

SELECTION OF STARTER CULTURES FOR THE FERMENTATION OF MARE, CAMEL AND GOAT MILK

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Abstract

In Kazakhstan, there is a wide variety of traditional fermented products based on camel and horse milk (kumiss, shubat, etc). However, their production is still based on artisanal practices and the strains used in the production are usually not characterized.

Existing dairy starter cultures have been developed mainly for cow's milk and are not optimal for the fermentation of milk obtained from other species.

Dairy farming is based on the production of camel, mare's milk; it has a long history and tradition in the Republic of Kazakhstan. Fermentation using lactic acid bacteria is the basis of the preparation of foods such as an ayran, shubat and is a traditional way to preserve milk and improve its healthy and nutritional properties. In developed countries, the modern dairy industry based on certain microbial cultures used in the production of fermented milk products, manufacturing technology which is designed primarily for cow's milk. Therefore, despite the great economic potential of fermented products based on camel, mare and goat milk in the Republic of Kazakhstan, development of production on an industrial scale, it is constrained by the lack of suitable starter cultures and dairy technology specifically designed for these types of milk.

Key words: *lactic acid bacteria, camel milk, goat milk, mare milk, starter*

In the world of milk, mostly consumed by the population is cow. It is about 90-95% of the total amount of milk consumed.

Nowadays, more and more attention is paid to the use of the milk of other species of farm animals (goats, mares, camels, buffalo, etc.), both individual and combined, allowing us to obtain products, balanced fatty acid and amino acid composition, improve their nutritional and biological value.

The milk of different species of farm animals is different, not only the total protein content, but also its fractional composition. The role of milk as a product and as a source of raw materials for food production cannot be overestimated.

From the literature data goat milk foreign and domestic scientists can be compared with the female, since they contain a large amount of beta-casein. Unlike cow milk, goat's milk has a better composition. It is significantly more nutrients, and minerals, such as antioxidants, phosphorus, potassium, sodium, calcium, magnesium, copper, iron and manganese. Vitamins in the goat milk is slightly less common among which ascorbic acid (vitamin C), retinol (vitamin A), thiamine (vitamin B1), riboflavin (vitamin B2), and cyanocobalamin (vitamin B12). For goat milk is characterized by a low content of lactose. In cow's milk, for example, lactose at 13%, and in breast milk - 41% more than in goat milk. And it is very important for people who suffer from lactose intolerance, besides cases of diarrhea are excluded.

During the year the goat gives milk to 15-20 times its weight. Milk from cow per year receives 3 times more protein than its meat and by goat - 8-10 times more. The average of milk yield of goats for 5-8 months of lactation of 700-800 liters. Some animals can provide up to 1700 liters of milk. Thus goat milk fat content is not less than 5.4%.

Mare's milk is bluish and sweet-tart taste, and also has antibacterial properties. It is used for the preparation of kumiss, which is used in the treatment of tuberculosis, ulcerous diseases of the gastrointestinal tract and anemia.

Lactation period of the horse is 6-12 months. Milk yield during this time varies from 1100 to 2600 liters; in some animals it reaches 3000 liters.

The mare's milk less fat, protein and minerals than cow. Instead, the vitamin C content in it is 5-7 times more. Mare milk composition closer to the female (Table 2), especially on the amount of protein, lactose and minerals

Currently in developed countries in the industrial scale production of dairy products depends on the quality of starter cultures with high specific composition and processing characteristics. However, the starter cultures are generally designed for cow milk and are not optimal for the milk obtained from other species.

The principles of the selection of bacterial strains in the composition of starter cultures depend on the type of dairy products, with the main criteria for the selection of starter cultures are: the suppression of the growth of opportunistic and technically harmful micro flora; Milk clotting activity; lack of mutual suppression; the number of viable bacterial cells in yeast production.

Thus, a variety of dairy products due to the use of bacterial starter cultures, the composition of which is represented by different types of lactic acid bacteria. Specificity of taste, texture and other properties of a number of dairy products depend on the strains belonging to the bacterial culture.

