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A STUDY CONCERNING QUALITY ASSESSMENT AND PROCESSING PARTICULARITIES IN CERTAIN DAIRY PRODUCTS

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Abstract

Featured by the so-called "nutritional value" and being highly beneficial for the young mammals, the milk is an important alimentary component. Milk and dairy products undergo a large number of analyzes, aiming to establish chemical composition, assessing of nutritional value, identifying falsifications, and adhering to manufacturing prescriptions. Through analyzes changes due to non-compliance with hygiene rules during milking or transport, can be identified and highlighted. The quality of raw milk is crucial in order to obtain dairy products that meet the applicable legal requirements. Standard laboratory analyzes have been used in this study in order to assess physical and chemical parameters of raw milk, such as: density, acidity, fat content, protein and dry matter. A total of 201 samples, consisting of milk samples for consumption and acidic dairy products, harvested from a processing plant from the south of the country were analyzed. Laboratory analyzes were carried out to identify the quality of raw milk and any differences in the nutritional values of the acidic dairy products. The results proved that parameters taken into consideration (fat, density, acidity) were within the admitted limits for all analyzed products. The density of the milk falls within the limits of the assortment, with values ranging between 1,028 g/cm^3 and 1,030 g/cm^3. Acidity is within admissible parameters, with an average of 15.06^{o}T for drinking milk, 84.75^{o}T for yogurt, 82.76^{o}T for sour-batter milk and an average of 67.60^{o}T for sour cream. As a technological particular step of obtaining dairy products, the high pasteurization method is used in the study unit, which guarantees a longer shelf-life. In conclusion, the products under study were within the admissibility parameters set by the manufacturing unit in accordance with the legal provisions.

Key words: *milk, dairy product, nutritional value, pasteurization.*

INTRODUCTION

Milk is an important food component. Raw milk is characterized by so-called "nutritional value", especially for young mammals, because it meets the body requirements in energy, plastic and biostimulating substances, positively influencing the health of consumers. This is an important source of protein, vitamins and minerals. Cow's milk is a major source of calcium. (Worsley et al., 2003; Usturoi M.G., 2007; Claeys et al., 2013; Claeys et al., 2014; Ladokun et al., 2014).

Food quality is an increasing area of study, food currently exceeding the feed limit. People need not only food in adequate amounts but also high-quality food (Visoescu et al., 2015).

It is considered that a liter of milk feeds the human body in the same way as (Figure 1): 750 g calf meat, 500 g of fish, 400 g pork, 8-9 eggs, 125 g of bread, 1400 g apples, 2600 g cabbage (Usturoi M. G., 2007).

Normally, foods should not contain physical traces (metal or plasctic pieces, hair, nails), chemical compounds (substances used in sanitation, toxic compounds) or hazardous biotic agents (pathogenic bacteria, parasites). Although, many of the chemicals, such as preservatives and food colorants, flavor enhancers have become indispensable for the normal development throughout people's lives (Savu C., Petcu C. D., 2002; Verraes et al., 2015).

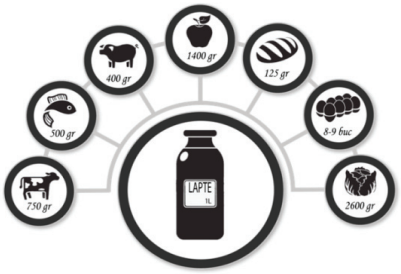

Figure 1. Comparative nutritional value of one liter of milk

Excessive chemical overdosage and environmental pollution through the multitude of human activities, as well as intentional addition of substances with various roles (stabilizers, preservatives, dyes etc.) resulted in unsafe foodstuff.

MATERIALS AND METHODS

Milk and dairy products are subject to a large number of analyzes before being placed on the market. Therefore, a foodstuff should be tested for assessing of chemical composition, evaluation of nutritive value, identification of falsifications, framing this way the product into the standard category.

The dairy processing unit taken into study is located in Southern Romania and it is supplied with milk from authorized sanitary veterinary farms, frequency of supply depending on the performance of animals and quantity of milk obtained from them (Tăpăloagă et al., 2018).

Raw milk is chilled in cooling tanks, then taken over in the company's tanks and transported to processing plant, where is analyzed and further processed. A number of qualitative parameters are tested in the laboratory at the reception of milk, for assessing whether the characteristics of the milk have changed due to non-compliance with the rules of hygiene during milking, transport or if any falsifications have been made (Varraes et al., 2015).

