

The Quality of Some Acid Dairy Products Obtained in the Traditional System

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Abstract

The transformation of milk into acidic products has led to a significant increase in its nutritional and biological value. Containing all the components of milk, but in a more easily digestible form, readily metabolizable calcium, significant amounts of vitamins (from the B complex, synthesized by microorganisms in starter cultures), acid-dietetic products hold a significant and well-deserved share in human nutrition. Consequently, through this work, we aimed to identify qualitative parameters of raw milk, and of some assortments of acidic products obtained in a traditional system. In the case of raw milk, the parameters were within the limits imposed by company standards (acidity $17.1 \pm 0.60^\circ\text{T}$; density 1.027 ± 0.002 , fat $3.5 \pm 0.4\%$; average delivery temperature of $6 \pm 0.50^\circ\text{C}$) with fluctuations generated by the season. The Buttermilk assortment presented organoleptic and physico-chemical characteristics close to those provided in standards (characteristic taste and color, acidity $145 \pm 100^\circ\text{T}$, fat $2.1 \pm 0.1\%$, proteins $2.9 \pm 0.2\%$). In the case of the Sana assortment, the physico-chemical parameters showed slight modifications compared to the standard, with lower acidity ($115 \pm 100^\circ\text{T}$), hence the weak expression of some sensory characteristics. The most important conclusion of this case study was that regardless of the classification of the unit, the physico-chemical and sensory properties of the products obtained are decisively influenced by strictly adhering to the technologies, otherwise risking severe deviations from the imposed standards.

Keywords: technologies; sensory characteristics; quality; acid-dietetic dairy products

1. Introduction

After ranking animal products according to their economic and nutritional importance, milk was placed second, right after meat. Generally, it can be stated that milk is one of the cheapest sources of animal protein with high biological value. Globally, the consumption of milk and dairy products per capita represents an indicator of the standard of living, and for this reason, in civilized countries, milk production accounts for over 40% of the gross income generated by agricultural production [1, 2].

Considered a "nutritional universe," milk is an irreplaceable, complete food, particularly due to its multiple beneficial effects, such as mineralizing action for the young, preventing decalcification in seniors, and protecting against highly toxic elements for those working in hostile environments. Rational consumption of milk ensures good physical and intellectual development, especially in young people, increases the body's resistance to diseases, extends longevity, and ensures overall health and well-being for all consumers [1-3].

Acidic dairy products contain all the nutrients of milk but in a more easily assailable form. Casein is found in a suspended form, while lactose is fermented and transformed into lactic acid. The therapeutic and dietary value of yogurt has been highlighted by several researchers, who attributed

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premature aging to autointoxication caused by an excessively meat-heavy diet.

Consuming acidic dairy products, obtained under hygienic conditions, ensures the maintenance of health through their nutritional and therapeutic value [4, 5].

Acid dairy products, such as yogurt, kefir, sour cream, and buttermilk, have been an integral part of human diets for centuries. These products are valued not only unique flavors and textures but also for their nutritional benefits, which include probiotics and essential nutrients like calcium, vitamins, and proteins. Traditionally, the production of acid dairy products relies on natural fermentation processes, which involve the use of specific strains of bacteria to convert lactose into lactic acid. This traditional system, often passed down through generations, emphasizes natural ingredients, minimal processing, and specific artisanal techniques that can significantly influence the quality of the final product [4-6].

Quality in acid dairy products is determined by various factors, including microbiological safety, sensory attributes (taste, texture, aroma), and nutritional content. The traditional fermentation process can enhance these qualities by promoting the growth of beneficial microorganisms while inhibiting pathogens, thus improving the safety and shelf life of the products. Additionally, traditional methods often result in more complex flavors and textures compared to mass-produced versions, as the slower fermentation allows for the development of a broader range of taste compounds [6-8].

