THE STUDY OF THE MAIN PARAMETERS QUALITY OF BUFFALO MILK
STUDIEREA UNOR PARAMETRII DE CALITATE AI LAPTELUI DE BIVOLIŢĂ

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ABSTRACT

Researches were conducted on a biologic material, a buffalo livestock, in different lactating stages and their physico-chemical parameters were determined: fat, protein, lactose, unfat dry substance, density, pH, temperature. Regarding the variation of these components, researches conducted emphasized differences determined by those conditions specific to reference seasons. Individual analysis on the buffalo livestock in the study, emphasized significant differences: fat 8.59-9.36%, protein 5.16-5.31% respective of lactation. Microbiologic determinations mainly envisioned: the number of somatic cells (NSC), number of total germs (NTG) Positive Coagulanzo Stafilococii, *Listeria*, *Salmonella*, determinations which lay at the basis of the assessment of buffalo milk quality. The positive Coagulanzo stafilococus was absent, excepting sample number 15 (2 germs/ml) and sample number 22 (4 germs/ml); *Salmonella* was absent. Regarding the total number of germs: values between 1.0-1.8 germs/ml were obtained. The detection of this microbiologic parameter in the composition of buffalo milk provides information regarding the hygienic conditions of their production and handling. Correlations between the number of somatic cells, milk production and composition are employed in dairy buffalo farms, in order to assess losses caused by mastitis and the implementing of certain measures for the control of these diseases. On the other hand, correlations between the number of somatic cells and milk composition prove useful in establishing milk processing behaviour, as the practice of setting milk-raw matter prices according to the number of somatic cells in the milk is becoming increasingly more frequent in developed countries.

KEY WORDS: buffalo, milk, chemical composition, microbiological quality

REZUMAT

Cercetările s-au desfăşurat pe materialul biologic reprezentat de un efectiv de bivolițe aflate în lactații diferite l-a care s-au determinat parametrii fizico-chimici: grăsime, proteină, lactoză, substanța uscată negrasă, densitate, pH, temperatură. Privitor la variația acestor componente, cercetările efectuate au pus în evidență şi diferențe determinate de condițiile specifice sezoanelor de referință. Analiza individuală pe efectivul de bivolițe cuprinsă în studiu, a evidențiat diferențe semnificative: grăsime 8.59-9.36%, proteina 5.16-5.31% în funcție de lactație. Determinările microbiologice au vizat în principal: numărul de celule somatice (NCS), numărul total de germeni (NTG), Stafilococii Coagulanzo pozitivi, *Listeria*, *Salmonella*, determinări care au stat la baza evidențierii calității laptelui de bivoliță. Stafilococul coagulanzo pozitiv a fost absent exceptând proba numarul 15 (2 germeni/ml) şi proba numarul 22 care au prezentat (4 germeni/ml); *Salmonella* a fost absentă. În ceea ce priveşte numărul total de germeni: s-au obținut valori cuprinse între 1.0-1.8 germeni/ml. Decelarea acestui parametru microbiologic din compoziția laptelui de bivoliță, oferă informații privind condițiile de igienă în care s-a produs şi manipulat. Corelații între numarul de celule somatice, producția de lapte şi compoziție este utilizată în fermele de bivolițe de lapte pentru a estima pierderile cauzate de mamite şi implementarea unor măsuri pentru controlul acestor afecțiuni. Pe de altă parte corelațiile între numărul de celule somatice şi compoziția laptelui se dovedeşte utilă în elaborarea modului de comportare a laptelui în cursul procesării, în țările dezvoltate fiind tot mai frecventă practica stabilirii prețului laptelui, materie primă, ținând cont şi de numărul de celule somatice din lapte.