An important indicator of the quality of leaven is suitability for the production of a given product, that the studies should be checked in a production environment.

In drawing up the starters take into account the specific properties of the product produced, the temperature modes of production, the relationship between microorganisms and others.

Lactic acid bacteria isolated from natural sources differ in the stability properties exhibited. Some strains retain the biochemical activity, in others it falls sharply and irreversibly, the third varies markedly. Considered valuable strains, long retaining biochemical activity depending not only on external factors (the composition of the nutrient medium, especially milk, temperature, etc.) but also on the ratio between the biochemically active and inactive cells in populations of microorganisms that determines viability of the culture, its practical value.

Thus, effective selection of starter cultures for the fermentation of milk obtained from different species, it is necessary to know the features of their biochemical properties.

Therefore, initially we learned biochemical properties of goat, mare's and camel's milk.

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Therefore, biochemical actively recruiting strains was studied.

RESEARCH RESULTS

When studying biochemical properties goat, mare's milk and camel on such parameters as fat, protein, lactose, density, acidity and caloric value, the greatest variations in the chemical composition noted in milk fat content, while the content of lactose and proteins continuously. In Table 1, Figures 1 and 2 show the results of studies on the physicochemical properties of the milk obtained from different specie.

Table 1. Physico-chemical properties of milks of various animal species.

Indicators	Type of milk		
	Goat	Mare	Camel
Fat, %	4,4	1,9	4,5
Protein, %	3,3	2,5	3,5
Lactose, %	4,9	6,7	5,0
Density, kg/m ³	1033	1034	1031
Acidity, T	15	6	15
Energy value, kcal	68,0	47,2	49,0

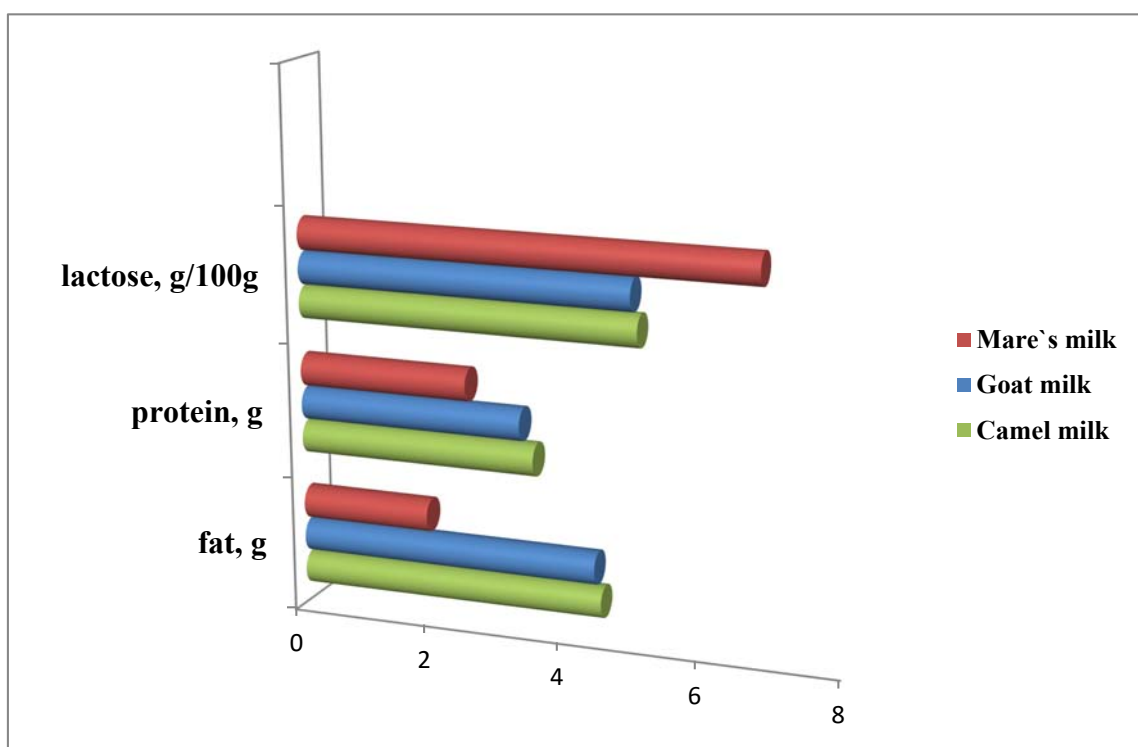


Figure 1. Comparison of physicochemical properties of various milks.

