Study on Quantity and Quality of Sheep Milk Sampled from Three Areas of Timis County

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Abstract
Investigations were carried out in April on raw sheep milk collected from three centres from west (V), centre (C) and east (E) part of Timis County. The milk was collected by a commercial dairy-factory, with the purpose to monitor quantity (l), the fat content (%), protein content (%), pH, the presence of antibiotics, this cow or goat milk added, freezing point and the addition of water. Based on these investigations we can state that in lowland areas (V and respective C) was producing significantly ($p \leq 0.001$) more milk compared to the hilly area (E).
The average fat percentage was significantly ($p \leq 0.001$) higher, by 0.56 and 0.46 percentage in V centre, compared to C and E. The average percentage of protein varied in very close (V = 5.75%, C 5.70% and E 5.66%), differences were not significant ($p > 0.05$). The milk had a slightly acid pH of 6.78. No antibiotics residues were identified or cow and goat milk was added. Addition of water was identified in 55% of milk samples taken from the C centre, and 22% from the E centre. Current results suggest that the milk of sheep taken from three centres in Timis County meets current European regulations on quality and food safety.

Keywords: sheep milk, fat, protein, milk residues, added water

1. Introduction

Through its content rich in protein containing all essential amino acids for humans, higher fat, lactose, vitamins, mineral salts, tonic substances, the sheep milk is one of the most complete foods and necessary for both lambs and humans [1]
Current and future requirement for increased production of ewe milk is dictated by the very high biological value of this product, scarcity of protein in human food and the need to diversify the food chain. In terms of biological value of sheep milk, it is competed only goat milk.

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Milk produced per total lactation in sheep has a heritability of $h^2 = 0.3$. Heritability decreases in second lactation, but the genetic correlation between lactations is positive and intense ($rG = 0.8$). Heritability for milk composition (protein, fat, dry matter) is higher ($h^2 = 0.6\text{-}0.8$) determinations can be made easily and genetic earnings per generation could be higher. [2]
Sheep milk contains higher levels of total solids and major nutrient than goat and cow milk. Lipids in sheep and goat milk have higher physical characteristics than in cow milk, but physico-chemical indices (i.e., saponification, Reichert Meissl and Polenske values) vary between different reports [3].
Sheep milk has higher fat and protein contents than goat and cow milk, only buffalo and yak milk contain more fat. Sheep milk also generally has higher lactose content than milk from cows,

buffaloes and goats. The high protein and overall solid contents of sheep milk make it particularly appropriate for cheese and yoghurt making [4]. Goat and sheep milk are very different in composition, the contents of fat, protein, total solids being 4.0% versus 7.5%, 3.5% versus 5.5%, and 13% versus 19%, respectively [5].

Different patterns of heat stability versus pH were observed between heat-stable and heat-unstable samples. Heat-stable milk samples had a maximum stability at pH close to their natural pH (i.e., pH 6.8), while heat-unstable milk samples had a maximum stability at higher values (pH 7–7.1) [5].

The presence of antibiotics in milk is undesirable in terms of innocuousness milk pasteurization and control effectiveness, especially in terms of technological and human health. Antibiotics from milk coming from the treatment of animals for various diseases, or for the purpose of preserving [6, 7].

Sheep milk is richer in solids and the amount of fat and albumin is almost double compared to cow's milk and goat, and that is the reason for control in milk processing factories, seeking the presence of milk from other animal species [8].

Diluting milk with water (forgery) increases the freezing point. The presence of any solutes will depress freezing point below zero degrees C. For each percentage of added water freezing point increase to 0.006 °C [9, 10].

In this paper we set as aim to study comparatively the qualitative parameters of sheep's milk, in a commercial dairy-factory from Timis, which three milk collection sites in western, central and eastern parts of the county.

2. Materials and methods

Timis county has the largest sheep population (800,000) of Romania. The predominant breed is Turcana, accounting for 90% of the sheep, with mixed production of milk-meat and course wool.

The study was carried out between 12 to 30 of April 2016, on milk coming from ewe’s in three important areas of Timis county, namely: the west (Valcani collection point), centre area (Bucovat and Padureni) and the eastern collection point (Begheiul Mic and Salbagel). In total 27 samples were analysed, taken directly from the transport tanks, 9 samples for each area.

Sheep farmers in these areas who delivered milk to the processing unit stored milk in cooling tanks at a temperature of 4 °C for a maximum period of 48 hours.

Before processing, from each tank samples were taken for qualitative analysis for: fat, protein, acidity, salinity, and detection of antibiotics, detection milk from other species (goat, cow) and the addition of water [11].