Laboratory analyzes used for this research aimed assessing of physical and chemical parameters of raw milk such as: density (areometric method), acidity (Thorner method), fat content, protein and dry matter (butirometric method or by using the Funke Gerber®LactoStar dairy analyzer) Butler et al., 2011). Samples were harvested between April 2017 and April 2018.

In order to identify the differences between some dairy production technologies, the corresponding technological flows have been followed in a dairy processing unit. Subsequently, 201 samples of milk for consumption and acidic dairy products were analyzed in the unit's own laboratory.

The main purpose of the analyzes was to identify the quality of raw materials and the technologies for obtaining dairy products, as well as to identify quality differences between categories of dairy products.

RESULTS AND DISCUSSIONS

Previous studies had shown that there is a direct correlation between the quality of the milk used in the preparation of acidic dairy products and that of the finished products obtained from it (Sala C.C., 2008; Murphy et al., 2016). That means only fresh milk with a lower contamination and a normal composition (excluding milk containing colostrum, counterfeit milk, milk from antibiotic-treated animals, milk from cows with mastitis, etc.).

The milk is refrigerated and stored at 2-4ºC immediately after milking, to avoid altering of organoleptic characteristics, rapid bacterial growth, as well as increasing of acidity (Stancu et al., 2001; Tremonte et al., 2014).

Analyzing the results obtained from the laboratory determinations, it was found that considered parameters (fat, density, acidity) are within the permissible limits, according to the sanitary veterinary in force provisions.

Results and discussions on laboratory analysis of raw milk

A batch of 31 samples of raw milk were taken into study, of which ten samples for production of 0.1% fat skim milk, ten samples for 1.5% fat pasteurized milk and eleven samples for 1.8% fat pasteurized milk.

No significant variations were observed in physical and chemical parameter for the aforementioned categories of raw milk.

Determination of the fat content of finished dairy products has revealed different values of fat content, the percentage of fat being specific to each product.

The density of the analyzed milk samples corresponds to the values established by the company standards.

The density of the milk falls within the limits of the analyzed assortment, the lowest value being 1,028 g/cm^3 and the highest value reaching the level 1,030 g/cm^3.

The highest values of acidity are recorded in the warm season, with a maximum of 16^{o}T, in the cold season the acidity value being minimal, with an average of 15.06^{o}T.

The results obtained from the physico-chemical determinations of the milk samples are presented in Table 1 and Table 2.

Table 1. Results obtained from the biochemical analysis of 0.1% fat skim milk samples

PRODUCT	No.	Fat %	Density g/cm^3	Acidity ^{o}T
SKIM MILK 0.1% fat	1.	0.1	1,030	16
	2.	0.1	1,029	15
	3.	0.1	1,029	15
	4.	0.1	1,029	15
	5.	0.1	1,029	15
	6.	0.1	1,029	15
	7.	0.1	1,029	15
	8.	0.1	1,029	15
	9.	0.1	1,029	15
	10.	0.1	1,029	15

Table 2. Results obtained from the biochemical analysis of 1.5% fat drinking milk samples

PRODUCT	No.	Fat %	Density g/cm^3	Acidity ^{o}T
PASTEURIZED MILK 1.5% fat	1.	1.5	1,029	16
	2.	1.5	1,028	15
	3.	1.5	1,028	15
	4.	1.5	1,028	15
	5.	1.5	1,028	15
	6.	1.5	1,028	15
	7.	1.5	1,028	15
	8.	1.5	1,028	15
	9.	1.5	1,028	15
	10	1.5	1,028	15

Results and discussions on laboratory analysis of yoghurt

A total of 32 yoghurt samples were analyzed in the study unit laboratory, including 13 samples of 0.1% fat yoghurt, eight samples of 2% fat yoghurt and eleven samples of 2.8% fat yogurt. Laboratory analysis proved that different percentages of fat correspond to each assortment of acidic dairy product.

The minimum value of acidity allowed for yoghurt is 75^{o}T and the maximum limit is 140^{o}T, increasing steadily during production.

The results obtained from the physico-chemical determinations of yoghurt samples are presented in Table 3, Table 4 and Table 5.

