Technology of using herbal ingredients for whey sauce

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Abstract. The study aims to provide high-quality and nutritious food products. The use of processed products of curd whey and herbal ingredients, in particular parsnips, in the development of recipe-component solutions for new structured products is advisable, since it enables not only to expand the range but also to combine the valuable nutrient composition and unique properties of these components, obtain a product of high nutritional and biological value. The authors have developed a resource-saving technology and investigated the qualitative composition of fermented milk sauce.

1. Introduction

Whey being a by-product obtained in the production of cottage cheese, cheese and casein holds a specific place among the various types of secondary dairy raw materials. The resources of whey obtained from the production of cheese and cottage cheese remain huge, and a slight decrease in the production of basic products does not solve the issue of whey processing [1-3]. Moreover, the volume of curd whey is comparable to the volume of cheese whey and accounts for about half of all whey produced.

Curd whey is obtained by acid coagulation of casein affected by lactic acid produced during the life of lactic acid bacteria. In this regard, curd whey contains more calcium, magnesium and phosphorus, which is associated with an increase in the concentration of hydrogen ions towards soluble calcium dihydrogen phosphate during fermentation. In the process of rennet clotting, a significant part of the calcium binds to paracasein and remains in the clot [4-6].

Curd whey is characterized by an increased content of lactic acid, which is due to the acidic method of protein coagulation, in which lactic acid is formed from lactose as a result of the vital activity of the starter culture introduced into milk during curd production. Curd whey contains 3.5 times more free amino acids and seven times more essential free amino acids since more intensive hydrolysis of proteins occurs during curd production. Serum contains monosaccharides represented by glucose and galactose [7].

Curd whey is distinguished by its qualitative composition. From a technological perspective, the composition and state of proteins, raw materials acidity, as well as the qualitative and quantitative composition of mineral components are important. Comparative analysis indicates the valuable composition of curd whey. In addition, the following factors have a great influence on the curd whey processing: whether the whey was quickly collected and whether it underwent further processing; modes of the original whey heat treatment; conditions for its reservation; types of equipment for whey processing, etc. [2, 8].
The use of vegetable crops, specifically parsnip powder (*Pastináca sátiva*), in the technology of traditional and new types of dairy products, seems to be very promising. A wide range of nutrients, physiologically active substances that make up vegetables, enables to consider them as raw materials for creating functional products, in particular, to include them in the diet of people suffering from diabetes mellitus. Patients with diabetes mellitus are advised to eat a diet high in complex carbohydrates and fiber and low in sugar and fat [3, 9].

Thus, the use of processed products of curd whey, herbal ingredients, in particular parsnips, in the development of a recipe-component solution for new structured products is, in our opinion, advantageous, since it allows not only to expand the range but also to combine the valuable nutrient composition and unique properties of these components, obtain products of high nutritional and biological value.

2. Materials and methods

During the experiment, the objects of research were as follows: natural curd whey according to OST 10-213-97, parsnip root vegetable powder, as well as a sauce based on the above ingredients. The work used the components necessary for the production of new products: drinking water (SanPiN 2.1.4.1074-01), gelatin (GOST 11293-89), apple pectin (GOST 29186-91), citric acid (GOST 908-79), flavoring substance (OST 10237-99), dye (OST 10093-96). All raw materials met the requirements of SanPiN 2.3.2.1078-2001 in terms of safety and microbiological indicators.

The methods used can be classified into research methods for organoleptic and physicochemical properties, structural and mechanical characteristics, microbiological research methods in the studied products, as well as methods for determining the food, biological and energy value of the developed recipe compositions and finished products.

3. Results and Discussion

The research work aimed to expand the range of milk sauces enriched with biologically active substances using secondary dairy raw materials and herbal ingredients.

The authors have developed a component-recipe solution and technology for a new fermented milk sauce using herbal ingredients.

The use of vegetable crops, in particular parsnips, in the technology of new types of dairy products seems to be very promising. A wide range of nutrients, physiologically active substances that make up parsnips enable to consider the root crop as a raw material for creating functional products [10].

The study of the biochemical composition of the culinary variety parsnip (*Pastináca sátiva*) has found that it is characterized by a high content of carbohydrates including fiber and pectin. As for the vitamins and minerals content, the greatest amount of vitamin C and the macroelement potassium can be underlined.

Parsnips were dried in a convective-vacuum-impulse (CVI) dryer. When drying by convective-vacuum-impulse, external and internal heat and mass transfer are intensified, the duration of the process is reduced and overheating of the products is excluded not only in the 1st drying period but also after the removal of free moisture. The prepared parsnips were dried at a temperature of 55-60°C, at which the thermolabile substances are preserved as much as possible. Duration of drying crushed root parsnips to moisture content from 8 to 14% during 45 - 60 minutes. When drying parsnips in the traditional way on belt conveyor dryers, the drying time was 140 ... 150 minutes. That is, using the modern method of CVI drying, the process was intensified by 2.5-3 times. It has been established that dried parsnips obtained by the CVI method are characterized by high nutritional value, high content of pectin, vitamin C, magnesium, potassium and phosphorus.

As studies have shown, the addition of up to 14% parsnip powder to curd whey increases the biological value of the mixture from 71.3% to 87.3%. Thus, the multitude of nutrients and physiologically active substances has determined that it is advisable to use parsnip powder for the production of sauces of high nutritional and biological value.
The technological scheme for the new sauce production implies the use of commercially available equipment and does not complicate the production process of the product. The curd whey obtained in the curd shop is cleaned of casein particles using a separator-purifier. Further, the whey is pasteurized at a temperature of 72 ± 2°C and cooled to a temperature of 20-25°C. Since the main recipe ingredient of the developed sauce is curd whey, rational parameters of its processing were determined.

