

Technology development of kumis functional drink

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ABSTRACT

Introduction. The purpose of this work is to develop the production technology and trade analysis assessment of kumis drink, which is functional food product.

Materials and methods. The mare's milk, kumis, kumis drink made of cow's milk rich in iodine and inulin was investigated. The content of mass concentration of iodine, lead, copper, zinc and cadmium in them using "Ecotest-VA" was determined. The antioxidant properties of inulin and inulin-iodine complex were determined by the chemiluminescence analysis.

Results and discussion. New objective measure of quality trade analysis of kumis and kumis drinks is developed. There has been developed a modified method for the chemiluminescence analysis using $1 \cdot 10^{-1}$ M solution of azodiisobutyronitrile acting as the initiator of free radical lipid peroxidation. The method of rapid assessment of qualitative characteristics of kumis by chemiluminescence analysis has been given scientific credence – it determines light sum and the maximum chemiluminescence luminosity in kumis. With the values ranging from $0,93 \pm 0,07$ pH to $2,17 \pm 0,26$ pH and from $0,57 \pm 0,05$ pH to $1,92 \pm 0,41$ pH, the product is assessed as a quality product having preserved a biological value. Production technology of kumis drink enriched with inulin and iodine is developed. For this technology there has been carried out laboratory and industrial testing. Experimental models of iodine deficiency in rats show that kumis drink rich in iodine and inulin, gives physiological activity. The calculation of economic efficiency for kumis drink production is defined. Implementation of development in dairy plants will allow to provide the population by health functional food.

Introduction

Development of technologies for industrial production of functional food products is one of the priorities enunciated as a state policy of the Russian Federation № 1873 - p dated 25.10.2010 "On the State Policy of the Russian Federation in the field of healthy nutrition for the period up to 2020".

Lack of protein, vitamins, dietary fiber, macro- and micronutrients in the diet causes the growth of socially dangerous diseases. It is known that insufficient intake of iodine in the human body leads to violations in the structure and function of the thyroid gland, inadequate production of thyroid hormones and the emergence of endemic goiter and diseases associated with dysfunction of various organs and systems, an imbalance of the immune system. Thus, malfunction of the thyroid gland causes diseases of the upper respiratory tract, and pulmonary tuberculosis particularly.

It is known that kumis being a product of therapeutic and prophylactic purposes, refers to a high-performance antituberculous means. Unfortunately, mare's milk kumis is produced only in the areas of Russian horse herd farming. In other areas mare's milk is not produced due to lack of raw materials and the impossibility of its long-term storage, though the need for kumis is very substantial. Therefore, the development of production technology of iodinated kumis drink, as close as possible to the natural, is of great and social importance. Making kumis drink along with the organization of industrial production has broad prospects for its use as an effective functional beverage.

The aim of this work is the development of production technology and trade analysis of iodinated kumis drink.

In accordance with the purpose of the investigation, the aims of the study are stated as follows:

- developing a method for rapid assessment of the quality characteristics of kumis and kumis drinks by chemiluminescence analysis;
- investigating the intensity dynamics of lipid peroxidation in kumis drink by chemiluminescence analysis, determining the concentration of malondialdehyde;
- developing the formulation and production technology of iodinated kumis beverage;
- carrying out a comprehensive trade analysis of kumis beverage;
- assessing the economic efficiency of production of iodinated kumis beverage;
- developing scientific and technical documentation for the iodinated kumis drink.

Materials and methods

This work has been carried out at the Branch of Razumovsky Moscow State University of Technology and Management in Meleuz in the Research Laboratory "Food Technology", accredited according to the analytical laboratory accreditation system GOST R ISO / IEC 17025-2006 (International Standard ISO / IEC 17025:2005), on the basis of Production Laboratory of JSC "Meleuz Milk Factory" and the joint expert laboratory of the National Union of Milk Producers "Soyuzmoloko". The objects of study are: mare's milk, kumis, kumis drink made of bovine milk, rich in iodine and inulin. The content of the mass concentration of iodine, lead, copper, zinc and cadmium has been determined in the mare's milk, kumis and kumis drink, it was done with the device "Ecotest-BA" (Guidelines № 001-110-01, 001-91-00). To evaluate the antioxidative properties of inulin and inulin-iodine complex by the chemiluminescence analysis there were used model test systems that simulated formation of reactive oxygen species and lipid peroxidation reactions. As the model system 1, there were used 20 ml of phosphate buffer with the addition of sodium

citrate and luminol (R. Farkhutdinov, 2003). As the model system 2, there was used a suspension of egg-yolk lipoproteins containing lipoprotein complexes (G. Klebanov et al, 1988).

Results and discussion

In developing the method of rapid assessment of kumis quality, we have chosen a method based on the study of super-weak luminescence intensity of the objects under investigation.

In order to conduct trade analysis there were produced experimental batches of kumis beverage under JSC "Meleuz Milk Factory" – kumis drink with potassium iodide and inulin 1.5% fat content - recipe number 1 (sample number 1), kumis drink with potassium iodide and inulin 0.05% fat - recipe number 2 (sample number 2). As a control there were used kumis drinks fat 0.05% (sample number 3) and 1.5% (sample number 4), prepared according to the same recipes, but without adding potassium iodide and inulin.

Kumis drinks were stored in a refrigerator at a temperature of $4 \pm 2^{\circ}\text{C}$. Physical, chemical and organoleptic characteristics were evaluated in the samples, their safety was determined on the basis of microbiological research, as well as the intensity of lipid peroxidation.

