of meat and dairy products" and the laboratory of the Department "Technology of food productions" of VSTU. Objects of research – samples of chicken cutlets: control – without additives, experimental sample 1 – with hemoglobin powder and soy isolate (0.18 and 0.75%, respectively), experimental sample 2 – with spinach (10%), experimental sample 3 – with spinach, hemoglobin and isolate (8; 0.18 and 0.75%, respectively). The mass fractions of proteins were taken in accordance with previous studies.

At the first stage, experimental samples were developed and organoleptic evaluation of minced meat and frozen semi-finished products was carried out.

At the next stage, the functional and technological properties of minced meat (moisture-binding, moisture-retaining, fat-retaining) were evaluated by sequential determination in one sample (the method of P. M. Salavatulina et al.).

At the next stage, physical and chemical studies of raw minced meat and ready-made semi-finished products were performed. The mass fraction of ash was determined in accordance with GOST R 51432-99 and recommendations. Determination of the mass fraction of fat in the finished samples was determined in the Soxlet apparatus in accordance with the recommendations, according to GOST 042-86. The mass fraction of moisture in minced meat and finished products was determined according to GOST 9793-74 by drying the sample sample with sand to a constant mass at a temperature of 103±2°C. Determination of the mass fraction of protein was carried out according to GOST 25011-81 by the Kjeldahl method.

The materials obtained in the course of research were processed by the method of variation statistics using the "Microsoft Office" software package on a PC.

### 3. Results and discussion

Poultry meat (fillet of breast and leg of chicken-broiler block) was crushed on a block cutter, in parallel, the preparation of auxiliary components was carried out. The minced meat was prepared in accordance with the recipe, mixed in the minced meat mixture for 3-5 minutes, after which the products were formed. Some of the samples were left in the freezer until freezing to -18°C, and then insulated to 0-8°C. The second half of the samples were brought to culinary readiness by steaming.

#### 3.1. The results of organoleptic test

Fresh samples were evaluated and regenerated after freezing and storage for 48 hours. The results of the research are presented in table 1. Chopped semi-finished products are emulsified meat products made from coarse raw materials, with partially preserved morphological (cellular) structure of meat, a low
degree of fat dispersion and a low content of fat and water in the system. The structure of such a product may differ in some looseness and the presence of air voids, so it is necessary to pay attention to technological techniques and the influence of additives that contribute to the formation of a denser consistency of the product.

| Samples | Indicator | Consistency | Color | Aroma |
|---------|-----------|-------------|-------|-------|
| Freshly processed samples |
| Control | the shape is rounded and flattened; the edges are even; the minced meat is evenly mixed | dense, not elastic, not juicy | light grey | |
| 1 | | not dense, not crumbly, elastic | light gray, interspersed with hemoglobin-stained | characteristic, pleasant, characteristic of chicken meat |
| 2 | | dense, not elastic, watery elastic, juicy | light with hints of spinach | |
| 3 | | dense, elastic, juicy | light with splashes of spinach and colored meat with hemoglobin | |
| Prepared |
| Control | the shape is rounded-flattened; the edges are smooth | not elastic | light brown | characteristic, pleasant, characteristic of chicken meat and additives, without extraneous |
| 1 | | not dense, not elastic | light brown, interspersed with dark brown, stained with hemoglobin | |
| 2 | | watery | light brown with hints of spinach | |
| 3 | | elastic, juicy | light brown with splashes of spinach and colored meat with hemoglobin | |

According to the results obtained, the samples with spinach had a more watery consistency compared to the control, and sample 3 had the best indicators both in freshly processed and cooked form. Sample 3 were characterized by greater juiciness and elastic consistency, while in appearance they were also not inferior to the control. Based on these data, it was concluded that it is advisable to include spinach together with animal and vegetable proteins in the recipes of semi-finished poultry products.

3.2. FTP of minced meat
The results of the study of functional and technological properties of the developed minced meat are shown in the figure 1. Analyzing the data obtained, it can be noted that there was an increase in the hydrophilicity of meat proteins, and this in turn led to an increase in MRA. As a result the finished product is more juicy. The maximum values of water and fat–holding capacity were observed in sample 3 – 89.5 and 73.2%, respectively.
3.3. Nutritional value of samples

Information about the content of the main macronutrients is given in table 2.

| Samples  | Indicator               | Mass fraction of protein, % | Mass fraction of ash, % | Mass fraction of fat, % | Mass fraction of moisture, % |
|----------|-------------------------|-----------------------------|-------------------------|-------------------------|-----------------------------|
|          | Freshly processed samples |                             |                         |                         |                             |
| Control  | 13.21±1.35              | 2.03±0.05                   | 12.67±2.03              | 72.17±4.35              |
| №1      | 14.70±0.9               | 1.98±0.03                   | 10.39±1.98              | 73.02±3.42              |
| №2      | 13.13±1.50              | 2.06±0.04                   | 8.80±1.87               | 76.04±3.2               |
| №3      | 15.30±1.64              | 2.07±0.04                   | 9.20±1.38               | 73.43±4.10              |
|          | Prepared                |                             |                         |                         |                             |
| Control  | 10.20±1.20              | 1.95±0.05                   | 9.64±1.96               | 71.00±4.35              |
| №1      | 12.20±0.98              | 1.93±0.03                   | 8.61±1.97               | 69.45±3.42              |
| №2      | 11.05±1.30              | 2.03±0.04                   | 8.80±1.56               | 77.30±3.20              |
| №3      | 13.82±1.50              | 2.01±0.04                   | 7.25±1.35               | 68.56±4.18              |

Analyzing the data of table 2 it can be noted that in comparison with the control prototypes was more a mass fraction of protein: for example, 1 sample – the value was more than 1.5%, 3 sample – by 2.1%, while fat content in experimental models. Loss of nutrients during heat treatment was as follows: protein content of 1.5-2.5%, the lowest loss observed for sample 3 is 1.5%. In terms of moisture content, when replacing part of the meat raw materials with the studied components, it changed in the acceptable range, giving the product juiciness, without violating its structure and rheological characteristics.

4. Conclusion

In the conclusions, it can be noted that at present there is a need for meat products of increased and biological value. In the scientific literature, a sufficient number of developments of new products with improved nutritional value have been proposed, but there are practically no such products introduced into wide production for consumers. We selected enriching additives, and proved the possibility of creating semi-finished products of increased nutritional and biological value. The selected additives will increase the content of protein, polyunsaturated fatty acids, vitamins and minerals in the finished product.
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