

TECHNOLOGICAL FEATURES OF THE USE OF WILD-GROWING RAW MATERIALS IN THE PRODUCTION OF SOUR-MILK BEVERAGES

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Abstract: This paper reviews the data on the development of the technologies of sour-milk beverages with the use of wild-growing raw materials. The general principles of the creation of preventive sour-milk beverages and the principal requirements to wild-growing raw materials used to enrich their composition are formulated. Tavolga syrup based on herbs, such as megasea (*Bergénia crassifólia*), meadowsweet (*Filipéndula ulmária*), and peppermint (*Méntha piperita*), and also whey extract and syrup based on balm (*Melissa officinalis*) are used in the work. The main regularities of the formation of organoleptic, physicochemical, mechanostructural, and probiotic properties of the sour-milk products with the use of aqueous and whey extracts and syrups based on wild-growing raw materials are shown. The prospects and possibility of the application of curd whey, which extracts nutrients from plant raw material, in the production of enriched sour-milk products is demonstrated. The content of milk whey in a sour-milk product is from 5 to 30%. The use of Tavolga syrup excludes the addition of colorants, flavors, and stabilizers, reduces the energy expenditures due to a decrease in the baking time, inhibits the accumulation of lactic acid by starter cultures, and also suppresses the growth of opportunistic microflora during the storage of sour-milk beverages. The technologies of Tavolga phyto-fermented baked milk and phytoyoghurt and Melissa and Lesnoi kefir beverages are described, and the nutritional value of the new sour-milk beverages is shown, including their vitamin composition. The developed technologies of the listed sour-milk beverages are competitive, as confirmed by their relevance, scientific validity, and engineering, social, and economic profitability.

Keywords: sour-milk beverages, phytoyoghurt, phyto-fermented baked milk, kefir beverage, wild-growing raw materials, megasea, meadowsweet, peppermint, balm, aqueous and whey extracts and syrups of wild-growing raw materials

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INTRODUCTION

The food consumption pattern and nutritional status of population are among the most important development indicators of a country. The importance of the nutritional status as a national health forming factor is confirmed by the adoption of the Food Security Doctrine of the Russian Federation, which classifies some real food consumption indicators as food security estimation criteria. One of the main ways to solve this problem is to provide dairy self-sufficiency [1].

In recent years, the food consumption pattern of population, including the population of Russia, is observed to be unbalanced by proteins, fats, and carbohydrates and deficient in complete proteins and polyunsaturated fatty acids at excess fats and carbohydrates. The nutrition ration of most peoples is observed to be deficient in polyunsaturated fatty acids (omega-3 and omega-6), soluble and insoluble dietary fibers, vitamins (group B, E, etc.), a wide spectrum of vitamin-like natural substances, macronutrients, and micronutrients.

Relying on the principles of evidence-based medicine, absolutely new data on the biological role of so-called minor bioactive substances for a human were obtained. This first of all concerns such bioactive substances as [2, 3]:

- Different groups of flavanoids (flavanols and their glycosides (quercetin, campherol, rutin, etc.), flavons (luteolin, apigenin, etc.), flavonons (naringenin, hesperidin, etc.), dihydroflavanols, proanthocyanidin, catechins, etc.), the physiological functions of which are very multifarious and important for decreasing the risk of many currently widespread diseases [4];
- Indoles, one of the most important function of which is the regulation of the activity of first- and second-phase xenobiotic metabolizing enzymes and the protective role with respect to some cancer pathology forms;
- Organic acids (succinic, malic, hydroxycitric, and other acids); and
- Phenols (hydroquinone, arbutin, hydroxycinnamic acids, etc.), which have a specific biological effect on the various functions of individual metabolic systems and an organism as a whole.

Among the bioactive substances of plant raw materials with a regulative effect on many body functions are phytosterols, isoflavons, isothiocyanates, glucomannans, polyfructans, inulin, chlorophyll, caffeine, and many others.

