COW MILKMARKETED AT DISPENSERS - CHEMICAL COMPOSITION AND TOTAL NUMBER OF GERMS

Mircea-Valentin MUNTEAN[1*], Ovidiu-Marius MARIAN[1], Aurelia COROIAN[2], Zamfir Ioan MARCHIS[2], Bogdan ONICA[1], Sorin TERHES[3]

[1]Faculty of Agriculture, University of Agricultural Sciences and Veterinary Medicine Cluj-Napoca, 3-5 Manastur Street, 400372, Cluj-Napoca, Romania.
[2]Faculty of Animal Science and Biotechnologies, University of Agricultural Sciences and Veterinary Medicine Cluj-Napoca, 3-5 Manastur Street, 400372, Cluj-Napoca, Romania.
[3]S.C. Farm Ecolact SRL, 111 Bujorilor Street, Zalau, Romania

[*]Corresponding author e-mail: ovidiu.marian@usamvcluj.ro

Abstract

The processing of raw milk for human consumption and its sale on the market requires compliance with certain quality standards. According to criteria of quality and food safety the Regulation of European Parliament and the council no. 853/2004, milk quality is influenced by many factors: lactation, fat, protein, lactose,total number of germs. Analysing some of these factors on samples collectedin October 2017 from four milk dispenser shows large variations for certain parameters that are outside the quality criteria. These values denotes that it iscomplies with hygiene conditions and raw milk is delivered to collection points uncontaminated which means lack of hygiene conditions and milk contamination. Following the analysis of the 40 samples the results obtained from the four dispensers studied, milk can be consumed sure from dispenser D2 and also with certain restrictions from the D3 dispenser. It is not recommended to consume milk from the D1 and D4 dispenser. The aim of this study is to determine whether milk marketed by dispensers under the conditions specific to this period is affected in terms of qualitative parameter analysis. The biological material study was represented analyzed by 40 samples of milk from fourcow milk dispensers functional located in this period in Cluj-Napoca city. These samples were collected at the same time period during 9- 20 October2017.

Key words: fat, lactose, milk, protein, total number of germs.

INTRODUCTION

The national program on the quality of raw cow's milk and the timetable for the measures taken to comply with the EU legislation of the European Union is finalized (Raducu et al., 2016). According to this, farmers will have to comply with European hygiene quality standards in order to sell raw milk.In order to process the raw milk and to comply with the Quality and Food Safety Criteria, the Regulations (CR) of the European Parliament and Council no. Regulation (EC) No 853/2004 laying down specific hygiene rules forFoods of animal origin, milk quality is still one of the most important problems in cow's farms in Romania, especially hygienic parameters.

Starting from the premise that the qualitative parameters of the fresh milking milk are in line with these requirements, the study follows the qualitative changes that may occur in milk marketed by dispensers. Number of people who consume raw milk Is growing because of its taste, beneficial effects for human health, non-destructive valuable nutrients By thermal treatments (Oliver et al., 2009).

Direct sales to the consumer through milk dispensers are given by the following standards: A.N.S.V.S.A.111/2008; A.N.S.V.S.A. no. 55/2010): total number of germs (maximum 100,000 / ml and somatic cells (400,000 / ml) without antibiotic healthy animals that do not suffer from diseases which can be transmitted to people through milk (Şteţca et al., 2014).

Milk sold through dispensers is sold at a lower price than packed in packs and the milk price can also be influenced by the following factors: total number of germs (TNG), number of somatic cells, and percentage of fat, protein, lactose, casein.

The total number of germs is one of the main indicators of the hygienic quality of milk (Velea et al., 2012; Barreto et al., 2013). The total number of germs increases in the

possibility of bacterial infections or tissue damage (Nagahata et al., 1987) and negatively influences the quality of the cheese by proteolytic enzymes present in the mass milk, decreases milk production and affects its physic-chemical composition, its taste and its nutritional value (Nagahata et al., 1987; Norman et al., 2011; Souza et al., 2012).