The milk samples were analysed with the apparatus, tests and kits with high accuracy. Thus, fat and protein content was analysed based on absorption device C3 Lactoscope by infrared milk components with an accuracy of ≤ 1% and a repeatability of ≤ 0.25%; acidity with Eutech pH-meter (pH 1-15); Beta Star tested the presence of antibiotics; IC kit for the added milk from cows with bovine and goat, with an accuracy of 0.5-1%; Cryostar device tested the water added to the resolution of 0.00010C.

Data obtained after carrying out these analyses were statistically processed by computer using software Statistica 7 (the mean, standard deviation, coefficient of variation), and testing the significance of differences for the quantity and quality of milk taken in three representative areas was carried out using nonparametric Mann-Whitney test.

3. Results and discussion

Sheep milk is a valuable food, used to produce high quality cheese, much appreciated by consumers.

Thanks to its special properties, the sheep milk produced in Timis and Caras-Severin counties, products made from this milk are marketed by the company a private dairy factory from Timis, and are exported in a high share in the US and some EU countries.

Quantity and quality parameters of sheep's milk (fat, protein, pH, antibiotic residues, the addition of milk from cows or goat milk, freezing point, water added), were taken in April, from Timis county, and the data are presented in Table 1.

Table 1. Quantity and quality parameters of sheep's milk sampled from Timis county

Specification	West are		Centre area		East area	
	X ± s	Cv %	X ± s	Cv %	X ± s	Cv %
Milk quantity	3876±679.26	17.53	3448±896.48	26.0	1833±585.57	31.94
Fat (%)	7.33±0.29	3.95	6.87±0.27	3.86	6.77±0.12	1.80
Protein (%)	5.75±0.15	2.68	5.7±0.08	1.43	5.66±0.15	2.60
pH	6.78±0.02	0.35	6.78±0.04	0.61	6.77±0.06	0.82
antibiotics	N	-	N	-	N	-
Bovine / goat	B-/C-	-	B-/C-	-	B-/C-	-
Freezing point (0 C)	0.585±0.006	0.83	0.578±0.007	1.20	0.587±0.016	2.66
Water added (%)	0	0	0.708±0.995	-	0.204±0.552	-

Looking at the data in this table and figure 1, computed in new shipments of raw milk it was found that in April the average amount of sheep milk was higher in the western part of the county of Timis (3876 l /tank), followed by the centre (3448 l /tank) and much lower in the eastern part (1833 l /tank).

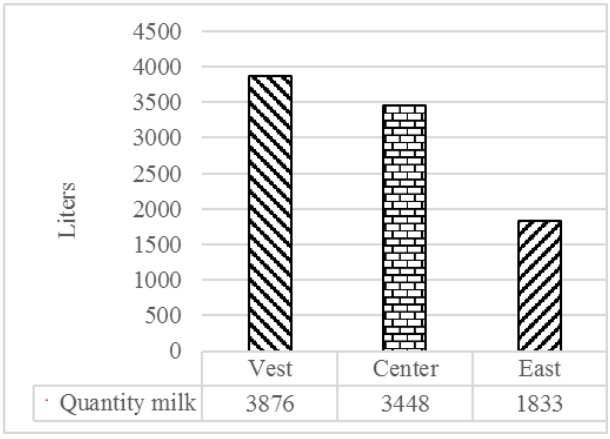

Figure 1 Graphical representation of the milk collected

Fluctuations in the quantity of raw milk taken in April are medium in the west (CV = 17.53%), high in the central (CV = 26.0%) and very high in the eastern (CV = 31.94 %) parts.

The average fat content is close to the standard value (of 7%), and it was 7.33% in the western area of 6.87% and 6.77% in the centre in the eastern county of Timis, respectively, with the variation being extremely small (CV = 1.8 to 3.95%).

The lipids in milk are in the form of globules dispersed in the aqueous phase as an emulsion, covered on the outside by an elastic layer of phospholipids, containing proteins and cholesterol and triglycerides, cholesterol esters and retinol esters [2].

The average percentage over raw milk protein (figure 2) is very similar in the three areas, being 5.75% in the western area of 5.70% in the central and 5.66% in the eastern and uniformity very high (CV = 1.43 to 2.68%).

