RESEARCH ON THE INFLUENCE OF EXPLOITATION TECHNOLOGY ON THE QUALITY OF MILK OBTAINED FROM THE BROWN BREED

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Abstract

In present paper is approach a current topic namely the influence of cow exploitation technology on their milk quality. The study was carried out on 85 cows from the Brown breed rearing in different exploitation systems, in the mountainous area. It was studied the technological factors and milk quality indicators like the number of somatic cells. For this indicator the average value was 466.78±207.121 thousand/ml in the herd exploited in extensive system and of 157.64±16.925 thousand/ml for herds exploited in the semi-intensive system. The percentage of fat in the cows' milk rearing in extensive system had an average value of 3.86±0.257% and for those exploited in the semi-intensive system the average value was 4.64±0.151%. The milk protein percentage had an average value of 3.36±0.137% in case of the extensive system, respectively an average value of 3.73±0.040%, for the semi-intensive system case. The quantity and quality of milk varies, within very wide limits, from one cow to another, depending on the technology applied, even if the animals benefit from the same exploitation system and feeding conditions.

Key words: *milk quality*, *exploitation technology*

INTRODUCTION

Milk is a yellowish-white, opaque liquid with a slightly sweet taste, rich in nutrients, being a perishable product due to its contamination with microorganisms since milking. Milk is a complex food due to its chemical composition, containing approximately 87% water and 13% dry substances (fats, protein substances, lactose, minerals, vitamins, gases etc.). This composition differs depending on the species of the animal from which it comes, the period of lactation, the type of feed, the region and the state of health [1, 2, 4, 7].

By dry substance is understood the totality of substances that remain after the evaporation of water from a certain product. Milk solids consist of fat, protein substances, lactose and minerals and it vary between 12-14 % for cow's milk.

The variation in milk solids is determined by the variation in the content of its components. The content in lactose and minerals does not show much variation. The content of protein substances varies greatly, and that of fat varies the most, variations which can reach up to 50 % [15, 16, 17].

Cow's milk is a complete food because it contains over 100 nutrients, 20 amino acids, 16 fatty acids, 45 mineral elements, 25 vitamins. Cow's milk has a high nutritional value and especially a biological one, providing 84% of the protein nitrogen, absorbed and used by the human body. It is one of the basic foods for all age groups and the raw material for an extremely diverse

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range of products. More than 1000 dairy products are obtained from milk, half of them being various types of cheese [10, 11, 12, 14].

The quality of raw milk is the main factor influencing the compositional characteristics and hygienic quality of dairy products. Due to its composition, chemical and biological structure, milk is an extremely favorable culture medium for the development of various types of microorganisms that arrive in milk and their presence has a particular importance for quality, sanitation and freshness. These microorganisms can increase or decrease the quality of products or make them inedible, either by their pathogenic action or by degradation and the production of toxic metabolites [6, 8, 13].

Considering what was presented, we proposed to carry out this research in which we followed the influence of exploitation technology on the quality of milk obtained from the Brown breed.

MATERIAL AND METHOD

The research was carried out on a herd of cattle belonging to the Brown breed, a total of 87 cows, of which 37 were exploited in an extensive system and 50 cows were exploited in a semi-intensive system, in the mountainous area of Neamț County. It is known that both internal factors, exploitation and environmental factors influence the quantitative and qualitative performances of cattle [6, 9].

Rearing of animals is the sum of the measures regarding housing, body hygiene, the movement of dairy cows and the daily technological flow, from the farm, with the aim of ensuring the reflection of the productive potential and the normal state of the animals' health.

In both farms, the tie system is practiced, with seating in two rows and arrangement end-to-end in closed shelters, equipped with waterers with a constant level, natural lighting ensured by large windows, for the following categories of animals: lactating cows, heifers, mounted youth females, females 12-18 months old, young bulls for fattening. The feeding alley communicates with the outside through wide doors and for milking, the evacuation of manure and the movement of animals, two circulation alleys are used connected with the outside through two doors located on the longitudinal wall. Cows are tethered vertically and, accordingly with this, the stand is short (1.8-1.9 m) on the semi-intensive farm and 2.30 m long stalls on the extensive system farm. The stands width was 1 .2 m [9].