CUVINTE CHEIE: bivoliţă, lapte, compoziţia chimică, calitatea microbiologică

DETAILED ABSTRACT

Cercetările s-au desfăşurat pe materialul biologic reprezentat de un efectiv de bivolițe aflate în lactații diferite l-a care s-au determinat parametrii fizico-chimici: grăsime, proteină, lactoză, substanța uscată negrasă, densitate, pH, temperatură. Privitor la variația acestor componente, cercetările efectuate au pus în evidență şi diferențe determinate de condițiile specifice sezoanelor de referință. Analiza individuală pe efectivul de bivolițe cuprinse în studiu, a evidențiat diferențe semnificative: grăsimea a prezentat valori cuprinse între 8.59-9.36%, (tabelul 1), iar proteina între 5.16-5.31%, în funcție de lactație (tabelul 1); comparând aceste rezultate cu datele din literatură se poate observa că sub raport cantitativ atât procentul de grăsime, cât şi cel de proteină este mai ridicat. Prin studierea însuşirilor fizico-chimice la mai multe rase de bubaline: pentru rasa Murrah grăsimea (%) a fost de 6.57±1.21, proteina de 4.27 ± 0.43, lactoza de 5.07 ± 0.13, pH de 6.53; pentru rasa Nili-Ravi grăsimea a fost de 6.53 ± 1.28, proteina de 4.16 ± 0.20, lactoza de 4.56 ± 0.10, pH de 6.39 ± 0.06, [1]. Compoziția chimică medie a laptelui de bivoliță pe lactații după [18] este următoarea: lactația I: grăsimea 7.39%, proteina 4.23%, lactoza 4.68%, cenuşa 0.89%, aciditatea 8.28, valoarea energetică 1110 cal/kg, densitatea medie 1.032, S.U.T. 17.39%; lactația II: grăsimea 7.49%, proteina 4.62%, lactoza 4.65%, cenuşa 0.91%, aciditatea 8.42, valoarea energetică 1150 cal/kg, densitate medie 1.032, S.U.T.17.67%; lactația III: grăsimea 7.81%, proteina 4.79%, lactoza 4.68%, cenuşa 0.94%, aciditatea 8.46, valoarea energetică 1180 cal/kg, densitate medie 1.033, S.U.T., 18.22%. În numeroasele cercetări realizate pe bubaline [18], atât pe bubalinele din Transilvania cât şi pe rasa Murrah s-au obținut următoarele valori medii pentru grăsime: 7.40% şi respectiv 8.35% pentru rasa Murrah. Normele internaționale şi în special cele ale Uniunii Europene prevăd ca laptele crud să aibă un număr de germeni sub 100.000/ml, în cazul în care este mai mare generează dificultăți de conservare şi în consecință este impropriu pentru procesare, totodată neavând cheltuieli speciale pentru pasteurizare, sterilizare [18]. Toxinfecțiile produse de germenii din genul Salmonella sunt mai frecvente în sezonul cald, deoarece temperatura este un factor favorizant al dezvoltării şi multiplicării lor [1]. Determinările microbiologice au vizat în principal: numărul de celule somatice (NCS), numărul total de germeni (NTG), Stafilococii Coagulazo pozitivi, Listeria, Salmonella, determinări care au stat la baza evidențierii calității laptelui de bivoliță. Stafilococul coagulazo pozitiv a fost absent exceptând proba numarul 15 (2 germeni/ml) (tabelul 3) şi proba numarul 22, care au prezentat 4 germeni/ml; Salmonella a fost absentă. În ceea ce priveşte numărul total de germeni, s-au obținut valori cuprinse între 1.0-1.8 germeni/ml (tabelul 3). Decelarea acestui parametru microbiologic din compoziția laptelui de bivoliță, oferă informații privind condițiile de igienă în care s-a produs şi manipulat. Corelații între numărul de celule somatice, producția de lapte şi compoziție este utilizată în fermele de bivolițe de lapte pentru a estima pierderile cauzate de mamite şi implementarea unor măsuri pentru controlul acestor afecțiuni. Pe de altă parte corelațiile între numărul de celule somatice şi compoziția laptelui se dovedeşte utilă în elaborarea modului de comportare a laptelui în cursul procesării, în țările dezvoltate fiind tot mai frecventă practica stabilirii prețului laptelui, materie primă, ținând cont şi de numărul de celule somatice din lapte.

INTRODUCTION

Milk cells were first signalled almost one hundred years ago and considered small milk components. Their importance for the health of the mammary glad, and thus implicitly, of the hygienic milk quality was issued relatively late. Presently, they are included among hygienic quality indices for human consumption milk [19]. Milk cellular profile represents an important health parameter for the mammary gland [14, 19]. The bovine mammary gland is equipped with defensive mechanisms, some of them being similarly adaptable to bubalines, while others are considered particular [2, 9, 10, 12]. Studies conducted on bubalines by [16] (1994) show that bubalines are more resistant to mamite than bovines, as there are qualitative and quantitative cellular differences in the milk of the two species [6, 16]. The main physical properties of milk are the pH and the electric conductibility; Buffalo milk fat is the most variable milk component, as it is influenced by genetic and specific factors [6, 7, 11]. Carbon hydrates can be found in the milk as lactose, a precedent of circulating glucose. Its level influences the quantity of milk produced and the synthesis rate of short-chain fatty acids [3, 4]. Lysteria monocytogenes serotypes that are pathogenic for animals are equally pathogenic for humans, as well - milk being considered one of the vectors for listeriosis [5]. Mamites are the most frequent buffalo diseases and lead to a reduction in the milk production, high treatment expenses and the reformation of dairy buffaloes. The inflammation of the mammary gland is associated with an increase in the number of milk somatic cells, a parameter which is employed as an indicator in the evaluation of the mammary gland health [4, 13, 15, 17]. These considerations lay at the basis of measures undertaken in our country, according to community norms, that aim at a qualitative improvement of raw matter milk and lead to a gradual reduction in the number of somatic cells until