Table 3. Results obtained from the biochemical analysis of 0.1% fat yogurt samples

PRODUCT	No.	Acidity at inoculation ^{o}T	Fat %	Acidity on delivery ^{o}T
DIET YOGURT 0.1% Fat	1.	15	0.1	85
	2.	15	0.1	86
	3.	15	0.1	88
	4.	16	0.1	90
	5.	15	0.1	86
	6.	15	0.1	84
	7.	15	0.1	88
	8.	15	0.1	90
	9.	15	0.1	88
	10.	15	0.1	86
	11.	15	0.1	85
	12.	16	0.1	86
	13.	15	0.1	85

Table 4. Results obtained from the biochemical analysis of 2% fat yogurt samples

PRODUCT	No.	Acidity at inoculation ^{o}T	Fat %	Acidity on delivery ^{o}T
YOGURT 2% Fat	1.	15	2	80
	2.	15	2	82
	3.	15	2	82
	4.	15	2	77
	5.	15	2	86
	6.	15	2	78
	7.	15	2	82
	8.	15	2	84

Table 5. Results obtained from the biochemical analysis of 2.8% fat yogurt samples

PRODUCT	No.	Acidity at inoculation ^{o}T	Fat %	Acidity on delivery ^{o}T
YOGURT 2.8% Fat	1.	15	2.8	83
	2.	15	2.8	84
	3.	15	2.8	84
	4.	16	2.8	90
	5.	15	2.8	82
	6.	15	2.8	82
	7.	15	2.8	84
	8.	15	2.8	88
	9.	15	2.8	88
	10.	16	2.8	81
	11.	15	2.8	88

It is noted that values have ranged between 77-90^{o}T, with an average of 84.75^{o}T, concluding that there are no irregularities in its freshness.

Results and discussions on laboratory analysis of sour-batter milk

A number of 13 samples of 2% fat sour-batter milk were analyzed. Taking into account that the maximum allowed acidity for milk is 120^{o}T, following the results obtained from the physico-chemical determinations of the sour-batter milk samples presented in Table 6, it is found that values range from 80-86^{o}T, with an average of 82.76^{o}T, concluding that there are no irregularities in its freshness.

Table 6. Results obtained from the biochemical analysis of 2% fat sour-batter milk samples

PRODUCT	No.	Acidity at inoculation ^{o}T	Fat %	Acidity on delivery ^{o}T
SOUR-BATTER MILK 2% Fat	1.	15	2	80
	2.	15	2	81
	3.	15	2	81
	4.	15	2	86
	5.	15	2	84
	6.	15	2	86
	7.	15	2	80
	8.	15	2	80
	9.	15	2	81
	10.	15	2	86
	11.	15	2	86
	12.	16	2	82
	13.	15	2	83

Results and discussions on laboratory analysis of sana product

A total of 12 samples of 3.6% fat sana product were analyzed in the dairy plant own laboratory. The maximum admitted acidity for the sana is 120°T. Following the results obtained from the physico-chemical determinations of the sana samples presented in Table 7, it is found that the values are in the range of 80-84°T with an average of 81.25°T. Thus, it have been concluded that no irregularities of freshness occurred in this product.

Table 7. Results obtained from the biochemical analysis of sana samples

PRODUCT	No.	Acidity at inoculation °T	Fat %	Acidity on delivery °T
SANA 3.6% Fat	1.	15	3.6	82
	2.	15	3.6	81
	3.	15	3,6	81
	4.	16	3.6	82
	5.	15	3.6	80
	6.	15	3.6	80
	7.	15	3.6	80
	8.	15	3.6	84
	9.	15	3.6	84
	10.	15	3,6	80
	11.	16	3.6	81
	12.	15	3.6	80

Results and discussions on laboratory analysis of kefir

A total of 8 kefir samples were analyzed, with an acidity between 76-84°T, falling within the limits of the assortment, thus achieving optimum freshness.

The results obtained from the physico-chemical determinations of the kefir samples are presented in Table 8.

Table 8. Results obtained from the biochemical analysis of kefir samples

PRODUCT	No.	Acidity at inoculation °T	Fat %	Acidity on delivery °T
KEFIR	1.	15	3.3	78
	2.	15	3.3	82
	3.	15	3.3	82
	4.	15	3.3	76
	5.	15	3.3	84
	6.	15	3.3	84
	7.	16	3.3	81
	8.	15	3.3	84

Results and discussions on laboratory analysis of fermented cream and sweet cream

A total of 36 samples of fermented cream were analyzed, of which 17 samples of 12% fat fermented cream, 12 samples of 18% fat fermented cream and 7 samples of 20% fat fermented cream. The fat content values are in line with the sour cream recipes obtained in the study unit.