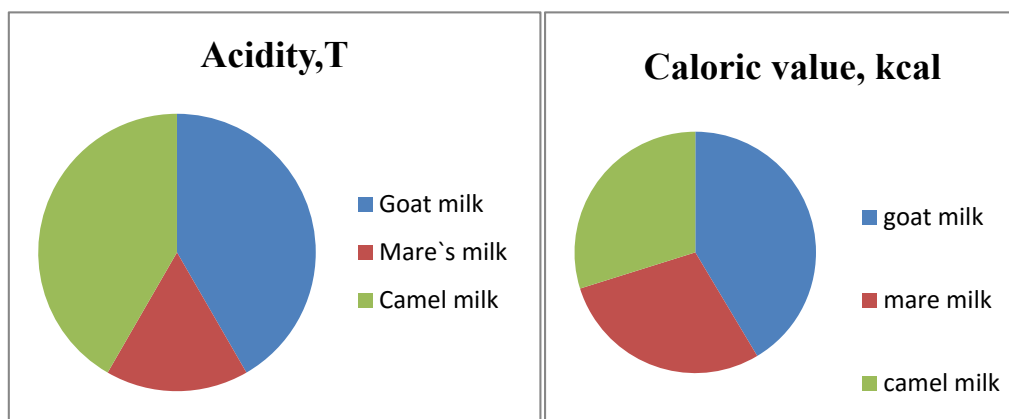


Figure 2. The acidity and the caloric value of different types of milk.

Thus, goat, camel milk contain more fat, and will be more extensively developed Bacteria lipolytic activity mare milk will promote the growth of bacteria developed laktozoliticheskoy activity. According to the parameters of the milk protein is similar to the three species.

Next, the actual problem is to determine which starter cultures and in what amounts it is advisable to include in the formulation, subject biosochetaemosti components. When choosing a sourdough are accounted for biochemical properties of milk and starter cultures. The selected microorganisms ferment based on biochemical properties of milk allows dairy product specific functional properties based on biotechnological parameters of its production.

Some of them include: biological fermentation time sufficient acidity of the finished product qualitative and quantitative composition of microflora and, of course, the high antagonistic activity against pathogenic and opportunistic microflora.

The study of the technological properties of lactic acid bacteria is necessary for selection of active starter cultures for making sourdough. In this regard, we have been determined the energy of acid, acid formation and antagonistic activity of crops, as well as the rate of clot formation and titer cells (see. Table).

Table 2. Technological properties of starter cultures.

Strains	Titratable acidity, °T		The titer of cells, CFU U/g	Antagonistic activity zone diameter, mm
	in 37°C	in 25°C		
Lc.diacetilactis 035ch	79	40	$2,1 \times 10^{12}$	14±0,5
Lb.acidophilus 05ch	75	37	$3,9 \times 10^{12}$	13±1,0
B.bifidum 7-96	70	28	$2,9 \times 10^{12}$	11,0±0,5
Lc.lactis 026ch	109	70	$1,6 \times 10^{12}$	22±1,8
Lb. acidophilus 015k-1	108	78	$1,5 \times 10^{12}$	22±1,3
Str.thermophilus 042k-2	83	38	$2,5 \times 10^8$	14±1,6
Lb.bulgaricus 018k -3	107	76	$1,1 \times 10^{12}$	20,8±0,5
Lb.bulgaricus 08ch-1	108	80	$1,7 \times 10^{12}$	22,5±1,2