the beginning of the year 2010, when they have to fully comply with norms in the other community countries.

MATERIALS AND METHODS

Buffalo milk samples were gathered individually according to the number of lactation and the compliance with necessary conditions to prevent their depreciation. Samples underwent examination on the day of sampling for the physico - chemical exam by means of the Lactoscan apparatus. The milk quantity was individually measured, upon each automatic milking with a device placed on the milking equipment. Data obtained after the microbiologic exam aimed at establishing certain correlations and the emphasis of existing variations between the number of somatic cells, the total number of Salmonella germs, positive coagulase Staphylococcus, Listeria. These parameters were determined by means of the following analysis methods: SR EN ISO: 659/2003, 6888/1, 2, 3/2002.

RESULTS

Table 1 and 2 present the results of the physico-chemical exam for buffalo milk as raw matter for different products. Physico-chemical parameters were determined on a monthly basis and an attempt was made at establishing correlations according to month, season and their interrelation. Results obtained allow for the assertion that an increase in the number of milk somatic cells leads to a decrease in milk lactose content and milk production, thus determining economic losses for producers and

Table 1 The analysis of the main buffalo milk characteristics according to lactations (I-III) and seasons on the Mesendorf farm
Analiza principalelor caracteristici ale laptelui de bivoliță pe lactații (I-III) în funcție de sezon la ferma Mesendorf

Crt. nr.	Characteristics/ Caracteristica	The variance analysis for the influence factor/ Analiza de varianță în funcție de sezon şi luna lactației	Lactation (F value and significance of difference)/ Lactația (valoarea lui F şi semnificația diferențelor)					
			I		II		III	
			X	F	X	F	X	F
1.	Daily milk quantity (l)	Season (A)	4.65 n=5	0.048 ns	4.44 n=14	19.946***	4.73 n=13	5.542*
		Month (B)		2.007 ns		0.348 ns		1.390 ns
		AB		5.868*		3.967*		1.381 ns
2.	Fat (%)	Season (A)	8.59 n=5	7.456*	9.01 n=14	40.751***	9.36 n=13	12.361**
		Month (B)		0.497 ns		7.597***		2.602 ns
		AB		0.140 ns		1.533 ns		3.326*
3.	Proteins (%)	Season (A)	5.31 n=5	0.133 ns	5.28 n=14	0.318 ns	5.16 n=13	1.587 ns
		Month (B)		0.909 ns		1.234 ns		5.636**
		AB		0.279 ns		0.704 ns		2.663 ns
4.	Lactose (%)	Season (A)	2.95 n=5	0.707 ns	2.88 n=14	20.072***	2.98 n=13	1.754 ns
		Month (B)		1.869 ns		1.362 ns		2.532 ns
		AB		0.968 ns		0.568 ns		0.458 ns
5.	Unfat dry substance (%)	Season (A)	10.07 n=5	2.767 ns	10.24 n=14	1.703 ns	11.14 n=13	0.801 ns
		Month (B)		0.905 ns		0.410 ns		1.282 ns
		AB		1.117 ns		0.545 ns		0.670 ns
6.	Density (g/cm³)	Season (A)	29.61 n=5	0.389 ns	29.69 n=14	9.439**	28.63 n=13	0.044 ns
		Month (B)		0.605 ns		0.568 ns		1.126 ns
		AB		0.275 ns		0.523 ns		1.232 ns
7.	pH	Season (A)	6.21 n=5	0.198 ns	6.17 n=14	3.085 ns	6.01 n=13	0.441 ns
		Month (B)		1.834 ns		3.142*		1.527 ns
		AB		1.946 ns		3.201*		4.309*
8.	Temperature (°C)	Season (A)	21.54 n=5	0.329 ns	20.81 n=14	3.820 ns	21.07 n=13	0.087 ns
		Month (B)		0.141 ns		0.340 ns		0.031 ns
		AB		0.240 ns		2.715 ns		1.197 ns

