Functional pasta on the basis of combining the food raw materials

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Abstract. The necessity for using the functional food products is dictated by the need of the human body for biologically active substances, which are insufficient in a normal diet. Currently, the assortment of domestic enterprises has almost no functional pasta. In the long term, borrowed European recipes will be presented on the Russian market, which can be an alternative to traditional types of products such as egg noodles and doughboys. The purpose of the research was to develop a recipe and technology for the production of functional “Rattles” pasta made of soft wheat flour, using German “Spätzle” doughboys as a prototype. Baking flour, linseed flour, milk powder and table eggs were used as the main ingredients. In order to increase the nutritional and biological value of a functional food product, it is advisable to additionally use ingredients that improve the functioning of the human organism. Such ingredients may include food additives such as spices of natural origin: turmeric and nutmeg. Using the technology of German doughboys “Spätzle” as a basis and the proposed set of ingredients as part of the recipe, innovative “Rattles” pasta has been developed. It is a functional product due to the content of flax flour and aromatic additives such as turmeric and nutmeg.

1. Introduction

Pasta is widely known and popular all over the world, many dishes are prepared using it. The Russian pasta market has a large variety of pasta. The structure of the pasta production market by type is presented in the diagram (Fig. 1).

In Italian and East Asian cuisines, pasta and its analogues act as a separate dish [14]. In our country, it is most often a side dish type. Pasta, in addition to nutritional value, also has a number of advantages, including a fairly low cost and high cooking speed. The technology for pasta production is constantly being improved as well as the quality of the product, its popularity is increasing and the reputation of pasta is changing. Previously, pasta was considered a high-calorie and less useful food product, contraindicated for people who adhere to a certain diet. Today, thanks to the popularity of Italian cuisine, it is gradually acquiring the status of a healthy product [8].
Consumer interest in instant food is growing, the attitude to pasta is gradually changing, it is perceived not only as a side dish, but also as a separate dish. Consumer commitment to pasta class A made from durum wheat remains unchanged [11].

Flour for the pasta production must comply with the requirements of Russian State Standard GOST 31463-2012 “Durum wheat flour for pasta. Technical conditions” [3] or GOST 31491-2012 “Soft wheat flour for pasta. Technical conditions” [4] according to organoleptic and physico-chemical indicators. In accordance with the standards for pasta, an admixture of no more than 15% soft wheat is allowed in durum wheat. Flour should be cleaned of metal impurities (not more than 3 mg per 1 kg of flour). The moisture content of flour should not exceed 15.5%. The gluten content in wheat flour should not be lower than 28% [17].

At the present time, the assortment of domestic enterprises has almost no functional pasta. One of the reasons is that the use of non-traditional raw materials affects the processes of dough preparation and drying, and also changes the properties and shelf life of finished products. That is, these problems require further study. Moreover, certain results in this direction are already available.

R.B. Temiraev et al. [10] obtained positive results by adding milk thistle extraction cake to dough for pasta production. The positive effect on the tread, physico-chemical and organoleptic qualities of the products were obtained. In addition, milk thistle cake extraction provides pasta with detoxifying properties, which allow removing heavy metals from the organism when consuming such pasta.

It is known that high-quality pasta is obtained from flour made of durum and strong wheat varieties. Macaroni flour differs from baking wheat flour in high protein content and granular structure. Because of this it has a fairly low water absorption capacity.

According to experts, domestic production of pasta in the long term can supply borrowed European recipes to the Russian market, which can put an alternative to traditional types of raw materials, primarily egg noodles and doughboys.

“Spätzle” are German homemade pasta, doughboys made of batter based on wheat flour, eggs and milk, they are also called German doughboys. They come in different lengths and thicknesses, depending on the device they were formed by.

In Germany, various special tools are used to make “Spätzle”. The dough can be put on a chopping board, cut into slices and placed to boiling water with a special flat knife, in this case thin oblong “Spätzle” are obtained, which are similar to noodles. Special spätzle-grates are also used, which are attached to the pan, and with the help of them the dough is wiped and then immediately falls into boiling water (Figure 2).
Figure 2. “Spätzle” molding tools.