It was found that the addition of apple pectin to the whey prior to pasteurization improves thermal stability and allows keeping most of the protein in its native state. The optimal conditions for pasteurization and whipping of curd whey have been determined. Part of the curd whey is used to prepare stabilizers, for which they are mixed in a ratio of 8:1 and reserved for 30-40 minutes. Before use, the prepared gelatin is heated until being completely dissolved. Then all the ingredients are mixed to obtain the finished sauce. The proposed scheme differs from the traditional one by the following technological operations: purification of curd whey from casein dust; whey pasteurization with stabilizer and cooling; mixing recipe ingredients. The finished sauce is stored at a high temperature of 4±2°C and a relative humidity of 70-75%.

Fermented milk sauce obtained by direct addition of the bacterial lyophilized starter Sacco Lyofast ST-328 was studied. To enrich the fermented milk sauce, we used parsnip powder (Pastináca sátiva), whose roots contain inulin and fiber, vitamins, macro- and microelements. The quality indicators were analyzed in the finished product (table 1, 2).

| Indicator | Descriptor |
|-----------|------------|
| Description, color | Light orange in color (depending on the dye color used), uniform throughout the mass |
| Consistency | Homogeneous, with moderately thick mass |
| Taste, smell | Sweet sour milk taste, the smell of the flavoring substance used |

Fortification of the nutrient composition of the fermented milk sauce with parsnip powder (Pastináca sátiva) increases its nutritional value. The developed sauce is rich in lactose. It satisfies the daily requirement for lactose by at least 15%. Along with the energy functions, lactose serves as a structural carbohydrate. In addition, being slowly absorbed in the intestines, milk sugar contributes to the maintenance of the vital activity of lactic acid and bifidobacteria.

The sauce is enriched with ballast substances. Fiber passes through the gastrointestinal tract and activates intestinal motility, which improves the digestion process [4]. It promotes the excretion of excess cholesterol from the body, normalizes the composition of intestinal microorganisms and promotes the formation of vitamins of group B. Pectin is a natural enterosorbent and binds gel-like structures, which contributes to clearing the body of toxic metals being biologically harmful substances that accumulate in the body.

The study of the mineral composition of the prototype sauce enables to conclude that it is an effective source of the main macronutrients, specifically, calcium, magnesium, potassium, sodium and phosphorus, for the human body. Calcium, the daily requirement for which is satisfied by more than 15%, also plays an important role in the processes of growth and activity of cells, participates in the regulation of the release of permeability of cell membranes, in the process of impulses transmission, muscle contractions, and controls a number of enzymes [1]. Phosphorus contributes to the maintenance of acid-base balance in cells, regulates the transfer of oxygen to tissues, provides the activity of a number of enzymes, hormones, and participates in the construction and functioning of biomerans. The developed product is rich in magnesium, which plays a structural role in bone tissue, membranes and chromosomes, as well as regulates ion transportation across membranes [10].
Table 2. Indicators of fermented milk sauce quality

| Food substance                  | Mass fraction |
|--------------------------------|---------------|
| Mass fraction of proteins, %    | 2.9           |
| Mass fraction of lactose, %     | 2.6           |
| Mineral substances, mg%, incl.  |               |
| sodium                         | 37.20         |
| potassium                      | 105.40        |
| calcium                        | 150.00        |
| phosphorus                     | 75.00         |
| iron                           | 6.30          |
| Vitamins, mg%, incl.           |               |
| thiamine                       | 0.03          |
| riboflavin                     | 0.09          |
| niacin                         | 0.50          |
| ascorbic acid                  | 15.60         |

Determining the shelf life is the most important step in assessing the quality of products. To establish this indicator in accordance with the requirements of SanPiN 2.3.2.1078-01, the microbiological and physicochemical indicators of the prototype were examined during storage. Samples of products were stored at a temperature of 4 ± 2°C. Organoleptic, physicochemical and microbiological parameters were determined every 24 hours. As a result of research, it has been found that the product meets the requirements of TR TS 021/2011 “On food safety” within 6 days of storage.

4. Conclusion

The component-recipe solution of the sauce containing herbal ingredients and ensuring the rational use of raw materials has been theoretically and experimentally substantiated. The composition, nutritional value and functional and technological properties of curd whey and parsnip puree (Pastináca sátiva) have been determined. The viability of the combined use of these ingredients in the production of a new fortified fermented milk sauce has been experimentally confirmed.

It was found that the best quality of the sauce in terms of organoleptic, physicochemical and structural-mechanical quality indicators is ensured when adding parsnip powder (Pastináca sátiva) in a dosage of 15-20%. Pasteurization conditions aimed to preserve up to 90% of proteins in the native state: 74 ± 2°C with exposure for 10 minutes and the use of 2% apple pectin as a stabilizer have been recommended. A resource-saving technology and a sauce recipe with a high content of biologically active substances have been developed based on the findings on the effect of parsnip powder (Pastináca sátiva) on the quality indicators of the finished sauce. The proposed technological method allows obtaining a sauce that meets the requirements of modern concepts of positive nutrition supplementing the diet of the population with valuable nutrients of plant and dairy raw materials. The advantages of the proposed technical solution are the increased nutritional and biological value, efficiency of using the resources of the dairy industry.

The composition and physicochemical properties of the developed sauce have been studied, its high nutritional and biological value has been established, and its safety has been confirmed. Based on a comprehensive study of organoleptic, physicochemical and microbiological indicators, the shelf life of the sauce is defined as 6 days. The consumer receives a more valuable product with the components necessary for the human body: whey proteins, vitamins, mineral and dietary fibers.

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