CYTOLOGICAL QUALITY OF GOAT MILK ON THE BASIS OF THE SOMATIC CELL COUNT

JAKOŚC CYTOLOGICZNA MLEKA KÓZ NA PODSTAWIE ZAWARTOŚCI KOMÓREK SOMATYCZNYCH

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ABSTRACT

The aim of the present paper was to evaluate the cytological quality of goat milk based on the somatic cell count in respective months of lactation. Besides there was defined the effect of somatic cell on the milk production and chemical composition of milk. The research covered goats of color improved breed in the 2nd and 3rd lactation. Daily milk yield, chemical composition of milk and its somatic cell count were defined based on monthly morning and evening control milkings from both teats, following the A4 method applied in District Animal Evaluation Stations. The research indicated that the greater the somatic cell count in milk, the lower the daily milk yield, however the greater the somatic cell count, the greater the percentage content of fat and dry matter and the lower the content of lactose.

KEY WORDS: goat, lactation, milk, somatic cells

STRESZCZENIE

Celem pracy była ocena jakości cytologicznejj mleka kóz na podstawie zawartości komórek somatycznych w mleku z poszczególnych miesięcy laktacji. Ponadto określono wpływ komórek somatycznych na wydajność mleczną i skład chemiczny mleka. Badaniami objęto kozy rasy barwnej uszlachetnionej w 2 i 3 laktacji. Dobową wydajność mleczną, skład chemiczny mleka i zawartość w nim komórek somatycznych określono na podstawie comiesięcznych rannych i wieczornych udojów kontrolnych z obu strzyków, zgodnie z metodą A4, stosowaną w Okręgowych Stacjach Oceny Zwierząt. W badaniach stwierdzono, że wraz ze wzrostem liczby komórek somatycznych w 1 ml mleka wzrastała istotnie wydajność dzienna mleka, jak również procentowa zawartość tłuszczu i suchej masy, a malała laktozy.

SŁOWA KLUCZOWE: koza, laktacja, mleko. komórki somatyczne

STRESZCZENIE SZCZEGÓŁOWE

Badaniami objęto 30 kóz rasy barwnej uszlachetnionej będących w 2 i 3 laktacji. Celem pracy była ocena jakości cytologicznej mleka koziego na podstawie zawartości komórek somatycznych w mleku z poszczególnych miesięcy laktacji. Ponadto określono wpływ komórek somatycznych na wydajność mleczną i skład chemiczny mleka. Dobową wydajność, podstawowy skład chemiczny mleka i zawartość w nim komórek somatycznych określono na podstawie comiesięcznych rannych i wieczornych udojów kontrolnych z obu strzyków, zgodnie z metodą A_4, stosowaną w Okręgowych Stacjach Oceny Zwierząt. Laktacja u kóz trwała od lutego do listopada, średnio 288 dni. Dzienna wydajność mleka od kozy w zależności od miesiąca laktacji kształtowała się w granicach od 1,80 kg do 3,70 kg (2,70 kg), o średniej zawartości tłuszczu 4,60%, białka 3,26%, laktozy 4,43% i suchej masy 13,54%. W 3, 4 i 5 miesiącu laktacji kozy charakteryzowały się istotnie wyższą dobową wydajnością mleczną w porównaniu do pozostałych miesięcy. Mleko z pierwszego i dwóch ostatnich miesięcy laktacji okazało się istotnie bogatsze w tłuszcz, białko i suchą masę. Natomiast procentowa zawartość laktozy była istotnie wyższa w mleku z dwóch pierwszych miesięcy laktacji i następnie wraz z upływem laktacji zawartość tego składnika systematycznie malała.

Średnia zawartość komórek somatycznych w 1 ml mleka wynosiła 634,82 tys. Mleko z 3 i 4 miesiąca laktacji, a więc okresu wiosennego charakteryzowało się istotnie wyższą zawartością komórek somatycznych w 1 ml mleka w porównaniu do mleka z pozostałych miesięcy laktacji. W badaniach wykazano istotny wpływ zawartości elementów komórkowych na ilość pozyskiwanego mleka. Wraz ze wzrostem liczby komórek somatycznych w 1 ml mleka wzrastała jego dzienna wydajność z 2,2kg (grupa A) do 3,2 kg (grupa D), zwiększała się procentowa zawartość tłuszczu, z 4,66% do 5,36%, jak również suchej masy z 13,03% do 13,79%. Zmniejszała się natomiast procentowa zawartość laktozy, z 4,51% do 4,36%. Wszystkie te różnice zostały potwierdzone statystycznie.

INTRODUCTION

The milk quality and composition are of interest not only to producers and dairy companies but most of all to consumers. High hygiene milk quality requirements are aimed at the protection of human health, maintaining the natural biological value of the raw material and ensuring the right course of technological processes throughout milk processing [4].

