Slovak J. Anim. Sci., 46, 2013 (3): 93-99
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ISSN 1337-9984

CHANGES IN MILK YIELD AND COMPOSITION AFTER LAMB WEANING AND START OF MACHINE MILKING IN DAIRY EWES

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ABSTRACT

Stress from weaning may cause problems with milk ejection resulting in remaining milk in alveolar part of the udder and thus changing the milk composition. It is important to know current health status of the udder immediately after lamb removal. The aim of this study was to determine changes in milk composition during first three milkings after lamb weaning and especially the frequency of distribution of ewes differed by somatic cell count (SCC). The study was performed on 36 lactating dairy ewes of two breeds - Tsigai and Improved Valachian within first three milkings after their lambs were weaned. Totally, 108 milk samples were collected for analysis. On the basis of SCC the animals were divided into three categories: low – SCC < 0.5×10^6 cells.ml^{-1}, middle – 0.5×10^5 < SCC < 10^6 cells.ml^{-1}, high – SCC > 10^6 cells.ml^{-1}. There were 64 percentages of ewes classified to low SCC category, 8 % - to middle and 28 % - to high SCC category at first milking after weaning. The average SCC was 5.39 ± 0.70 $\log_{10}$.ml^{-1} at first milking, 5.66 ± 0.73 $\log_{10}$.ml^{-1} at second, 5.68 ± 0.65 $\log_{10}$.ml^{-1} at third and 5.26 ± 0.61 $\log_{10}$.ml^{-1} at fourth milking. Significant negative correlation of SCC with lactose content (r = -0.467) and total milk yield (r = - 0.196) and order of milking and lactose (r = - 0.319) was found out. In conclusion, higher percentage of ewes with high SCC during first milking indicates health problems of the udder at the end of suckling period, and increasing SCC during next two milking could by caused by stress from weaning and starting of machine milking.

Key words: dairy ewes; weaning; somatic cells; stress

INTRODUCTION

Traditionally, dairy breed lambs are allowed to suckle after birth and the milking period for ewes begins after the lambs are weaned (Jaeggi *et al.*, 2008). In our traditional management lambs suckle 40-70 days after birth. When ewes are not exclusively machine milked immediately post-partum, the longer they remain in contact with their lambs during the suckling period, the more difficult it is for them to adapt to exclusive machine milking following weaning (Gargouri *et al.*, 1993; Labussière, 1988; 1978). Thus, the lamb removal from their mother and shift from suckling to machine milking could be considered as certain stress factors suppressing oxytocin release coming from the lost of lambs in combination with the new milk removal manner (Negrão and Marnet, 2003). Not completely removed milk from the udder due to stress response causes reduction in milk yield and possible negative impact on immunity resulting in higher incidence of udder problems like mastitis (Paape *et al*., 2002).

Somatic cells in milk are considered as an effective indicator of udder health (but also other factors are involved in their count in milk: parity, stage of lactation, season, herd, handling of ewes, diurnal variation (Gonzalo *et al.*, 1994; Gonzalo and San Primitivo, 1998), oestrus, vaccination, change in diet and change in the milking routine (Paape and Contreras, 1997; Barkema *et al*., 1998). Many authors (Lafi, 2006; Bergonier and Berthelot, 2003; Fthenakis, 1994) reported that over 80 % of ewes which had somatic cell count (SCC) over 10^6 cells per ml, had positive reaction on California

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Received: December 4, 2012
Accepted: August 20, 2013

mastitis test.

If machine milking not working and maintained correctly, is considered as adverse factor on the udder health, due to contamination of the teat skin, changes in teat condition, the penetration and spread of bacteria into the teat canal, and the inconsistent emptying of the udder (Hamann, 2000). The lambs' mouths and milkers' hands are the sources of milk contamination (Albenzio *et al.*, 2003). Suckling is still considered as positive factor in the prevention of mastitis as compared with machine milking (Krohn, 1999).

