

# TRADITIONAL SOUR MILK PRODUCTS AS A BASIS FOR THE DEVELOPMENT OF NEW PRODUCTS IN INDUSTRIAL CONDITIONS

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**Abstract:** This paper analyzes the chemical composition and organoleptic properties of 5-made industrial products that are declared as “yogurt” with 2,8% fat and 5 products made by traditional technology, which are known as traditional products called “sour milk”. Tests were conducted to determine the differences between the two products (which are very similar), and attempt to execute the standardization of “sour milk” made according to traditional technology, and to determine the acceptability of these products by consumers.

**Keywords:** bio

## Introduction

Traditional food plays an important role in the identification of local communities, consumer behavior, transmission of cultural heritage to future generations, and the interaction of this heritage with the rest of the world (Albayrak and Gunes, 2010). In most countries, the promotion and protection of traditional products is channeled through the quality and policy of development of agriculture and food industry. Traditional food products can be protected through the application of relevant regulations. In this sense, traditional food is viewed from different angles: by manufacturer, by consumers and by marketing (Hani et al., 2003; Grujić and Grujić, 2011). Traditional products have become an important instrument of marketing approach of many countries in the world. Given the costs of developing new products are high, the traditional form of the product’s potential in terms of product diversification is more common. In addition, the demand for traditional forms of food in many countries is increasing. Consumption of this group can influence the development of processing facilities in the food industry, especially small and medium enterprises (Grujić and Grujić, 2011). Traditional food attracts attention as a potential resource for creating your own marketing in some countries (Grujić et al. 2006).

The aim of this study was to evaluate and highlight the geographical dimension in the production of traditional products in the Republic of Srpska and Bosnia and Herzegovina and point to their role in technology transfer and development of new food products in industrial conditions.

The processes of globalization have contributed to the rapid changes and convergence of markets and a change of lifestyle and consumer orientation, and influence the company to constantly seek new forms of food products. With the entry of a large number of foreign brands and products into the market, the traditional structure of consumption has changed significantly. However, it must be stressed that many countries invest significant efforts to protect traditional forms of food, as one of the most important elements of cultural heritage. In addition, efforts are directed towards a greater consumption of these products.

In published papers, claims are made that the traditional products are healthier. In fact it is stated that the traditional food that is produced by the domestic technology has health benefits. For example, yogurt is a product that contains mineral calcium and vitamins in quantities necessary for bone development.

Traditional food plays an important role in rural development and especially in the development of small and medium-sized enterprises, although this fact has not yet been sufficiently exploited. This is indicated by the fact that the mere protection of geographical indications of origin for food crafted in the traditional way is not enough. The protection of traditional forms of food should be taken seriously. In many countries, protection of geographical origin is used as an instrument of support for the production of traditional foods and local products (Grujić et al., 2006). Price of milk that is used to make Parmigiano Reggiano cheese, which has a label of geographic origin, is high, which has a positive effect on local development because it encourages manufacturers of milk (Roest and Menghi, 2000).

Food production in the traditional way, on the other hand, is an effective tool in preventing unfair competition and creation of brands. The protection of traditional dishes relates to the protection of cultural heritage, consumer and producer. It allows creation of new jobs, particularly increasing participation of women in the economy. It ensures the development of food products in accordance with the requirements of product safety and contributes to the promotion of each country.

Changing the image of traditional products and requirements for the product range. For producers, it is important to assess consumers' attitudes. A study conducted in six countries of the European Union has highlighted the positive attitude of consumers towards traditional food products (Weichselbaum et al., 2009a). In the paper of Pirogue et al. (2004) states that consumers consider the products fresher, if they carry the local brand.

Authentic processing of milk and products obtained in this way form the basis for the expansion of product range and quality of dairy products on the market. Indigenous products have had and still have value, price and consumers. We are looking for products with a safe geographical area, clearly marked with the origin and quality, and as such its value obtained (Dozet et al., 2004; Sarić et al., 2001; Dozet et al., 2011). All indigenous dairy products are not of equal value, it is necessary to extract the best, affect their production and sales.