However, the quality of acid dairy products obtained through traditional methods can vary significantly based on several factors. These include the quality of the raw milk used, the specific bacterial cultures involved, the conditions under which fermentation takes place (such as temperature and time), and the handling and storage practices employed. Traditional methods typically eschew the use of artificial additives and preservatives, relying instead on the natural preservative effects of lactic acid and other fermentation byproducts [9-12].

2. Materials and methods

The study was conducted using classical analysis methods. Specifically, these methods include

standard procedures for data collection, processing, and evaluation, which are widely accepted in scientific research.

Organoleptic analysis method for acido-dietetic dairy products is based on the sensory evaluation of acid-dietetic dairy products by observing characteristics such as appearance, color, smell, and taste to determine the quality and acceptability of the product. Thorner method for determining acidity consists in titrating the dairy product with a known concentration of sodium hydroxide (NaOH-0,1 N) solution, using phenolphthalein as an indicator, until reaching the equivalence point to measure the lactic acid content. Butyrometric method for determining fat content use a butyrometer, a specially designed device, in which the fat in the milk is separated and measured volumetrically after treatment with sulfuric acid and isoamyl alcohol, to determine the fat content.

Lactodensimeter method is based on the use of a lactodensimeter, a type of hydrometer, which measures the density raw milk or of dairy milk. By comparing the obtained density with standard values, the composition of the milk and possible water additions can be estimated [11, 12].

The pH meter method for determining pH uses a pH meter, an electronic instrument that measures the activity of hydrogen ions (H⁺) in solution, to determine the acidity or alkalinity of the dairy product. For statistical interpretation, ExcelSTAT, a comprehensive statistical software, was utilized. ExcelSTAT offers a variety of statistical tools and functions. In terms of data collection, fifteen samples were gathered for each category being analysed. This sample size is adequate to provide a representative assessment of each type, ensuring that the results are statistically significant and reliable. The selection and handling of these samples followed strict protocols to maintain consistency and accuracy throughout the study [12].

3. Results and discussions

The organoleptic qualities of raw milk, as shown in Table 1, are generally in line with expected standards. Raw milk's taste is described as pleasant and sweet, characteristic of its species, which is a normal expectation for fresh milk. The smell is noted to be pleasant and slightly ketonic or butyric, indicating the presence of specific

compounds that are common in dairy but within acceptable limits, free from foreign odors. The color is described as white to slightly yellowish, a natural variation due to the cow's diet and seasonal changes. The consistency and aspect of raw milk, being fluid and opalescent with no foreign bodies, aligns with standards for high-quality milk. [13-15]. The organoleptic qualities of raw milk in the results of this research align with the literature,

which also describes fresh milk as having a pleasant, slightly sweet taste, and a clean, mildly ketonic or butyric smell, indicating the presence of dairy compounds within normal limits. The color variation from white to yellowish and the fluid, opalescent consistency without foreign bodies is consistent with documented characteristics of high-quality raw milk across various studies [1, 4, 5, 15].

Table 1. The organoleptic properties - raw milk

Characteristics	Specification	Samples
Taste	Pleasant, sweet, characteristic of the species	Pleasant, sweet, characteristic
Smell	Pleasant, specific, slightly ketone and butyric	Characteristic, without foreign odors
Colour	White, yellowish	White, slightly yellowis
Consistency	Fluid	Fluid
Aspect	Opalescent liquid, without foreign bodies	Opalescent, free of foreign bodies

The physical-chemical properties of raw milk, as outlined in Table 2, provide insights into its quality and compliance with established standards.

Acidity (°T): The measured acidity of 17.10°T falls below the maximum permissible limit of 19°T, indicating that the milk is fresh and free from spoilage. The standard deviation (± 0.60) and low coefficient of variation (2.46%) suggest that the acidity values are consistent, further supporting the milk's freshness and stability.

Fat content (%): The obtained fat percentage of 3.50% exceeds the minimum required value of 3%, indicating that the milk has an adequate fat content, essential for both nutritional value and sensory quality. The standard deviation (± 0.40) and coefficient of variation (2.38%) show slight variability, but the fat content remains within acceptable limits for high-quality raw milk.

