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QUALITY ASSESSMENT OF THE COW MILK TRADED ON THE IASI MARKET

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Abstract

This paper presents the data of a cross-sectional study on the commercial quality of fresh cow`s milk marketed in Iasi. The biological material came from three bovine farms, distributed in the chilled state through milk dispensers. From each source, two litres of milk, in sterile containers, were purchased for five consecutive days, from which the laboratory samples were homogenized and maintained until the analysis, as indicated by the manufacturers. Ten samples were dosed from each farm and subjected to physiochemical analysis by means of isometric, gravimetric, titrimetric, potentiometric and ultrasonometric methods. Regarding the freshness indicator, acidity, the highest value was obtained for the milk of the F3 group where the average was 18.1 ± 0.21°T, while for the milk of the group F1 and F2 the mean values were 16.28 ± 0.20°T and 17.24 ± 0.31°T respectively. Regarding the chemical composition, determinations were made for the determination of SUNG, GB, PB and lactose. In terms of fat content, the mean values were 4.05 ± 0.01% for F1, 3.27 ± 0.01% for F2 and 4.03 ± 0.01% for milk from F3. The milk was not suspected of being falsified because no added water was detected in the analyzed samples and the density was within the normality range of at least 1.029 g/cm^3. The results of the researches carried out indicated that the marketed milk is in compliance with the quality standard in force, even if there were significant differences between the qualitative parameters analyzed.

Key words*: milk, quality, ultrasonometric.*

INTRODUCTION

In the current paper, we aimed to realise a qualitative analysis of milk raw material came from three bovine farms, distributed in the use of milk and milk products as human food has got a very long history. Human rational nutrition couldn't be conceived without milk and dairy products due to its exceptional nutritive value and accessibility (Bartowska et. al., 2006). As first class complete food milk could be fully considered a strategic food, contributing to the improvement of life quality and at assuring of food safety by covering the numerous nutritive demands of humans (Rațu et al., 2017). Globally, consumers pay great attention to food and its composition due to a pivotal relationship between diet and human health (Rafiq et. al., 2016).

The milk, as it is meant to be the first and sole food for offspring of mammals, is an almost complete food.

The quality of milk products is reliant on milk composition that varies with stage of lactation, milking methods, environment, season, diet, feeding system, breed and species (Kittivachra et al., 2007). However, the composition of milk fluctuates markedly among different species (Pavic et al., 2002; Ahmad et al., 2008).

Also, these proteins are ranked as quality proteins with the highest biological value, good digestibility (97% to 98%), rapid absorption and utilization in the body (Schaafsma, 2000). One of the most important protein is caseins (Bos et al., 2000).

Quantity and quality of proteins in milk influence the yield, technological and health-beneficial properties of milk. The value of milk proteins is more than twice that of milk fat. The amount of whey proteins produced by cows depends strongly on many factors, including cows' diet, health, stage of lactation, breed and time of year (Kuczynska et al., 2011).

The amino acids profile of caseins and whey proteins occupy a unique position in human nutrition. It contains in a balanced form all the necessary and digestible elements for building and maintaining the human and animal body. In

addition, it contains immunoglobulins which protect the newly born against a number of diseases (Kittivachra et al., 2007).
Milk is the best diet for human health because it contains a good source of essential minerals such as calcium and phosphorous (Rațu et al., 2018).
Due to the nutritional importance milk is consumed at large scale in recent time. Milk is also considered a raw material formed by animals.
A good understanding of the properties of milk minerals is important for fundamental research but also for the development of dairy products in which this fraction appears to be complex, dynamic, and in strong interaction with the chilled state through milk dispensers.

MATERIALS AND METHODS

Collection of milk samples

The biological material came from three bovine farms, distributed in the chilled state through milk dispensers. From each source, two litres of milk, in sterile containers, were purchased for five consecutive days, from which the laboratory samples were homogenized and maintained until the analysis, as indicated by the manufacturers. These samples were labelled, ice packed and transported to the laboratory. All milk samples were then placed in the refrigerator at 4°C for further analysis.

