Sour Milk Production Technology and Its Nutritive Value

Farida Smolnikova, Zhanar Moldabayeva, Marina Klychkova, Olga Gorelik, Ruslan Khaybrakhmanov, Irina Mironova, Azamat Kalimullin, Gulnara Latypova

Abstract*: This paper presents the method of sour (fermented) milk drink production technology and its nutritive value. The method includes the preparation of mixture from milk and plant ingredients (dill and parsley), cooling, adding the symbiotic starter "Simbilact VIVO with lactulose", fermentation and mixing, cooling the product and packaging. Souring the mixture is carried out at 37 °C for 6-8 hours, and the ingredients are taken at the following ratio: milk 91%, parsley 2.5-5.0%, dill 2.5-5.0%, symbiotic starter 1.5%. The nutritive value is higher in developed sour milk drink as compared to the control milk drink. The developed sour milk product tends to have more vitamins (especially Vitamin C), minerals and protein than the control sour milk product.

***Index Terms*: sour milk, fermentation, dill, parsley, technology, symbiotic starter culture**

I. INTRODUCTION

Currently, the health status of the population has begun to deteriorate due to weakened immunity. Weakening of immunity can be associated with destructive habits, unhealthy diet, negative emotions, as well as poor ecology [1, 2].

The development of new technologies of sour (fermented) milk drinks using plant materials for immunostimulating action contributes to an increase in the range of fermented milk products [3, 4]. Domestic production focuses on the development of yogurt formulations, which may not be suitable for different categories of food. Therefore, nowadays the development of unsweetened sour milk drinks is relevant [5].

Scientific studies of overall human health improvement based on the wide use of fermented milk products are one of the new promising directions in medicine, nutritiology and engineering [6, 7]. The most famous and popular milk product among the consumers in different countries is kefir - fermented (sour) milk product. In Kazakhstan, in the last decade, the theory and practice of the production of fermented milk products has been actively developing [8, 9].

The goal of this study is to develop the production technology and analyze the nutritive value (chemical, amino acid, mineral and vitamin composition) of sour milk product.

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Farida Smolnikova, Shakarim State University of Semey, Semey, Kazakhstan
Zhanar Moldabayeva, Shakarim State University of Semey, Semey, Kazakhstan
Marina Klychkova, Orenburg State University, Orenburg, Russia
Olga Gorelik, Ural State Agrarian University, Yekaterinburg, Russia
Ruslan Khaybrakhmanov, State University of land management, Moscow, Russia
Irina Mironova, Bashkir State Agrarian University, Ufa, Russia
Azamat Kalimullin, Bashkir State Agrarian University, Ufa, Russia
Gulnara Latypova, Bashkir State Agrarian University, Ufa, Russia

II. MATERIALS AND METHODS

Fresh cow milk was purchased from the local milk farm of Semey region, Kazakhstan and stored at -2 to -4 °C before the experiments.

As the starter culture, "Simbilact VIVO with lactulose" is used, which includes lactulose and microorganisms, such as *Streptococcus thermophius, Lactobacillus deibrueckii ssp. bulgaricus, Lactobacillus acidophilus, Bifidobacterium lactis, Lactococcus lactis ssp. cremoris, Lactococcus lactis ssp. lactis, lactococcus lactis ssp. lactis var. diacetilactis.*

Technological process of sour milk production

The technological process of production of cottage cheese bio-product consists of the following steps:

- acceptance and assessment of milk quality;
- cleaning, normalization of milk;
- milk heating up to 55 °C, homogenization at a pressure of 10-12 MPa;
- preparation of vegetable components (grinding);
- adding of grinded vegetable components (dill, parsley);
- pasteurization at a temperature of 85-87 °C with a holding time of 5-7 minutes;
- cooling to 30-36 °C;
- milk fermentation using VIVO 1.5% starter culture;
- cooling to 2-4 °C;
- packaging;
- storage and sale.

Milk acceptance

The primary processing of milk includes filtering, cooling, heating, separating, thermalizing and pasteurizing, reserving and storing.

Cleaning

The cleaning process includes the filtering under the action of gravity or pressure and separating on milk separators.

Homogenization.

This method of mechanical processing of milk increases the dispersion of the fatty phase in milk, which allows to avoid settling of fat during milk storage, the development of oxidative processes, destabilization and knocking with intensive mixing and transportation. Homogenization helps to increase the strength and improve the consistency of protein clumps and prevent the formation of a fatty plug on the surface of the product.

Pasteurization of milk is the process of heating milk to certain temperatures and keeping it under these conditions for a specified time. The purpose of pasteurization is the reduction of all pathogens of milk. Pasteurization of milk is carried out at 85-87 C, with an exposure of 5-7 minutes. Next, the milk is cooled to

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the fermentation temperature.

Fermentation.

For the fermentation of milk the starter culture for cottage cheese is used. The amount of culture 1.5 g per 1 liter of milk. After adding the culture, the milk is thoroughly mixed, and left for 6-8 hours for fermentation.

Storage. The finished product is stored in the refrigerator for no more than 3 days.

Table 1 shows the formulation of a fermented milk drink.

Table 1 - Formulation of sour milk drink

Ingredient	Quantity, g
Milk with a mass fraction of fat 2.5%	928,50
VIVO Ferment	1,5
Parsley	35
Dill	35

III. RESULTS AND DISCUSSION

To ensure the normal functioning of the body, the food must contain the essential nutrients. These include essential amino acids, vitamins, some fatty acids, minerals and trace elements.