The data accumulated in the field of nutrition science indicate that the need of an organism for all the nutrition and minor bioactive substances required for its survival can not adequately be satisfied via

traditional nutrition under contemporary human life conditions. A considerable increase in the consumption of traditional food with the purpose of elevating the amount of micronutrients in it will lead to an equally abrupt increase in the consumption of fats and carbohydrates and, consequently, to obesity and associated diseases. The problem of nutrition unbalance with respect to micronutrients can be solved via the targeted enrichment of food products by health-beneficial ingredients.

The deficiency of these nutrients and bioactive components in the ration lead to different disfunctions in the immune system of adult population and a decrease in the resistance of an organism to adverse environmental factors. This provokes the growth of the disease (infective, allergic, and cancerous) incidence rate and decreases the efficiency of therapeutic measures.

One of the objective reasons of the worsening of actual nutrition is the consumption of canned, refined, cured, and preserved food products. The rapid development of new technologies for the processing of raw materials and the production and preservation of food products has led to a considerable decrease in the share of native food products in the ration of a contemporary human. Severe technological regimes of processing and preservation deprive food of important bioactive substances, to the consumption of which our organism adapted for several thousands of years [5, 6]. Unfortunately, the share of such products in the nutrition of population continuously decreases.

The insufficient awareness of population on the rational nutrition requirements to the nutritional value of individual food products, food preparation techniques, which provide the preservation of essential nutrients, nutrition regime, etc., should be mentioned among the subjective reasons worsening the qualitative adequacy of nutrition.

Such a nutrition situation has a pronounced negative effect on the health and workability of population and requires nutrition rationalization measures.

In this connection, contemporary nutrition science assigns an important role to therapeutic and preventive food products alongside with the organization of adequate, rational, and safe nutrition [7, 8]. The development of therapeutic and preventive nutrition is required even now, as there are almost no absolutely healthy peoples, many of which work or live in an adverse environment. It must be pathogenetically substantiated therapeutic and preventive individual nutrition, which would take into account the state of health, the existence of a pathology (acute or chronic diseases), energy expenditures, the occupational factor, the state of a living environment, climate, genetic disposition, ethnic cuisine features, and also negative pathology risk factors. However complicated the problem of the development of pathogenetically substantiated therapeutic and preventive individual nutrition may currently seem, life urgently requires its solution, as the efficiency of health-improving measures depends on this factor [7].

In the therapy of patients suffering from different

diseases, great priority is currently assigned to the improvement of the efficiency of their nutrition, in particular, by elevating the bioactivity of food products.

An important element of balanced healthy nutrition is functional food products. They are designed for the nutrition of all the major groups of healthy population in the structure of traditional rations, but contain health-beneficial food ingredients, which can produce a favorable effect on one or several organism's functions. Functional products play a great part in the optimization of population nutrition rations as remedies for the prevention and early correction of different diseases. The systematic consumption of functional products may increase the role of a ration as a health-maintaining factor [9].

In recent years, food industry manifests a great interest in medicinal plants of native regions, as they contain bioactive substances, such as alkaloids, glycosides, saponins, essential and fatty oils, vitamins, organic acids, and many others. This complicated spectrum of components at naturally dosed ratios in combination with therapy promotes metabolism, stimulates an organism as a whole, normalizes the state of its internal environment, and increases the resistivity of an organism to adverse factors. At the same time, wild-growing plants are more beneficial sources of plant raw materials from the environmental viewpoint than the traditionally used plants cultivated with the application of fertilizers and pesticides.

The positive properties of many plants (in particular, medicinal, essential oil, spicy-aromatic plants) are due to their ability to activate the enzyme systems and energy supply of an organism.

The structure of the bioactive substances of a plant cell has much in common with the components formed in animal and human cells. For this reason, they are easily digested and biochemically destructed in a human organism.

The value of wild-growing raw materials, including medicinal plants, consists in that they contain bioactive substances in the combination, which is difficult to reproduce artificially. The components extracted from plants have not often the same therapeutic effect as the plants themselves. The use of wild-growing raw materials in the production of food products enables the creation of targeted and preventive functional foods, such as tonic, antistress, diabetic, and radioprotective products and foods improving the functioning of the immune, cardiovascular, and gastrointestinal systems and other organs.