Density: The measured density of 1.027 is slightly below the standard value of 1.03, though it remains close to the norm. This minor deviation may be attributed to natural variations in milk composition, such as water and fat content, with a

standard deviation of ± 0.002 and a low variability (1.22%). Despite the slight difference, the density still falls within acceptable ranges for raw milk.

Overall, the data demonstrates that the raw milk evaluated meets key quality criteria, confirming its suitability for consumption.

The obtained acidity of 17.10°T is consistent with the literature, which generally reports values between 16°T and 18°T for fresh raw milk, indicating good milk quality without signs of spoilage. The fat content of 3.50% is slightly higher than the minimum standard of 3%, aligning with typical values in literature, which often range from 3.2% to 4%, depending on breed and diet. The density measured at 1.027 is marginally lower than standard 1.03, which is commonly seen in raw milk studies due to natural variations such as fat content and water proportion. Similar small deviations in density have been observed in other research, attributed to environmental factors and seasonal fluctuations in milk composition. Overall, these results fall within the typical ranges documented in the literature, supporting the milk's quality and compliance with established norms [1, 3, 6, 16].

Table 2. Physical-chemical properties - raw milk

Properties studied	Specification	Data obtained	
		$\bar{X} \pm s \bar{X}$	V%
Acidity (°T)	Max. 19	17.10 \pm 0.60	2.46
Fat (%)	Min. 3%	3.50 \pm 0.40	2.38
Density	1.03	1.027 \pm 0.002	1.22

The organoleptic properties of lapte bătut (buttermilk) in Table 3 align closely with standard expectations for this fermented dairy product.

Taste: The samples exhibit the desired pleasant, sour, and refreshing taste with a characteristic aroma, confirming successful lactic fermentation. The taste profile matches the expected sensory qualities typically associated with properly fermented lapte bătut, making it appealing to consumers.

Smell: The specific aroma observed in the samples is indicative of successful lactic fermentation, with no off odors. This is consistent with the expected properties of a well-fermented product and suggests that microbial activity has progressed correctly during the fermentation process.

Colour: The white to yellowish tint observed in the samples is typical of lapte bătut, with the slight yellowing attributed to fat content and variations in the cow's diet. This coloration falls within the acceptable range for this product.

Consistency: The samples show finely dispersed curds of appropriate consistency, without the separation of whey or the formation of gas

bubbles. This indicates proper fermentation and coagulation processes, maintaining the integrity of the curd.

Aspect: The porcelain appearance of the samples aligns with expectations for high-quality lapte bătut, providing a visually appealing product. Overall, organoleptic characteristics suggest that the lapte bătut samples meet the quality standards for texture, taste, and appearance.

The organoleptic properties of lapte bătut in these results closely align with those reported in the literature. The pleasant, sour, and refreshing taste is consistent with standard descriptions of fermented dairy products, which emphasize a balanced acidity and characteristic aroma. Similarly, the specific lactic fermentation aroma observed in the samples mirrors what is documented in studies, where the absence of off-odors is a key indicator of proper fermentation. The white to yellowish color, also noted in the literature, is a normal variation caused by factors like fat content and diet. Finally, the proper curd consistency and porcelain appearance match those found in other research, where a firm curd without whey separation or gas bubbles is considered a marker of high-quality lapte bătut [8-10, 14, 15].

Table 3. The organoleptic properties – *Lapte batut*

Characteristics	Specification	Samples
Taste	Pleasant, sour, refreshing, characteristic aroma	Pleasant, sour, refreshing, specific aroma
Smell	Specific aroma, with properties specific to lactic fermentation	Specific aroma
Colour	White with a yellowish tint	White - yellowish
Consistency	Firm curds, without gas bubbles and whey removal	Curd of the right consistency, finely dispersed
Aspect	Porcelain appearance	Porcelain appearance

The physical-chemical properties of lapte bătut presented in Table 4 provide key insights into its quality and compliance with established standards.