The amino acid composition of developed sour milk is presented in Table 2.

Table 2 - Essential amino acid content in the developed sour milk

Amino acid	Content in g		Amino acid score, %
	In ideal protein, per 100 g of protein	In developed sour milk, per 100 g of protein	
Valine	5.0	1.35	27
Isoleucine	4.0	1.48	37
Leucine	7.0	2.72	38.9
Lysine	5.5	1.73	31.5
Methionine	3.5	0.69	19.7
Threonine	4.0	1.29	32.3
Tryptophane	1.0	0.39	39
Phenylalanine	6.0	1.36	22.7

Sour milk contains all 8 essential amino acids. Most notably it contains tryptophan (AS 39%). The adult's daily need for tryptophan is 0.25 g, children under 7 years old are about 1 g. Tryptophan helps induce natural sleep, reduces pain sensitivity and acts as a non-drug antidepressant. It also reduces some of the symptoms of biochemical disorders in the body associated with alcohol intake, and also prevents alcoholism [10].

Fermentation of milk is basically subjecting milk to anaerobic processes to obtain products such as buttermilk, yoghurt, cheese etc. Initially, the human population relied solely on naturally fermented milk products. However, with the rapid development in technology that has actually permeated all spheres of human life, we have witnessed the artificially fermented milk products take over the market. We inevitably have to consume developed food today. Both the control and developed fermented milk products have their merits and demerits. One key advantage of developed foods is that they have helped a great deal to deal with the shortage of food of various types. Below is an elaborate discussion of the differences in the contents of both developed and control fermented milk products. In this case we have used a hundred grams as our reference amount (Table 3).

Table 3 - Nutritive value of developed fermented milk product in comparison with control fermented milk product

Indicator	Developed sour milk drink	Control sour milk drink
Vitamin B_1, mg/100g	2.113	1.324
Vitamin B_2, mg/100g	8.425	5.186
Vitamin C, mg/100g	18.240	3.748
Protein, g	6.0	3.0
Fat, g	2,5	2,5
Carbohydrate, g	4.0	4.0
Acidity, ^oT	93	80
Minerals		
K, mg/100g	163	154
Ca, mg/100g	361	349
Na, mg/100g	138	116
P, mg/100g	258	257
Mg, mg/100g	18	14

Generally speaking, the developed fermented milk products tend to have more vitamins than the control fermented milk products. To be precise enough, a hundred grams of developed milk contains about 2.113 milligrams of vitamin B1 while an equal amount of control fermented milk contains 1.324 milligrams of the same vitamin. The same reference amount of developed fermented milk contains 8.425 milligrams of vitamin B2 while the same amount of control fermented milk contains 5.186 milligrams of the same vitamin. In addition, a hundred grams of developed fermented milk contains 18.24 milligrams of vitamin C while the same amount of control fermented milk contains 3.748 milligrams of the same vitamin. These differences can be attributed to the production of 9-epoxypolysaccharides of vitamins and bacteriocins by probiotic bacteria [11]. It is also widely argued that these vitamins are added directly by the manufacturers [12]. It has also been suggested that artificially synthesized bacteria are introduced during the manufacturing process and they contribute to the large amounts of vitamins in developed fermented milk products.

A hundred grams of developed fermented milk contains six grams of proteins while the same amount of control fermented milk has three grams of proteins. This is due to the synthesis of extra proteins angiotensin 1 converting enzyme during the manufacturing process [13]. The antioxidant proteins are also synthesized. Both forms of fermented milk have the same amount of fat; two and a half grams per every hundred grams of fermented milk. Another content that does not vary is the carbohydrate which stands at four grams per every hundred grams of fermented milk. Developed fermented milk tends to be less acidic than control fermented milk. This is due to the fact that more lactic acid is obtained from natural fermented of milk.

Minerals are a key component of fermented milk. Generally speaking, the developed fermented milk has more minerals compared to the control fermented

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milk. A hundred grams, the reference amount, of developed fermented milk contains one hundred and sixty-three milligrams of potassium while the same amount of control fermented milk contains about one hundred and fifty-four milligrams of the same mineral. Again, the reference amount of developed fermented milk contains one hundred and thirty-eight milligrams of sodium while the same amount of control fermented milk contains about one hundred and sixteen milligrams of the same mineral. For phosphorus, the reference amount of developed fermented milk contains about two hundred and fifty-eight grams which is just a digit above the content of the same mineral from the control fermented milk. Another important mineral is magnesium. The same trend is seen.The reference amount of developed contains about eighteen milligrams of the mineral while the same amount of control has about fourteen milligrams of the same mineral. In all these it is assumed that the minerals are actually added during the manufacturing process. The same trend is seen with calcium. A hundred grams of the developed contains about three hundred and sixty-one milligrams of the mineral while the same amount of control contains three hundred and forty-nine milligrams of the same mineral.

IV. CONCLUSION

The developed fermented milk contains more nutrient**s** than the control fermented milk. In addition, it helps to cut the deficit created by the current global food shortage. Analysis of the data obtained shows that sour milk drink contains the whole complex of useful biologically active substances, amino acids, vitamins, mineral substances. The obtained sour milk product can be recommended for everyday and dietary food.

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