Hence, on the one hand, the evidences of the important role of bioactive substances in maintaining the life of a human organism have been obtained on the basis of broad-scale epidemiological studies and, on the other hand, their deficit in the nutrition of a contemporary human has been revealed. Among different groups of foods, dairy products are of great interest. The enrichment of dairy products with minor bioactive substances contained in wild-growing herbal raw materials may be considered as one of the alternative ways to satisfy the deficit of these micronutrients in the food of great masses of population.

One of the approaches in population nutrition policy is the use of the native raw material sources of consumer living regions. This increases the economic efficiency of food enterprises, decreases the primecost, and enriches the ration of population with necessary macro- and microelements, vitamins, and other non-synthetic components, the deficit of which has been registered in certain regions.

Taking into account the urgency of the matter, the scientific and practical principles of the production of dairy products with the use of wild-growing raw materials of the Siberian region have been developed in the Kemerovo Institute of Food Science and Technology. A particular stage of the work was the development of the technology of functional sour-milk products enriched with the bioactive substances of wild-growing raw materials.

REVIEW OF SOUR-MILK PRODUCTS TECHNOLOGIES WITH THE USE OF WILD-GROWING RAW MATERIALS OF THE SIBERIAN REGION

The creation of new sour-milk products was based on the principles developed for dairy products with a complex raw material composition, such as

- The food safety of new enriched dairy products;
- The biological and nutritional adequacy of new products;
- High organoleptic characteristics; and
- A sufficient content of vitamins, minerals, and other bioactive substances.

In this case, the following principal requirements to wild-growing raw materials for the enrichment of dairy products were taken into consideration:

- The resources of such plant raw materials must be easily renewable, and plants must not be registered in the Red Book;
- Used plants must be safe by the characteristics, which are commonly accepted in the world practice, such as toxic elements, pesticides, mycotoxins, sanitary-significant microorganisms, radionuclides, etc.;
- Applied medicinal plants must be approved for use by the Ministry of Healthcare, as the use of uncertified medicinal plants with a pronounced pharmacological effect (hellebore, false helleborine) may be harmful to human health;
- Plant raw materials must not contain any components decreasing the digestion of valuable substances of milk raw materials, such as antienzymes, antivitamin, and demineralizing substances; and
- Medicinal plants must not contain great amount of components with a pronounced pharmacological activity, such as cardiac glycosides, biogenic amines, some alkaloids, etc.

The consideration of the dose of wild-growing raw materials requires the following approach. It is necessary, first, to provide the presence of substances, which are vitally important for an organism, in a new product, second, to exclude the occurrence of its medicinal properties and, third, to provide its safety by the criterion of the content of specific pharmacologically active components [10]. The dose of used plant raw materials must satisfy the need of an organism in declared pharmacologically active components by no less than 10%

and no more than 50–60% of a single therapeutic dose in the use of a given plant as a medicinal remedy.

The technologies of the Tavolga, Melissa, and Lesnoi sour-milk beverages with the use of wild-growing and introduced raw materials of the Siberian region were developed in compliance with the above stated concepts. Extracts and syrups of wild-growing raw materials were used to enrich the composition of the sour-milk beverages.

The technology of the sour-milk beverages, namely, Tavolga phytoyoghurt and phyto-fermented baked milk, was developed with the use of syrup based on wild-growing herbs, such as megasea, meadowsweet, and peppermint. The performed studies have shown their considerable effect on the formation of organoleptic, physicochemical, probiotic, and rheological properties of the sour-milk beverages with long-term pasteurization regimes and an increased level of protein.

The introduction of wild-growing plant syrups into the sour-milk beverages leads to the loss of their viscosity. The negative effect of a syrup dose can be neutralized by increasing the mass fraction of dry skim solids in a product.

In the process of storage, the sour-milk beverages on the basis of Tavolga syrup acquire the character of a condensation or irreversibly destroying structure, so bonds become more fragile and weak after the stirring of a blob, and the viscosity of a product decreases. The highest degree of syneresis was observed for samples with a low mass fraction of dry skim solids and fat and a high dose of syrup. This indicates a decrease in the moisture-retaining ability of milk blobs upon the introduction of Tavolga wild-growing herb syrups. The above listed factors smooth away this negative effect. The formation of acid during the storage of the sour-milk beverages with syrups was observed to be slightly reduced in comparison with control samples.

