Study of quality indicators of fermented dairy foods

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Abstract. Samples of kefir products with a vegetable component addition were developed in the work. The rheological properties of the products were also studied in this paper. The strongest bond with the clot was determined in the samples with the vegetable component addition in the amount of 4 and 5%. An improvement in the rheological parameters of the kefir product was proven: a viscous structure, a reduced tendency to syneresis compared to the control sample. The functional and technological properties of dried food kelp and agave syrup used in the technology of the curd product were also investigated. Starter cultures with quail egg powder were selected for fermented dairy beverage.

1. Introduction

Kefir manufacture in the Russian market is constantly expanding due to the introduction of new technologies. The range of manufacture of kefir products is also increasing [1, 2].

A new kefir product including the following recipe components: whole milk; skim milk; concentrated bacterial starter culture "Profiline"; pumpkin seed meal was produced at the Department of Technology of Animal Origin Products of the Federal State Budget Educational Institution of Higher Education "VSUET".

Fermented dairy foods are functional products. The increased value in them is achieved by the addition of different flavoring components. Analysis of the literature data showed that the production of the kefir product with the above recipe and component composition is planned for the first time.

The range of curd products expanded significantly with the development of the dairy industry. They are convenient for medical nutrition, a number of diets, as well as daily use due to the increased energy value of curd products and delicate consistency. Today, the range of curd products depends directly on the product ingredient composition. The functional and organoleptic properties of vegetable components depend on their plant raw materials quality. Vegetable ingredients are perfectly combined with curd products giving them new functional properties [3].

Technologies including the enrichment of products with essential nutrients and biologically active substances that have a positive effect on the body are of great interest to the dairy industry. In addition, fermented dairy foods are among the most useful products that are not only functional and allow you to recover and even to prevent some diseases, in particular those associated with the gastrointestinal tract.

2. The purpose of study

The structure of the concentrated bacterial starter culture "Profiline" includes: Streptococcus salivarius ssp. thermophilus, Lactococcus lactis ssp. lactis, Lactococcus lactis ssp. cremoris, Lactococcus lactis
ssp. lactis biovar diacetylactis, Leuconostoc mesenteroides ssp. mesenteroides, Kluyveromyces marxianus, which makes it possible to obtain a yeast kefir product with high quality indicators.

Pumpkin seed meal contributes to the enrichment of the kefir product with protein, fiber, dietary fiber, vitamins, macro-, microelements and has a beneficial effect on the nutritional value of the latter improving its rheological properties.

One of the most effective and efficient methods of combating nutritional diseases is mass prevention, which is associated with the enrichment of micro- and macroelements of the most common food products. In this regard, the development of technology for dairy foods enriched with iodine with high digestibility and in a bioavailable form is relevant and promising.

Fermented dairy beverages are favorite products of many people due to their refreshing taste, delicate texture, and biological benefits. Now you can find many enriched fermented dairy beverages on shop counters, but unfortunately, some of them are created without taking into account the compatibility of the milk base and the enrichment component, both biologically and functionally. The study of quail egg powder application as a component-enrichment in the technology of fermented dairy beverages is of particular interest.

3. The object of study
The objects of study are samples of kefir product, kefir, fermented dairy beverage, quail egg powder, mixed cultures starters.

In the process of research work carrying out, the focus was on the study of the functional and technological properties of dried food kelp and agave syrup. Also, the objects of study were samples of a curd product enriched with iodine and agave syrup.

4. Materials and methods
Syneresis was determined by the filtration method and the viscosity of fermented dairy beverages - with a SV-100 vibro viscometer.

Studies of the enriched fermented dairy beverage were carried out with the application of a generally accepted method using a pH-meter.

The studies were carried out with the following methods: inductively coupled plasma mass spectroscopy, inductively coupled plasma atomic emission spectrometry, stripping voltammetric method for the mass concentration determining of iodine in curd product.

5. Discussion of results
The kefir product was manufactured according to the traditional scheme, taking into account the temperature and time of starter culture fermentation.

The vegetable component dosage was varied from 1 to 5%. Evaluation of samples quality indicators (No. 2 - 1% pumpkin seed meal, No. 3 - 2%, No. 4 - 3%, No. 5 - 4%, No. 6 - 5%) was carried out in comparison with the product without additives (sample No. 1).

The rheological properties of kefir products were studied in the work (figure 1).
In the studied kefir products samples, syneresis took place to a greater extent in the first hour: in sample No. 1 $76 \pm 1\%$ of its volume was released within 5 hours of syneresis; in sample No. 2 $72 \pm 1\%$; in sample No. 3 $81 \pm 1\%$; in sample No. 4 $77 \pm 1\%$; in sample No. 5 $81 \pm 1\%$; in sample No. 6 $77 \pm 1\%$.

During the next hour (1 - 2 hours) of syneresis, the whey amount in sample No. 1 was $15 \pm 0.5\%$; in sample No. 2 $16 \pm 0.5\%$; in sample No. 3 $14 \pm 0.5\%$; in sample No. 4 $16 \pm 0.5\%$; in sample No. 5 $15 \pm 0.5\%$; in sample No. 6 $15 \pm 0.5\%$.

Then the intensity of the whey release after 1 hour (2 - 3 hours) decreased to $6 \pm 0.5\%$ in samples No.1 and No. 2; up to $4 \pm 0.5\%$ in samples No. 3 and No. 4; up to $2 \pm 0.5\%$ in sample No. 5; up to $4 \pm 0.5\%$ in sample No. 6. The whey increase for the next hour (3-4 hours) averaged 1.5-2%.