Physicochemical analysis

Determination of fat content was realised using acid-butyrometric method (dissolution of protein substance from milk in the presence of sulphuric acid and far separation by centrifugation, using heat and isoamyl alcohol) (ISO 488/2009).
Total dry matter (T**DM**) was determined by oven drying method (Simeanu et al., 2018; Nacu et al., 2018).
Water content was established by difference using the formula:
Water (%) = 100 – DM(%) (ISO 488/2009)**.**
Non-fat dry matter (NFDM) was determined by using the relation:
NFDM (%) = TDM – Gwhere TDM = total dry matter and G = fat content of milk (Mierliță et al., 2018).
Lactose (%) contents were determined according to standard protocol of SR ISO 5548:2008.
Acidity was determined by using Thörner method - – neutralizing of organic acids with NaOH (0.1N) titration, using phenolphthalein as witness pigment (SR ISO 11869; 2000; SR ISO 6091),.
Milk density was determined with a thermo-lacto-densimeter, this physical parameter representing the rate between milk mass at +20°C and mass of the same water volume at a temperature of +4°C (STAS 2418:2008).
The **ash** content was estimated by incineration of samples in muffle furnace at 550°C for 6 hours, as given in AOAC, No. 945.46 (2005).

Nitrogenous fractions

The crude protein (CP), true protein (TP), casein, noncasein-nitrogen (NCN), whey proteins and non-protein nitrogen (NPN) contents were determined by using Kjeldahl method according to standard protocol of IDF (1993).
Protein (nitrogen) fractions were calculated as:
TP = CP–NPN,
Casein (N %) = Total protein (N%)–NCN (N %)
Whey protein = NCN–NPN.

Statistical analysis

Collected data were subjected to statistical computation, using the ANOVA one-way algorithm included in MsExcel, to calculate the descriptive statistics (mean, standard error) and find out whether there were significant differences and upgraded with PostHoc Daniel's XL Toolbox version 4.01 (http://xltoolbox.sf.net), to identify the differences (Radu-Rusu et al., 2014).

RESULTS AND DISCUSSIONS

The first quality parameters analyzed for the milk from the three dispensers in Iași consisted of determining the fat content, density and acidity.
For the fat content, the average of the milk collected from the F1 dose was 4.05 ± 0.01%, 3.27 ± 0.01% for the F2 picker and 4.03 ± 0.01% for the milk at the F3 metering unit.
Calculation of differences between batches revealed that there was a very significant difference between F1 vs. F2 (P-value = 1.1556), the same difference being noted between F1 vs. F2. F3 (P-value = 2.5888). Comparison of F1 vs. F3 revealed insignificant differences (P-value = 0.2252).

For density, we obtained a mean value of 1.0300±0.0003 g/cm^3 for milk collected on F1, 1.0290±0.0002 g/cm^3 for milk collected on F2 and 1.0296±0.0002 g/cm^3 for milk collected on F3. Statistically there were no differences in statistical significance between the three groups analyzed (P> 0.05) (Table 1).

To highlight the milk freshness state, acidity was determined by the tittering method. The mean obtained value was 16.28±0.31°T for milk collected on the F1 milk dispensers, 17.24±0.29°T for milk collected on the F2 milk dispensers and 18.10±0.05°T for milk collected on the F3 milk dispensers.

In terms of the statistical analysis of the data, there were no significant differences between F1 vs. F2 (P value = 0.0550), very significant between F1 vs. F3 (P value = 0.0004) and significant between F2 vs. F3 (P value = 0.0202) (Table 1).

Table 1. Physical-chemical parameters for milk, distributed in the chilled state through milk dispensers

Qualiy parameters	F1	F2	F3	ANOVA computation and analysis		
				Compared period	P value	Significance
Fat content (%)	4.05±0.01	3.27±0.01	4.03±0.01	F1 vs.F2	1.1566	***(P<0.001)
				F1 vs. F3	0.2252	ns (P>0.05)
				F2 vs. F3	2.5888	***(P<0.001)
Density (g/cm^3)	1.0300±0.0003	1.0290±0.0003	1.0296±0.0002	F1 vs.F2	0.0557	ns (P >0.05)
				F1 vs. F3	0.3465	ns (P >0.05)
				F2 vs. F3	0.1720	ns (P >0.05)
Acidity (˚T)	16.28±0.31	17.24±0.29	18.10±0.05	F1 vs.F2	0.0550	ns (P >0.05)
				F1 vs. F3	0.0004	***(P<0.001)
				F2 vs. F3	0.0202	* (P <0.05)
NFDM (%)	8.76±0.10	9.06±0.11	8.75±0.11	F1 vs.F2	0.0842	ns (P >0.05)
				F1 vs. F3	0.9642	ns (P >0.05)
				F2 vs. F3	0.0894	ns (P >0.05)
DM (%)	12.82±0.11	12.34±0.12	12.78±0.12	F1 vs.F2	0.0178	* (P <0.05)
				F1 vs. F3	0.8305	ns (P >0.05)
				F2 vs. F3	0.0287	* (P <0.05)
Water (%)	87.18±0.12	87.66±0.12	87.22±0.12	F1 vs.F2	0.0178	* (P <0.05)
				F1 vs. F3	0.8305	ns (P >0.05)
				F2 vs. F3	0.0287	* (P <0.05)
Lactose (%)	4.80±0.01	4.25±0,02	4.75±0,02	F1 vs.F2	1.7816	***(P<0.001)
				F1 vs. F3	0.1171	ns (P>0.05)
				F2 vs. F3	1.6729	***(P<0.001)