Table 2 The analysis of the main buffalo milk characteristics according to lactations (IV-VIII)) and seasons on the Mesendorf farm
Analiza principalelor caracteristici ale laptelui de bivoliță pe lactații (IV-VIII) în funcție de sezon la ferma Mesendorf

Nr. crt.	Characteristics/ Caracteristica	The variance analysis for the influence factor/ Analiza de varianță în funcție de sezon şi luna lactației	Lactation (F value and significance of difference)/ Lactația (valoarea lui F şi semnificația diferențelor)									
			IV		V		VI		VII		VIII	
			X	F	X	F	X	F	X	F	X	F
1.	Daily milk quantity (l)	Season (A)	5.23 n=8	5.504*	5.37 n=16	18.334***	5.05 n=7	2.764 ns	6.60 n=6	0.204 ns	5.31 n=8	0.022 ns
		Month (B)		4.866*		6.881**		0.150 ns		0.081 ns		5.507*
		AB		1.293 ns		6.968**		2.651 ns		0.481 ns		0.496 ns
2.	Fat (%)	Season (A)	8.63 n=8	17.254**	8.51 n=16	10.299***	8.89 n=7	61.724***	9.40 n=6	1.791 ns	9.63 n=8	0.986 ns
		Month (B)		1.252 ns		2.299 ns		4.585*		2.979 ns		2.820 ns
		AB		1.367 ns		1.403 ns		0.481 ns		0.480 ns		1.684 ns
3.	Proteins (%)	Season (A)	5.21 n=8	0.827 ns	5.28 n=16	1.721 ns	5.23 n=7	1.187 ns	5.40 n=6	0.688 ns	5.35 n=8	1.453 ns
		Month (B)		1.240 ns		1.885 ns		1.483 ns		0.156 ns		0.796 ns
		AB		1.345 ns		0.120 ns		8.013**		1.833 ns		0.509 ns
4.	Lactose (%)	Season (A)	3.01 n=8	0.710 ns	3.02 n=16	6.217**	3.07 n=7	4.206*	3.38 n=6	3.698*	2.99 n=8	0.988 ns
		Month (B)		0.874 ns		1.390 ns		1.213 ns		0.745 ns		0.839 ns
		AB		5.971**		1.143 ns		1.179 ns		2.717 ns		0.724 ns
5.	Unfat dry substance (%)	Season (A)	10.50 n=8	0.909 ns	10.17 n=16	0.069 ns	10.65 n=7	0.181 ns	10.54 n=6	0.028 ns	10. 39 n=8	31.299***
		Month (B)		1.008 ns		0.139 ns		0.627 ns		0.289 ns		1.995 ns
		AB		0.854 ns		1.740 ns		0.314 ns		3.123*		1.536 ns
6.	Density (g/cm³)	Season (A)	30.11 n=8	0.003 ns	29.47 n=16	1.973 ns	29.27 n=7	0.001 ns	30.2 n=6	0.027 ns	30.28 n=8	2.989 ns
		Month (B)		2.769 ns		0.224 ns		0.583 ns		0.375 ns		2.198 ns
		AB		1.425 ns		1.216 ns		0.255 ns		0.056 ns		0.065 ns
7.	pH	Season (A)	5.97 n=8	0.070 ns	6.29 n=16	3.286*	6.28 n=7	0.222 ns	6.18 n=6	0.485 ns	6.27 n=8	0.912 ns
		Month (B)		0.637 ns		1.141 ns		1.447 ns		0.273 ns		0.434 ns
		AB		4.596*		0.024 ns		1.939 ns		0.460 ns		3.793*
8.	Temperature (° C)	Season (A)	21.60 n=8	0.027 ns	20.55 n=16	0.045 ns	20.12 n=7	0.356 ns	21.54 n=6	0.501 ns	21.19 n=8	0.345 ns
		Month (B)		1.628 ns		1.754 ns		1.456 ns		1.315 ns		1.423 ns
		AB		0.741 ns		0.876 ns		0.734 ns		1.015 ns		1.296 ns