As seen in Figure 1, inulin has a significant effect on the titratable acidity in kumis drinks. So, if indicators of acidity in kumis drinks 1.5% fat and 0.05% without introducing inulin increased by 45.64 % and 44.2 %, in kumis drinks containing inulin the similar figure increased respectively by 57.1 % and 55.4 % on the 10th day. Consequently, inulin has an inhibitory effect on the formation of free fatty acids and other acidic compounds in the functional food product.

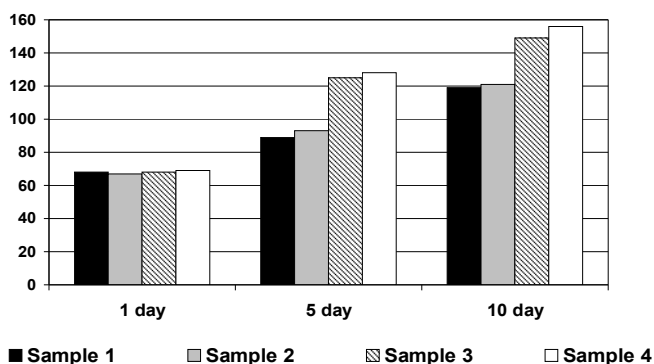


Figure 1. Titratable acidity indicators.

Results of studies for determining fat, protein, MSNF (milk solids non-fat) and density on the 10th day of storage showed that they did not significantly change during storage, remaining within a similar data determined on the 5th day of storage. Consequently, the introduction of inulin and potassium iodide in the kumis drinks 1.5% fat and 0.05% contributes to the preservation of physical and chemical parameters.

The results of organoleptic examination of kumis beverages enriched according to recipes number 1 and number 2 on the 10th day of storage are as follows: the taste is specific, fermented, refreshing, with the flavour and smell of yeast, a little spicy, nipping, without foreign tastes and odors; the consistency presents homogeneous, aerated and slightly foaming liquid with impaired clot. Kumis drinks without inulin, that is samples 3 and 4, had a sour taste and smell.

From the results obtained in determining the level of toxic elements, aflatoxin M₁, pesticides, antibiotics and microbiological parameters it is revealed that kumis drink rich in iodine and inulin is safe to use and meets the Sanitary Standards 2.3.2. - 1078 - 2003.

Kumis drink enriched with potassium iodide and inulin is produced by the reservoir method. The main technological stages of production are: acceptance, preparation of kumis mixture, homogenization, pasteurization, enrichment of kumis mixture with potassium iodide and inulin, fermentation, acidification, filling, packing, cooling and maturation.

Milk is separated and then sent for recycling. Dry cheese whey is reduced in the drinking water, heated to 50-55 °C until the mass fraction of solids comprises at least 9.5 %. After that it is pasteurized at a temperature of 70-74 °C with exposure to 15-20. Other raw milk is pasteurized at a temperature of 83-87 °C with exposure to 15-20. Homogenization of the mixture takes place at a temperature of 61- 65 °C and at pressure of 10-12 mPas. Potassium iodide and inulin are introduced into the mixture cooled to 31-35 °C.

For fermentation the production fermentation mixture is applied, it consists of acidophilous bacteria, *Lactobacilli bulgaricus*, and milk yeast in a ratio of 2:2:1 introduced in an amount of 0.9 liters per 3.0 liters of the mixture (from 20 % to 30% of the weight of the fermenting mixture) with the expectation that the acidity of fermented mixture makes 50-60 °T. Fermentation continues till acidity rises to 68-70 °T maintaining temperature of 26-30 °C, then the product is poured into a consumer package, hermetically sealed and placed on a maturation period of 2-2.5 hours at a temperature of (28 ± 2)°C. Ripened product in a consumer package is placed in a cooling chamber for cooling to the temperature of (2-4) °C. When this temperature is reached, the shelf life of the product makes 10 days.

Conclusions

Studies on the development of production technology of iodinated kumis drink lead to the following conclusions:

1. A new objective trade index for making quality analysis of kumis and kumis drinks is suggested, it is based on the study of super-weak luminescence intensity of the product. The modified method of the chemiluminescence assay has been worked out. This method uses $1 \cdot 10^{-1}$ M solution of azodiisobutyronitrile as initiator of free radical lipid peroxidation.

2. The method of rapid assessment of qualitative characteristics of kumis by chemiluminescence analysis is given scientific credence: the light sum and maximum luminosity of kumis chemiluminescence is determined. Ranging from $0,93 \pm 0,07$ pH to $2,17 \pm 0,26$ pH and from $0,57 \pm 0,05$ pH to $1,92 \pm 0,41$ pH the product is evaluated as a quality product having a definite biological value.

3. In experimental models of iodine deficiency in rats, it is shown that kumis beverage enriched with inulin and iodine is characterized by a physiological activity.

4. The choice of inulin for giving antioxidant properties to kumis drinks is proved. It is found that inulin inhibits the processes of formation of ROS (reactive oxygen species) in the model test system, reducing the light sum emission by 40.4 %, the amplitude of the

flash by 79.4 %, and the maximum luminosity by 48.7 % relative to the control, which is used as a test system containing no inulin.

5. Laboratory and industrial testing of developed technology of kumis drinks enriched with inulin and iodine is carried out under JSC "Meleuz Milk Factory".

6. There has been developed and approved regulatory and technical documentation for kumis drink, rich in iodine and inulin, in "Bashkir center for certification and expertise" Ltd.

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