The data of the syneresis intensity, % in the samples under study, depending on the time, were studied in the work. The strongest bond with the clot was determined in samples with the addition of the vegetable component in the amount of 4 and 5%.

In freshly developed experimental samples, the viscosity was higher compared to the control one, which is associated with the presence of pumpkin seed meal in their recipe- and component composition. During the storage, a significant increase in viscosity was observed in experimental samples.

The chemical composition of dried food kelp with a particle size of up to 200 microns was investigated in the work. The data are presented in table 1. The studies carried out showed that dried food kelp contains a significant amount of L-fructose, proteins, vitamins C, B12, B1, B2, D, carotene, macro- and microelements, violaxanthin, as well as the following pigments: fucoxanthin, neoxanthin, neofucoxanthin [4, 5].

As for minerals, calcium, magnesium, sodium, potassium, phosphorus were found in kelp. The research results showed the content of a significant amount of iodine $-676 \text{mg} / \text{kg}$, most of which is in the form of iodides and organoiodine compounds, in particular, diiodotyrosine [6].

**Table 1. Macronutrients content in dried food kelp.**

| Macronutrients content in dried food kelp, mg / g |
|---------------------------------------------|
| Calcium                                    | 26201.0 |
| Magnesium                                  | 11271.0 |
| Sodium                                     | 8195.0  |
| Potassium                                  | 3727.0  |
Phosphorus 1372.0

| Microelement | mg/g |
|--------------|------|
| Silicon      | 3.64 |
| Copper       | 2.2  |
| Iodine       | 676.0|
| Selenium     | 0.02 |
| Cobalt       | 0.13 |

Due to the fact that the fruit- and vegetable filler for the curd product is exposed to the temperature effect of positive temperatures in the range of 85 ... 90 °C, as well as low temperatures (-2 ... -6 °C) during the technological process, it was necessary to determine the effect of temperature on the change in the iodine mass proportion in the product. In the course of study, we found out that temperature affects significantly the change in the amount of iodine (figure 2).

![Figure 2](image)

**Figure 2.** Influence of temperature processing on the iodine content in the filler with dry food kelp for curd product.

It was found out that dry food kelp should be added to the initial mixture in concentrations that provide the iodine content in the final product at the level of 40-50 mg / 100 g - 0.16 ... 0.19 g / 100g of the product of dry food kelp.

The fermented dairy beverage was produced by the reservoir method according to the traditional scheme. The beverage recipes with the introduction of quail eggs powder in a dosage of 0.2 to 10% of the normalized product mixture were investigated in the work. The enriching agent dosage was carried out taking into account the organoleptic, physicochemical indicators, structural and mechanical indicators [7].

It was found out that an increase in the mass fraction of the enriching agent results into a fishy taste of the product, thereby reducing the attractiveness and saturation of the fermented dairy beverage.

With an increase in the component mass fraction in the mixture, a sharp hardening of the clot and a significantly rapid whey separation were observed, which led to an increase in the viscosity of the finished product.
The study of the starter cultures selection for the beverage production was carried out. The starter cultures study containing symbiosis of such strains as *Streptococcus thermophilus* and *Lactobacillus bulgaricus* is of particular interest. The application of mixed starter cultures made by the company "Chr. Hansen, Denmark (table 2) was considered in the work to obtain a functional enriched fermented dairy beverage with high consumer properties. The amount of starter culture was introduced according to the manufacturer's recommendation [8, 9].

**Table 2.** Species composition of the starter cultures used.

| Starter name   | Strains                                         |
|----------------|-------------------------------------------------|
| F-DVS YoFlex Mild 1.0 | *Streptococcus thermophilus, Lactobacillus bulgaricus* |
| F-DVSYoFlex Harmony 1.0 | *Streptococcus thermophilus, Lactobacillus delbrueckii subsp. bulgaricus, Lactobacillus fermentum* |
| F-DVS YoF-L901   | *Streptococcus thermophilus, Lactobacillus bulgaricus* |

It was found out that the starter culture F-DVS Yo-Flex Mild 1.0 is characterized by the highest ability to acid formation in a shorter period of time (figure 3).

![Figure 3. Acid-forming ability of starters.](image)

The exopolysaccharides synthesized by microorganisms have a significant effect on the product texture. They allow to get a dense and even consistency satisfying the consumer with a pleasant fermented milk aroma. The same substances are a binding framework that prevents possible syneresis in the product. Most thermophilic bacteria are known to be excellent producers.

The F-DVS Yo-Flex Mild 1.0 starter culture is characterized by the highest ability to synthesize exopolysaccharides, the required viscosity and texture to ensure high consumer properties of the resulting product. Thus, relying on the research carried out the best characteristics for the product obtaining is the starter culture F-DVS Yo-Flex Mild 1.0.
6. Conclusion
Improvement of rheological parameters of kefir product with pumpkin seed meal was proved: viscous structure, reduced tendency to syneresis in comparison with the control sample.

The enrichment method and the mass fraction of the dried food kelp introduction into the fruit and vegetable filler for the curd product were determined to enrich dairy products with iodine.

The possibility of obtaining a functional product with quail egg powder was determined and the starter cultures for its production were selected in the work.

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