The rational process parameters in the production of the sour-milk beverages on the basis of Tavolga syrup are the following:

- Syrup dose, 4.5–5.0%; blob acidity before the introduction of syrup, 65–70°T; baking regime, 1.5 h at a temperature of $97 \pm 2^\circ\text{C}$ for phyto-fermented baked milk;
- Syrup dose, 5%; blob acidity before the introduction of syrup, 75 – 80°T for phytoyoghurt.

The use of Tavolga syrup

- Excludes the introduction of colorants, flavors, stabilizers, and sweeteners due to pronounced brown color, rich flavor, and bactericidal properties, performing the functions of the above listed ingredients in the production of phytoyoghurt;
- Reduces the expenditures of heat and energy resources due to a decrease in the baking time (from 3–4 to 1.5 h) and also the time of the entire technological cycle in the production of phyto-fermented baked milk; and
- Produces an inhibiting effect on the accumulation of lactic acid by starter cultures (*Str. salv. subsp. thermophilus* and *Lbc. delbr. subsp. bulgaricus*) and also suppresses the growth of opportunistic microflora during the storage of the sour-milk beverages.

The technology of the Lesnoi kefir and Melissa beverages was developed with the use of whey extract and syrup based on balm raw materials, respectively.

The technology of the production of whey extracts was substantiated and described in the works [11, 12]. Relying on the performed studies, the possibility and advisability of the use of aqueous and whey extracts and syrups of wild-growing raw materials in the production of sour-milk products were substantiated.

The effect of the dose of balm extract and the type and dose of a stabilizer on the formation of the rheological characteristics and organoleptic properties of the beverages were studied. The optimal balm extract dose was established to be 30% of the mixture mass, and locust bean gum in the amount of 0.4% was selected as a stabilizer.

The effects of the balm syrup dose, the acidity regulator type, and the syrup introduction temperature on the formation of the rheological and organoleptic properties of the kefir beverages were studied. The optimal parameters were established to be the following: balm syrup dose, 10%; introduction temperature, 16°C; a mixture of lactic and citric acids at a ratio of 1 : 1 was selected as an acidity regulator.

The effect of different individual and mixed sweeteners on the organoleptic properties of the kefir beverages with balm extract was studied, and their sugar equivalents were calculated. Relying on these studies, stevioside was recommended as a sweetener for the kefir beverage with balm extract.

In accordance with the results of studies, the technology of the sour-milk beverages, such as Tavolga phyto-fermented baked milk, Tavolga phytoyoghurt, and Melissa kefir beverage, by the vat method was proposed. The name Tavolga of the sour-milk phyto-beverages was agreed with OOO Medicina, nauka, tekhnika (Novokuznetsk, Kemerovo oblast), a syrup producer.

The sour-milk beverages on the basis of wild growing raw materials are produced with the use of

- Milk, which corresponds to GOST R (Russian State Standard) 52054-2003 and is no worse than second-rate quality;
- Dry skim milk corresponding to GOST R (Russian State Standard) 52791;
- Tavolga syrup based on wild-growing herbs, such as megasea, meadowsweet, and peppermint (TU (Technical Specifications) 9185-021-02068315-97);
- Whey obtained in the production of cottage cheese by ultrafiltration or curd whey ultrafiltrate; and
- Dry balm raw materials.

All the raw materials and fillers must be approved for use by the institutions of the Hygienic and Epidemiological Service of the Russian Federation and correspond to the hygienic requirements stated in “Federal Law. Technical Specifications on Milk and Dairy Products” to the quality and safety of food raw materials and products.

The technological process of the production of Tavolga phyto-fermented baked milk and phytoyoghurt includes the following operations:

- Acceptance and quality control of milk;
- Cooling;
- Normalization of the mass fraction of fat for phyto-fermented baked milk and fat and protein for phytoyoghurt;
- Exposure for an hour and stirring for phytoyoghurt;
- Purification of the normalized mixture;
- Homogenization of the mixture;
- Pasteurization;
- Baking for phyto-fermented baked milk;
- Cooling to an inoculation temperature;
- Inoculation and souring;
- Stirring and cooling;
- Addition of syrup based on wild-growing herbs and stirring;
- Bottling, packing, and labeling; and
- Cooling.

