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### STUDY OF ORGANOLEPTIC AND TECHNOLOGICAL PROPERTIES OF FISH MAFFINS WITH ADDITION OF PEARLY POWDER

The authors propose a new type of snack muffins with the addition of dry minced fish from sea and freshwater fish, enriched with pearl powder. It provides high protein content and good taste of finished products. The article presents the results of experimental studies on the enrichment of dry minced fish with pearl powder and the addition of these compositions to the recipes of snack muffins. Tasting analysis showed that the best organoleptic indicators have samples of flour culinary products with the content of enriched dry minced fish in 25%. However, such a quantity of recipe ingredients introduced negatively affects the process of dough formation and the appearance of finished products. The amount of added pearl powder was 2.3% of the amount of dry minced fish. The increase in the amount of added pearl powder to 5% does not contribute to an increase in the hydrophilic-city of dry minced fish in the composition of the dough piece for snack muffins. A further increase above 5% adversely affects the organoleptic characteristics of the finished culinary products. Thus, the accepted amount of dry minced fish was 15%. Adding 2.3% of pearl powder to the amount of dry minced fish allowed the physiological required ratio of calcium and phosphorus, which was 2:1 and provide preventive doses of organically bound calcium and phosphorus by 24-28% depending on age.

**Keywords:** snack muffins; dry minced fish; pearl powder; calcium; phosphorus.

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### ДОСЛІДЖЕННЯ ОРГАНОЛЕПТИЧНИХ І ТЕХНОЛОГІЧНИХ ВЛАСТИВОСТЕЙ РИБНИХ МАФФІНІВ ІЗ ДОДАВАННЯМ ПЕРЛИННОЇ ПУДРИ

Автори пропонують новий вид закусочних мафінів із внесенням сухого рибного фаршу з морських і прісноводних риб, збагаченого перлинною пудрою, що забезпечують підвищений вміст білка і гарний смак готових виробів. У статті представлені результати експериментальних досліджень по збагаченню рибних сухих фаршів перлинним порошком і додаванню отриманих композицій до складу рецептурної суміші закусочних мафінів. Дегустаційний аналіз показав, що найкращими органолептичними показниками володіють зразки борошняних кулінарних виробів із вмістом збагаченого рибного сухого фаршу в 25%. Однак, така кількість внесених рецептурних інгредієнтів негативного впливає на процеси тістоутворення і зовнішній вигляд готових виробів. Кількість внесеної перлинної пудри склала 2,3% від кількості сухого рибного фаршу. Збільшення кількості введеної добавки перлинної пудри до 5% не сприяє збільшенню гідрофільності сухого рибного фаршу у складі тістової заготовки для закусочних мафінів. Подальше збільшення вище 5% негативно впливає на органолептичні показники готової кулінарної продукції. Таким чином, прийнята кількість внесеного рибного фаршу склала 15%. Внесення 2,3% перлинної пудри від кількості сухого рибного фаршу дозволило забезпечити фізіологічні необхідне співвідношення кальцію і фосфору, яке склало 2:1 і забезпечити профілактичні дози органічно зв'язаного кальцію і фосфору на 24-28% залежно від віку.

**Ключові слова:** закусочні мафіни; сухий рибний фарш; перлова пудра; кальцій; фосфор.

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### ИССЛЕДОВАНИЕ ОРГАНОЛЕПТИЧЕСКИХ И ТЕХНОЛОГИЧЕСКИХ СВОЙСТВ РЫБНЫХ МАФФИНОВ С ДОБАВЛЕНИЕМ ЖЕМЧУЖНОЙ ПУДРЫ

Авторы предлагают новый вид закусочных маффинов с внесением сухого рибного фарша из морских и пресноводных рыб, обогащенного жемчужной пудрой, обеспечивающих повышенное содержание белка и хороший вкус готовых изделий. В статье представлены результаты экспериментальных исследований по обогащению рыбных сухих фаршей жемчужным порошком и добавлению полученных композиций в состав рецептурной смеси закусочных маффинов. Дегустационный анализ показал, что наилучшими органолептическими показателями обладают образцы мучных кулинарных изделий с содержанием обогащенного рибного сухого фарша в 25%. Однако, такое количество внесенных рецептурных ингредиентов негативно влияет на процессы тестообразования и внешний вид готовых изделий. Количество внесеной жемчужной пудры составило 2,3% от количества сухого рибного фарша. Увеличение количества вводимой добавки жемчужной пудры до 5% не способствует увеличению гидрофильности сухого рибного фарша в составе тестовой заготовки для закусочных маффинов. Таким образом, принятое количество внесенного рибного фарша составило 15%. Внесение 2,3% жемчужной пудры от количества сухого рибного фарша позволило обеспечить физиологические необходимое соотношение кальция и фосфора, которое составило 2:1 и обеспечить профилактические дозы органически связанного кальция и фосфора на 24-28% в зависимости от возраста.

