

THE QUALITY INDICES OF YAGHURT MANUFACTURED WITH COW MILK AND GOAT MILK

Bulgaru Viorica, Botezat Olga

Technical University of Moldova, Chisinau, Republic of Moldova

Bulgaru Viorica: viorica.bulgaru@yahoo.com

Summary: Goat milk is perfect as a food recommended for children's nutrition due to its well-balanced chemical composition, curative properties, fine curd formation and high digestibility. In this paper 5 samples of goat milk yoghurt, cow's milk and their mixture were developed. 100% goat milk yogurt has formed the finest, softer curd compared to samples with cow's milk without whey removal. All samples obtained high values of organoleptic indices, maximum values obtaining sample 2 and 4. Maximum viscosity values were obtained for sample 3 (mix of cow's milk and goat milk 50:50), minimum values for 100% milk sample goat. The physicochemical and microbiological indices determined fall within the limits specified in the yogurt specific normative documents.

Key words: goat milk, cow's milk, yoghurt, casein, fermentation

Introduction

The primary concern of nutrition specialists is to replace breast milk to a dairy product that is as close as possible to its composition. Milk has a key role in the nutrition and development of the human body, even in the first year of life.

However, some specialists in the field emphasize that the milk of animal origin can not be compared to the mother's milk in terms of nutrient content and balance. But the easily assimilable fat content and casein that form a homogeneous and soft curd compared to casein of cow's milk make it possible for goat milk to be consumed among children with cow's milk allergies and digestive tract problems. [1]

The goat milk fat globules are 1/5 of the size of the cows' milk, they have a better dispersion and make a more homogeneous mixture. It consists of several different components, including glycoproteins, non-polar lipids, phospholipids and sphingolipids, all contributing to the nutritional and technological aspects of fat globulin membrane components. [2, 3, 4]

The amount of short-chain fatty acids (glycerol ethers) in the goat's milk fat is higher than in cow's milk, important for the nutrition of the newborn. [5]

Also, the goat's milk fat is more easily digestible, and can be considered an important source used in various metabolic processes, and even for combating some metabolic diseases. [7, 8]

Goat milk proteins are more easily digestible than cows' milk proteins. Goat milk has lower casein content and a lower coagulation capacity. This difference in coagulation power is attributed to low levels of α_{s1} -casein in goat milk compared to cow's milk, being a key reason for goat's milk to be considered as more easily digested than cow's milk. Casein of breast milk is completely hydrolyzed, compared with 96% casein from goat milk and 76-90% casein from cow's milk. The result is attributed to the higher level of β -casein and a lower level of α_{s1} -casein in casein of human and goat milk. [6]

Milk is a source of the important micro- and macroelements easily assimilated by the organization. In children's diet, dairy products are an important source of minerals such as calcium, magnesium, selenium and vitamins.

Reaction of goat's milk is alkaline, just like breast milk, while cow's milk produces an acidic reaction. An acidic environment stimulates the growth of bacteria, fungi and viruses. [4]

Thanks to well-balanced chemical composition, curative properties, fine curd formation and high digestibility goat milk perfectly fit among the products recommended for children's nutrition. The use of goat's milk in acidic dairy products assortment can highlight all its beneficial properties complete with a positive impact on the gastrointestinal tract due to the finished product microbiota.

Methods and research materials

Raw goat milk was received according to the Moldavian standard SM: 2015, adopted on 29.09.2015. Raw goat and sheep milk. Specifications. This standard establishes technical conditions for the quality of raw goat and sheep milk collected for industrial processing.

Lyophilized starter culture type YO-MIX 485 LYO 200 DCU was used. Dosage 10-20 DCU / 100 liters. Composition: lactobacillus delbruekii ssp. Bulgaricus, Streptococcus thermophilus. Additions of sucrose and maltodextrin.

Drinking water according to HG - 934 of 15.08.2007, Annex 2.