Acidity ($^{\circ}T$): The obtained acidity of $145^{\circ}T$ is slightly lower than the specified standard of $150^{\circ}T$, but it remains within an acceptable range for fermented milk products. This value indicates sufficient lactic acid development, essential for the sour taste and microbial stability of lapte bătut. The low variation (3.58%) shows consistent acidity across samples.

Fat (%): The measured fat content of 2.10%

slightly exceeds the minimum requirement of 2%, aligning with expectations for lapte bătut. The low standard deviation (± 0.06) and minimal variation (1.24%) suggest uniform fat distribution, which contributes to the product's creamy texture and mouthfeel.

pH: The pH value of 4.5 is slightly lower than the specified 4.6, reflecting the acidic nature of fermented milk products. This slight deviation is typical in fermented dairy, with the pH supporting both flavour development and preservation, while the low variation (3.46%) suggests good consistency across the samples.

Protein (%): The protein content of 3.4% is higher than the specified 2.9%, which is a positive indicator of the product's nutritional quality. This higher-than-expected protein content enhances the nutritional profile of the lapte bătut, and the low variability (4.12%) indicates consistency across the batches.

The physical-chemical properties demonstrate that the lapte bătut meets or exceeds key quality parameters, particularly in fat and protein content, while maintaining appropriate acidity and pH for a well-fermented dairy product.

The acidity of 145°T in lapte bătut samples is slightly below the typical range reported in the literature, which often cites values around 150-160°T for well-fermented products, indicating a

successful fermentation process. The fat content of 2.10% aligns well with literature values, which generally report a range of 2-3% for lapte bătut, supporting its creamy texture and mouthfeel. Similarly, the pH of 4.5 is consistent with established standards, as most studies suggest a pH range of 4.5 to 4.6 for fermented dairy products, confirming the product's acidity is within expected limits. The higher protein content of 3.4% exceeds the typical range of 2.5-3.0% reported in the literature, suggesting a potentially enhanced nutritional profile for your lapte bătut. Overall, these results reflect a quality product that aligns with or exceeds many of the benchmarks established in previous studies [8, 9, 14, 16, 17].

Table 4. Physical-chemical properties - Lapte bătut

Properties studied	Specification	Data obtained	
		$\bar{X} \pm s$	V%
Acidity (°T)	150	145±10	3.58
Fat (%)	2	2.10±0.06	1.24
pH	4.6	4.5±0.12	3.46
Protein (%)	2.9	3.4±0.20	4.12

The organoleptic properties of sana (3.6% fat) presented in Table 5 highlight the product's quality and alignment with expected sensory characteristics.

Taste: The samples exhibit a pleasant, sour taste with a specific aroma, which is characteristic of well-fermented sana. This aligns with expected flavor profiles, indicating that the fermentation process has successfully developed the desired sensory qualities.

Smell: The specific aroma noted in the samples is consistent with the lactic fermentation properties typical of sana. This aromatic profile not only enhances the overall sensory experience but also confirms the microbial activity involved in the fermentation process, indicating that the product is fresh and of high quality.

Colour: The color of the samples, described as white and characteristic of milk, is in line with the standard expectations for sana. This uniform color suggests the absence of any unwanted discoloration or impurities, further emphasizing the quality of the product.

Consistency: The fine consistency of the curd observed in the samples aligns with the desired texture for sana. A well-formed curd without excessive separation or graininess is a key indicator of proper fermentation and handling, contributing to the product's appeal.

Aspect: The compact appearance of the samples matches the expected presentation for sana, indicating good processing and storage conditions. Overall, the organoleptic properties suggest that the sana is of high quality, meeting consumer expectations for taste, aroma, and texture.

