

SOMATIC CELL COUNT IN SIMMENTAL BREED COWS MILK FROM FAMILY FARMS ACCORDING TO THE ORDER OF LACTATION AND LACTATION STAGES

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Abstract: Simmental breed cows although being dominant breed at the family farms in Croatia are not yet sufficiently adapted to the machine milking due to their improper udder index. The aim of this study was to determine the somatic cells count in Simmental cows milk according to the order of lactation and lactation stages. Survey has been conducted at four family farms and a total of 61 cow of Simmental breed from first to third lactation were enrolled in a study. The study results have shown that the maximum somatic cell count is in milk (LSCC=3.59) from the stables with have a downward floor, but not significantly higher in comparison to other ways of keeping the cows. However, the lowest udder hygiene was in the stables where the milking was performing by putting the milk into the cans and where cows were kept on the embroidery. The significant increase in LSCC ($P<0.05$) was determined in the third lactation in comparison to the second lactation. Given the stage of lactation largest LBSS was found in the second stage, which was significantly higher when compared to the first. Farms with a free way of keeping cows and milking cows in parlours are becoming more and more like guidelines in current milk production, and animals that reside in those farms have healthier udders and less micro-organisms in milk.

Key words: somatic cell, Simmental cows, order of lactation, lactation stages, family farms

Introduction

A good cow is a synonym for high-dairy, health and resistance and properly developed and functional udder. The most common udder disease is the mastitis with in dairy cattle breeding inflicted the greatest damage. Somatic cell count in milk is a recognized parameter for the evaluation of udder health in many countries, including the Republic of Croatia (*N.N., 102/2000*). Bacterial infection of milk glands is the main source of increased somatic cells in milk (*Antunac et al., 1997*). The authors stated that the milk with the somatic cell count above 400.000/mL and isolated pathogenic microorganisms in it is the mastitis milk. The consequences are reflected in reduced secretion of milk, changes in the chemical composition and physical, bacteriological and technological characteristics of milk. Percentage of separated cows due to udder health problems has been recently steadily increasing according to the *Roth et al. (1998)*. In the province of Schleswig - Holstein (Germany) on family farms this percentage is even 20.3%. Additionally, there were many subclinically sick animals, which leads to a significant financial losses in the milk production. With increasing order of lactation and lactation stages the somatic cell count in milk also increases, particularly in dairy cow breeds (*Bahr et al., 1995*).

Increase of somatic cells count through order of lactation in older cows can be explained by the aging process of udder tissues, and in the course of lactation that can be explained by the reduced amount of milk. With increasing time from calve the number of cows with poor udder health status is also being increased. Causes of the frequent udder illnesses with increasing age of the animals are errors during milking, feeding and keeping animal, disturbances in fertility, and general constitutional deterioration.

The aim of this study was to determine the udder health condition of Simmental cows, viewed through a somatic cell count in milk, according to the order of lactation and lactation stages. This breed, as breed of combined characteristics, regarding the number of animals belonging to it is the dominant breed on family farms in Croatia (around 70%).

Materials and Methods

The survey was conducted at four family farms in eastern Croatia whose basic features are shown in Table 1. The total of 61 Simmental breed cows from first to third lactation was enrolled in the study. Lactation period was divided into three stages: first stage covered the period from 7 to 100 day of the lactation production, the second stage covered the period from 101 to 200 day of the lactation production and third stage covered the period from 201 to 300 day of the

lactation production. All animals enrolled in the study were healthy, with the correct morphological udder appearance and at the time of the measurements they were not being treated with any veterinarian means of treatment.

Table 1. General features of the examined family farms

Farm	Total number of cows at the farms	Number of cows enrolled in the study	The way of animal keeping	Milking method
A	75	26	Free range keeping / bearing	Milking parlour 2x3
B	70	18	Free range keeping / downward floor	Milking parlour 2x3
C	38	8	Tying	Bucket machine milking
D	50	9	Free range keeping / bearing	Milking parlour 2x2

One minute before the start of milking for each cow enrolled in the study the preparation for milking has been made, and which was consisted of washing and disinfection of the teats and checks of the first jets of milk on a black background of the milking vessel. Measurements were made by using the mobile measuring device for the control of milk yield *Lactocorder* © (*WMB, Balgach, Switzerland*) which was connected to the dairy unit. Device has measured the milking quantity of milk in kilograms. During milking with *Lactocorder* the bottled sample of milk for chemical and microbiological analysis has been taken. All analysis of taken milk had been performed at the central laboratory for milk quality control in Krizevci, Croatia.