Under the authentic milk products are considered the products that are made on the rounded area, which are produced by the old, original technologies while respecting the fundamental principles of the milk production. In addition, it is necessary to learn all factors which affect the quality of local products: the quality of milk, types and breeds of animals that received milk, the processing and distribution. Be sensitive while talking to people who have kept this production (Dozet et al., 2004).

Especially important is the relationship of original products and areas from which the product originated. Today the ratio is known, as well as the process of protection of geographical indications. Change in the environment affects the quality of the product. In some localities varieties have developed, so it is necessary to determine whether to preserve the original characteristics of the varieties of indigenous products, which confirmed quality. Improvement of indigenous milk processing and preservation of authenticity, requires the implementation of a series of measures relating to the operation, customer care and above all protection of producers of local products (Hani et al., 2003).

Milk production is considered a strategic agricultural sector in BA, and is based on the breeding of cattle, sheep and goats. Milk production is the most common form of agricultural production, taking into account the fact that about 100.000 farm households own cows for milking. Of these, about 33.000 households produce milk for commercial purposes. On the territory of Bosnia and Herzegovina in 2008, there were 35 dairies in operation, of which 22 in FBiH and 13 in the Republic of Srpska. According to estimates, the capacity of milk processing factory that operated in 2008 (35 dairies) was about 400 million liters (260 million liters in the Federation BiH, 160 million in Srpska), with the degree of utilization of about 59%. Production of fermented milk products (yogurt and sour cream) at the state level has increased by about 17% over the previous year (UNDP, 2010).

The production of indigenous milk products in Bosnia and Herzegovina has been preserved for centuries, in spite of numerous wars, displacement and frequent migrations to the cities. These products are characterized by great diversity. Authentic processing of milk in the Republic of Srpska is distributed primarily in the mountainous regions. Under these conditions, a specific characteristic of the milk processing technology and quality are developed and maintained. In those areas, farming was developed in the earlier periods of nomadic and semi-nomadic. Milk processing was primarily, and still is, focused on sour milk, cheese and scorup-cream. Authentic processing is kept in closed mountain oases, and today is a great wealth of technology for the study of inherited and specific quality of these dairy products (Dozet et al., 1996; Dozet et al., 2011).

Specific eating habits play a major role in the traditional habits of many cultures (Weichselbaum et al., 2009a). The use of certain food ingredients in the preparation of some dishes are passed from generation to generation, and they are still known as the “traditional food/dishes.” These include food that is consumed for a long time at the local or regional geographic area. Method of preparing traditional dishes is part of the folklore of a country or region. Some of the traditional dishes are in the danger to disappear, because the amended ways of life. It is important to study the traditional dishes well, and by that reserve the part of the cultural heritage.

Although the term “traditional food / dishes” is long in use, there is no single definition that describes the traditional dishes, so that everyone can have their vision of it. Traditional food has specific properties, for which it is clearly different from other similar products from the same category in the use of “traditional resources” in the sense of ownership of a specific “traditional group” in terms of making the “traditional technology” or “processing method” (Weichselbaum et al., 2009b).

Industrial yogurt is produced by fermentation of milk with a mixture of *Streptococcus* subsp. *thermophilus* and *Lactobacillus delbrueckii* subsp. *bulgaricus* (Lee and Lucey, 2010). Basic steps in the process of making yogurt in industrial conditions include: standardization of milk (fat and protein), homogenization, heat treatment of milk, incubation / fermentation, refrigeration and storage.

## Materials and methods

For the purpose of research in this paper, a product that is traditionally produced in the Balkans has been used, and is known as “sour milk.” The quality and characteristics of products are highly unstandardized. In different parts of the Balkans, and even in neighboring villages, the products obtained in different ways are called “sour milk”, though there are cases where the products obtained in the same way were given different names. This work was carried out by testing of products from milk produced by a procedure traditionally applied in the middle Drina river (Zvornik, Vlasenica, Bratunac and Srebrenica).