negatively affecting raw matter milk quality. The stage for the assessment of the microbiologic parameters in milk and dairy products is an essential stage in the product quality control. To continue with, the results of the microbiologic exam on raw matter buffalo milk for industrial processing are presented. Determinations were conducted on a number of 22 buffalo milk samples. Table 3 presents the results of the buffalo milk microbiologic exam. We can thus depict that: regarding the detection of the presence and number of positive coagulase staphylococci, the positive coagulase staphylococcus was detected absent except sample number 15 (2 germs/ml) and sample number 22 (4 germs/ml); The contamination in this case was possible through human handling or from buffalo udder or skin, as the contamination with this germ is possible even in the case of automatic milking or when hygiene conditions try to be complied with; the detection of the presence and number of Salmonella bacteria was absent; regarding the total germ number: values between 1.0-1.8 germs/ml were obtained; the detection of this microbiologic parameter in buffalo milk composition provides information regarding hygiene conditions of its production and handling; the determination of the number and presence of buffalo milk somatic cells: following the analyses conducted it can be asserted that the milk complied with the present stas. Listeria monocytogenes serotypes which are pathogenic for animals and humans alike, as milk is considered a vector for listeriosis propagation; It can be thus observed that once the number of milk somatic cells increases, there is a decrease in the content of milk lactose, caused by a weakening of synthesis activity in the affected mammary gland ultimately leading to a decrease in milk production. Considering the concentration effect of milk constituents, which is produced at the end of lactation once milk production decreases, it can be asserted that milk proteins and fats are not quantitatively affected by an increase of the somatic cell number.

DISCUSSIONS

The variation of the main components of milk in Romanian buffalo, in accordance with the season and alimentation during the hole season were made between 1978-1992 [18]. The total dry substance was 18.6%, the fat 8.0%, the protein 4.6%, lactose 4.8%, ash 1.2% and density 1.034 in the winter season; 17.9% for total dry substance, 7.5% fat, 4.7% protein, 4.8% lactose, 0.9% ash and 1.032 density in the spring; total dry substance 17.8%, fat 7.4%, protein 4.6%, lactose 4.8%, ash 1.0% and density 1.032 in the summer season and total dry substance 18.3%, fat 7.8%, protein 4.6%, lactose 4.8%, ash 1.1% and density 1.033 in the autumn. These dates are approximately similar with those presented here. Studying physical and chemical parameters of buffalo milk (percent represented), [1] shows that the fat is 6.57±1.21, the protein is 4.27±0.43 and lactose is 5.07±0.13 to Murrah breed, to a value of pH by 6.53; for Nili-Ravi breed, the fat was 6.53±1.28, the protein 4.16±0.20 and lactose 4.56±0.10, pH 6.39. These values are variable and influenced by the breed and technology. Comparing with Romanian buffalo, the fat and protein percent are lower, but lactose is higher. The Coliform bacteria from buffalo milk to Murrah breed has 3.95±0.07, Escherichia coli 1.80±0.23 and Streptococus aureus 1.80±0.23, fungi 1.33±0.46; to Nili-Ravi breed the Coliform bacteria has 2.16±0.30, Escherichia coli 1.80±0.23, Streptococus aureus 1.95±0.36 and fungi 1.33±0.46.

CONCLUSIONS

In order to obtain high-standard milk and dairy products satisfactory on a physico-chemical and microbiologic level, the following aspects must be considered: the increase of the specific hygienic-sanitary knowledge level must be conducted on an organized basis for personnel working in raw matter and processing sectors, as well as the application of a unitary system that provides normal conditions for food security; the limitation of economic losses; an education of personnel in the food sector must be accomplished regarding the importance of milk and dairy products quality parameters; the accomplishment of a stimulating framework for selective competition based on objective grounds for consumer advantage; the improvement of dairy products processing technology according to EU norms and requirements; the extension and modernizing of the official production control must be considered in order to increase milk production for bubaline breeding and development, especially for the private sector; to increase the number of active population; the number of milk somatic cells is associated with a severe decrease of physiologic and processing milk traits, at times hazardous for consumer health.The negative effects on buffalo milk production, composition and health require for increased efforts to trace and establish properties of preventive measures on time. The determination of somatic cell number is an important parameter that must be taken into consideration for the control of management programmes for raw matter milk quality and as a control parameter for measure efficacy within the mamite control programme for dairy buffaloes. The evolution of somatic cells appears in accordance with buffalo milk production. Another highly important aspect that draws our attention refers to the microbial charge, which is influenced by breeders' degree of education, by hygiene conditions that have to be respected in milking

and milk storage until capitalization.

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