Obtained result which is related to the somatic cell count (SCC) in milk has been logarithmic transformed using the formula: $(\log_2 (\text{SCC}/100.000) + 3)$, and marked as LSCC (*Ali and Shook, 1980*). This value is afterwards used in the statistical procedure. The data were analyzed using the general linear model procedure of the StatSoft, Inc. *Statistica* (2008). Multiple comparison of mean values was made with the Post Hoc Test together with Fisher LSD method at the significant level of $P < 0.05$ and $P < 0.01$. The fixed linear model had the following layout:

$$Y_{ijkl} = \mu + F_i + OL_j + SL_k + e_{ijkl}$$

Where:

Y_{ijkl} = observed feature

μ = general average

F_i = fixed effect of i farm (1, 2, 3 and 4)

OL_j = fixed effect of j order of lactation (1, 2 and 3)

SL_k = fixed effect of k lactation stages (1, 2 and 3)

e_{ijkl} = random error

Results and Discussion

The results of study that are related to different ways of keeping Simmental cows on farms and dairy equipment used in these farms has shown certain differences (Table 2).

Table 2. Studied characteristics of the milk of Simmental cows in the surveyed farms (Least square means \pm Standard error of means)

Trait	Unit	Farm				Total
		1.	2.	3.	4.	
The amount of milk	kg	7.06 \pm 0.59	8.26 \pm 0.66	6.04 \pm 0.75	7.51 \pm 0.64	7.34 \pm 0.35
Milky fat	%	4.32 \pm 0.19	4.22 \pm 0.21	4.25 \pm 0.21	3.74 \pm 0.08	4.19 \pm 0.11
Milky proteins	%	3.74 \pm 0.07 ^a	3.64 \pm 0.08 ^A	4.02 \pm 0.11 ^{b,B}	3.66 \pm 0.07 ^a	3.74 \pm 0.04
LSCC	log	2.51 \pm 0.39	3.59 \pm 0.44	3.22 \pm 0.59	2.84 \pm 0.69	3.18 \pm 0.25
Microorganisms	1.000	70 \pm 21.61	78 \pm 20.51	99 \pm 16.25	69 \pm 12.74	79 \pm 11.35
Number of cows		26	18	8	9	61

^{a, b} $P < 0.05$ ^{A, B} $P < 0.01$

Although the differences in farms were visible in the amount of milk per milking, milky fat, LSCC and in the number of microorganisms, they were not significant. The only significant difference ($P < 0.01$) was recorded at the milky proteins. The largest LSCC was on the farm where the cows were held freely on the downward floor (LSCC = 3.59), and the highest number of microorganisms, as expected, was on the farm where the milk has been milked into the cans and milking was performed in the production stable. However, some studies (Mijić et al., 2003) have shown significant impact of different systems of milking and keeping cows on the udder health, but in Holstein breed cows. It is assumed that the Simmental cows are more resistant to these studied impacts. However, farms that are now used in the production of milk, should be certainly adjusted to a modern production, in which the udder health and hygiene of the milk should be among the primary objects of such production.

Table 3. Studied characteristics of the milk in Simmental cows according to the order of lactation (Least square means \pm Standard error of means)

Trait	Unit	Lactation		
		1.	2.	3.
The amount of milk	kg	7.17 \pm 0.42	7.29 \pm 0.75	7.60 \pm 0.63
Milky fat	%	4.26 \pm 0.21	4.14 \pm 0.13	4.19 \pm 0.19
Milky proteins	%	3.67 \pm 0.08 ^a	3.89 \pm 0.07 ^b	3.65 \pm 0.06 ^a
LSCC	log	2.73 \pm 0.45 ^a	2.73 \pm 0.44 ^a	3.92 \pm 0.35 ^b
Microorganisms	1.000	75 \pm 8.49 ^a	78 \pm 16.80	84 \pm 24.87 ^b
Number of cows		19	19	23

^{a, b} P<0.05

The amount of milk per milking is increased through the order of lactation, but not significantly (Table 3), where the greatest value was found in the third lactation (7.60 kg). Given the LSCC, significant difference (P<0.05) was found between the first and third and second and third lactation. These results confirm the hypothesis of this work that with the increase in lactation udder health impairs gradually. Similar results were found by some other authors who have studied udder health of Holstein cows in Germany (*Bahr et al., 1995; Naumann et al., 1998*). *Fall et al. (2008)* pointed out that with the increase of the order of lactation in dairy cows in Sweden the somatic cell count has also been increased regardless of whether it was a conventional or organic farm. *Klass et al. (2004)* stated that there are several reasons of this undesirable trend growth of the somatic cell count in milk, such as especially little udder, irregular shape of the udder and dirty udder.