The taste profile of the samples, described as pleasant and sour with a specific aroma, aligns closely with literature descriptions of sana, which typically emphasizes a well-developed flavor due to proper fermentation. The specific aroma noted in analysed samples is consistent with documented characteristics, where the smell is identified as typical of lactic fermentation, indicating good microbial activity during production. The white, milky color observed matches standard expectations, as literature often describes sana as having a uniform and appealing color that reflects its freshness and quality. Furthermore, the fine curd consistency reported is in line with the ideal

texture cited in studies, where a well-formed curd is critical for quality assessment. Lastly, the compact aspect of the samples supports findings in

the literature, which note that a compact structure is essential for a high-quality sana, ensuring a visually appealing and stable product [1, 4, 15].

Table 5. The organoleptic properties - Sana (3,6% fat)

Characteristics	Specification	Samples
Taste	Pleasant, sour, specific aroma	Pleasant, sour, specific aroma
Smell	Specific aroma for the Sana assortment, with properties specific to lactic fermentation	Specific aroma of Sana, with specific smell of lactic fermentation
Colour	White, milky	White, characteristic of milk
Consistency	Curd of fine consistency	Curd of the right consistency
Aspect	Compact	Compact

The physical-chemical properties of sana (3.6% fat) presented in Table 6 provide important insights into its quality and compliance with established standards.

Acidity (°T): The measured acidity of 115°T is significantly below the specified standard of 140°T, indicating that the sana may be less sour than typically expected. This lower acidity could suggest incomplete fermentation or a longer shelf life, potentially impacting flavor and microbial stability. However, the standard deviation (± 10) indicates some variability among samples, suggesting that further monitoring may be necessary to ensure consistent fermentation.

Fat (%): The fat content of 3.7% slightly exceeds the specified level of 3.6%, which is advantageous for the product’s richness and mouthfeel. This higher fat content may enhance the overall sensory experience and align with consumer preferences for creamier dairy products. The low standard

deviation (± 0.24) indicates a consistent fat distribution across samples, supporting the quality of the sana.

pH: The pH value of 4.5 is very close to the specified 4.6, reflecting an appropriate level of acidity for sana. This slight variation falls within acceptable limits and suggests that the fermentation process was adequately controlled, resulting in a product that maintains the desired flavor profile and stability. The standard deviation (± 0.24) indicates minimal variation in pH across samples, which is a positive sign of consistency.

Protein (%): The protein content of 3.1% exceeds the specified minimum of 2.8%, enhancing the nutritional profile of the sana. A higher protein content is often associated with improved texture and flavor, contributing to a more satisfying product for consumers. The standard deviation (± 0.20) indicates a moderate level of consistency in protein content across the samples.

Table 6. Physical-chemical properties - Sana (3,6% fat)

Properties studied	Specification	Data obtained	
		$\bar{X} \pm s$	V%
Acidity (°T)	140	115 \pm 10	6.28
Fat (%)	3.6	3.7 \pm 0.24	3.42
pH	4.6	4.5 \pm 0.24	4.46
Protein (%)	2.8	3.1 \pm 0.20	3.20

The measured acidity of 115°T in these sana samples is significantly lower than the typical range reported in the literature, which generally suggests acidity levels around 140-160°T for well-fermented products. This lower acidity may indicate a variation in fermentation time or conditions compared to the standards outlined in previous studies. The fat content of 3.7% aligns well with literature values, which often state that

sana should contain between 3.5% and 4% fat, supporting its creamy texture and richness. Additionally, the pH of 4.5 falls within the acceptable range reported in the literature, where pH levels for sana typically range from 4.5 to 4.6, indicating that the acidity is appropriately balanced. Finally, the protein content of 3.1% exceeds the typical minimum of around 2.5-3.0% found in the literature, suggesting a potentially

higher nutritional value for your sana compared to standard benchmarks [6, 9-11, 16, 17].

5. Conclusions

Through the conducted study, it was demonstrated that the manufacturer maintains traditional technologies, and the products obtained adhere to the standards set by the company. However, we deem it necessary to process only milk that meets the minimum quality conditions mandated by current regulations. To address consumer demands effectively, it is beneficial to utilize information gathered from customers through conducting opinion polls in the regions where the unit sells its products.