The aim of this study is to determine whether milk marketed by dispensers under the conditions specific to this period is affected in terms of qualitative parameter analysis. These samples were collected at the same time period during.

MATERIALS AND METHODS

During 9- 20 October 2017, qualified personnel collected 40 samples from four cow milk dispensers functional in this period in Cluj-Napoca city. The samples were collected in special containers purchased from the milk quality foundation in Cluj-Napoca. The samples were collected from each dispenser at the same time (12.00-13.00, each day), ambient temperature at the time of collection varied between 7 degrees to 21 degrees Celsius which were kept atrefrigeration temperature for about one hour until the moment of analyse. All dispensers are equipped with milk refrigeration systems.Analyzes were made at Foundation for Milk Quality Control, Str. Avram Iancu, 407280, Floreşti, Romania.

Analysis of milk chemical composition and total numbers of germs (TNG) (Ştețca et al., 2014): To determine the chemical composition of raw milk, the following parameters were determined: fat content, protein, lactose, pH and total numbers of germs (TNG).

Based on international standard methods (ISO 9622:2013) milk components were determined using CombiFoss™ FT+, a combination apparatus between MilkoScan™ FT+ and Fossomatic™ FC (FOSS, Denmark). MilkoScan returns milk chemical component values by using infrared light measurement (Fourier Transform Infra-Red Spectropho-tometry principle). Analysis duration was about 30 seconds. The electronic instrument,

Fossomatic™ FC, used for the detection of somatic cell count (SCC) in milk, works based on the principle of coloring the somatic cells, than continues by counting them (flow cytometry). Milk sample was mixed with a fluorescent dye which colors the somatic cell's DNA molecules. A very thin string of milk was put under the counting unit, which permitted only one somatic cell to pass at a time. In the counting unit sample was exposed to blue light, which cause them to emit red light. Thus, the instrument can count the cells. All samples were analyzed in triplicate and the final results are listed below.

The European rules, represented by European Regulations 853/2004 and 854/2004, stipulate that the total number of germs (TNG) for healthy milk is below 200,000/ml of milk. Comparative determination of the number of total number of germs (TNG) from the samples taken from four dispensers considered reveals that TNG increases with conditions of poor hygiene and non-treatment of diseases in the mammary gland.The fat quality indicator states that the values obtained must be between 3.5 - 4.5%.The protein quality indicator states that the values obtained should be between 3.0 - 3.5%. Percentage, the lactose quality indicator indicates that the values obtained must be between 4.0 - 4.5%.The values presented in the table 1 are analyzed statistically by the program R-Project, ANOVA and LSD test (Vidican et al., 2013).

RESULTS AND DISCUSSIONS

From the indices presented in Table 1, the total number of germs (TNG), fat, protein, lactose and pH content were considered to be relevant for this study relative to the temperature.

For processing the data presented in Table 1, each sample received a codeand the following notations were made: D1 for milk collected from first automatic milk dispenser machine (ex D1-08 - sample 8), D2 for milk collected from second automatic milk dispenser machine (ex D2-06 - sample 6). Similarly, the sample codes for the dispensers 3 and 4 were noted D3 and D4.

