Scientific Papers. Series D. Animal Science. Vol. LXIII, No. 1, 2020
ISSN 2285-5750; ISSN CD-ROM 2285-5769; ISSN Online 2393-2260; ISSN-L 2285-5750

RESEARCH ON PERCENTAGE VARIATION CONCERNING COW'S MILK PROTEIN, LACTOSE AND FAT, DEPENDING ON THE SEASON

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Abstract

This research paper consisted in carrying out a study that elucidates how the quality of cow's milk varies depending on the time of lactation initiation (calendar month in which the cows gives birth and the lactation starts). Thus, there were examined milk samples from two groups of cows that gave birth in different seasons (autumn and spring). The determinations concerned were the following: the percentage of protein, the percentage of lactose and the fat percentage in milk. After analyzing the results, compared to the cows that gave birth in autumn, we observed that the percentage of protein increased in the milk from the cows that gave birth in spring, whereas the percentage of fat decreased. The percentage of lactose varied within the similar limits for both experimental groups.

Key words*: composition, cow, milk, season.*

INTRODUCTION

Milk has a high biological value and that is why it is the only consumed product by both human and mammal babies in the first period of their lives. It is the most complete food because it provides all the necessary nutrients for growth and development of the newborn. Having a rich and varied chemical composition, milk ensures most substances that are necessary for living tissue and for maintaining metabolic processes in the organism (Cotor et al., 2012; Codreanu et al., 2012; Mihai et al., 2019; Nistor et al., 2019). Cow milk is an important food for people (due to its special chemical composition and nutritional value) and it also represents a major row material for the manufacture of dairy products (Vidu et al., 2014; Oprea et al., 2019). We should mention that milk and dairy products maintain their freshness and physical-chemical characteristics only if they are properly packaged and stored (Petcu, 2014a; Petcu, 2014b; Visoescu et al., 2015). It is well-known that there are many factors which influence milk production, including: breed, age, individual, ways of feeding and watering, housing conditions, milk management, health status and individual hormonal status etc. (Cotor et al., 2011; Codreanu et al., 2018). Studying the literature, we came across very few data regarding the variation of milk production and its chemical composition during the lactation period, depending on the moment when the lactation started.

This study is important mainly for farmers (cow's milk breeders), as they have the opportunity to organize their farm so that they can obtain raw material for the industry during the whole year (Savu et al., 2002; Petcu, 2006). However, they should take into consideration how the production varies (quantitative and qualitative), depending on the season in which cows gave birth (Tapaloaga et al., 2016; Tapaloaga, 2018).

MATERIALS AND METHODS

We used 20 cows (Holstein breed) in order to carry out this research. They were divided into two experimental groups: first group (n = 10) included cows that gave birth at the beginning of autumn (September-October) and the second group (n = 10) included cows that gave birth at the beginning of spring (February-March).

To evaluate the parameters taken into account, milk samples were collected at different times of lactation.

Regarding the first group, the milk samples were analysed at the end of the first lactation month (October), in the middle of the third month of lactation (December), in the middle of the fifth month of lactation (February) and in the middle of the seventh month of lactation (April).
Regarding the second group, the milk samples were analysed at the end of the first lactation month (March), in the middle of the third month of lactation (May), in the middle of the fifth month of lactation (June) and in the middle of the seventh month of lactation (August).
The evaluated parameters were percentage of protein, the percentage of lactose and the percentage of fat. All the determinations were performed within the laboratory of the milk processing unit.
The protein percentage determination was completed using the protein titration method, the lactose percentage was achieved with the potassium ferricyanide method (Savu et al., 2002) and the fat percentage determination was done by the Gerber method (Ghiță, 2008).
The statistical analysis and the relevance of the assessment concerning the differences between the obtained sets of values, were calculated using the t test (Student).

RESULTS AND DISCUSSIONS

The results are presented in tables and figures for each determined parameter (percentage of protein, percentage of lactose and percentage of fat), being accompanied by interpretations and discussions.

Results and discussions regarding the percentage of milk protein

The evolution of the milk protein percentage during the entire lactation is presented in dynamics in Table 1 and Figure 1, for both experimental groups.