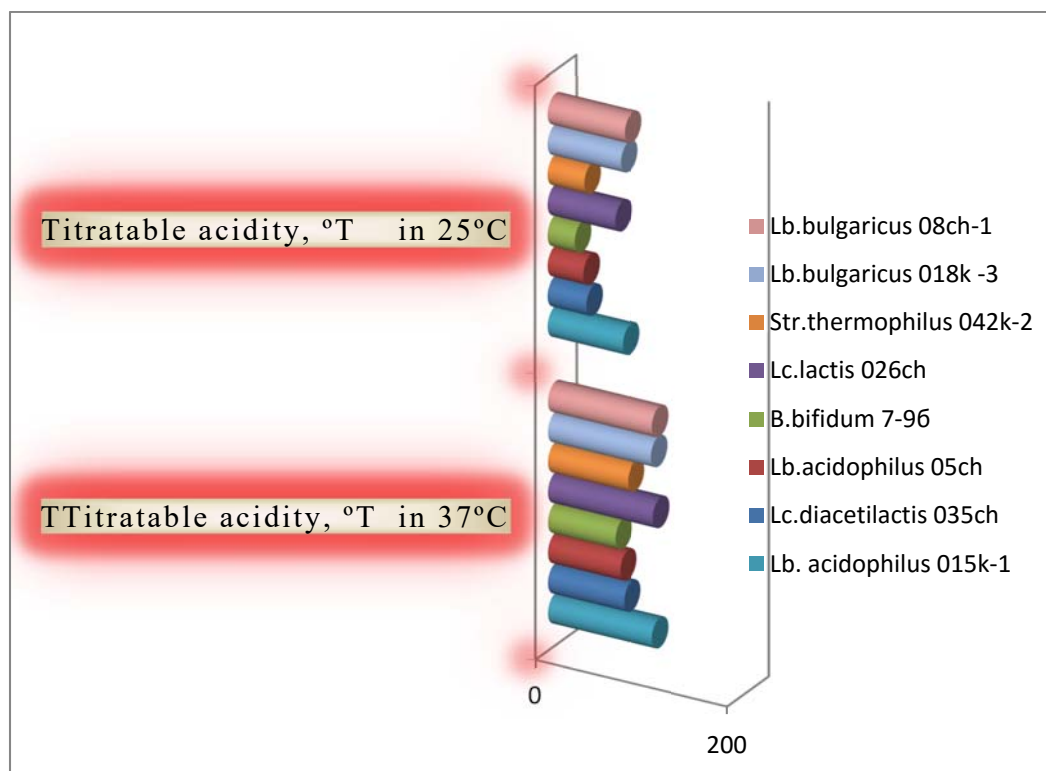


Figure 3. Determination of the dynamics of changes in acidity at different temperatures

Experiments results show that with the same titer cell ICD most energetic acidifier during the fermentation of the milk at 37 ° C are Lc.lactis 026ch, Lb. acidophilus 015k-1, Lb.bulgaricus 018k -3 and Lb.bulgaricus 08ch-1 (titratable acidity of 107-109 ° T). Culture Lc.lactis 026ch, Lb. acidophilus 015k-1, Lb.bulgaricus 018k -3 and Lb.bulgaricus 08ch-1 formed a growth inhibition zone within 17,3-23,8 mm, indicating their high antagonistic activity.

These cultures were used for the study of different types of milk. Selected strains have high organoleptic characteristics and relevant to the finished product of physical and chemical indicators. As a result of tasting, highest organoleptic quality possessed dairy drink based on goat's milk.

The results of evaluation of appearance, texture, taste, smell and color of fermented beverages. It is fully consistent with the characteristics of the data types of the product.

This is important: the high rate of fermentation (with the introduction of 5% sourdough), the average acidity (within 70-90°T), high viscosity (greater than $5 \text{ Pa} \times \text{s} \times 10^{-3}$), sufficient water-holding capacity. It strains having such properties include the following: Lc.lactis 026ch, Lb. acidophilus 015k-1 and Lb.bulgaricus 08ch-1.