Unsignificant differences have been recorded in acidity of the sour cream, its values being in the range 65-72°T, but not exceeding the maximum allowed of 90°T.

The average acidity value for 12% fat fermented cream is 68°T, for 18% fat fermented cream it is around 67.17°T and for 20% fat fermented cream is 67.42°T.

The results obtained from the physico-chemical determinations of the fermented cream samples are shown in Table 9, Table 10 and Table 11.

Table 9. Results obtained from the biochemical analysis of 12% fat fermented cream samples

PRODUCT	No.	Acidity at inoculation °T	Fat %	Acidity on delivery °T
SOUR CREAM 12% Fat	1.	15	12	67
	2.	15	12	67
	3.	15	12	66
	4.	15	12	66
	5.	15	12	67
	6.	15	12	68
	7.	15	12	67
	8.	14	12	68
	9.	14	12	68
	10.	15	12	70
	11.	15	12	72
	12.	15	12	70
	13.	15	12	70
	14.	15	12	70
	15.	15	12	67
	16.	15	12	67
	17.	15	12	66

Table 10. Results obtained from the biochemical analysis of 18% fat fermented cream samples

PRODUCT	No.	Acidity at inoculation °T	Fat %	Acidity on delivery °T
SOUR CREAM 18% Fat	1.	15	18	65
	2.	15	18	68
	3.	15	18	67
	4.	15	18	65
	5.	15	18	66
	6.	15	18	66
	7.	14	18	67
	8.	15	18	70
	9.	15	18	70
	10.	15	18	68
	11.	16	18	66
	12.	15	18	68

Table 11. Results obtained from the biochemical analysis of 20% fat fermented cream samples

PRODUCT	No.	Acidity at inoculation °T	Fat %	Acidity on delivery °T
SOUR CREAM 20% Fat	1.	15	20	65
	2.	15	20	67
	3.	15	20	68
	4.	15	20	65
	5.	15	20	72
	6.	15	20	68
	7.	15	20	67

In the case of sweet cream samples, seven samples were analyzed in the dairy plant own laboratory, their average acidity being 17.14°T. The results obtained from the physico-chemical determinations of the sweet cream samples are shown in Table 12.

The organoleptic features of analyzed products did not show any nonconformities in appearance, consistency, color or smell during their shelf-life.

The results obtained from the summary statistics (mean values and standard deviation) of milk samples collected from dairy plant are shown in Table 13.

Table 12. Results obtained from the biochemical analysis of sweet cream samples

PRODUCT	No.	Fat %	Acidity °T
SWEET CREAM	1.	32	16
	2.	32	18
	3.	32	18
	4.	32	16
	5.	32	16
	6.	32	18
	7.	32	18

Table 13. Summary statistics of milk samples collected from dairy plant (mean values and standard deviation)

Measure / Plant products	Density	Acidity at inoculation °T	Acidity on delivery °T	Total samples
0.1% fat skim milk	1.0291±0.000316		15.1±0,316228	10
1.5% fat drinking milk	1.0281±0.000316		15.1±0.316228	10
0.1% fat diet yogurt		15.1538±0.375534	86.6923±1.93152	13
2% fat yogurt		15±0	81.375±2.973094	8
2.8% fat yogurt		15.1818±0.40452	84.909±3.048099	11
2% fat sour-batter milk		15.0769±0.27735	82.769±2.521701	13
Sana		15.1667±0.389249	81.25±1.484771	12
Kefir		15.1250±0.353553	81.375±2.973094	8
12% fat fermented cream		14.8823±0.332106	68±1.767767	17
18% fat fermented cream		15.0833±0.288675	67.167±1.696699	12
20% fat fermented cream		15±0	67.428±2.370453	7
Sweet cream			17.143±1.069045	7

CONCLUSIONS

The results of the tests on milk and dairy samples have shown that organoleptic and physico-chemical parameters are respected, which means that raw material used in their manufacture meets the requirements of the standards, the hygiene conditions also being respected.

As a technological characteristic of obtaining dairy products, the high temperature pasteurization method is used in the diary plant, which guarantees a longer shelf life.

The technological features of obtaining dairy products in the investigated plant fall within the general technologies applicable to the field of activity.

Moreover, reponsible persons with food safety and quality have established and implemented self-control programs, performing assessments in both in-house or external laboratories.

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