### *Production of “sour milk” in the traditional way*

Samples of “sour milk” are taken from five rural households that produce this product for their own use. During sampling, a survey was conducted with each of the hosts about how they work. From this survey, the following procedure can be summarized: a product “sour milk” in the middle Drina is made from cow milk, although sometimes, when there was more sheep, cow milk in part was added to the sheep milk (sheep milk gives the product density). The milk is boiled (cooking sometimes takes 15-20 minutes,

during which evaporation of the water in milk, reduces the volume of milk by one third). After cooling the milk (temperature above 40°C), a small amount (50-100 g) of sour milk from the previous day is added to it, boiled milk of dairy bacteria infects the culture (the culture is not pure and it is different than lactic acid bacteria, there are also other species and strains. They do not give a clean product, but give specific product properties. Recently, the household during the development of “sour milk” used industrially produced culture, so called. May). After that, the milk is scheduled for the procedure of fermentation (pickling). Most households try to maintain the desired temperature of milk as long as possible (in any case temperature should be above 35°C) by holding milk container with a plate in the corner with a wood stove that heats the house, or next to the stove or in the wrapping cloths that represents insulation against cooling. It is desirable that these conditions should be preserved for several hours. In some cases the container with the product remains on the stove or oven overnight. After fermentation, the specific product is obtained which is characterized by: thick consistency, slightly sour taste, white to yellowish color and a specific odor. Sour milk that was added to the milk of the sheep has a pronounced odor of sheep and more intense flavor. After fermentation, the product is cooled (kept in a cold room or refrigerated), which further slows down the fermentation process. During the summer heat, if it does not cool down sufficiently, “sour milk” takes on a pronounced sour taste, it can emit gases, and for product-specific development of large amounts of foam (a product of “whispering” - the fact that the bubbles break through the liquid and come to the surface and create a specific sound). Such product is used as a refreshing drink, and people who do not want a high degree of acidity add some water to the “sour milk” and drink it after that.

Production of yogurt in industrial conditions was carried out according to the international standard (IDF, 1987). After homogenization, the milk is heated up to 90°C for 3 minutes (pasteurization), and then cooled down to 45°C. Then the milk is added to mixed cultures of lactic acid bacteria in the amount of 2.5% (*Streptococcus thermophilus* and *L. bulgaricus* in a 2:1 ratio). Thus inoculated milk is incubated at 45°C for about 4 hours, with a pH value of milk dropped to 4,4. When it reaches the final pH value, the product is cooled down and stored at 6°C at the same temperature until testing. Production of yogurt as provided above was performed in 5 different industrial structures, with selected final products declared as with 2.8% milk fat.

All the tested samples (sour milk and yogurt) from the total amount of product taken randomly, with tests for samples from the same series was repeated three times and the mean value was calculated.

### *Analyses carried out in the work*

Measurement of chemical and physico-chemical properties was carried out according to the standard AOAC methods (AOAC, 2005). The acidity (acid system managers) was determined by titration with 0,1 M NaOH solution to neutralize 100 ml buttermilk or yogurt, along with phenolphthalein as indicator, and the results are expressed as degrees Soxhlet-Henkel (° SH). pH value of the samples of milk and yogurt were determined potentiometrically using a combined glass electrode and were calibrated using standard solutions of pH 6,8 and pH 4,0. On that occasion the pH Bench Meter Jenway 3520 device was used. The fat content in yogurt was determined using the Gerber-in. Dry matter was determined by drying to constant weight by drying at  $102 \pm 2^\circ\text{C}$  (AOAC, 2005). The content of sodium chloride in acid milk and yogurt was determined using the Volhard-in (AOAC 2005).

