Comparative Data Regarding the Quality Parameters of Raw Milk from Different Livestock Systems

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Objective: The purpose of this study was to analyze the quality of raw milk coming from two different livestock systems: semi-intensive farming and extensive farming.
Materials and methods: In this paper the milk was analyzed from the perspective of its most important quality indicators: the total number of germ, the somatic cell count and the presence of inhibitors. The study was conducted on 18 month period, between January 2011 and June 2012. The samples came from 6 semi-intensive farm system and from 6 collecting centers.
Results: Regarding the sanitary conditions and milk quality, over all, a significant difference between the two systems has been noted ($p<0.001$). The analysis of the samples that came from the semi-intensive farm system showed a high level of fit milk of up to 90%. So, this system is adequate for obtaining milk that corresponds with the directives imposed by the European Union to be obtained until December 2013.
Conclusions: Early detection of antibiotics and residues in raw milk may prevent the occurrence of risks to human health and may prevent significant economic loss for the milk processors.

Keywords: milk, quality, antibiotics, somatic cell count

Introduction

Milk is a very important matrix in the agricultural economy of the EU (European Union). More than 1 million producers are providing 148 million tons of milk annually [1].

The quality of raw milk is an important and actual subject as the sanitary conditions must be strictly respected in order to have safe products, knowing that milk is a perishable product. Romanian sanitary claims are corresponding with the EU claims, therefore, the quality parameters limitations are very well defined.

Once Romania has adhered to EU, it has received the deadline of December 2009 for bringing the raw milk quality to an accepted level for trading it in the EU community. Unfortunately, due to certain economic issues the deadline has been postponed and Romania requested a delay until December 2013 that has been approved by the EU. [2]

The purpose of this study was to analyze the quality of raw milk from two different livestock systems: semi-intensive farming and small family farms, as a function of its quality parameters.

Materials and methods

The quality of milk mainly refers to 3 important parameters:

- the total number of germs (TNG) which reflect the milking hygiene;
- the somatic cells count (SCC) which reflects mammary health and the animal's health;
- the presence of inhibitors, meaning antibiotics residues and hormones, which are administrated to milking cows for different reasons.

In this paper the milk was analyzed from the perspective of its most important quality indicators: TNG, SCC and the presence of inhibitors. The study was conducted on a 18 month period, between January 2011 and June 2012. The research was conducted with the help of a milk processing unit, from Mures county.

The samples came from six semi-intensive farm system and from six collecting centers, centers where the raw milk coming from the small family farmers is collected, this small farms represents the extensive system. All of these producers are delivering their milk to the processing unit collaborating with us. The farms have different output capacity oscillating between 100 and 800 daily liters of milk from a number of cows between 25 and 120.

The population of cows is mainly formed of Romanian Spotted Cattle. The farms are equipped with automated milking and cooling systems and with natural and artificial illumination. Each farm is provided with computerized monitoring systems for tracking eventual diseases in time, in order to remove the ill cattle from milking. The feeding type differs by season, therefore in the summer the cattle are fed with grass and in the winter are being fed with hay and succulence.

The milk collecting centers receive the milk from the small farmers which own an average number of 1.5 animals. This way, for each collecting center, a number of 250 to 800 liters of milk are collected. The most popular breed is also the Romanian Spotted Cattle and the milking process is mainly manually.

The milk samples collected once a week from each producer were analyzed for:

- testing the TNG which, according to REG.CE. 853/2004, must be at 30°C (/ml) ≤ 100,000
- testing the SCC from the raw milk which, according to REG.CE. 853/2004 must be (/ml)≤ 400,000
- testing the antibiotics residues presence which must be negative [3].

The TNG determination was made using the SOLERIS

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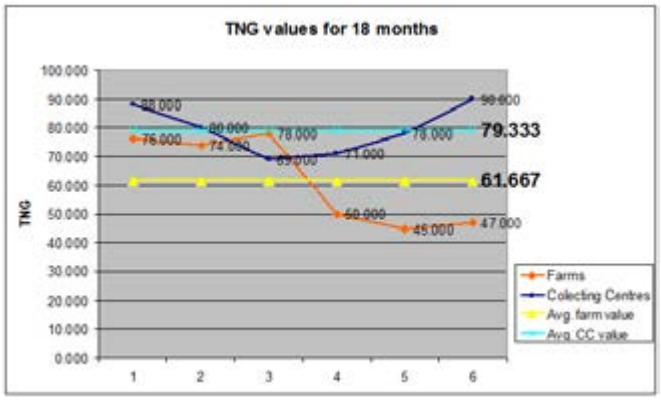

Fig. 1. Milk samples TNG values for 18 months

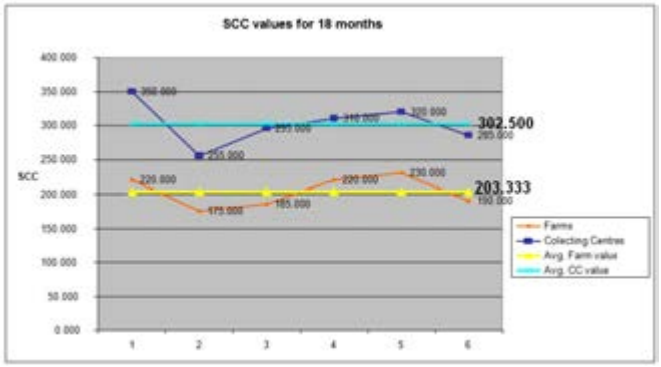

Fig. 2. Milk samples SCC values for 18 months

system, the SCC determination was made using the EKOSCOPE system and for the antibiotics residues determination, the BETA STAR COMBO test was used for β-lactam and tetracycline.