**Ключевые слова:** закусочные мафины; сухой рыбный фарш; жемчужная пудра; кальций; фосфор.

**Introduction.** Currently fish processing is based on the use of rational technologies, as obtaining mixtures of minced meat from low-grade varieties fish, most of which also contain a lot of bones [1–4] and enrichment of minced fish with biologically active substances [5–11]. During the processing of fish raw materials use the activity of natural antioxidants to improve the microbiological stability of minced meat [7, 10, 11]. A sufficiently wide range of semi-

finished products of high readiness from minced mixtures allows rational distribution of fish raw materials. [1, 4, 7, 8, 10, 12–14, 18, 19]. However, most of the products are presented in the form of frozen convenience foods. It is expensive to store and requires responsibility for compliance with sanitary regulations and standards during transportation and processing.

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It is expensive to store and requires responsibility for compliance with sanitary regulations and standards during transportation and processing. In this regard, there is a need to develop new types of semi-finished fish meat products with improved technological properties, increased shelf life and nutritional value, as well as a reduced likelihood of pathogenic microflora contamination and oxidation of the protein and lipid components.

Semi-finished products of long-term storage, which are made on the basis of dry fish mince, used in the manufacture of extruded products [15], fish snacks [16], gastronomic products and other semi-finished products. This is one of the promising directions in the development of the fish processing industry.

**The formulation of the problem in general form and its connection with important scientific or practical tasks.**

**1. Analysis of the current state of the problem.** In recent years, new types of minced fish-based products have been developed in the fish processing industry. This allows to significantly expand the range of semi-finished and finished products based on minced fish.. However, until now the main task is to obtain finished products with high physiological value and improved consumer properties. There are different methods are used, such as enrichment with dry egg and dairy products, vitamin and mineral supplements, flavonoids, polysaccharide mixtures, dry and liquid extracts based on medicinal herbs and aromatic plants, powders based on fruit and berries, vegetables and wild-growing berries. Relatively new is the method of enrichment with powders based on natural raw materials with a high calcium content, as an element that forms and maintains the normal state of bones and teeth. Calcium provides blood clotting, muscle contraction, nerve impulse transmission, hormone release, cell division, etc.

Calcium can prevent the risk of osteoporosis, colorectal cancer, hypertension, overweight with daily and long-term consumption. However, the showing of the

beneficial properties of calcium is possible only in the presence of other substances, such as vitamin D, proteins, phosphorus or fluorine, which are found in fish dry powders in the required amount to carry out biochemical reactions. However, it should be noted that the creation of products that are balanced by chemical composition does not guarantee their relevance in the market. Consequently, the development of technologies that allow obtaining enriched products with a high consumer rating is the main task of food engineering.

**2. Determination of the main research criteria.** The purpose of this article is to expand the range of culinary products with a balanced chemical composition based on dry minced fish from sea and freshwater fish with the addition of pearl powder. The assortment is based on simulated recipes of flour culinary products.

To achieve this goal, the main tasks were identified:

- determine the basic recipe of muffins, as products that enjoy increased consumer demand among the population;
- model the recipe of the combination products, balanced by chemical composition;
- prepare prototypes of products for tasting with their subsequent organoleptic evaluation and determination of nutritional and biological value.

**Presentation of the main research material with the full justification of the obtained scientific results.**

The results of the analysis of scientific and technical information allowed to testify about the advantages of combining various types of protein-containing raw materials with the aim of mutual enrichment and increase the biological value of fish and flour culinary products that have become objects of research.

Table 1 shows a comparative analysis of the chemical composition of fish raw materials (in the form of dry minced meat and wheat baking flour. The table data clearly shows that the content of the main components of these two raw material components differ significantly (Table 1).