*Sensory methods of analysis of yoghurt and sour milk:* After making yoghurt and sour milk, the sensory acceptability of the product was made by 9 assessors - members of the panel, pointing to the fifth point system (1 = very unacceptable, 2 = moderately unacceptable, 3 = neither acceptable nor unacceptable, 4 = moderately acceptable, 5 = very acceptable (Meilgaard et al., 1999). The article rating the acceptability of yogurt was made with a method of ranking with tests by trained assessors, who represented the employees at the Faculty of Technology, University of East Sarajevo, and milk processing factory in Zvornik. Selection of reviewers is done on the basis of their previous experience and the sensitivity of the senses and prior assessment of the samples were passed by assessors for the evaluation of a short course of yogurt. Assessors were aged between 20 and 55, 3 women and 7 men.

On that occasion the following parameters were evaluated: taste, smell, color, adhesiveness and cohesiveness. The taste of both products was evaluated in relation to the acidity of which is formed during fermentation of lactose to lactic acid. During evaluation the panelists had to comply with strict rules of assessment, varying results down to a minimum. At each evaluation the panelists were given 5 g of the sample with the temperature of 10°C. They were asked to keep a sample 12 seconds in their mouth and then swallow it. Assessors are supposed to get a taste of the most natural way, keeping a closed mouth and swallowing the sample. The order of presentation of samples was random. Mouthwash between the two samples was done by the use of water. Between two samples of assessment, the evaluators were rested for several minutes.

After that, members of the evaluation committee evaluated the cohesiveness of the maximum deformation capacity of the sample before the interruption. Evaluation techniques require the use of spoons. Adhesion was determined as the force required to overcome surface forces coagulum, or force required to separate the coagulum from the surface of materials in contact (in this case spoon was used). The texture of the product is defined as property that is formed during the contact.

### *Microbiological methods of analysis*

In order to determine the hygienic quality of yoghurt and sour milk, the determination of the following microorganisms was made: *Salmonella*, *Staphylococcus aureus*, *Clostridia*, *Proteus species*, *Escherichia coli* according to the ISO 6785:2001 and ISO 93 IDF IDF 5944:2001.

## **Results and Discussion**

The results for the chemical composition of sour milk made according to the traditional technology and yogurt that is made in industrial conditions are shown in Table 1. Data on dry matter content is an important indicator of the quality of milk and sour milk products, and consists of the total protein, lactose, minerals, fats and other solid ingredients that are dissolved in the milk. The dry matter content depends on the share of these ingredients together with milk fat ranging from 11% -14%. After extracting the fat, dry matter content of milk ranges from 8-10%.

**Table 1.** The chemical composition of “sour milk” and “yogurt”

Parameter	Sour milk is made by traditional technology					Yogurt is made in industrial conditions				
	A1	A2	A3	A4	A5	P1	P2	P3	P4	P5
Dry matter (%)	10,5	16,6	13,2	12,3	11,9	10,6	12,4	12,0	12,0	11,4
Milk fat (%)	3,2	4,9	6,6	4,0	4,1	2,6	2,7	2,7	2,7	2,8
NaCl (%)	0,89	0,78	0,75	0,68	0,69	0,14	0,32	0,17	0,11	0,17

Table 1. shows that the dry matter content in the “yogurt” is between 10,6% -12,4%, and “sour milk” between 10,5% and 16,6%. It should be noted that the variation of results obtained by determining dry matter in the “yogurt” is significantly less than the variation of dry matter content in the “sour milk”. This fact indicates a lack of standardization of the milk stage in the process of this group. Sour milk products with a higher dry matter content have better consistency and higher viscosity (Table 3).