ANOVA within rows, between groups for different superscripts, one by one comparison: ns: not significant; significant = * (P <0.05); distinguished significant = ** (P <0.01); highly significant = *** (P <0.001).

Also, in order to determine the milk quality parameters, NFDM was determined, a parameter for which the mean values calculated by us were 8.76 ± 0.10% for milk collected from F1, 9.06 ± 0.11 for the collection from F2 and 8.75 ± 0.11% for that collected from F3. Statistically, no differences in statistical significance were reported for this indicator (Table 1).

Milk of dairy cows is a biological solution containing approximately 12.8% of dry matter. Milk dry matter consists of proteins, carbohydrates, fats, minerals and vitamins (Coballero et al., 2003; Roginski et al., 2003).

As for the DM content, the highest value was found in milk from F1, the average being 12.82 ± 0.11%, followed by the milk collected from F3 (12.78 ± 0.12%) and then the F2 collected, where the value mean was 12.34 ± 0.12%.

On the comparison of data, for this parameter it were found significant differences between F1 vs. F2 and F2 vs. F3; between the F1 vs. F3 reported differences were insignificant. The same differences were also highlighted in the case of the milk content of the milk analyzed by us (Table 1).

For lactose content, the mean calculated by us was 4.80±0.01% for milk collected on the F1 milk dispensers, 4.25±0.02% for milk collected on the F2 milk dispensers and 4.75±0.02% for milk collected on the F3 milk dispensers.

Regarding the differences between the three analyzed lots, these were very significant between F1 vs. F2 and F2 vs. F3 (P <0.001) and insignificant between F1. vs. F3 (P> 0.05).
Protein is an important constituent of milk which contains about 95% of the total nitrogen present. In the current exploration, protein fractions like CP, TP, caseins and whey proteins, NCN and NPN contents showed significant differences (p<0.05) between the milk collected. The CP (3.398%±0.02%), TP (3.084%±0.03%), caseins (2.656%±0.02%) and NPN (0.314%±0.002%) contents were relatively higher in milk collected from the F1.
Concerning the comparative analysis of CP data, the differences between the F1 vs. F2 and F2 vs. F3 (P <0.05) and insignificant among the F1 vs. F3.

Regarding the TP content (representing the difference between CP and NPN) the mean values obtained were 2.990 ± 0.02% for F2 and 3.076 ± 0.03% for F3. The ANOVA test revealed significant differences (P <0.05) between F1 vs. F2 and insignificant (P> 0.05) between F1 vs. F3 and F2 vs. F3.
For the casein content, the lowest level was found in the milk collected from the F2 doser, ie 2.574 ± 0.02%, followed by the milk collected from the F1 doser (2.656 ± 0.02%) and then the milk collected from F3 (2.664 ± 0.03%). Following the ANOVA test, significant differences (P <0.05) between F1 vs. F2 and insignificant (P> 0.05) between F1 vs. F3 and F2 vs. F3 (Table 2).