Feeding, in both studied farms, is seasonally differentiated. In the farm with a semi-intensive exploitation system, forage is ad libitum, and from the analysis of the ration it was found a surplus of dry matter (DM) with 6.51%, of protein (PDIN) with 7.74%, respectively (PDIE) with 5.85%. In terms of macronutrients, there is a slight excess of calcium (Ca) by 0.43% and a slight excess of phosphorus (P) intake by 1.15%. The summer ration was in excess compared to feed norms for dry matter (DM) by 2.37%, protein (PDIN) by 19.23% and (PDIE) by 7.51% respectively.

In the farm with extensive exploitation system, from the analysis of the ration, also in winter and in summer, it was found a slight deficiency compared to the feed norms for dry matter (DM) by -0.66%. Instead, there is an excess of metabolizable energy (UFL) of 10.78%. It should be noted that during the summer the cows are kept more on pasture and with meadow hay and in the winter and as a supplement to the ration, wheat bran is added.

Several indicators regarding quantitative and qualitative milk production were analyzed: milk Kg/day, fat %, protein %, number of somatic cells (NSC thousand/ml), urea mg/dl, lactose %, casein % and pH %. The values of the mentioned

indicators were determined in the specialized laboratory of the company that collects the milk and in the university laboratory. The devices used were LACTOSCAN and SOMACOUNT brand.

The sample is collected in sterilized plastic bottles of 10 ml, placed in a stand with 20 places, which is inserted into the rail support of the device. 3 ml of milk are extracted from each bottle and transported through a hose to the incubator, which is equipped with 23 wells. 1 ml of milk and 1 ml of acridine-orange dye solution are sown in each well. Incubation lasts 7-8 minutes at 45°C, after which it is withdrawn with a syringe and diluted with a solution containing 3 drops of TRITON X and 1 ml of ammonia/1 l of distilled water. It is then filtered through a 0.6μ polyvinyl propylene filter membrane from which 1 ml is extracted which is sent to a laser reader. The reading result is displayed on the monitor and printed on the printer. A raw number appears on the printer (2780, for example) representing the number of whole cells and broken cells, followed by the c.f.u. (u.f.c. 973, for example) which represents N.T.G./ml. The result is multiplied by 1000.

The processing was done with the help of a statistical program, analysis of variance and covariance (S.A.V.C.) All data were processed statistically $\bar{X}$, $\pm s_{\bar{x}}$, s, V% synthesized in tables and represented graphically. The analysis and interpretation of the results was correlated with the numerous observations made directly on the farm [3, 6].

RESULTS

For the farm with a semi-intensive exploitation system, the results obtained from the statistical processing of the data with the quality indicators of the milk of the 50 analyzed cows from the Brown breed are presented in table 1. From the table we can see that the average values obtained fall within the optimal limits provided by EU.

From a microbiological point of view, the number of somatic cells (NSC) together with the total number of germs (NTG), represent the most important indicators of milk quality. The number of somatic cells gives us information about the health of the animal, knowing that any infection of the mammary gland results in an increase in the values of this indicator. Regarding this parameter, the maximum value allowed by both national and European legislation is 400,000 somatic cells/ml of milk.

Table 1 Statistics for quality indices of milk in the herd of cows of the Brown breed exploited in a semi-intensive system

Indicator	n	$\overline{X}$	$\pm s_{\bar{x}}$	s	V%	Minim	Maxim
NSC thousand/ml	50	157.64	16.925	116.031	73.606	27.00	521.00
Fat %	50	4.64	0.151	0.624	13.450	3.29	5.65
Protein %	50	3.73	0.040	0.229	6.139	3.45	4.17
Lactose %	50	4.84	0.026	0.085	1.756	4.77	5.06
Urea %	50	23.37	0.684	5.762	24.653	11.00	39.90
Casein %	50	28.78	0.787	5.218	17.818	22.59	36.71
pH %	50	6.60	0.012	0.050	0.757	6.50	6.70
Milk production (kg / day)	50	23.67	1.382	5.595	28.456	17.00	36.06

The results obtained for the farm with exploitation of cows of the Brown breed in an extensive system, are presented in table 2. We find that the results obtained are inferior to the results obtained with cows exploited in a semi-intensive system. The average value at NSC thousand/ml exceeds the maximum value allowed by both national and European legislation.

