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ASPECTS REGARDING THE QUALITY OF RAW MILK, USED FOR CONSUMPTION AND PROCESSING IN THE AREA OF BRAŞOV

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Abstract: *This paper presents results of the experimental researches effectuated on 30 samples of cow, sheep and goat milk coming from 5 mixed farms specialized in animal growth and exploitation and from 5 collecting centres which collect milk from small individual producers. The research is based on some qualitative aspects of the milk, such as: the total bacteria count (TBC), total number of somatic cells (NSC) and the potential falsification of some types of milk. There are outlined the situations in which the milk is negative (it respects the European and Romanian in force rules), but also some cases in which the analyzed milk is positive.*

Key words: *milk industry, raw milk, experimental researches.*

1. Introduction

The milk and its derivatives are products that are permanently part of people's alimentation, from a younger to an older age. The breeding of milk-producing animal species is one of the oldest human preoccupations, these species being the ones that adapted the best to the environmental condition from different geographical regions of our planet. The ties between people and the milk producing animals (and other milk products) have at time become so strong that the life without them is almost impossible. For example, when it comes to the Hindu population (indians) the cows are considered to be sacred because their milk helps continuing the breastfeeding started by the mothers and without it the evolution of the children would be jeopardized.

In the geographical area in which Romania is placed, the main raw milk-producing animals are cattle, sheep and goats, and in small areas there are also buffalo cows. In extremely special cases, mare and donkey milk is also used, as medicinal products, thanks to their property of immunity against the bacillus which produces tuberculosis.

After Romania's accession to EU and the need of enacting legislation and severe regulations related to the quality of the existing products. Within the community, the breeding of all animal species in specialized farms has been highly encouraged. This also meant that the

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animals would have to permanently undergo sanitary- veterinary controls with the purpose of preventing and tracking types of disease which could have negative effects on the ones who consume products obtained from sick animals. At the same time in which the specialized farms animal breeding and exploitation are developing, the breeding of animals in small households is also continued, the obtained products being mainly used in individual food consumption, but also in commercialization with or without the NSVFSA's approval, sometimes in poor hygienic conditions. As a result, Romanian population is often confronted with cases of food poisoning due to the consumption of various products infected with different pathogens because it is known that the milk is one of the most easily deteriorating products when it comes to this.

The individual producers give the milk to some collecting centres that are properly equipped for refrigerating and keeping the milk in appropriate conditions, until it is taken by special cars to transport them to the processing units.

The major milk processors collect the raw material from extended geographical areas as a result of some contracts made with farms specialized in animal growth and exploitation and with the small individual producers, who do not process their milk themselves.

The milk reception in farms or collection point implies only determination of the quantity and fat content, other qualitative indicators being established only when the reception at the processing units is made because they have accredited laboratories for this kind of analyses.

2. Material and Method

The experimental researches regarding some qualitative aspects of raw milk have been done on 30 samples of cow, sheep and goat milk, coming from 5 mixed farms specialized in animal growth and exploitation and from 5 collecting centres of milk from individual producers, as shown in Table 1.

Sources of the milk samples subject to the qualitative analyses Table 1

Unit type	Milk Type	Number of collecting farms/centres (samples)
Mixed farms specialized in animal growth and exploitation	Cow milk	5
	Sheep milk	5
	Goat milk	5
Regional collecting centres	Cow milk	5
	Sheep milk	5
	Goat milk	5

The research has been made in the following period: 16-17.05.2016, in the specialized laboratory of a big milk processing unit from Brasov (S.C. Brasov Dairy S.A.), and the raw milk sources are placed in locations from Brasov and near Brasov. The experimental researches have strictly followed the rules regarding the control of the analysed samples, the way of sampling them, receiving, depositing and handling the samples, the responsibilities of those implied in these researches, also the criteria of rejecting them.

The following documents were the basis of thee rules:

- SR EN ISO/CEI 17025/2005 – General requirements for the competence of testing and calibration laboratories [10];

- STAS 10000-6 /1983 – The principles and methodology of standardization [3];
- SR ISO 8402/1995 – Quality – Vocabulary [8];
- SR EN 30012/1995 – Requirements regarding the assuring the quality of the equipments of testing/analyzing [9];
- ISO 10011/1994 – Quality audit [7].

The equipment and the way of conducting the research are presented for each qualitative indicator of the milk analysed in this paper.