Table 2. Milk protein fractions of different milk, distributed in the chilled state through milk dispensers

Qualiy parameters	F1	F2	F3	ANOVA computation and analysis		
				Compared period	P value	Significance
Crude protein-CP (%)	3.398±0.02	3.286±0.02	3.382±0.03	F1 vs.F2	0.0195	* (P <0.05)
				F1 vs. F3	0.7208	ns (P >0.05)
				F2 vs. F3	0.0431	* (P <0.05)
True protein-TP (%)	3.084±0.03	2.990±0.02	3.076±0.03	F1 vs.F2	0.0422	* (P <0.05)
				F1 vs. F3	0.8615	ns (P >0.05)
				F2 vs. F3	0.0635	ns (P >0.05)
Casein (%)	2.656±0.02	2.574±0.02	2.664±0.03	F1 vs.F2	0.0498	* (P <0.05)
				F1 vs. F3	0.8519	ns (P >0.05)
				F2 vs. F3	0.0517	ns (P >0.05)
Whey protein-WP (%)	0.428±0.004	0.416±0.006	0.412±0.006	F1 vs.F2	0.1894	ns (P >0.05)
				F1 vs. F3	0.0497	* (P <0.05)
				F2 vs. F3	0.6453	ns (P >0.05)
Non-casein nitrogen-NCN (%)	0.742±0.003	0.712±0.003	0.718±0.005	F1 vs.F2	0.0004	***(P<0.001)
				F1 vs. F3	0.0019	** (P <0.01)
				F2 vs. F3	0.2896	ns (P >0.05)
Non-protein nitrogen-NPN (%)	0.314±0.002	0.296±0.004	0.306±0.002	F1 vs.F2	0.0049	** (P <0.01)
				F1 vs. F3	0.0497	* (P <0.05)
				F2 vs. F3	0.0655	ns (P >0.05)

ANOVA within rows, between groups for different superscripts, one by one comparison: ns: not significant; significant = * (P <0.05); distinguished significant = ** (P <0.01); highly significant = *** (P <0.001).

Several findings concerning the protein content of cow milk proteins (Ozrenk et al., 2008; Shamsia, 2009) have shown harmony with present research.
Similarly, the TP contents of cow milk, are in line with the investigations of Pirsi et al. (2000). The findings of previous studies are comparable with the results of current exploration concerning the casein contents of cow milk (Imran et al., 2008.).

It is also known that proteins are an important factor affecting the quality of dairy products as the reduction in proteins and casein (α- and β-casein) contents results in poor cheese making properties (Bernabucci et al., 2002). The findings of Borkova and Snasolva (2005) have shown that cow milk contains 0.47%±0.01% whey proteins.
Regarding the WP values obtained by us, mean values were 0.428 ± 0.004% for milk collected

from F1, 0.416 ± 0.006% for that collected from F2 and 0.412 ± 0.006% for F3 collected.
The results of the ANOVA test on the WP milk content analyzed by us showed insignificant differences (P> 0.05) between F1 vs. F2 and F2 vs. F3 and significant differences (P <0.05) between F1 vs. F3.
Concerning the NCN content (%), the average values obtained by us oscillated between 0.712 ± 0.003% as obtained for the milk collected from F2 and 0.742 ± 0.003% as obtained from the milk collected from F1. The ANOVA test revealed very significant differences (P <0.001) between F1 vs. F2, distinctly significant (P <0.01) between F1 vs. F3 and insignificant between F2 vs. F3.
A final parameter analyzed was NPN (%) where the averages obtained were 0.314 ± 0.002% for milk collected from F1, 0.296 ± 0.004% for F2 and 0.306 ± 0.002% for that collected from the F3 doser 2).
The NPN obtained within the study is higher than one in American researches (Raden and Powell, 2009) – 0.19%. While NPN content found in research conducted in the Netherlands was lower (Heck et al., 2009) than in this study (0.182%).
Researches performed prior in other countries affirm changes in non-protein nitrogen content depending on holding, breed, lactation, day in lactation and season (Ng-Kwai-Hang et al., 1985); therefore, the author of this paper has evaluated results of this research considering all the factors above.

CONCLUSIONS

The breed from which it originates and the type of diet administered to the animals may influence the quality of the milk. Consequently, following the determinations made by us, significant strength differences were noted in the case of fat content. Significant differences were also noted for the lactose content where the mean values were 4.80% for milk collected from F1, 4.25% for the F2 collected and 4.75% for the collection from F3.
For protein content, the differences noted were significant between F1 vs. F2 and F2 vs. F3.
The data indicated in this studio indicate that milk distributed in the city of Iasi through tonometers is of superior quality.
Also, the present investigation would be useful for the dairy processing industries to formulate nutritionally enhanced milk based functional products for the vulnerable segment of the population.

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