Spätzle-presses (resembling a garlic squeeze press, only larger) are also used, in which the dough is placed and squeezed into a pot of boiling water.

2. The goal, materials and methods of the research

The goal of this research was to develop a formulation and technology for the production of “Rattles” functional pasta from soft wheat flour, using German “Spätzle” doughboys as a prototype.

The experimental part of the study was carried out on the basis of the department of production technology and processing of agricultural products, FSBEI HE Stavropol SAU.

Baking flour of at least first grade according to Russian State Standard GOST R 52189-2003 [6], linseed flour (producer OOO “Plesa”, Moscow), and skimmed milk powder in accordance with Russian State Standard GOST R 52791-2007 [7] were used as the main ingredients for making “Rattles”. Also, table eggs according to Russian State Standard GOST 31654-2012 [5] and food additives like salt, turmeric and nutmeg were used. The dough was kneaded in a laboratory dough mixer. Shaping and cooking of products was carried out using laboratory kitchen equipment.

The quality composition of the products obtained was determined by laboratory and tasting methods. In addition to the main component – wheat baking flour, flax flour is included in the recipe for obtaining a test for “Rattles” (table 1). This is a natural product that is obtained as a result of processing flaxseed into powder after pressing the oil.

### Table 1. The nutritional value of “Plesa” flax flour.

| Indicator                      | Content, % |
|-------------------------------|------------|
| Proteins, not less than       | 30         |
| Fats, including               | From 12 to 20 |
| - linoleic acid (omega-6)     | 5-15       |
| - oleic acid (omega-9)        | 1.8-3.0    |
| - linolenic acid (omega-3)    | 1.0-1.6    |
| Carbohydrates, including      | 38         |
| - digestible                  | 8          |
| Dietary fiber, including      | 32-44      |
| - cellulose                   | 7          |
| Ash, no more                  | 6          |
| Energy value, kcal            | 270-280    |

Flax flour “Plesa” contains at least 30% protein, from 12 to 20% fat, which contains biologically valuable fatty acids (omega-3 and omega-6), as well as carbohydrates and dietary fiber (of which about 7% is fiber), which allows considering this product as an ingredient for functional products.

The nutritional value of flaxseed flour is 280 kcal per 100 g of product. Of particular value are polyunsaturated fatty acids, which are part of the flaxseed fat fraction. They are necessary for the proper growth and functioning of the human body, since they are contained in all cell membranes.
Their deficiency leads to an extensive pathological change in various organs, delay growth and reproductive dysfunction [9].

An important component of the “Spätzle” dough is a chicken egg. It is a unique natural product that has important biological properties in addition to high nutritional value. The chemical composition of eggs includes the avidin protein, which binds vitamin H (biotin), regulates neuroreflex activity by forming the avidobiotin complex. The composition of chicken eggs includes a fairly large amount of fat, most of which is concentrated in the yolk. They are characterized by a low melting point, which contributes to good absorption by the human body. It is important that the composition of yolk fats includes essential fatty acids such as arachidonic, linoleic and linolenic, as well as a rich set of macro- and microelements, B vitamins and other biologically valuable nutrients.

In order to increase the nutritional and biological value of the food product, as well as to give it a functional orientation, it is advisable to additionally use ingredients that improve the functioning of the human organism. For example, such food additives as spices of natural origin like turmeric and nutmeg could be included.

Turmeric (or yellow root) is a ginger bloodline plant from Southeast India. Its stems and rhizomes are used as a spice. Turmeric contains vitamins K, B, B 1, B 3, B 2, C and following micronutrients: calcium, iron, phosphorus and iodine. However, it is difficult to determine their value, as they are contained in microdoses in the plant itself. Thus talking about the significance of these elements does not make sense, when used in vestige amounts in a pinch of seasoning added to food. However, turmeric contains components that have a healing effect on the human body even in microscopic amounts. These are essential oils and their components: sabinen, borneol, zingibern, terpene alcohols, fellandren, curcumin and a number of other components. Curcumin plays a special role in this list.

Curcumin gives a yellow color to the seasoning, as well as to the products to which it is added. Turmeric has anti-inflammatory, anthelmintic, antimicrobial, antiseptic, antiviral, cleansing, immunomodulating, regenerating, sedative, tonic, warming effects [14].