Table 1. Raw milk from milk dispenser's indices analysed

Identification sample	Day	Temp [^{0}C]	Fat (g/100g)	Protein (g/100g)	Lactose (g/100g)	pH	TNG/ml x1000
D1 - 01	9-Oct-17	7	3.76	3.38	4.7	6.58	715
D2 - 01	9-Oct-17	7	3.9	3.42	4.6	6.49	140
D3 - 01	9-Oct-17	7	3.35	3.36	4.66	6.42	215
D4 - 01	9-Oct-17	7	3.8	3.44	4.53	6.44	305
D1 - 02	10-Oct-17	8	3.74	3.39	4.75	6.56	716
D2 - 02	10-Oct-17	8	3.85	3.45	4.68	6.48	162
D3 - 02	10-Oct-17	8	3.35	3.36	4.66	6.42	198
D4 - 02	10-Oct-17	8	3.7	3.44	4.53	6.41	220
D1 - 03	11-Oct-17	12	3.74	3.46	4.78	6.56	620
D2 - 03	11-Oct-17	12	3.84	3.38	4.67	6.48	144
D3 - 03	11-Oct-17	12	3.33	3.36	4.76	6.42	240
D4 - 03	11-Oct-17	12	3.7	3.43	4.61	6.41	325
D1 - 04	12-Oct-17	16	3.92	3.31	4.77	6.66	516
D2 -04	12-Oct-17	16	3.98	3.45	4.76	6.68	230
D3 - 04	12-Oct-17	16	3.35	3.36	4.72	6.47	314
D4 - 04	12-Oct-17	16	3.91	3.39	4.69	6.56	420
D1 - 05	13-Oct-17	14	3.72	3.36	4.79	6.62	680
D2 - 05	13-Oct-17	14	3.58	3.49	4.57	6.48	169
D3 -05	13-Oct-17	14	3.42	3.37	4.63	6.51	226
D4 - 05	13-Oct-17	14	3.76	3.44	4.71	6.47	287
D1 - 06	16-Oct-17	18	3.72	3.32	4.72	6.51	560
D2 - 06	16-Oct-17	18	4.04	3.48	4.68	6.56	206
D3 - 06	16-Oct-17	18	3.51	3.33	4.73	6.62	280
D4 - 06	16-Oct-17	18	3.78	3.42	4.75	6.54	240
D1 - 07	17-Oct-17	19	3.34	3.39	4.77	6.56	420
D2 - 07	17-Oct-17	19	3.78	3.53	4.73	6.48	176
D3 - 07	17-Oct-17	19	3.46	3.44	4.57	6.55	209
D4 - 07	17-Oct-17	19	3.82	3.53	4.79	6.63	206
D1 - 08	18-Oct-17	21	3.72	3.36	4.68	6.58	380
D2 - 08	18-Oct-17	21	3.92	3.45	4.75	6.61	216
D3 - 08	18-Oct-17	21	3.52	3.41	4.64	6.64	270
D4 - 08	18-Oct-17	21	3.83	3.39	4.79	6.49	320
D1 - 09	19-Oct-17	18	4.02	3.32	4.77	6.57	446
D2 - 09	19-Oct-17	18	3.76	3.48	4.72	6.55	199
D3 - 09	19-Oct-17	18	3.5	3.44	4.68	6.49	189
D4 - 09	19-Oct-17	18	3.67	3.39	4.73	6.62	214
D1 - 10	20-Oct-17	17	3.88	3.34	4.67	6.63	360
D2 - 10	20-Oct-17	17	3.88	3.41	4.57	6.68	210
D3 - 10	20-Oct-17	17	3.47	3.42	4.63	6.59	180
D4 - 10	20-Oct-17	17	3.78	3.38	4.66	6.56	215

Analysing the obtained charts, the following are observed:

- The variation of protein must be between the permissible values of 3.0 ... 3.5 %; the results of the four dispensers in the study highlights the fact that all samples were within the normal range which shows that feed rations were carefully monitored and that there was concern for improving milk obtained (Figure 1);

- The fat variation must be between the permissible values of 3.5 ... 4.5%. Lower values than the admissible limit of 3.5% (3.35) of fat content were recorded only at dispenser D3 (Figure 2). Samples with fat percentages below this limit were either in the case of sampling techniques errors or by incorrect methods of determination; in the case of the other 3 dispensers (D1, D2 , D4), their values show an average of 3.8% and the maximum values exceed by 3.9% which denotes a low fat content but in the admissible limit values;