References

1. Nistor, C. E., Bacila, V., Avram, P., Usturoi, A., Avarvarei, B. V., Evaluation of raw milk quality gathered from north east area of Romania, *Scientific Papers. Series D. Animal Science*, 2019, LXII(2), 289-295.
2. Davidescu, M. A., Pânzaru, C., Usturoi, A., Radu-Rusu, R. M., Creangă, Ș., An Appropriate Genetic Approach to Endangered Podolian Grey Cattle in the Context of Preserving Biodiversity and Sustainable Conservation of Genetic Resources, *Agriculture*, 2023, 13(12), 2255.
3. McCarthy, K. S., Lopetcharat, K., Drake, M. A., Milk fat threshold determination and the effect of milk fat content on consumer preference for fluid milk. *Journal of Dairy Science*, 2017, 100(3), 1702-1711.
4. Rațu, R. N., Usturoi, M. G., Usturoi, A., Radu-Rusu, R. M., Ivancia, M., Quality assessment of the cow milk traded on the Iasi market. *Scientific Papers. Series D. Animal Science*, 2019, 62(1).
5. Usturoi, M. G., Rațu, R. N., Usturoi, A., Avarvarei, B. V., Studies regarding quality of powder milk. *Lucrări Științifice-Universitatea de Științe Agricole și Medicină Veterinară, Seria Zootehnie*, 2018, 69, 121-124.
6. Popescu, A., Tindeche, C., Marcuța, A., Marcuța, L., Hontus, A., Stanciu, M., Concentration Trends In Milk Production And Number Of Dairy Cows In Romania, *Scientific Papers Series Management, Economic Engineering in Agriculture and Rural Development*, 2023, 23(4).
7. Davidescu, M.-A., Gradinaru, A.-C., Creanga, St., Endangered Romanian cattle breeds-between traditional breeding and genetic conservation, *Scientific Papers-Animal Science Series: Lucrări Științifice - Seria Zootehnie*, 2021, 75, 66-75.
8. Avarvarei, B. V., Usturoi, M. G., Usturoi, A., Analyse of commodity for some fresh milk assortments sold on Iași city market. *Lucrări Științifice-Universitatea de Științe Agricole și Medicină Veterinară, Seria Zootehnie*, 2012, 58, 177-182.
9. Rațu, R. N., Veleșcu, I. D., Stoica, F., Usturoi, A., Arsenoaia, V. N., Crivei, I. C., Brumă, I. S., Application of Agri-Food By-Products in the Food Industry, *Agriculture*, 2023, 13(8), 1559.
10. Usturoi, A., Rațu, R. N., & Usturoi, M. G., Nutritional value of some animal products included in the structure of breakfast, *Proteins*, 2022, 21(21.41), 0-41.
11. Poroșnicu, I., Rațu, R. N., Davidescu, M. A., Mădescu, B. M., Matei, A. C., Creangă, Ș., Usturoi, M. G., Research on the quality assessment of mozzarella cheese for the safety of use, *Scientific Papers. Series D. Animal Science*, 2020, 63(2).
12. Liua, Z., Loganb, A., Cocksac, B. G., Rochfort, S., Seasonal variation of polar lipid content in bovine milk, *Food Chemistry*, 2017, 237, 865-869.
13. STAS 2418-61- Whole cow's and buffalo's raw milk, accessed at [14.04.2023].
14. STAS 6352/2-87-Milk and dairy products, accessed at [21.04.2023].
15. SR 6345:1995 - Milk and dairy products. Sensory analysis, accessed at [11.02.2023].
16. STAS 6352/1-88-Milk and dairy products. Determination of the fat content of milk, acid dairy products and by-products, accessed at [19.04.2023].
17. SR EN ISO 8968-1:2014-Milk and milk products. Determination of nitrogen content. Part 1: The Kjeldahl method and the calculation of crude protein content, accessed at [21.05.2023].