Table 4. Studied characteristics of the milk in Simmental cows per lactation stages (Least square means \pm Standard error of means)

Trait	Unit	Lactation stages		
		1.	2.	3.
The amount of milk	Kg	8.12 \pm 0.59	8.12 \pm 0.72 ^a	6.49 \pm 0.48 ^b
Milky fat	%	3.96 \pm 0.24	4.17 \pm 0.19	4.30 \pm 0.15
Milky proteins	%	3.58 \pm 0.12	3.81 \pm 0.07	3.76 \pm 0.06
LSCC	Log	2.51 \pm 0.53 ^a	3.42 \pm 0.39 ^b	3.31 \pm 0.38
Microorganisms	1.000	68 \pm 24.43	71 \pm 6.21 ^a	100 \pm 19.01 ^b
Number of cows		13	19	29

^{a, b} P<0.05

The results that were observed by lactation stages (Table 4) have shown that the maximum value of somatic cells was recorded in the second stage (LSCC = 3.42) and was significantly higher (p<0.05) from the first stage of lactation (LSCC

= 2.51). Maximum number of microorganisms in milk was determined in the third stage of lactation, which was significantly higher ($P < 0.05$) when compared to the second stage. *Busato et al. (2000)* stated that in the first stage of lactation (up to 100 day) in some udder quarters of the Simmental cows in Switzerland 21.2% of the subclinical mastitis had been recorded, and the level had been increased in the second and third stage of the lactation up to 34.5 %. The authors mentioned various environmental factors that may affect the udder health and between them faintly aired and closed barns had been emphasized.

Conclusion

Based on this study, we have concluded that in Simmental cows largest LSCC is in the stables that have downward floor, but not significantly in comparison to other ways of keeping cows. However, the lowest udder hygiene was found in the stables where milking was performed by putting the milk into the cans and where cows were kept on the embroidery. The LSCC was significantly higher ($P < 0.05$) in the third compared to the other lactation, as well as the number of microorganisms in the third compared to the first lactation. Given the stage of lactation the largest LSCC was found in the second stage, which was significantly higher compared to the first stage. Farm with a free way of keeping cows and milking in parlours are becoming more and more like a guidelines in current milk production, and animals that reside in those farms have a healthier udders and less micro-organisms in milk. This is shown in this study on Simmental breed cows which is the dominant cow breed at the family farms in Croatia.

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Broj somatskih ćelija u mleku od krava simentalske rase sa porodičnih farmi prema laktaciji po redu i stadijumu

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Rezime

Krave simentalske rase, iako su dominantne na porodičnim farmama u Hrvatskoj, nisu u dovoljnoj meri adaptirane na mašinsku mužu zbog svog

nepovoljnog indeksa vimena. Cilj ove studije je bio određivanje broja somatskih ćelija u mleku simentalских krava prema broju laktacije po redu i stadijumu. Istraživanje je izvedeno na četiri porodične farme i ukupno 61 krava simentalске rase od prve do treće zaključene laktacije je bila uključena.

Rezultati istraživanja su pokazali da je maksimalni broj somatskih ćelija u mleku (LSCC=3.59) utvrđen na farmama sa podom pod nagibom, ali ne signifikantno viši u odnosu na ostale načine držanja krava. Međutim, najlošija higijena vimena je utvrđena u štalama gde se mleko stavljalo u kante i gde su krave držane na vezu. Signifikantno povećanje broja somatskih ćelija ($P<0.05$) je utvrđeno u trećoj laktaciji u poređenju sa drugom. U odnosu na stadijum laktacije, najveći LBSS je utvrđen u drugoj fazi laktacije, što je bilo signifikatno veće u odnosu na prvu fazu.

Farme sa slobodnim držanjem krava i mužom krava u izmuzilištima sve više postaju smernice u sadašnjoj, modernoj proizvodnji mleka, i životinje koje se drže u takvim objektima imaju zdravija vimena i manje mikroorganizama u mleku.

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