Therefore, the drivers of the milk collecting tanks will present to the receptionist from the processing unit the accompanying consignment note (CMR) and the samples drawn from the collecting points in order to compare the results, samples that were kept in a mini-fridge in the tank's cabin. In the collecting points of the milk the tank compartments have been sealed, the unsealing being done at the reception of the processing unit, in order to draw samples. The samples are collected in 60ml sterile glasses with bar codes sticked on them for their secure identification at different analyses.

On the glass it is also written the type of milk and the provenient compartiment, respectively the place of origin (Figure 1).

Fig. 1. *Milk samples drawn for qualitative analyses*

2.1. Determining the Total Bacteria Count (TBC)

For this analysis is used the first drawn sample from each compartment of the tanks, respectively the one without stirring of the milk, the research equipment type being Bactosan, whose principal functioning principle is based on flow cytometry (Figure 2).

Fig. 2. *General view on the equipment used for determining the total bacteria count of the milk*

The device colours the bacteria with a fluorescent dye (ethidium bromide) and reduces and disperses the milk's constituents to avoid the interference with other particles. The light impulses are transformed into electronic impulses, counted and shown on the device's screen. Between two consecutive analyzes the pipette and the agitator are carefully cleaned to reduce the possibility of distorting the raportation and the risk of clogging the analyzer. The results are presented in Table 2.

The following aspects were evidentiated regarding the TBC:

- The cow milk from the mixed farms specialized in animal growth and exploitation is 100% negative, which means that at its milking, refrigeration and transport all the legal requirements have been met.

- The cow milk from the collecting centres (from the smaller producers) is only partially negative, thing which indicates that the sanitary-hygienic conditions have not been met in the milking-refrigeration-transport process.
- Regarding the sheep milk has been found a good conformity to the one coming from the collecting centres in comparation with an only partial conformity of the one coming from the mixed farms specialized in animal growth and exploitation which own a bigger number of sheep;
- When it comes to the goat milk partial concordances were evidentiated, for the one coming from mixed farm specialized in animal growth and exploitation, but also for the one coming from collecting centres.

The status of the bacteria number in the analyzed milk samples Table 2

Unit of origin	**Milk type**	**Unit no. (of the sample)**	**Accepted limits**	**NTG [no./ml]**		
				Negative	**Positive**	**%**
Mixed farms for animal growth and exploitation	Cow milk	1	<100,000	26223	-	100% negative
		2		1840	-	
		3		325	-	
		4		38739	-	
		5		163	-	
	Sheep milk	1	<1,500,000	360,000	-	60% negative 40% positive
		2		770,000	-	
		3		-	1,600,000	
		4		960,000	-	
		5		-	1,750,000	
	Goat milk	1		1,300,000	-	80% negative 20% Positive
		2		920,000	-	
		3		-	1,800,000	
		4		560,000	-	
		5		1,150,000	-	
Milk collecting centres	Cow milk	1	<100,000	38,464	-	80% negative 20% positive
		2		281	-	
		3		-	115,263	
		4		447	-	
		5				
	Sheep milk	1	<1,500,000	23,523	-	100% negative
		2		460,000	-	
		3		790,000	-	
		4		960,000	-	
		5		570,000	-	
	Goat milk	1		1,300,000	-	60% negative 40% positive
		2		-	1,550,000	
		3		980,000	-	
		4		-	1,600,000	
		5		1,200,000	-	

2.2. Determining the Number of Somatic Cells (NSC)

The number of somatic cells is a defining parameter for the raw milk's quality, but also an indicator of the udder's health. In this research the number of somatic cells within the milk has been established with the Fasssomatic F.C. equipment, which counts the somatic cells by applying the flow cytometry in order to detect the DNA of the cells (Figure 3).

Fig. 3. *The Fassomatic F.C. equipment used to count the somatic cells from the milk (NSC)*

The functioning principle of the Fassomatic F.C. equipment is based on marking somatic cells with a fluorescent dye (ethidium bromide), process after which they are electronically counted. The somatic cells are exposed to light with a specific wavelength, in such a way that they emit light pulses with a different length wave, they are magnified and recorded then with a photo detector. The results of this research are presented in Table 3.