Table 2 Statistics for quality indices of milk in the herd of cows from the Brown breed exploited in an extensive system

Indicator	n	$\overline{X}$	$\pm s_{\bar{x}}$	s	V%	Minim	Maxim
NSC thousand/ml	37	466.78	207.121	621.364	133.118	22.00	1755.00
Fat %	37	3.86	0.257	0.772	20.018	2.60	4.90
Protein %	37	3.36	0.137	0.412	12.270	2.73	3.87
Lactose %	37	4.68	0.076	0.229	4.896	4.29	5.04
Urea %	37	26.49	2.620	7.859	29.669	13.30	35.20
Casein %	37	27.72	0.795	2.386	8.607	24.72	30.81
pH %	37	6.72	0.027	0.082	1.220	6.61	6.85
Milk production (kg / day)	37	16.72	1.787	5.361	32.062	8.40	24.08

The comparative results regarding the quality of the milk obtained in the two farms with different systems of exploitation of cows from the Brown breed are presented in figure 1.

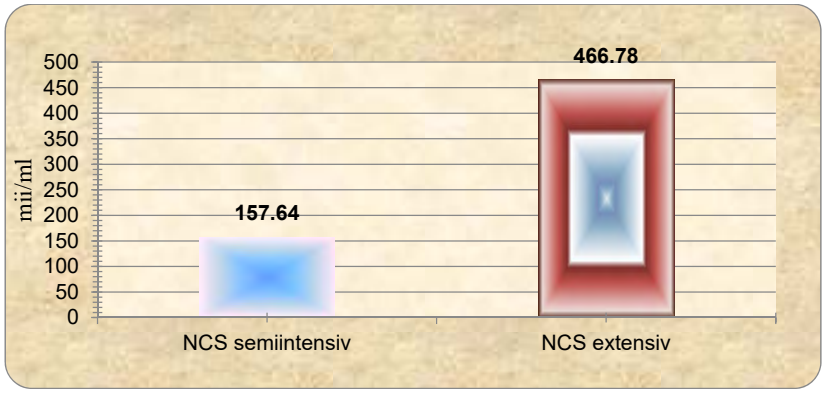

Fig. 1 Graphical and comparative representation of NCS for milk quality

DISCUSSIONS

The Brown breed in Romania was formed by crossing unimproved domestic bulls - the Sura de Stepă breed and the Mocănița mountain breed with Brown breed bulls from Austria and later from Switzerland. It should be stated that it is not the quantitative production of milk per lactation that makes the Brown breed a special breed, but other characteristics, especially related to the quality of the milk [5, 9].

Thus, the fat ratio is very tight. Also, the protein quality is very good, with a very high casein content (78% of the total milk protein), especially k-casein. Brown cows

produce milk that contains 7-8% more calcium and phosphorus, more lactose (milk sugar), but less chlorides, which makes this milk tastier [5, 9].

Due to these qualities, the milk from Brown breed cows is the most suitable for the cheese industry, the yield being approximately 16% higher compared to other breeds, the coagulation time reduced due to the content in mineral salts, arguments to which are added, of course, the special organoleptic characteristics (taste, flavor, color, etc.).

In the milk produced by Brown breed cows rearing in the semi-intensive system (table 1), a much lower number of somatic cells were found, the statistical average for this indicator being 157.64 ± 16.925 thousand/ml of milk.

The limits between which the 50 calculated values fell were quite wide, respectively 27 thousand/ml the minimum and 521 thousand/ml the maximum, so that the coefficient of variability has a relatively high value of 73.606%. The much lower number of somatic cells, existing in the milk from the cows on this farm, is directly related to the feeding conditions and especially to the maintenance and sanitation conditions that are ensured in this zootechnical farm. The proportion of fat in the milk from cows raised and exploited in the farm with a semi-intensive exploitation system, has a statistical average of 4.64 ± 0.151%, with variation limits between 3.29% and 5.65%, the variability being V=13.45% (table 1).