Table 1. The dynamical evolution of the milk protein percentage, for each experimental group

Lot category	Month I	Month II	Month V	Month VII
Lot1	3.70	3.58	3.52	3.80
Lot 2	3.68	3.78*	3.92*	4.06*

*(P<0.05)

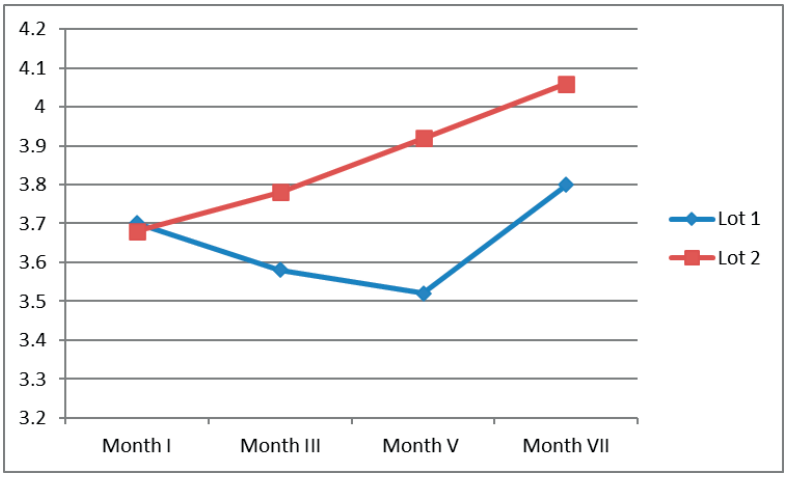

Figure 1. The evolution of the percentage of milk protein in the case of the two experimental groups (red - cows that gave birth in spring; blue - cows that gave birth in autumn)

From the data presented in Table 1 and Figure 1, it is observed that in the case of the cows which gave birth in spring (group 2), the milk protein percentage had continuously increased throughout the lactation with a bimonthly growth rate of 2.7-4.8%. On the other side, the

milk from the cows that gave birth in autumn (group 1), had an initial decrease in the protein percentage until the 5th month, after which, it registered an increase until the 7th month, when exceedances from the initial values by even 2.7%, could be observed. The differences between the two experimental groups in the 3rd, 5th and 7th months of lactation were statistically significant (P<0.05).

These results could be explained by the animal's diet because in the summer, their food provides a higher nutritional contribution, from a qualitative point of view because the green fodder contains consistent amounts of protein, compared to the dry fodder and the silo (that are used as food source in the winter).

These results are similar to those reported in literature by Yang et al. in 2013 and by Bertocchi et al. in 2014.

Results and discussions regarding the milk lactose percentage.

The evolution of the milk lactose percentage during the entire lactation is dynamically presented in Table 2 and Figure 2, for both experimental groups.

Table 2. The dynamical evolution of the milk lactose percentage, for both experimental groups

Lot category	Month I	Month III	Month V	Month VII
Lot 1	4.72	4.70	4.68	4.70
Lot 2	4.70	4.64	4.62	4.68

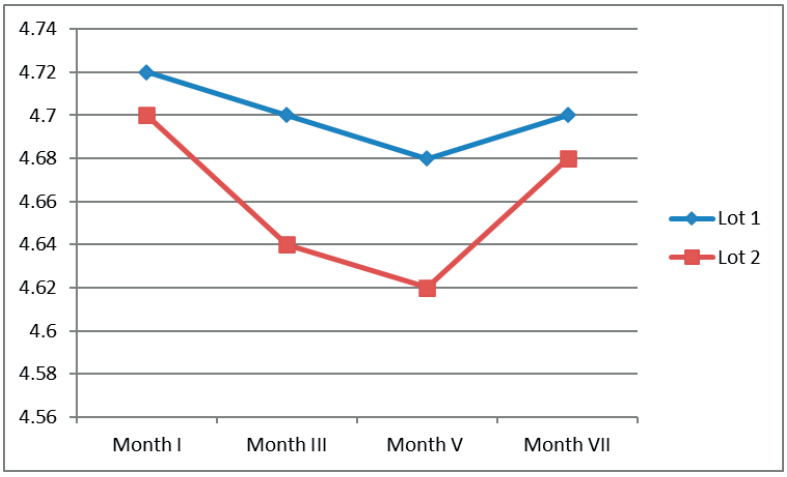

Figure 2. The evolution of the milk lactose percentage, for both experimental groups (red - cows that gave birth in spring; blue - cows that gave birth in autumn)

From the presented data in Table 2 and Figure 2, it is observed that the dynamic of evolution is almost the same in the case of the two experimental groups (the obtained values are similar). The statistical analysis showed that there are no significant differences between the two groups (P>0.05), regarding this parameter. It is obvious that the lactose percentage is not influenced by the diet.