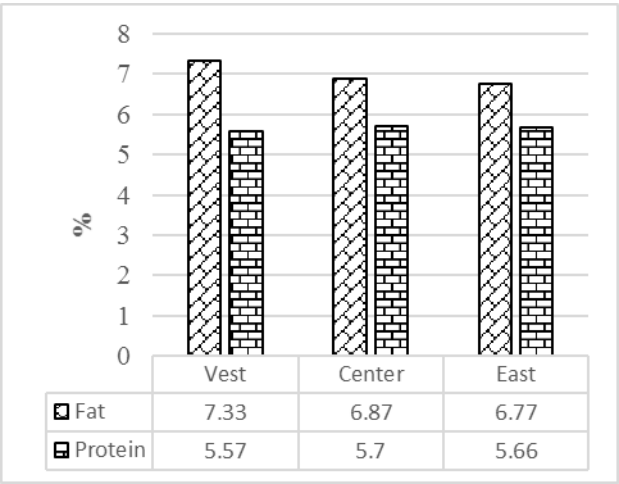

Figure 2 Graphical representation of the percentage of fat and protein in sheep milk

Raw sheep's milk proteins are found in protein casein and serum proteins. Casein protein micelles are agglomerates of the smaller quantities bind iron, zinc, copper and selenium.

Depending on the breed and feeding regime, 100 g raw sheep milk contains 5-7 g protein, so protein levels in raw milk taken from the three areas analysed are within the normal range [1, 2].

Buffering properties of the milk are due to the protein substances and mineral salts, particularly citrates and phosphates. All 27 samples of raw milk taken from the three zones of Timis county

had a slightly acidic pH of 6.77 to 6.78 average with extremely low variation (CV = 0.35 to 0.82%).

Beta Star test using specific detection of antibiotic residues in the milk of sheep was noted that all samples analysed were negative, being under the current veterinary norm for this issue.

The presence of bovine milk and / or goat was tested with kits IC for cattle and goat with an accuracy of 1%, negative results for all 27 samples of the three areas analysed.

Freezing point had very similar values (0.585; 0.578; 0.587) and almost constant in all nine samples of raw milk collected, very low variability (CV = 0.83 to 2.66%).

Diluting milk with water can be detected with high resolution by determining the freezing point at 0,0060C which increases with every percentage of added water. At any evidence analysed in the west did not detect water added. In the central area, water was added in a proportion of 0.31 to 2.89% in 5 out of 9 samples analysed from the transport tanks, which corresponds to an addition of 214 l of water.

Table 2 presents the significance of the differences calculated by Mann Whitney test for the amount of milk and two very important indicators for the quality of raw milk, fat and protein percentage depends on the quality and yield of products processed from the milk.

After computing, the results have highlighted that in April, in the west are has processed significantly ($p < 0.001$) more milk with 2043 l and from the central zone ($p < 0.01$) more milk compared with 1615 l in the east. Between western and central area found no significant differences ($p > 0.05$). We have to mention that in the western and central areas are focused a greater number of sheep, which are better fed compared to sheep reared in the hilly region of Timis county.

Table 2. The significance of differences for the amount of milk, fat and protein content

Specification	Area	Center		East	
		Differences	Significance	Differences	Significance
Amount	West	+428	0.3 ns	+2043	0.0004
	Center		-	+1615	0.001
Milk (a)	West	+0.46	0.002	+0.56	0.0006
Fat (%)	Center		-	+0.04	0.35 ns
Protein (%)	West	+0.05	0.7 ns	+0.09	0.33 ns
Specification	Center		-	+0.04	0.45 ns

Note: $p \leq 0.01$; $p \leq 0.001$

The percentage of fat in raw milk produced had significant ($p < 0.01$) higher values in the western area of 0.46 percentage points compared with the central zone and 0.56 percentage points from the east area. For protein percentage were not significant differences ($p > 0.05$) for raw milk taken from the three areas, the differences being in the range of 0.04 - 0.09 percentage points.

4. Conclusions

Through comparative analysis of raw milk sheep produced in three areas (west, centre and east) of the Timis county, processed by a commercial dairy-plant, results have shown the followings:

- Average amount of milk collected from the west (3876 l) and centre (3448) was significantly ($p \leq 0.001$) higher than the eastern highland (1833 l) area.
- Milk fat percentage was significantly ($p \leq 0.001$) higher in the west (7.33%) compared to the centre (6.87%) and the eastern (6.77%) regions.
- Milk protein percentage varied in very close between 5.66 to 5.75%, and differences between areas were insignificant ($p > 0.05$).
- pH was slightly acidic in the raw milk collected, and was very similar in values, ranging from 6.77 to 6.78.
- There has not been identified in sheep milk antibiotic residues and milk from cattle and goats.
- Added water in sheep milk was found only in the central (5 samples) and in the eastern (2 samples) regions.

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