Appreciation of sensory quality based on the score scale. Method principle: Evaluation of each organoleptic characteristic by comparison with scoring scales of 0 ... 5 points and obtaining the average score of the tasters group, (ISO 6658: 2005).

$$P_{mp} = P_{mnp} \times f_p, \quad (1)$$

where: P_{mnp} – Unmatched average score (arithmetic mean of results);

f_p – the weight factor (shows how a sensory character carries the total sensory quality of the product).

$$P_{tp} = \sum P_{mp} \quad (2)$$

Titrate acidity determination (GOST 3627).

Determination of fat content by the acid-butyrometric method, (GOST 5867).

Determination of milk protein content. The principle of the method consists in blocking the amyl groups of proteins with formaldehyde and the liberation of the carboxylic groups, which are neutralized with 0.1N NaOH solution.

The viscosity of the acid dairy products determined by the Brookfield DV-III rotary viscometer.

Determination of Yoghurt Syneresis Index. The principle of the method consists in the separation between solid phase (gel) and liquid during coagulation of milk as a result of active physicochemical phenomena (casein network restructuring) and passive (porosity and permeability of the gel).

$$S = \frac{m_z}{m_p} \times 100, \quad (3)$$

where: m_z – the amount of exuded whey, g;

m_p – sample mass, g; , S – syneresis index, %.

Determination of total dry matter content. (MAC Humidity Analyzer, Radwag).

Determination of the total number of microorganisms (number of bacteria is assessed indirectly, based on the number of colonies generated by the microorganism cells after thermostation at 37 °C for 48 hours.)

$$\frac{X = a \times 10^n}{q} \quad (4)$$

where: a- arithmetic average of the colonies number;
q – hthe volume of material placed on the plate, cm³;
n – product degree decimal dilutions.

Determination of yeasts and molds. GOST 10444.12-88

Results and discussions

For the manufacture and analysis of quality indices, 5 samples of classic yoghurt from the goat milk mix with cow's milk were proposed in the following proportions:

Table 1. Assortment of children classic yogurt.

Nr. sample/ row material (%)	Sample 1	Sample 2	Sample 3	Sample 4	Sample 5
Cow milk	100		50	25	75
Goat milk		100	50	75	25

Yogurt has been manufactured by the thermostat method, being an effective method for the appreciation of the firmness formed coagulum, an important aspect of the acidic dairy products quality for children. The coagulum of these products must be firm but at the same time fine to be easily assimilated by the body of the children.

To assess the quality of the produced yoghurt, organoleptic, physicochemical and microbiological indices were determined.

The recipe of yoghurt contains natural milk and starter culture, without any auxiliary material including stabilizers. Considering this, and given that they are acidic dairy products intended for small children, their shelf life is lower. The products were stored for 72 hours.

The degree of syneresis indicates the amount of whey removed to the surface (%) after the dairy products coagulation. In the case of experimental samples, no whey discharges were detected at the surface, the value being 0%.

The dry matter content depends on the content of proteins, minerals, fats. The higher their concentration, the higher values has the dry substance. Maximum values of dry matter content were obtained for sample 4 and 5.

Quality indices of children goat milk and cow's milk are shown in the table 2.

Table 2. Children yaghurt of goat and caw milk quality indices.

Nr.	Characteristics	The experimental value				
		Sample 1	Sample 2	Sample 3	Sample 4	Sample 5
Physico-chemical indices						
1.	Dry substance, %	14	15,5	17,5	19,5	17
2.	Protein content, %	2,23	2,49	3,76	2,69	2,56
3.	Fat content, %	3,7	4,1	4,25	3,9	3,2
4.	Viscosity, m²/s	3,0*10 ²	2,6*10 ²	3,2*10 ²	2,1*10 ²	2,9*10 ²

Nr.	Characteristics	The experimental value				
		Sample 1	Sample 2	Sample 3	Sample 4	Sample 5
5.	Titrable acidity, °T	80	100	110	120	100
Microbiological characteristics						
6.	Total number of microorganisms, NTG	2*10 ⁷	1,5*10 ⁷	1,8*10 ⁷	1,6*10 ⁷	1,8*10 ⁷
7.	Yeast and mold	absence	absence	absence	absence	absence
Sensory characteristics						
8.	Appearance and consistency	liquid, moderately viscous undamaged curd				
9.	Taste and smell	lactic taste, without foreign smell and taste				
10.	Color	white, in the sample 1,3,5 with yellow shades				