The fat content in the “acid milk” is in the range of 3,2% to 6,6%, and ‘yogurt’ of 2,6% and 2,8% (Table 1.). Fresh milk contains an average of 3-5% milk fat. The fat content is the most important information in assessing the quality of milk products and sour milk products, and the applicable regulations shall not be less than 3,2% (by Gerber). The fat content of sour milk products is an important quality parameter (energy source, the holder of aromatic substances, etc.). Based on data presented in Table 2. it can be concluded that the average values of total fat “yogurt” are very consistent and almost identical to the values that are listed on the product. Unlike them, the average fat content in “sour milk” vary considerably (3,2% to 6,6%), and each is different in regard to all samples as a result of the lack of standardization of the operation of milk, which in terms of rural households is not carried out.

The results of the determination of sodium chloride in “sour milk” and “yogurt” are shown in Table 1. From the table, it can be seen that the values of the content of sodium chloride in “sour milk” are higher than the average values obtained for yogurt produced in industrial conditions. The obtained value is 0,89%, 0,78%, 0,75%, 0,68% and 0,69%. The increased chloride content in “sour milk” (located within the boundaries of acceptable values) is probably a consequence of old milking cows, not the animals suffering from mastitis. This confirmation of data is obtained through assessment of the state prior to the use of milk for pickling. In all cases the sensory score showed that the milk does not have salt and / or bitter taste and unpleasant smell, which is typical of milk obtained from diseased cows.

During the fermentation of milk, pH decrease was observed in both test series of products (“sour milk” and “yogurt”). pH of fresh milk ranges from 6,5 to 6,7. Under these conditions, micelles of calcium - phosphate-casein in milk are very stable. Average pH values measured in the “yogurt” at the end of production range from 4,09 (P4) to 4,11 (P2). Average pH values for other “yogurt” products (P1, P3, P5) are located within this interval and statistically are not significantly different. From Table 2., it can be seen that the average pH values measured in samples of domestic “sour milk” vary widely (4,25, 4,00, 4,20, 4,21, 4,20). Sokolinski et al (2004) measured the decrease in pH during fermentation of milk with 6,7 to 4,34.

The explanation for the results can be found in the way of production of yogurt and sour milk in industrial conditions and in household conditions. When making domestic sour milk at home, hygienic conditions present in the dairy with modern technological equipment can not be achieved. In addition, the process of fermentation in terms of rural households was delayed by the inability to maintain optimal temperatures for pickling and the fact that the milk is added to the pure starter culture, but the added lactic acid bacteria originates from the “old” milk and / or from the outside. Acidity is lower for domestic yogurt because of the weaker ability of bacteria to ferment lactose, so that the proportion of lactic acid in this case is also smaller.

Fadela et al (2009) in their research data show that the time needed for a successful fermentation and storage of yogurt, significantly affects the decrease in pH. Since the pH value is in correlation with the acidity, then the pH value is higher, as can be seen from the Table 2. Precipitation of casein is not absent even in this case. At achieved pH values, miscela casein are unstable and begin to settle creating a gelatinous gel throughout the volume of milk, whose properties are due to the differences in the technological parameters of production, which are different from the properties of yogurt produced in industrial conditions.

**Table 2** Physico-chemical parameters of “sour milk” and “yogurt” samples

Parameter	Sour milk is made by traditional technology					Yogurt is made in industrial conditions				
	A1	A2	A3	A4	A5	P1	P2	P3	P4	P5
Acidity (°SH)	33,0	45,2	33,5	33,0	33,0	37,0	37,0	42,0	42,0	37,0
pH	4.25	4.00	4.20	4.21	4.20	4.10	4.11	4.10	4.09	4.10

The degree of “sour milk” and “yogurt” acidity under the applicable regulations should not be greater than 45°SH (Anon, 2009). Thus, it is evident that the results are within optimum limits; highest acid level was 41,8°SH. The results of the acidity of home sour milk are given in Table 2. Similar results were obtained by Gueimonde et al (2003), Salvador and Fiszman (2004), and Fadela et al (2009). Table 2. shows that the domestic value of “sour milk” acidity noted below is in relation to the industrially manufactured product “yogurt”. Samples of “sour milk” measured lower acidity compared to the industrial product “yogurt”. The data for the acidity of the sample A2 does not fit the facts (45,26 °SH). The reason for this deviation should be sought in the conditions that prevailed during the development of products, quality and hygienic quality of milk from which the product is made and the temperature during transportation and sales (a sample was received at the public market). In all other cases, the acidity of the “sour milk” was lower than the acidity resulting in industrial products because of dirt or used bacteria cultures, fermentation temperature, lower flow production of domestic “sour milk” or time in which the fermentation took place. The latter should be linked with producer-consumer practices that give priority to the less acidic product.