One of the elements which determine the milk hygiene quality is the somatic cell count which is also the main mammary gland health condition measurement. In the cause of udder infection, their count increases even to a dozen or so million per 1 ml of milk [1,4,5.6,7]. Udder disease condition results in a lower quality and quantity of the milk obtained, shortens the time of goat utilization and has a negative effect on the kid rearing indicators, and thus it decreases the goat farming profitability. The count of cell elements in milk is species-specific. Goat milk contains on average a higher somatic cell count (ks) than cow milk [4,8], which is due to the apocrine character of milk secretion in goats, namely involving the destruction of the milk-producing cell and its reaching the light of milk-producing alveolus. In cattle and sheep milk secretion is mesocrine in character [4,5]. Goat milk obtained from a healthy udder contains from a few hundred thousand to a few million ks in 1 ml, and in cow milk in the first lactation the somatic cell count should not exceed 100 thousand per 1 ml, and in successive 200 thousand per 1 ml [3,4,5,8,10]. The somatic cell count depends on many factors, namely: the breed, age, lactation period, season, nutrition, milking technique, and most of all the health condition of udder.

The aim of the present paper is to evaluate the cytological quality of milk on the basis of the somatic cell count in goat milk depending on the lactation period and the effect on milk production and chemical composition.

MATERIAL AND METHODS

The research involved 30 goats of color improved breed in the 2nd and 3rd lactation, whose milk utilization was under controlled. The animals were kept using the alcove system (the whole year in a building) and fed ad libitum, with traditional feeds; root crop feeds, silages, hay, straw, protein mixtures, chestnuts and tree twig.

The daily milk yield, as well as the chemical composition of milk and its somatic cell count were defined based on monthly morning and evening control milkings from two teats, following the A_4 method applied in District Animal Evaluation Stations. The following were determined in the milk obtained: the percentage content of dry matter, fat, protein and lactose, applying Milko Scan 133B and 5200.

In order to define the hygiene quality of the milk researched, the somatic cell count (ks) was determined using Fossomatic, following the method of fluorescence.

The paper defines the following:

- Effect of the lactation period on the milk production and the content of fat, protein, lactose, dry matter and the somatic cell count per 1 ml of milk.
- Effect of the somatic cell count on milk production and

Table 1. Chemical composition of milk of the goats researched in successive lactation months

Lactation month	n	Fat (%)		Protein (%)		Lactose (%)		Total dry matter (%)	
		x	S_x	x	S_x	x	S_x	x	S_x
1 – February	18	5.27	1.45	3.06	0.44	4.70	0.23	13.45	1.65
2- March	25	4.23	1.63	3.13	0.55	4.65	0.21	12.61	1.87
3- April	30	4.08	2.17	2.76	0.32	4.46	0.20	14.04	2.25
4- May	30	4.37	2.42	2.73	0.27	4.43	0.20	14.32	2.45
5- June	30	4.65	1.34	2.79	0.34	4.47	0.20	12.80	1.54
6- July	30	4.29	1.51	2.68	0.33	4.44	0.25	12.11	1.78
7- August	30	3.44	1.20	3.03	0.49	4.23	0.19	12.31	1.50
8- September	30	4.56	1.47	3.81	0.82	4.39	0.36	13.61	1.89
9-October	30	5.50	1.51	4.50	0.93	4.28	0.47	15.24	2.28
10- November	13	5.49	1.92	4.90	1.02	4.27	0.23	16.41	2.28
Total		4.60	1.88	3.26	0.89	4.43	0.30	13.54	2.27
Significance of differences		1, 9, 10 – 2,3,4, 5,6,7,8[x] 2,3,4,5,6,7,8 - 7[x]		1,8,9,10 – 2,3,4,5,6, 7[x]		1,2 – 7,8,9,10[x]		9,10-1,2,3,4,5,6, 7,8[x]	

[x] $p \leq 0.05$

Table 2. Daily milk yield and the somatic cell count per 1 ml of milk in successive months of lactation

Lactation month	n	Daily yield (kg)		Somatic cells (thousand, cells/ml)			
		x	Sx	x	min.	max.	Sx
1-February	18	2,40	0.42	399.61	19	1616	480.01
2-March	25	2,50	0.36	355.68	40	2565	544.13
3-April	30	3.70	0.50	1142.72	113	6549	1327.26
4-May	30	3.50	0.58	1439.87	154	10261	2412.10
5-June	30	3.10	0.38	539.70	112	1835	374.91
6-July	30	2.70	0.36	499.13	10	2517	460.23
7-August	30	1.80	0.20	332.07	40	1142	251.59
8-September	30	1.90	0.18	379.73	32	2811	520.90
9-October	30	1.80	0.18	484.23	14	1980	480.33
10.- November	13	1,90	0.10	534.82	10	1820	395,28
Total		2,70	0,33	634,82	10	10261	1869,68
Significance of differences		3,4,5 – 6,7,8,9,10[x] 6 – 7,8,9,10[x]	1,2,5,	1,2,5,6,7,8,9,10-3,4[x]			

[x] $p \leq 0.05$

chemical composition.