Table 1 – The chemical composition of wheat flour 1 grade and fish raw materials (dry minced fish) [17]

Content per 100 g of product	Name of raw materials				
	Wheat flour 1 grade	Pikeperch	Salmon (trimming, ridges)	Carp	Crucian
Proteins, g	11,1	165,6	183,78	144	159,31
Fats, g	1,5	9,9	120,78	47,7	16,2
Carbohydrates, g	67,8	-	-	-	-
Minerals, mg					
- sodium	4	315	531	495	450
- potassium	176	2520	3267	2385	2520
- calcium	24	315	81	315	630
- magnesium	44	225	243	225	225
- phosphorus	115	2070	2160	1890	1980
- iron	2,1	4,5	3,06	7,2	7,2
- iodine, mcg;	-	45	-	45	-
Vitamins, mg					
B <sub>1</sub>	0,25	0,72	1,89	2,07	0,54
B <sub>2</sub>	0,08	0,99	1,44	3,42	1,53
PP	4,3	18	78,03	70,74	18,9
A, mcg	-	90	360	108	180
D, mcg	-	-	59,76	-	-
C	-	27	35,1	-	9
E	1,8	16,2	31,95	-	3,6

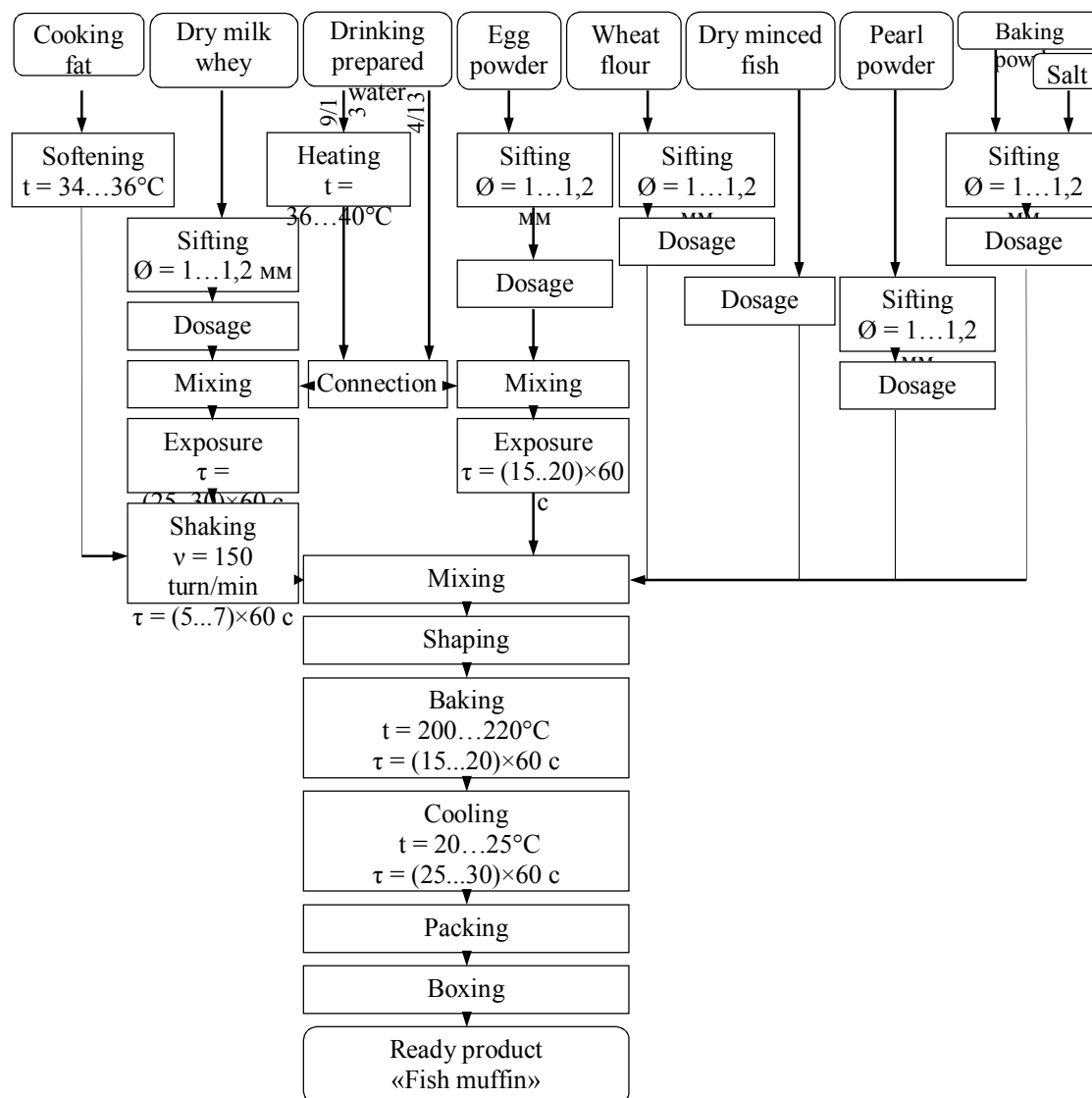


Fig. 1. Technological scheme of fish-flour culinary products (muffins)

According to the results of the analysis of table 1, the carbohydrates in dried minced fish are very small, therefore the starch flour is the raw component that regulates the carbohydrate content. Minerals are presented in a wider range

It is established that a rational ratio of flour and combined dry fish powder, which allows to maximize the biological value of fish foods culinary products is 10:90 and 15:85. This is ensured when the dosage of dry minced fish is 10–15% by weight of fish culinary products made from wheat flour of I grade. The same concentrations became interesting both technologically and economically.

Minced freshwater and saltwater fish were prepared by finely chopping fish fillets on the skin, followed by washing in citric acid solution. The concentration of acid to the mass of minced meat did not reach 0.3%, the hydromodule mince: water was 1:3. The final moisture

content of the dried minced fish did not exceed 13%. During the analysis of existing technological operations for the preparation of fish-flour culinary products, it was found that the preparatory stage of production lasts an average of 2–3 hours. The existing technologies analysis of various fish mince pies made it possible to identify opportunities for improving the technological process of preparing muffins for snacks and substantiate new recipes for fish and flour products, in particular, muffins based on dry minced fish enriched with pearl powder as a source of biologically active calcium. As can be seen from the scheme in fig. 1, the classic recipes of flour culinary products with fish fillings and the technological process of their production was changed. Milk and eggs were replaced with dry milk and egg products. The participation of whey in the recipe is advisable, since the pH of the dough piece decreases and the gluten proteins of flour and minced fish swell better. Also in the