Nutmeg is the core of the bony part of the nutmeg tree fruit. It is a spice that is not only tasty, but also healthy. Nutmeg kernels contain vitamins (A, groups B, PP, H, E), minerals (phosphorus, magnesium, iron, calcium, chlorine, sulfur, sodium, zinc, copper, iodine and others), essential oils, starch and pectin.

Its nutritional value is presented in Table 2.

| Content, g per 100 g | Energy value, kcal |
|----------------------|-------------------|
| Proteins 21          | Fats 49           |
| Carbohydrates 7.5    | Ash 3.1           |
| Water 9.5            | 557               |

The useful properties of nutmeg are manifested when it is used in small doses in the form of ground powder. In cooking, nutmeg has found many uses. It is used for baking rolls, all kinds of cookies, muffins. It goes well with fruit cocktails. At home canning, it is used as a flavoring and preservative for the preparation of marinades. In the meat industry, spices are included in sausages and pastes. The tobacco industry produces cigarettes with the addition of nutmeg essential oil [13].

3. Research results
A recipe and technology has been developed (table 3) for “Rattles” pasta, which is similar to doughboys.
Table 3. “Rattles” and “Spätzle” pasta recipe.

| Name of ingredient               | “Rattles”   | “Spätzle”  |
|----------------------------------|-------------|------------|
| Wheat flour                      | 52.50       | 52.00      |
| Flax flour                       | 4.55        | -          |
| Chicken egg                      | 35.90       | 45.50      |
| Skimmed milk powder              | 5.0         | -          |
| Salt                             | 2.00        | 2.50       |
| Nutmeg                           | 0.10        |            |
| Turmeric                         | 0.04        |            |
| **Total:**                       | **100.0**   | **100.0**  |

Flax flour and skimmed milk powder are used as the main ingredients in the developed recipe, the table salt content is reduced by 0.5%, and functional aromatic additives, such as turmeric and nutmeg, are introduced.

Flour of both types and milk powder must be sifted. Then salt, turmeric and ground nutmeg are added to the resulting mixture. Eggs are slightly beaten in a separate container and kept at a temperature of 8 ± 2 °C for at least one hour. Then, the egg mixture is poured into the prepared flour mixture, and all this is thoroughly mixed with a mixer. The dough should be viscous (like the one for pancakes). The differences in the dough composition for both types of pasta are presented in table 4.

Table 4. Nutritional value of pasta, “Rattles” and “Spätzle”.

| Indicator              | “Rattles” | “Spätzle” |
|------------------------|-----------|-----------|
| Proteins, %            | 12.9      | 11.1      |
| Fats, %                | 5.0       | 4.9       |
| Carbohydrates, %       | 40.8      | 36.2      |
| Energy value, kcal     | 260.0     | 233.7     |

Cooked “Rattles” (Figure 3) are ready for use as a separate or side dish.

In order to give the product a market appearance and the realization possibility, after cooking they must be dried on a perforated surface and sent to the freezer for shock freezing at a temperature not exceeding minus 25 °C.

After freezing, the “Rattles” are packed in bags from which air is removed, and hermetically sealed. In packaged form, the product can be guaranteed to be stored for at least 90 days at a temperature of minus 18 °C.
4. Discussion
The traditional “Spätzle” recipe includes three following ingredients: wheat flour, egg and salt. In the recipe of the innovative product “Rattles”, the amount of eggs is reduced by 15%, and new components, such as flaxseed flour, skimmed milk powder and spices are introduced.

Despite following insignificant differences in the quantitative composition of the obtained products: protein is 1.8% more, fat – 0.1%, carbohydrates – 4.6%, “Rattles” are enriched with protein and carbohydrates of animal origin, and the fat fraction is enriched with unsaturated fatty acids. Moreover, adding even small amounts of turmeric and nutmeg gives a functional focus to the product.

5. Conclusions
Thus, using a set of ingredients of animal and vegetable origin, and the technology of German “Spätzle” doughboys as a prototype, an innovative “Rattles” pasta is developed. It can be considered as a functional product due to the content of flax flour and aromatic additives, such as turmeric and nutmeg.

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