To do so, the milk samples were divided into 4 experimental groups, depending on the somatic cell count per 1 ml of milk:

A – to 200 thousand ks

B – from 201 to 600 thousand ks

C – from 601 to 1000 thousand ks

D – from 1001 thousand ks

All the characters researched were verified statistically, calculating means, standard deviation, and the significance of the differences was determined with variance analysis using Statistica V.5.5.

RESULTS AND DISCUSSION

Lactation in goats of color improved breed was, on average, 288 days long February through November.

The daily color improved breed goat milk yield ranged from 1.80 kg to 3,70 kg (on average 2.70 kg), depending on the lactation month, of an average content of fat of 4,60 %, protein 3.26 %, lactose 4.43 % and total dry

Table 3. Production and chemical composition of milk and the somatic cell count

Group	Somatic cell count (thousand cells/1 ml)	Count of samples	Performance (kg)		Fat (%)		Protein (%)		Lactose (%)		Total dry matter (%)	
			x	S_x	x	S_x	x	S_x	x	S_x	X	S_x
A	< 200	82	2.20	1.16	4.66[a]	1.55	3.16	0.72	4.51[a]	0.27	13.03[a]	1.92
B	202 - 600	95	2.,30	1.01	4.73[b]	1.77	3.19	0.84	4.40	0.29	13.12[b]	2.19
C	601 – 1000	41	2.80	0.86	4,93	2.03	3.14	0.73.	4.42	0.38	13.72	2.23
D	1001 >	34	3.20[b]	0.89	5,36	2.12	3.20	0.97	4.36[a]	0.28	13,79[ab]	2.35

Means in columns followed by the same letters are significantly different ($p \leq 0.01$)

matter 12.54 % (Tables 1, 2). According to Tables 1 and 2, the lactation month significantly affected both the production and the content of respective nutrients. The highest yield was found in goats in the 3rd (3, 70 kg), 4th (3,50 kg) and 5th (3,10 kg) month of lactation. The milk obtained from the first and the last two months of lactation was richer both in fat, protein and dry matter in comparison to the milk obtained in the remaining months of lactation. The differences were statistically verified.

An average content of cell elements in the milk of the goats researched was 634,82 thousand cell elements/1 ml, ranging from 10 thousand to 10,261 thousand, depending on the lactation month (Table 2), which demonstrates that the hygiene quality of the examined milk was good. However, the maximum values of the somatic cell count are distressing, and thus the goats in which the highest content of cell elements in milk kept repeating should be culled from breeding in the future in order not to deteriorate the quality of the raw material obtained. Tietze et al. [10] in their research involving goats of white improved breed, found that the average somatic cell count in 1ml of milk ranged from 980 thousand to 1100 thousand/1 ml. Similar results were reported by Bernacka [1,2] in her earlier research into goats of white improved breed.

As it is shown in Table 2, the highest content of cell elements was found in milk obtained in the 3rd and 4th month of lactation (April and May). The differences were significant. The results correspond to the earlier results reported by Bernacka [1]. A higher level of ks at the beginning of lactation could have been due to incompetent feeding transition from winter to summer nutrition. Different results were reported by Danków et al. [4] and Litwińczuk et al. [7] who demonstrated the highest somatic cell count in milk obtained in autumn and winter, and the lowest – in spring.

Table 3 presents the effect of the somatic cell count on the milk production and chemical composition of goat milk. An increase in the somatic cell count in milk (groups C and D) was accompanied by an increase in the daily milk yield as well as its content of fat. The differences were significant. The present research showed no effect of the somatic cell count on the content of protein in goat milk. However there was noted a significant effect of the content of cell elements in milk on its content of lactose; the worse the cytological quality of milk, the lower its value. Analyzing the effect of the somatic cell count on the content of dry matter, it was found that the greater the count of cell elements, the greater the content of dry matter. The research by Strzałkowska et al. [9] which involved a white improved breed goat population demonstrated that an increased somatic cell count significantly affected the increased content of total protein, conditioned foremost by an increasing share of whey proteins. The highest concentration of lactose was found in milk (similarly to the present research) of animals of the lowest level of cell elements in milk, and the increase in the somatic cell count was accompanied by a significant decrease in the lactose concentration. A higher somatic cell count was accompanied by an increase in the content of fat, which resulted in a significant increase in the content of total dry matter in milk of these animals [9].

CONCLUSIONS

- Mean somatic cell count in 1 ml of color improved breed goat milk was about 634 thousand/ml, which indicates a good hygienic quality of milk and good health condition of goats' udders.
- Milk obtained in the 3rd and 4th month of lactation (April, May) was characterized with a higher somatic cell count per 1 ml in comparison to the milk obtained in the remaining months of lactation.
- The present research demonstrated a significant effect of the content of cell elements on the amount of obtained milk. The increase of the somatic cell count in milk was followed by its higher yield.
- A significant effect of the somatic cell count in goat milk on the proportional content of fat, lactose and dry matter was observed. The increase of the ks count was followed by the greater content of fat and total dry matter and the proportionally lower content of lactose.

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