The ability to accumulate acid - basic property of lactic acid bacteria used in production. Acidifying activity evaluation was performed by cultures Turner, determining titratable acidity in the medium. Acid-forming ability in the studied strains was different. Limit kislotonakopleniya made for goat milk - from 110 ° to 200 ° T T, and for the mare's milk - from 90 ° to 110 ° T T. This cluster was characterized by dense smooth texture and a pleasant sour-milk taste and aroma. The number of viable microorganisms also highest in these strains.

Lactic acid bacteria differ in composition of casein decay products, as they have a complex intra - and extracellular proteolysis enzymes, consisting of a mixture of proteases. Streptococcal protein predominantly decomposed to peptides (with a minor amount of accumulation of amino acids), a large number of rods form of free amino acids in the milk.

Different types and strains of lactobacilli, having unequal proteolytic activity form qualitative and

quantitative composition of protein degradation products, which leads to the accumulation of various amino acids in a specific ratio.

The proteolytic activity is shown as the coagulation of milk and thermophiles bacillus and streptobacteria. During proteolysis of milk proteins, especially at the beginning of the culture strains in milk, mainly accumulate amino acids (aspartic acid, glycine, serine, glutamic acid, threonine, tyrosine, phenylalanine, isoleucine), and peptides.

Lactic acid bacteria are characterized by a high degree of hydrolysis of casein. Since Streptococci and sticks can transfer soluble form in 25-30% casein coagulants - only 15-17%, while they accumulate different amounts of free amino acids in the milk. Among sticks the greatest proteolytic activity has LBM. Bulgaricum, Lbm. acidophilus, Lbm. Helvetica, and LBM. plantarum.

To produce products intended for long-term storage, using strains of bacteria having low proteolytic activity, and for products sold in the fresh market, by contrast, bacteria that have expressed proteolytic activity. Particularly active proteolysis takes place when warming kefir and kumiss (1).

The table below shows an example of ripening of different dairy products.

Table 3. The temperature and time of fermentation of different types of milk

Product	The microflora of starters	Fermentation temperature	Duration fermentation (h)
Mare's milk	Lc.lactis 026ch	30°C	16-18
	Lb. acidophilus 015k-1		8-10
	Lb.bulgaricus 08ch-1		14-16
Camel milk	Lc.lactis 026ch	38°C	8-10
	Lb. acidophilus 015k-1		10-12
	Lb.bulgaricus 08ch-1		8-10
Goat milk	Lc.lactis 026ch	33°C	12-14
	Lb. acidophilus 015k-1		8-10
	Lb.bulgaricus 08ch-1		10-12

Clot formation at the selected high acid-forming activity of strains was observed after 8-10 hours. The rest of the culture of the clot formed after 12 hours or more.

The high nutritional and biological value of goat's milk, as well as the best of their digestibility, compared with other types of milk, allowed to create a product that meets the physiological needs of the body in essential nutrients and energy.

As a result of studying the development of active starter culture in the medium goat milk, mare's milk and camel milk at different sowing doses microorganisms found optimal amount of leaven - 5%, the use of which provides a sufficiently high yield of lactic acid bacteria and a relatively rapid increase in acidity of the medium during the fermentation of various milks.

As a result of this work on the basis of study of the composition of dairy products developed by biotechnology produce fermented milk-based drink goat's milk, which allows to extend the range of dairy products.

Analysis of the data has helped us to create a leaven for a certain kind of milk given temperature conditions and physico-chemical properties of each type of milk. The study of industrial properties (acid-and-Terrorism antagonist activity, the rate of formation of the curd, cell titer) allowed to select

2 active strain of the representatives of various types of lactic acid bacteria - Lb. acidophilus 015k-1 for the fermentation of goat and mare's milk, Lc.lactis 026ch for camel milk fermentation and recommend them as active starter cultures for the preparation of national milk beverages.

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