The technological process of the production of Tavolga phyto-fermented baked milk is performed as follows. The raw materials selected by quality are normalized by the mass fraction of fat. The mixture is further heated to a temperature of $43 \pm 2^\circ\text{C}$, purified on centrifugal milk purifiers, homogenized at a pressure of 15.0 ± 2.5 MPa and a temperature of $45\text{--}85^\circ\text{C}$, pasteurized at a temperature of $97 \pm 2^\circ\text{C}$, and allowed to stand at this temperature for 1.5 h. In the course of baking, the mixture is stirred 1–2 times to prevent the formation of skins. After baking, the mixture is cooled to an inoculation temperature of $40 \pm 2^\circ\text{C}$. The mixture for phyto-fermented baked milk is inoculated with the symbiotic starter consisting of *Streptococcus thermophilus* and *Lactobacillus bulgaricus* cultures with the addition of the specially prepared starter on the basis of *Lactobacillus acidophilus* strains in the amount of 20% of the total starter volume.

The starter is introduced into the mixture in the amount of 3–5% of the mixture volume. It is allowed to use lyophilized and freeze-dried direct vat set (DVS) cultures containing the above listed set of lactic starter strains. The inoculated mixture is stirred for 15 min. The termination of souring is determined by the formation of a rather strong blob and the attainment of an acidity of 68–70°T. The process of souring lasts from 3 to 4 h. After the termination of souring, the mixture is cooled to a temperature of $25\text{--}27^\circ\text{C}$ for 20–50 min by supplying glacial water into the interwall space of the vat. The blob is then stirred for 10–15 min, thereupon Tavolga syrup with a temperature of $20\text{--}25^\circ\text{C}$ is introduced. The product is carefully stirred for 10–15 min and delivered to bottling. The packed product is cooled in a cooling chamber to $4 \pm 2^\circ\text{C}$.

The principal properties of the finished product are given in Tables 1 and 2.

Table 1. Organoleptic properties of Tavolga phyto-fermented baked milk

Property	Characterization
Appearance and consistence	A homogeneous mass with a destroyed blob and a viscosity inherent to this blob. The separation of whey on the surface in the amount of no more than 3% of the product volume is admitted.
Taste and smell	A pure moderately sweet sour-milk product without foreign taints and smells with a specific filler (Tavolga syrup) flavor.
Color	Pronounced cream and uniform over the entire mass.

Table 2. Physicochemical properties of Tavolga phyto-fermented baked milk

Property	Standard for phyto-fermented baked milk		
	1.0	2.5	4.0
Fat, wt %, no less	1.0	2.5	4.0
Acidity, °T	70 – 110	70 – 110	70 – 110
Temperature of release from an enterprise, °C	4 ± 2	4 ± 2	4 ± 2
Phosphatase	n/a		

The organization of the technological process of Tavolga phytoyoghurt consists in the following.

Selected raw materials are normalized by the mass fraction of fat and solids. The fat-normalized mixture is then normalized by the mass fraction of solids via the addition of dry whole or skim milk at a temperature of 40–60°C (depending on the design of a used apparatus). The normalized mixture is carefully stirred for 10–15 min. The amount of milk components must correspond to the recipe.

The normalized mixture heated to 43 ± 2°C is purified on centrifugal purifiers, homogenized at a temperature of 45–85°C and a pressure of 15 ± 2.5 MPa. The mixture is then pasteurized at a temperature of 92 ± 2°C or 87 ± 2°C and allowed to stand for 2–8 or 10–15 min, respectively. After heat treatment, the normalized mixture is cooled to a temperature of 40–43°C. The storage of the non-inoculated mixture is not admitted. The inoculation and souring of the mixture is performed in vats equipped with a cooling jacket and agitators providing the uniform stirring of the soured mixture and finished blob.

