

Development of minced fish semi-finished products enriched with polyunsaturated fatty acids

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Abstract. One of the priority areas of resource-saving technologies in the food industry and public catering is the development of functional products based on a balanced combination of protein-containing raw materials of animal origin and plant raw materials. In the work, for the production of chopped fish semi-finished products - cutlets (CFSFPc), based on the analysis of chemical composition data, the main raw materials and sources of polyunsaturated fatty acids (PFA) were selected; in accordance with the principles of creating functional products, the quantitative composition of the recipe components is optimized; the functional and technological properties (FTP) of model minced meat have been studied; an assessment of the organoleptic characteristics of finished products was carried out.

1 Introduction

The development of functional products using plant components in addition to protein-containing raw materials of animal origin in recipe bases is one of the priority areas of resource-saving technologies in the food industry and public catering. Currently, there is a tendency to optimize and correct health through food. In this regard, there is an expansion of the world market for functional products and, as a result, an increase in the volume of their production.

One of the scarce, but vital components are polyunsaturated fatty acids (PFA), which affect: fetal development; biochemistry of the nervous system; retaining moisture in the skin and hair; regulation of inflammatory reactions; processes of lipid transport in the bloodstream; the ability of immune cells to activate; suppression of autoimmune reactions, improved absorption of vitamins in the gastrointestinal tract; regulation of water balance and other [1, 2].

In accordance with the «Norms of physiological requirements for energy and nutrients for various groups of the population of the Russian Federation» the need for adults in ω -6 and ω -3 PFA is 8-10 g/day and 0.8-1.6 g/day, respectively. The optimal ratio of fatty acids ω -6 to ω -3 in the daily diet should be 5-10: 1 [3], while for medical nutrition this ratio is different and is 4: 1.

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The aim of the research is the development of chopped fish semi-finished products (cutlets), enriched with polyunsaturated fatty acids. Tasks - analysis of literature data for the selection of the main type of raw materials and sources of PFA (polyunsaturated fatty acids); selection of enrichment criteria; research of functional and technological properties of minced meat systems; evaluation of the organoleptic characteristics of the developed products.

2 Material and methods

The article presents research on the development of chopped fish semi-finished products (cutlets), enriched with polyunsaturated fatty acids.

Based on the analysis of literature data on the chemical composition of fish and plant raw materials containing PFA (polyunsaturated fatty acids), the main raw material and enrichment component were selected for the production of an innovative functional product. Further, the criteria for fortification of cutlets were established in accordance with the principles of functional nutrition.

To optimize the recipe composition of CFSFPC, model minced meat with different content of PFA (polyunsaturated fatty acids) sources was prepared and their functional and technological properties were studied, as well as a tasting assessment by non-professional tasters to assess the quality of finished products.

3 Results and discussion

The production of CFSFPC is characterized by simplicity of technological processes, minimal costs for auxiliary raw materials. Analysis of data on the chemical composition of some fish species showed that cod meat should be chosen as the main raw material for the objects of research. In the composition of this fish, the fat content is minimal; accordingly, PFA (polyunsaturated fatty acids) are practically absent (Table 1).

Table 1. The chemical composition of some fish species.

Name of fish species	Proteins, g	Fats, g	PFA ω -3, g	PFA ω -6, g
Tuna	24.4	4.0	1.11	0.04
Zander	18.4	1.1	0.11	0.02
Pike	18.4	1.1	0.13	0.05
Sea bass	18.2	3.3	0.39	0.03
Ice fish	17.7	2.7	0.7	0.03
Catfish	17.2	1.5	0.18	0.04
Hake silver	16.6	2.1	0.52	0.02
Cod	16.0	0.6	0.18	-
Pollock	15.9	0.9	0.31	0.01

The selection criteria for PFA sources are determined by the quantitative composition and balance of polyunsaturated ω -6 and ω -3 fatty acids. For the enrichment of fish cakes with PFA, walnut kernels were selected, which are characterized by the most optimal ratio of ω -6 and ω -3 fatty acids - 5: 1. The total content of PFA in 100 g of this product exceeds the daily physiological requirement for them by 5 times.

Before introducing walnut kernels into model mincemeats, they were preliminarily ground. The range of variation of the sources of PFA is from 5 to 10 % by weight. This amount of nuts added to the recipe is selected in accordance with the norms of daily con-

sumption of PFA. At the same time, it was taken into account that the amount of components enriching the product should be at least 20 % of a person's daily need for them [4, 5].

In the production of products from minced meat, indicators of their functional and technological properties (FTP) are of great importance. These systems are multicomponent, so any change in the ratio of their prescription components leads to changes in the quality of the finished product. In this regard, it is necessary to select such quantities of new ingredients introduced into the minced meat systems so that the development of the processes of moisture retention (WHC water holding capacity) and fat (FHC fat-holding capacity) during their manufacture, as well as the stability of minced meat during heat treatment were optimal [6].