- The lactose variation must be between the permissible values of 4 ... 4.5 %.The diagram analysis in figure 3 indicates that the maximum value is exceeded by up to 6% by dispenserD1 and by 5.5% by dispenser D 4. These variations may occur due to the structure of the food ration, which shows concentrations different carbohydrates;

- The total number of germs (TNG) must be less than 200,000/ml. Variation indicates (Figure 4) in the case of the first dispenser D1 average values to 2.75, which indicate a major problem of hygiene conditions regarding milking and / or contamination of milk. In the case of the fourth dispenser D4, average values reach 1.375 which puts the same problem as with the D1 dispenser; values closer to the upper limit are for the D3 dispenser of 1,075;

- In the case of the four metered dispensers, the only one whose average values fall within the permissible range is the D2 metering device, which indicates that the hygienic conditions of the milks are complied with and that the raw milk is delivered to the uncontaminated collection points.
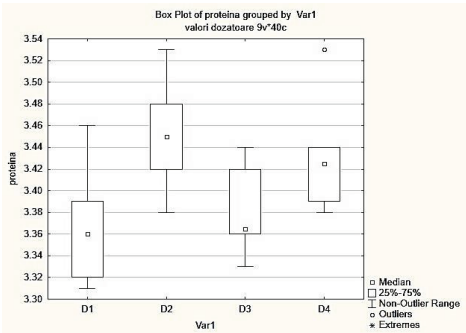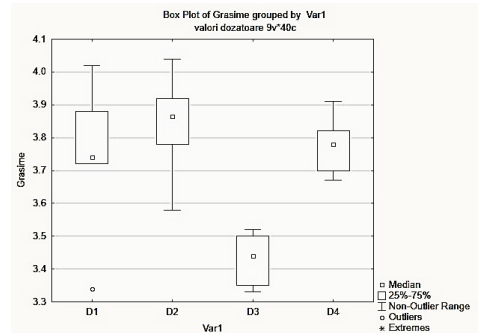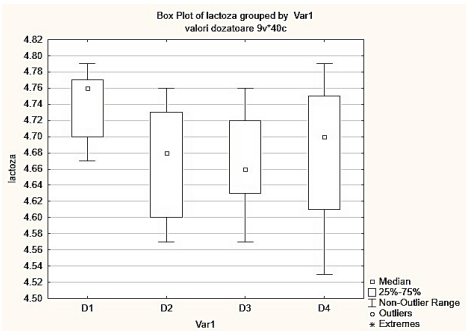

Figure 1. Protein variation

Figure 2. Fat variation
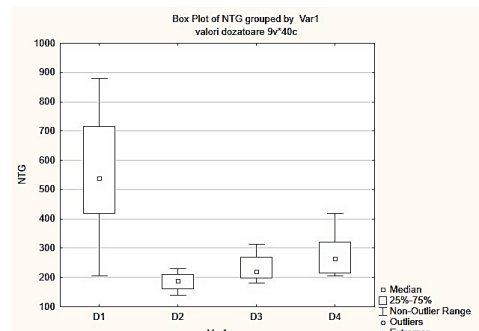

Figure 3. Lactose variation

Figure 4. Total numbers of germs (TNG) variation

CONCLUSIONS

Total number of germs (TNG) is dependent on many factors and in the case of analysed samples can draw a conclusion on how they performed milking hygiene and animal health which have a direct impact on milk quality.

Analysing the total number of germs (TNG) in the period 9-20 October 2017 it is noted that in case of samples collected from first automatic milk dispenser D1 they exceed until 2.75 times the maximum admissible values. In case of D4 dispenser, the maximum admissible value is exceeded by 1,375 times and for D3 the excess is reduced by 1,075 times.

The samples collected from second automatic milk dispenser D2 are up to the maximum allowable values which show that milking hygiene and animal healthare at the European standards required.

Consumption of milk from this dispenser can be done without endangering the health.

The fat content analysis shows that only the dispenser D3 has a fat content lower than the minimum admissible value and the other three dispensers are closer to the minimum value but are within the range provided by the standards.