The density of the mixture before inoculation must be no less than 1.042 g/cm³. The mixture is inoculated immediately after cooling with the symbiotic starter consisting of pure *Streptococcus thermophilus* and

Lactobacillus bulgaricus cultures. The starter is prepared in compliance with the instruction on the application and preparation of starters. The mass fraction of the starter is 3–5% with respect to the volume of the normalized mixture. The use of lyophilic freeze-dried DVS cultures containing the strains of the above listed lactic bacteria is admitted. The starter amount and the inoculation temperature are specified in compliance with the application instruction. The starter is introduced into the vat together with the normalized and pasteurized mixture and stirred for 30 min.

The souring of the mixture is performed at a temperature of 40–43°C for 3–6 h. The termination of souring is determined by the formation of a strong blob and the attainment of an acidity, which must not exceed 85°T. After the termination of souring, glacial water is delivered into the interwall space for 30–60 min, thereupon stirring is performed for 15–30 min. Syrup based on wild-growing herbs is introduced into the product partially cooled to a temperature of 25–27°C. The syrup temperature must be 20–25°C. Stirring is performed for 10–15 min, thereupon the finished product is delivered to packing. The packed product is additionally cooled in a cooling chamber to 4 ± 2°C. The principal properties of the finished product are given in Tables 3 and 4.

Table 3. Organoleptic properties of Tavolga phytoyoghurt

Property	Characterization
Appearance and consistence	A homogeneous mass with a destroyed blob and a viscosity inherent to this blob. The separation of whey on the surface in the amount of no more than 3% of the product volume is admitted.
Taste and smell	A pure moderately sweet sour-milk product without foreign taints and smells with a specific filler (Tavolga syrup) flavor.
Color	Pronounced cream and uniform over the entire mass.

Table 4. Physicochemical properties of Tavolga phytoyoghurt

Property	Standard for phytoyoghurt		
	1.5	2.5	3.5
Fat, wt %, no less	1.5	2.5	3.5
Milk protein, wt %, no less	3.9	3.6	3.5
Dry skim milk solids, wt %, no less	11.0	10.0	9.5
Titration acidity, °T	75–140	75–140	75–140
Total sugar on invert sugar basis, wt %, no less	7.1	6.6	5.1
Temperature of release from an enterprise, °C	4 ± 2	4 ± 2	4 ± 2
Phosphatase	n/a		

Melissa and Lesnoi kefir beverages are produced with whey balm syrup and extract, respectively. The technological process of the production of kefir beverages is begun with the preparation of extract or syrup. The whey obtained in the production of cottage cheese

by ultrafiltration or the curd whey purified from proteins is immediately cooled to 4 ± 2°C and stored for no longer than 12 h before processing. It is further pasteurized at a temperature of 85 ± 3°C, balm is added in the amount of 10% of the whey mass, and extraction

is performed for 30 min. Then pulp is separated out. The obtained extract is used in the production of Lesnoi beverage in compliance with the process chart or in the preparation of syrup. For this purpose, granulated sugar is introduced into the extract at a ratio of 1 : 1, and the resulting mixture is then stirred, heated to a boiling temperature without exposure, and

cooled to a temperature of 60–65°C, thereupon the acidity regulator (lactic and citric acids) is added to pH 4.3–4.5.

The obtained syrup is cooled to 14–16°C (syrup introduction temperature) or to $4 \pm 2^\circ\text{C}$ in the case of long-term storage. The process chart of the production of Lesnoi kefir beverage is shown in Fig. 1.