Table 3. represents the results of sensory evaluation of “sour milk” and “yogurt” samples. The results showed the uniformity of all sensory properties of “yogurt” samples. Unlike these, products that are made according to traditional technology were evaluated by assessors so that between them there is a statistically significant difference when evaluating taste, smell and adhesiveness. Sample A2 was rated the best (highest average score of all organoleptic properties). Assessors, in addition provided scoring grades and descriptive ratings as follows: natural color, texture - smooth, sweet taste with salt, smell nice. The lowest score received samples A4 and A5.

**Table 3.** Sensory analysis of “sour milk” and “yogurt” samples

Parameter	Sour milk is made by traditional technology					Yogurt is made in industrial conditions				
	A1	A2	A3	A4	A5	P1	P2	P3	P4	P5
Taste	4,5	4,7	4,3	3,9	4,0	4,6	4,3	4,2	4,7	4,4
Odor	4,3	4,8	4,2	4,0	4,0	4,5	4,0	4,0	4,7	4,3
Color	6,1	4,5	4,4	4,0	3,9	4,3	4,1	4,3	4,5	4,1
Adhesiveness	3,2	3,4	3,1	3,8	3,9	3,1	3,2	3,3	3,3	3,1
Cohesiveness	3,7	4,1	3,8	4,3	3,4	4,0	3,9	3,9	4,1	3,8

Table 4. shows the results of microbiological “yogurt” and “sour milk” analysis, according to the method prescribed in the applicable regulations for microbiological control of milk products (Anon, 2009). As shown in Table 4, test results of all samples were negative for both the yogurt and sour milk, so that all tested products were microbiologically acceptable.

**Table 4.** Microbiological analysis of sour milk

Isolated microorganisms:	Escherichia coli	Salmonella	Staphylococcus aureus	Proteus	Clostridia
A1	∅	∅	∅	∅	∅
A2	∅	∅	∅	∅	∅
A3	∅	∅	∅	∅	∅
A4	∅	∅	∅	∅	∅

To ensure the best protection of indigenous milk products we need to ensure that they are made from the milk of indigenous production, produced in the traditional geographical area, and that are made according to the original traditional technology, which is continuously controlled during the operation (Grujić et al., 2006).

On the market, there are different types of industrially produced yogurt, which differ according to the additives used in their production (sweeteners, fruits, flavors, etc.) or procedures that are applied in order to extend the viability of these products (yogurt freezing or drying, and liquid or solid yogurt). In principle, all these products are made by the use of identical or very similar technology and with the same microorganism. Modern technology allows the standardization of products (in relation to fat content, total dry matter content, etc.). The quality and standardized products can vary depending on the used milk quality, hygiene and the use of “wild microbiological culture” (Younus, 2002; Olugbuyiro and Oseh, 2011).

## Conclusion

The results obtained in this study showed that the chemical composition, physico-chemical and sensory properties of fermented milk products made according to traditional technology, e.g. “sour milk”, vary depending on the manufacturer, so in order to protect the origin of the product label, the first necessary thing to do is the standardization of production and product characteristics, and then access to its mass production as well as indigenous products. On the other hand, the results showed no significant differences in the composition and characteristics of industrially made products, i.e. “yogurt”, in the domestic market. In continuation of this research it is necessary to work on standardization of production and product attributes, and to study other properties of products made by traditional technology, especially the study of the composition of microflora, which is used for fermentation in rural households.

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