Similar results were obtained in other studies conducted by Cotor et al. in 2015 and by Van Laer et al. in 2015.

Results and discussions regarding the percentage of milk fat

The evolution of the milk fat percentage of during the entire lactation is dynamically presented in Table 3 and Figure 3, for both experimental groups.

Table 3. The dynamical evolution of the milk fat percentage, for both experimental groups

Lot category	Month I	Month III	Month V	Month VII
Lot 1	3.78	4.34	4.51*	4.42*
Lot 2	3.98	3.86	3.74	4.11

*(P<0.05)

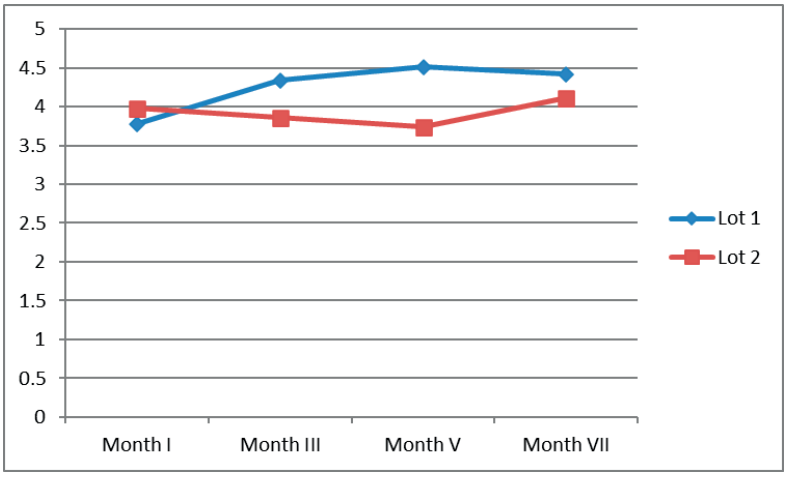

Figure 3. The evolution of the milk fat percentage, for both experimental groups (red - cows that gave birth in spring; blue - cows that gave birth in autumn)

From the presented data, regarding the cows that gave birth in autumn (lot 1), a continuous increase of the milk fat percentage can be observed, with bimonthly rates between 14.82% (3rd month) and 3.92% (5th month).

Regarding the cows that gave birth in spring (lot 2), we initially found a decrease in milk fat percentage until the 5th month, when a decrease of 3.11% was registered, compared to the 3rd month. After that, a huge increase of this parameter was noticed until the 7th month of lactation, at which point an increased value of 9.89% was registered, compared to the 5th month. The differences between the two groups were statistically significant (P<0.05) for the 5th and 7th months of lactation.

These differences are due to the diet. Regarding the cows that gave birth in spring, their lactation took place during the hot season, having had the benefits of succulent fodder, which induced a volumetric increase of milk production, based on the hydric component of milk secretion. This fact led to a dilution of the hydric component and an implicit decrease in fat percentage. At the end of lactation (October), an increase of the analysed parameter is noticed. Our results regarding this parameter, are similar to those obtained by other authors cited in literature (Cotor et al., 2009).

Concerning the cows that gave birth in autumn, their lactation took place in the cold season, so their diet was predominantly represented by coarse fodder. Studying the literature, we noticed that there is a positive correlation between the size of fat globules of milk and the percentage of cellulose from fodder (the main source of volatile fatty acids) (Alstrup et al., 2016). This explains the higher values of this parameter in the case of this group.

CONCLUSIONS

Unlike the ones that gave birth in autumn, the cows that gave birth in spring registered an increase in milk protein percentage during the lactation, with significant differences (P<0.05) for the 3rd, 5th and 7th months.

The milk lactose percentage varied within the same limits for both experimental groups. The differences that we found were not statistically significant (P>0.05).

Unlike the cows that gave birth in spring, the cows that gave birth in autumn registered an

increase in milk fat percentage during the lactation, with significant differences ($P<0.05$) for the 5th and 7th months.

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