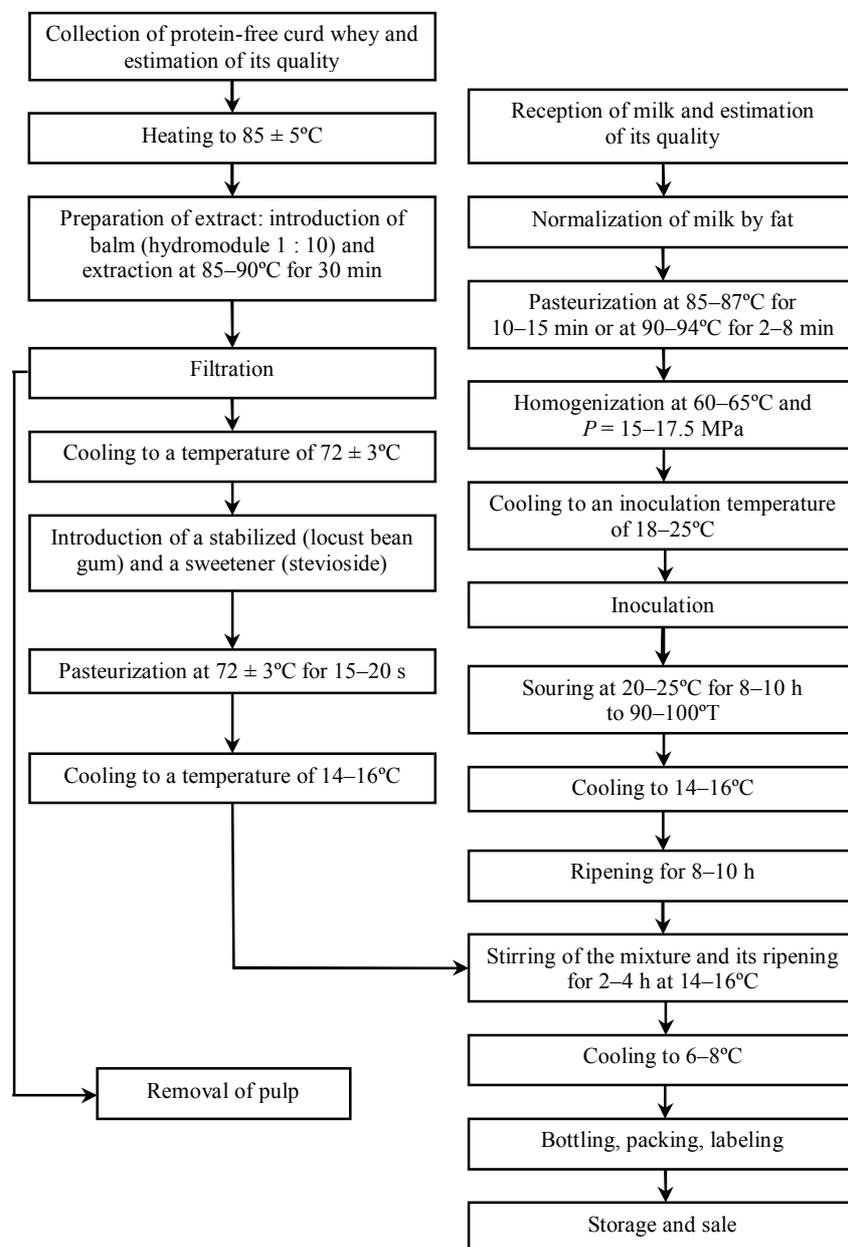


Fig. 1. Process chart for the production of Lesnoi kefir beverage.

Milk of no worse than second-rate quality with an acidity of no more than 19°T and a density of no more than 1027 kg/m³ is used for the production of the sour-milk beverages. The milk is normalized by the fat mass fraction. The normalized mixture is subjected to heat treatment.

After pasteurization and homogenization, the mixture is cooled to an inoculation temperature of 20–25°C and then delivered to an inoculation vat. A starter in the amount of 3–5% of the inoculated mixture mass is introduced into the cooled mixture.

After the termination of souring, the product is immediately cooled to a temperature of 14–16°C to perform ripening. The ripening time is 8–10 h, thereafter balm syrup is added, the mixture is stirred, and ripening is continued for 2–4 h. The finished product is cooled to a temperature of 6–8°C, bottled, packed, labeled, and delivered to a cooling chamber. Thereafter the process is considered to be completed, and the product is ready for sale. The organoleptic properties of Melissa and Lesnoi kefir beverages are given in Table 5.

The nutrition and energetic value of the sour-milk beverages are given in Table 6.