Sample 3 shows the maximum values of viscosity than the other samples. This is due to the fact that the protein content in the sample is much higher and the coagulum was obtained as a strong one as sample 1. The lowest values were obtained for sample 2 - 100% goat milk yoghurt. According to the researches carried out [9], the casein micelles in goat milk differ from those in cow's milk, having a higher β -casein solubility, more calcium and phosphorus, and a lower stability to heat treatment. This is why the coagulum is softer and influences the duration of digestion, because in the acidic environment of the gastrointestinal tract it forms smaller and softer clusters than cow's milk, which is an advantage for the children's body.

The highest acidity values correspond to samples 3 and 4. Titrable acidity depends on the lactic acid content obtained of lactic acid fermentation by lactic bacteria. Thus, the more lactose is in milk, the more lactic acid is produced and the acidity will increase. Normative values for yoghurt range from 85-120°T. If these values exceed the normative limit in the analyzed product, this is an indication that the product is no longer safe for consumption.

The total number of germs determined for the yogurt samples falls within the yogurt-specific normative values. Yeasts and molds have not been detected.

Sensory characteristics of the products were analyzed by method 5 points according to the quality requirements under existing documents (MS ISO 22935-3: 2015).

The yoghurt samples have an average score of 20 points and according to their scoring scale they are given the "very good" and "good" qualifier and can be characterized as "Product with pleasant, specific, well-defined traits, non-defective sensory perceptible". The visible defects from sensory analysis were fat-to-surface separation in samples where the cow's milk content was 100%, 50%, 75%. These defects are due to the lack of a homogenization process that aims at transforming fat globules of $\approx 15\mu\text{m}$ in size into small ones between 0.2 - 1 μm . As a result of this process the defect of fat separation on the surface disappears, the color becomes white with creamy shades.

The results of the sensory analysis are shown in Figure 1, according to the average score.

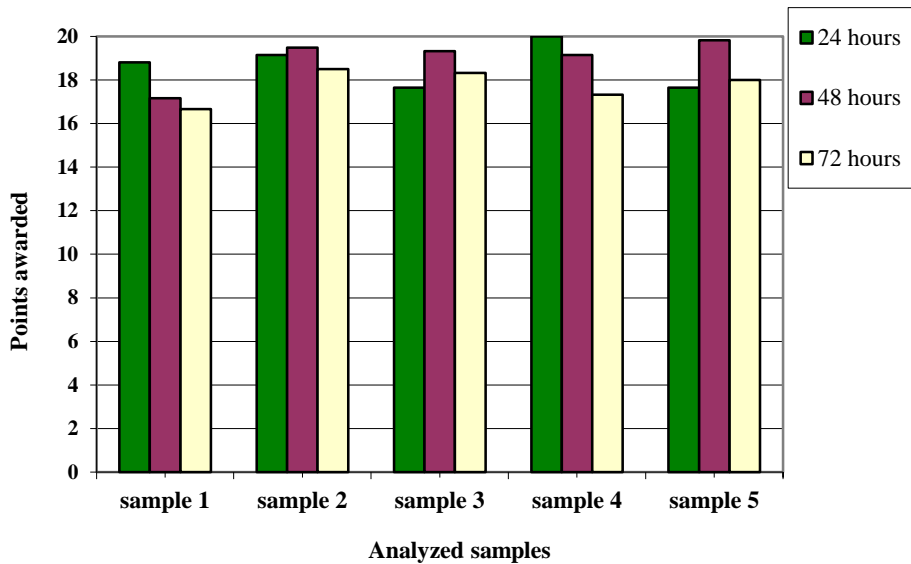


Figure 1. Samples sensory quality variation for 72 hours.

Conclusions

Goat milk is considered to be superior to cow's milk due to its nutritive, tonic, anti-anemic and anti-infectious effects. Also, goat's milk has a lower casein content and a lower coagulation capacity and higher digestibility. Because of these characteristics, goat's milk is recommended in the diet of a wider group of consumers, including children over 8 months of age. In children's diet, dairy products are the most important source of minerals and vitamins.

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