For protein, the normal protein content should be between 3-3.5%.Protein varies according to many factors including diet, season, stabbing, grazing, lactation cycle.Analyses of the four dispensers show that the values analysed are in the parameters required by the standards, indicates that animals are included in a selection and improvement program.

The values obtained for lactose are higher than 4.5%, which is the upper limitthese variations canit is due to the composition of the food ration, which has different carbohydrate concentrations

Following the analysis of the 40 samples the results obtained from the four dispensers studied, milk can be consumed sure from dispenser D2 and also with certain restrictions from the D3 dispenser.

Number of people who consume raw milk Is growing because of its taste, beneficial effects for human health, non-destructive valuable nutrients by thermal treatments (Oliver et al., 2009).

It is not recommended to consume milk from the D1 and D4 dispenser.

REFERENCES

Barreto M.L., Rangel A.H., Spyrides M.H.C., Lima Junior D.M., Oliveira G.P.S., Lima F.F., 2013. Stages of lactation and delivery in quality and composition of diary cattle. Journal Veterinaria e Zootecnia, 20(2), Supl.1, 163-164.

Nagahata H., Saito S., Noda H., 1987. Changes in N-acetyl B-D-glucosaminidase and B-glucuronidase activities in milk during bovine mastitis. Can J Vet Res., 51(1), 126-34.

Nagy P., Faye B., Marko O., Thomas S., Wernery U., Juhasz J., 2013. Microbiological quality and somatic cell count in bulk milk of dromedary camels (*Camelus dromedarius*): descriptive statistics, correlations, and factors of variation. J. Dairy Sci., 96, 5625–5640

Norman H.D., Lombard J.E., Wright J.R., Kopral C.A., Rodriguez J.M., Miller R.H., 2011. Consequence of alternative standards for bulk tank somatic cell count of dairy herds in the United States. J Dairy Sci., 94(12), 6243-6256.

Oliver S.P., Boor K.J., Murphy S.C., Murinda S.E., 2009. Food safety hazards associated with consumption of raw milk. Foodborne Pathog Dis., 6(7), 793-806.

Raducu Camelia, Miresan Vioara, Coroian Aurelia, Pop C., Coroian C.O., Cocan D., Andronie Luisa, 2016. Study on the milk quality parameters in three farms from Salaj county. Bulletin USAMV Animal Science and Biotechnologies 73(2), DOI: 10.15835/buasvmcn-asb: 12257, pp. 256-258.

Ștețca Gh., Arghir I., Șuteu Lenuța, Coldea Teodora, 2014. Raw Milk Hygiene at Local Markets and Automatic Milk Dispenser Machines, Bulletin UASVM Food Science and Technology, 71(2), ISSN-L 2344-2344; Print ISSN 2344-2344; Electronic ISSN 2344-5300, DOI: 10.15835/buasvmcn-fst:10822.

Velea C., Marginean G., 2012. Tratat de crestere a bovinelor, Editura Risoprint, 1, 145-150.

Souza F.N., Blagitz M.G., Penna C.F.A.M., Della Libera A.M.M.P., Heinemann M.B., Cerqueira M.M.O.P., 2012. Somatic cell count in small ruminants: Friend or foe? Small Ruminant Research, 107(2-3), 65-75.

Vidican Roxana, Stoian V, Rotar I, Păcurar F, 2013. Use of Non-metric Ordination and Group Analysis for the Assessment of Influence Level of Climatic and Technological Factors over Mycorrhizal Parameters, Romanian Journal of Grasslands and Forage Crops, 67.

***DIN EN ISO 13366-2:2007-01: Milk. Enumeration of somatic cells. Part 2: Guidance on the operation of fluoroopto-electronic counters

***ISO 9622:2013 (IDF 141): Milk and liquid milk products. Guidelines for the application of mid-infrared spectrometry.