State of the somatic cells in the analyzed milk samples Table 3

Unit of origin	Milk type	Unit no. (of the sample)	Accepted limits	NCS [no./ml]		
				Negative	Positive	%
Mixed farms for animal growth and exploitation	Cow milk	1	<400,000	221,320	-	100% negative
		2		156,367	-	
		3		183,390	-	
		4		191,413	-	
		5		169,831	-	
	Sheep milk	1		345,654	-	80% negative 20% positive
		2		298,452	-	
		3		-	430,547	
		4		380,748	-	
		5		312,874	-	
	Goat milk	1		312,451	-	60% negative 40% positive
		2		359,176	-	
		3		-	407,381	
		4		361,245	-	
		5		-	421,453	
Milk collecting centres	Cow milk	1	<400,000	156,214	-	100% negative
		2		220,423	-	
		3		176,864	-	

Unit of origin	Milk type	Unit no. (of the sample)	Accepted limits	NCS [no./ml]		
				Negative	Positive	%
		4		124,562	-	
		5		195,678	-	
	Sheep milk	1		356,213	-	100% negative
		2		287,453	-	
		3		346,129	-	
		4		367,815	-	
		5		278,126	-	
	Goat milk	1		-	456,195	60% negative 40% positive
		2		361,428	-	
		3		-	412,391	
		4		356,371	-	
		5		-	405,693	

The following aspects were evidentiated as a result of this analysis:

- The cow milk, irrespective of the unit of origin was 100% negative;
- The sheep milk from the collecting centres was 100% negative, while the milk coming from mixed farms for animal growth and exploitation was 80% negative, and 20% positive;
- An inadequate situation was that of the goat milk which was negative in a percentage of 60% when it came from mixed farms for animal growth and only of 40% when it came from collecting centres.

The conclusion that can be drawn from here is that a more carefully done health check of the goats' udder and a disposal of the causes that provoke their sickness are needed.

2.3. Determining the level of milk falsification

2.3.1. Determining the Level of Falsification of Cow Milk

A potential water addition in the cow milk can be tracked by using the cryoscop method, respectively by establishing the freezing point, the temperature at which the milk is freezing. The freezing point value is dependent of various factors, as:

- The concentration of the soluble substances in lactose (lactose, soluble mineral salts, nitrogenous substances which form up the non-protein nitrogen);
- Substances added in order to lower acidity(carbonates etc.), which represent an additional falsification by masking the milk's real acidity;
- Substances added to grow the dry matter content;
- Diluting milk with water (falsification). For each percentage of water added the freezing point increases by 0.006^0C.

For various milk types the freezing point varies between -0.512…+ 569°C. The device used in order to establish the freezing point of the cow milk (its eventual falsification) is presented in Figure 4.

The results regarding the state of cow milk falsification, obtained through laboratory tests, are shown in Table 4.

It is stated that regarding two of the analyzed milk centres, coming from mixed farms for cow growth and exploitation the milk was falsificated by water addition, with 1.36%, and respectively 7.36%.