presence of lactic acid, the process of dissolving pearl powder is accelerated with the formation of a highly digestible salt of calcium lactate and carbon dioxide. CO<sub>2</sub>. Such chemical processes can reduce the amount of baking powder and ensure the stabilization of the dough pH and the finished product is normal.

**Conclusions and perspectives of further development of this direction.** On the basis of research on the improvement of the technology of fish-flour culinary products using combined dried minced fish stuffed with biologically active calcium, we can summarize the following: the optimum physicochemical and organoleptic parameters of snack fish muffins can be considered as those that were obtained when minced fish in the range of 10 ... 15%; the use of combined dry minced fish, enriched with pearl powder, provides high quality products and biological value.

Analyzing the results, we can note the following. The addition of combined dry minced fish from marine and freshwater fish enriched with powder from pearl powder positively affects the energy and biological value of the fish in question due to increased protein content, reduced moisture and a slight decrease in the content of carbohydrates. This is observed as the amount of flour is replaced with minced fish. It should be noted that there is an increase in mineral and vitamin components depending on the number of minced fish. The number of minced fish significantly affects the structural and mechanical characteristics of the product. It should be noted that these experiments can be used for therapeutic and prophylactic nutrition, quality control of products and more complete use of low-value fish raw materials.

High moisture retention capacity of prototypes was noted. This contributed to minimal losses during heat treatment and a high percentage of finished products output. The organoleptic parameters of the prototypes on the average point of the tasting analysis are higher than the control samples by 20...25% of the total number of points. Experimental samples are characterized by a good commercial appearance, a more pleasant fish smell, higher taste characteristics. The slice view of the prototype has a more attractive color and juicy consistency than the control. The use of the proposed production of fish and flour culinary products reduces energy costs by eliminating the heat preparation of the filling, expanding the range of products with increased biological value. In addition, the replacement of milk and eggs with dry whey and egg powder can reduce the areas of the production zone where milk and egg products are prepared for production, as well as their storage, with the obligatory maintenance of cooling regimes.

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