The use of functional ingredients (syrups and extracts

of wild-growing raw materials) has allowed the enrichment of the sour-milk beverages with tannins, bioflavonoids, carotenoids, vitamin C, and tocopherols (Table 7).

Table 5. Organoleptic properties of Melissa and Lesnoi kefir beverages

Property	Standard
Structure and consistence	Homogeneous, with a destroyed blob in the vat method. The separation of whey in the amount of no more than 2% of the product volume and the formation of gases in the form of isolated bubbles due to the growth of normal microflora are admitted.
Taste and smell	Sour-milk, refreshing, with light lemon-mint flavor and taste. Taste is moderately sweet, slightly spicy.
Color	Light-brown, homogeneous over the entire mass, typical for the filler.

Table 6. Nutrition and energetic value of the sour-milk beverages

Product	Content of components per 100 g of product, g				Energetic value, kcal
	protein	fat	carbohydrates	ashes	
Tavolga phyto-fermented baked milk	3.2	1.0	6.7	0.8	51
	3.1	2.5	6.6	0.8	63
	3.0	4.0	6.6	0.8	76
Tavolga phytoyoghurt	3.9	1.5	7.5	0.7	60
	3.6	2.5	6.0	0.7	66
	3.5	3.5	6.8	0.6	74
Melissa kefir beverage	2.7	2.5	8.7	0.7	68
Lesnoi kefir beverage	2.3	1.0	4.1	0.7	34

Table 7. Vitamin composition of the sour-milk beverages with wild-growing raw materials

Components	Tavolga phyto-fermented baked milk	Tavolga phytoyoghurt	Melissa kefir beverage	Lesnoi kefir beverage
Tannins, mg/100 g	150	150	0.78	2.5
Bioflavonoids, mg/100 g	14	14	1.4	6.0
Vitamins, mg/100 g				
A (retinol)	0.03	0.03	0.03	0.03
B-carotin	0.2	0.1	0.37	1.45
B ₁ (thiamine)	0.05	0.06	0.34	0.35
B ₂ (riboflavin)	0.20	0.30	0.20	0.40
B ₃ (pantothenic acid)	0.15	0.15	0.14	0.55
B ₆ (pyridoxine)	0.06	0.05	0.05	0.22
B ₁₂ (cobalamin), µg/100 g	0.30	0.43	0.14	0.54
C (ascorbic acid), mg/100 g	7.3	5.8	7.5	13
E (tocopherols)	0.03	0.03	0.03	0.11

Among tannins are arbutin and bergenin, which are able to bond metal ions and withdraw them from an organism and have radioprotective, anti-inflammatory, and bactericidal properties.

Bioflavonoids have P-vitamin activity and an antihypertonic and capillarotonic effect. Many studies show that the preparations created on the basis of different groups of flavonoids are highly efficient antineoplastic remedies, have antioxidant properties,

and decrease the risk of cardiovascular diseases [13, 14].

Due to the presence of the above listed components, Tavolga sour-milk beverages may be classified as products, the consumption of which will favor the prevention of the mentioned diseases.

Lesnoi kefir beverage is characterized by a higher content of vitamins in comparison with Melissa sour-milk beverage. This is explained by the use of the

enriching component in the form of extract and its higher dose. The content of bioactive substances in extracts is nearly two times higher than in syrups.

The sour-milk beverages on the basis of syrups and extracts of wild-growing raw materials have a well-balanced composition of basic minerals. They have an increased content of potassium, calcium, iron, and zinc in comparison with traditional sour-milk beverages. The new sour-milk beverages are especially rich in iron (0.6–1.2 mg/100 g). For comparison, traditional kefir contains 0.08–0.10 mg/100 g of iron.

The sell-by period of the beverages of developed

assortment is from 5 to 8 days. During this period, the products are ensured to have high organoleptic characteristics with a content of living lactobacteria of no less than 10^7 CFU/g at the end of the use-by period. The use of Tavolga syrup in the production of sour-milk beverages suppresses the growth of opportunistic microflora in the process of storage, thus increasing the sell-by periods of the products.

The developed technologies of the mentioned sour-milk beverages are competitive, as confirmed by their relevance, scientific validity, and engineering, social, and economic profitability.

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