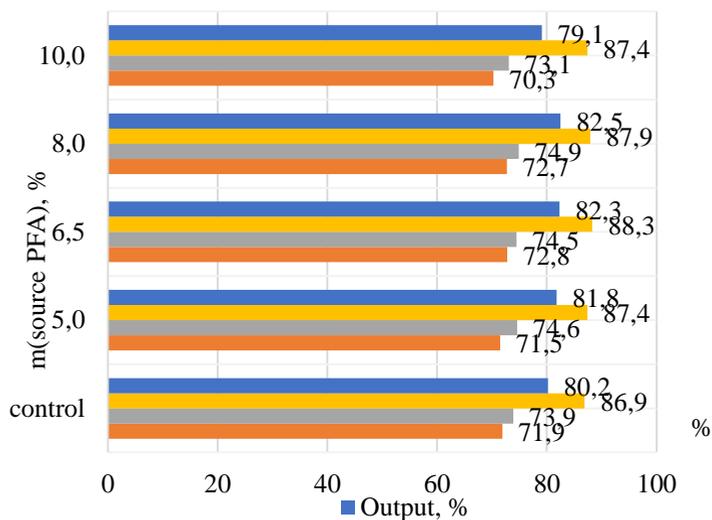


Fig. 1. Investigation of the functional and technological properties of model minced meat systems.

It has been established (Fig. 1) that WHC and FHC of model minced meat systems, when walnuts are introduced into them, increase and reach maximum values at 3.4 % by mass of minced meat. This dynamics is explained by the swelling capacity of dietary fibers contained in nuts. Their further removal in the composition of minced meat leads to a decrease in the processes of binding and retaining moisture and fat in systems.

Such results can be explained by an increase in the content of vegetable oils and an insufficient amount of lipophilic and hydrophilic groups in the system. Similarly, the stability index of the studied model minced meat changes, which is a generalizing indicator characterizing the development of both the moisture-binding capacity of the raw minced meat system and the WHC and FHC after heat treatment [5, 6]. The output of finished products containing up to 3.4 % by weight of minced meat increases in proportion to the amount of introduced plant complexes. With the introduction of vegetable complexes into minced meat more than 3.5 %, this dependence is inverse.

In addition to the FTP (functional and technological properties), the main quality criteria of food products are their organoleptic characteristics, which form consumer demand. The sensory evaluation was carried out with the involvement of non-professional tasters on a five-point scale by the simultaneous presentation of coded product samples. The research results are shown in Fig. 2.

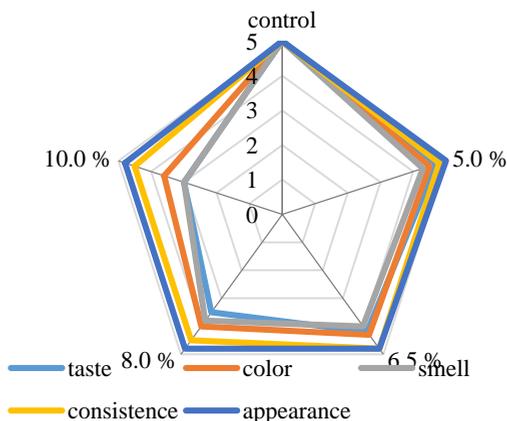


Fig. 2. The results of organoleptic evaluation of model samples of cutlets in comparison with the control.

It was found that the most preferred finished products were obtained when 13 - 16% of nuts were added to the recipe by weight of minced meat. The higher content of walnut kernels neutralized the taste and smell of cooked cutlets. Also, the amount of nuts in the samples of more than 16% negatively affected the color of the finished products. He acquired shades of brown or rich gray tones. Thus, it was found that the samples containing up to 16% of PFA sources in terms of organoleptic indicators practically do not differ from the control. The content of polyunsaturated fatty acids in them is 20 – 22% of the daily requirement for them.

The results of the studies have shown the feasibility of combining fish and non-traditional plant raw materials for this type of product to obtain a product with increased nutritional value due to an increase in PFA. The resulting culinary products are recommended for retail trade, as well as inclusion in the diets of various groups of the population.

4 Conclusions

The main findings of the research:

- experimentally, the optimal amount of walnut kernels, introduced into the formulation of chopped semi-finished fish products, was established - 13 – 16% g to the mass of minced meat.
- there is an increase in the content of polyunsaturated fatty acids in the finished product up to 20-22% of the daily requirement for them.
- the developed semi-finished products (cutlets) are recommended for retail trade and inclusion in the diets of various population groups in order to adjust the nutritional status.

5 References

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