The procentage of protein in this milk varied between 3.45% and 4.17%, the 50 values entered in the statistical calculation having an average of 3.73±0.040%. In this case, the coefficient of variability was lower, namely 6.139%.

The proportion of lactose was calculated at an average statistical value of 4.84±0.026% with the limits of variation between 4.77% and 5.06%, the coefficient of variability being 1.756%.

Regarding the proportion of urea in this milk, the analyzes carried out revealed values between 11.00% and 39.90% and from the statistical calculation of the 50 primary data an average of 23.37±0.684% resulted. Since the variation limits are quite wide, the specific coefficient of variation is high, having a value of 24.653.

The proportion of casein in the milk from the cows of the Secuieni farm (Brown breed) was calculated at an average statistical value of 28.78±0.787% after the 50 primary data oscillated between rather wide limits, respectively 22.59 and 36.71% and determined a coefficient of variability of 17.818%. Regarding the acidity of this milk, the values measured in the 50 analyzed samples fell between the limits of 6.50 and 6.70 pH units, with a statistical average of 6.60±0.012 pH units. The variability for this character is very low below 1.00%, 0.757% to be exact.

The quantitative milk production of the 50 cows from this farm studied varied between 17.00 and 36.06 kg/head, and the statistical average was 23.67±1.382 kg/head/day. The variability of this character is high, the specific coefficient having a value of 28.456%.

In cows farmed in an extensive system, the first indicator related to the number of somatic cells in milk was found to have a statistical average value of 466.78±207.121 mii/ml with very large variation limits, the extremes being between 22 mii/ml and 1755 mii/ml respectively ml. The coefficient of variability, in this case, is extremely high and unnatural, namely 133.118% (table 2). The very high number of somatic cells in the milk produced betrays the lack of hygiene conditions in the cow sheds and during milking, as well as possible cases of mastitis or other udder diseases in this herd of cows.

The proportion of fat in the milk produced in this farm registers a statistical average of 3.86±0.257%, with variations between 2.60% and 4.90, the coefficient of

variability having an average value of 20.018%.

The proportion of protein in the milk from the farm with extensive exploitation system varied between 2.73% and 3.87%, the statistical average of the 37 values included in the calculation being 3.36±0.137%.

The proportion of lactose in this milk has an average of 4.68±0.076%, the 37 values being very close, namely between 4.29% and 5.04% and the coefficient of variability is low (V=4.896% table 2). The milk from the cows exploited in this farm contains on average 26.49 ± 2.62% urea, but the 37 values were between 13.30% and 35.20%, which determined a high variability coefficient of 29.669%.

The proportion of casein in the milk produced in this farm was between 24.72% and 30.81%, the statistical average of the 37 values included in the calculation being 27.72 ± 0.79%, and the coefficient of variability was 8.607%, which indicates a population of homogeneous cows from this point of view. Regarding the daily quantitative milk production of this farm, it was in average 16.72±1.787 kg/day/cow head, but the variability for this character was more pronounced, namely 32.062%.

Milk acidity (pH) has a statistical mean of 6.72 ± 0.027 pH units, with limits between 6.61 and 6.85. Average milk production per day and per head of animal of 16.72 ± 1.787 kg, varying between 8.40 and 24.08 kg.

The differences found in the milk quality indicators at the two studied farms are statistically significant for $p < 0.05$ and C.I. = 95%. The influence of the exploitation technology on the quantitative and qualitative milk production is obvious, and from figure 1 we can see that the non-compliance of milking technology and an extensive type of feeding, without an additional ration, significantly influences the quality of the milk.

CONCLUSIONS

1. The Brown breed is special for its protein quality, with a very high casein content (78% of the total milk protein) especially k-casein. Brown cows produce a milk that contains 7-8% more calcium and phosphorus, more lactose (milk sugar) but less chlorides, which makes this milk tastier and the most suitable for the industry the cheeses.

2. The exploitation technology influences the quantitative and qualitative milk production, statistically significant differences were found between the two farms with different exploitation systems for $p < 0.05$ and C.I. = 95%. In the farm with a semi-intensive system of exploitation, the average value for NSC was 157.64 ± 16.925 thousand/ml, and in the farm with an extensive system of exploitation of cows, the average value for NSC was 466.78 ± 207.121 thousand/ml.

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