The analyzed milk is the milk used by the processing unit for obtaining drinking milk or for different dairies. This is why the milk has to be adequate with the sanitary standards for raw cow milk, the unfit milk cannot be collected.

Results

To sum up, during those 18 months a quantity of 194,400 liters of milk coming from farms have been analyzed, with a monthly average of 10,800 liters of milk and a quantity of 160,560 liters of milk coming from collecting centers, with a monthly average of 8.920 liters of milk. During this period we analyzed a total number of 864 milk samples.

Regarding the sanitary and quality milk conditions, as a whole, a significant difference between the two systems was observed ($p<0.001$).

For the farm milk, the 18 months average for TNG was 62,000 germs/ml, having significant differences among the winter months and the summer months ($p<0.0031$), the TNG average for June 2011 being 73,000 germs/ml, 32% higher of December 2011, which was 55,000 germs/ml (Figure 1). There were 29 unfit samples, representing 6,7% out of the total number of samples coming from semi-intensive farms.

For the samples coming from the collecting centers, the TNG average was 79,000 germs/ml, the differences between the summer and the winter months being 20%; 75,000 germs/ml in July and 90,000 germs/ml in December, the same year. There were 227 unfit samples, representing 52,5% out of the total number of samples coming from collecting centers.

The determination of the somatic cell count was realized for all the samples using the DRAMINSKY system which is a guiding test. There were 208 unfit samples, representing 24,07% of the total number of samples, 171 coming from collecting centers and 37 coming from farms.

The fit samples were quantitatively analyzed using the EKOSCOPE system.

As for the semi-intensive system, the SCC 18 month average was 203,333 somatic cells/ml, while for the extensive system was 302,500 somatic cells/ml, both of the values fitting in the admitted norms (Figure 2).

For the SCC has been noticed a significant statistical difference ($p=0.01$) between the summer months and the winter months, regarding the farm milk. The value of SCC are higher in the summer months by 30% for the both systems.

Out of the total of 864 analyzed samples, 239 samples were positive for beta-lactams and tetracycline residues, meaning 27.3%. The majority of positive samples were recorded in the summer months

Discussions

At the end of our study, we can state that milk coming from semi-intensive farm system presents a good quality resulting from superior hygienic conditions that are found here due to the hygiene of animals, shelter and people. Also automatic milking system and early detection of caws mastitis contributes to the quality of milk.

The number of unfit samples for TNG and SCC was higher in extensive production system. Milk from "small farmers" has a lower quality, due to the poor conditions of milking. In the majority of them the milking process is manual. The lack of periodical control of veterinarians is a anther possible cause, animals following treatment can not provide quality milk and small farmers usually don't respect the period after treatment when the milk is unfit for processing. Studies showed that milk positive for antibiotics residues obtained from 20 caws can stop or delay the fermentative processes of milk coming from 25.000 cows [4].

Of the total samples analyzed for TNG, 93.3% of analyzed milk from farms and 47.5% of samples from collecting centers were fit.

In terms of SCC, a percentage of 91.4% farm milk and a 34% milk from collecting centers was fit.

For the antibiotics residues a percentage of 72.7% of the samples were negative. Positive samples are destroyed

because the antibiotic residues in milk are a great concern to dairy farmers, milk processors, regulatory agencies, and consumers. β-lactam residues in milk, besides inhibiting the starter cultures in the production of milk products, can cause allergic reactions in some hypersensitive individuals. [5,6,7].

According to the National Sanitary Veterinary and Food Safety Authority in the summer of 2011, 80% of milk supplied by cattle farmers from Romania to the processing units complies with European regulations, the difference of 20% of unfit milk comes from collection centers. The report also shows that out of 784,200 of cattle holdings in Romania, with a herd of 3.11 million head, 540,000 (85%) are those with 1-3 heads of cattle, this are small family farms that hold a total of over 930,000 animals.[8] By the end of 2013, this small farms must rich the quality parameters imposed by E.U, in case they don't, they wont be able to sell their milk to the dairy producers and this is a very important problem for Romania.

In May 2012, the amount of milk collected from farms and collection centers by processing units increased from the previous month by 25.5%, and from May 2011 with 1,4%. In the first five months of 2012 compared with the same period in 2011, the amount of milk collected from farms and collection centers by processing units increased by 6.3%. Compared to the previous year, May 2012, the amount of cow milk collected by processing units increased by 1,269 tones (+1.4%) [9], showing that the quantity of fit milk is higher as we approach the year 2013.

Conclusions

Analyses performed on samples taken from farms that applied a semi-intensive system, shows a high level of compliance by up to 90%, so this system is favorable for obtaining fit milk that follows requirements imposed by the European Union. In the near future small farms will no longer be allowed to sell their milk to processors units if they do not improve their hygiene conditions.

Early detection of antibiotics in raw milk may prevent the occurrence of risks to human health and may prevent significant economic loss for the milk processors.

Acknowledgement

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