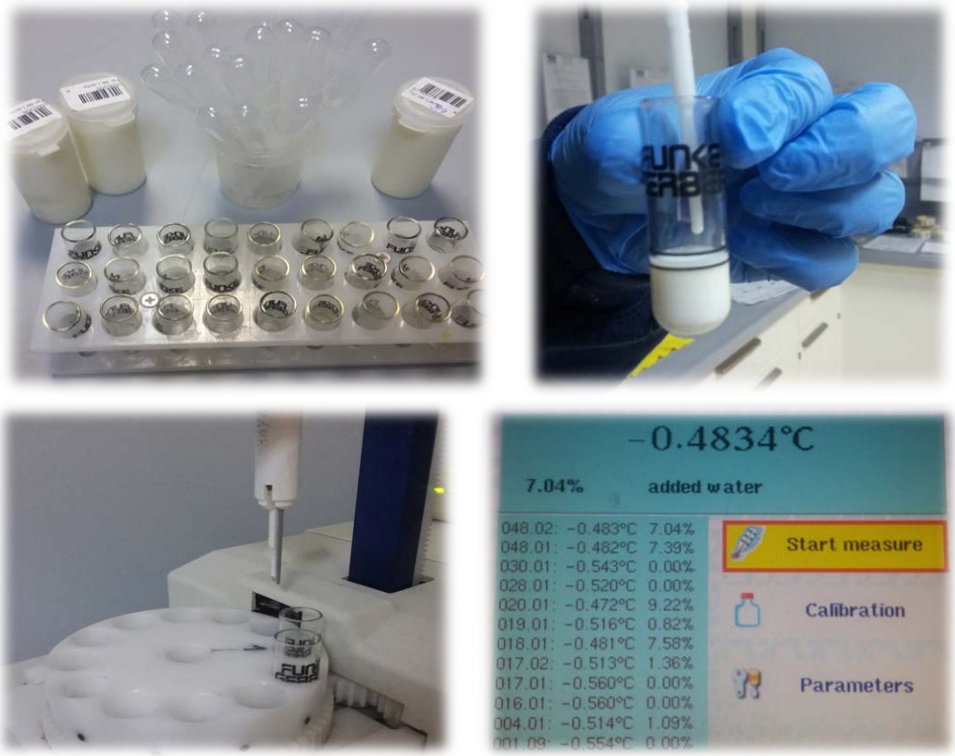

Fig. 4. *The equipment used to establish the cryoscopic point of cow milk*

The state of cow milk falsification Table 4

Unit of origin	Milk type	Unit no. (of the sample)	Cryoscopic point (-0.52…-0.59 °C)	Water added [%]	Result	
					Positive (+)	Negative (-)
Mixed farms for animal growth and exploitation	Cow milk	1	-0.513	1.36	✓	-
		2	-0.483	7.04	✓	-
		3	-0.520	0	-	✓
		4	-0.542	0	-	✓
		5	-0.560	0	-	✓
Milk collecting centres	Cow milk	1	-0.555	0	-	✓
		2	-0.554	0	-	✓
		3	-0.535	0	-	✓
		4	-0.560	0	-	✓
		5	-0.543	0	-	✓

2.3.2. Determining the Level of Falsification of Sheep Milk

In the case of researching the level of falsification of sheep milk the rapid method I.C. Bovino/Caprino has been used, which is a rapid qualitative with the purpose of a fast depistation of a mixture between cow and sheep milk (I.C. Bovino) or goat milk (I.C. Caprino). The test is based on the detection of (Ig G) cow (I.C. Bovino) or goat milk immunoglobulin (I.C. Caprino) in sheep milk samples. This test can be used for whole milk, fresh milk,

skimmed or pasteurized milk, also for dairy products samples. It is recommended for the test to be used before the heat treatment (t>72 °C), which can affect the milk's immunogloblin and can lead to false results.

For the experimental research there have been used (Figure 5): ampoules with dilution solution, recipients for sticks or rods, disposable mini test tubes and micropipettes, stacks for the mini test tubes etc.

Also, the milk samples can be refrigerated (1-2 days) or frozen -20 °C. The working methodology has been rigorously followed.

The results are evidentiated by a specific colour marking of the sticks, in this case being presented in the Table 5.

It was noticed that the sheep milk has been falsificated with cow milk (40% of the samples), in both cases of milk collected from mixed farms for animal growth and exploitation and from collected centres. Regarding the falsification of cow milk with goat milk all the results were negative.

2.3.3. Determining the Falsification Level of Goat Milk

The verification of a potential falsification of goat milk has been made by using the I.C. Bovino test in order to track if it contains cow milk, as well. The results of the experimental researches are presented in Table 6.

It is stated a falsification percentage of 20% of the goat milk with the cow milk, when it comes to the milk coming from mixed farms for animal growth and exploitation of goats.

Fig. 5. *Equipment used on the research of sheep milk falsification level*

The state of sheep milk falsification Table 5

Unit of origin	**Type of milk**	**Unit no. (of the sample)**	**Sheep milk falsificated with cow milk (Bovino test)**			**Sheep milk falsificated with goat milk (test Caprino)**		
			+	-	%	+	-	%
Mixed farms for animal growth and exploitation	Sheep milk	1	-	✓	60% negative 40% falsificated	-	✓	100% negative
		2	✓	-		-	✓	
		3	-	✓		-	✓	
		4	-	✓		-	✓	
		5	✓	-		-	✓	
Collecting centres	Sheep milk	1	-	✓	60% negative 40% falsificated	-	✓	100% negative
		2	-	✓		-	✓	
		3	✓	-		-	✓	
		4	✓	-		-	✓	
		5	-	✓		-	✓	

The state of goat milk falsification Table 6

Unit of origin	Milk type	Unit no. (of the sample)	Result		
			Positive	Negative	Percentage
Mixed farms for animal growth and exploitation	Goat milk	1	-	✓	80% negative 20% falsificated
		2	-	✓	
		3	✓	-	
		4	-	✓	
		5	-	✓	
Collecting centres	Goat milk	1	-	✓	100% negative
		2	-	✓	
		3	-	✓	
		4	-	✓	
		5	-	✓	

3. Conclusion

1. Milk is one of the most important foods in human alimentation and by processing it a wide range of products are obtained.
2. Thanks to the nutrients, found in optimal proportions, the milk is better absorbed by the organism in comparison with any other aliment and being consumed as fresh milk, but also under to form of various dairy products.
3. The knowledge of the organoleptic characteristics of milk is of high importance because it helps at the identification of milk's qualities or flaws.
4. The specialists from dairy products farms and from the food industry, but also merchants and consumers, are especially interested in the following organoleptic characteristics: color, aspect, smell, taste, texture and the degree of contamination.

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