Hypothesis of the work was that lambs weaned from their mothers will change the milk composition as a possible negative effect of machine milking on udder health or/and stress from weaning due to the effect of milk removal disturbances. The aim of the experiment was to study the changes of milk composition during first three milkings after lamb weaning and mainly the frequency of distribution of ewes differed by SCC.

MATERIAL AND METHODS

The study was performed on experimental farm of the Animal Production Research Centre in Nitra, Slovakia. 36 lactating dairy ewes of two breeds - Tsigai (TS) and Improved Valachian (IV) were use in this investigation. Involved ewes were at their 3rd-9th lactations. The ewes were lambing from 2nd to 27th of February 2011 and were housed together with lambs and managed identically. The lambs were weaned from their mothers at 10th of April, and machine milking started twice daily on rotary parlour since next morning. Milking machine was set to provide 160 pulsations per minute at the ratio of 50:50 with a vacuum level of 38 kPa.

The experiment was performed during first three continuous milkings after lamb weaning and one control milking two weeks later (order of milking – OM). The first morning milking was performed approximately 12 hour after lamb weaning. Milk samples were collected individually from each ewe. Totally 108 samples from 36 ewes were collected during experimental milkings. Total milk yield (TMY) was recorded using electronic jars with 2-wire compact magnetostrictive level transmitters (NIVOTRACK, NIVELCO Ipari Elektronika Rt, Budapest, Hungary) connected to computer. Collected samples of SCC were analyzed on Somacount 150 (Bentley Instruments, Inc., Chaska, Minnesota). Milk components were analyzed by MilkoScan FT120 (Foss, Hillerød, Denmark).

According to Lafi (2006), Bergonier and Berthelot (2003), and Fthenakis (1994) animals on the basis of SCC were divided into the three categories (low – SCC $< 0.5\times10^6$ cells.ml^{-1}, middle – $0.5\times10^6 <$ SCC $< 10^6$ cells.ml^{-1}, high – SCC $> 10^6$ cells.ml^{-1}) to study the frequency of distribution of animals in selected category throughout experimental period. Also on the basis of above-mentioned SCC category at first milking only, three groups of animals were formed to study the frequency of animal distribution within group at next two milking and control milking.

Statistical evaluation of milk composition data from all four milkings was done by a One-Way ANOVA using Scheffe`s post-hoc test with order of milking (OM) as a factor. Before calculation the real data of SCC were transformed by log function. Relation between OM and TMY, milk composition at first three milkings was studied using regression analysis. Also, relation between SCC and TMY and milk composition was calculated with regression analysis – Linear model. Analyses were performed using IBM® SPSS® Statistics (version 20, IBM Corp.).

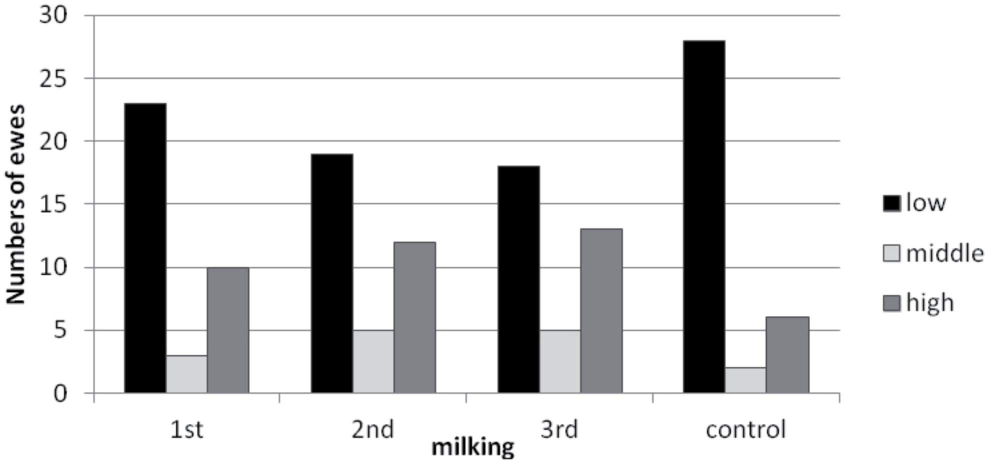

Fig. 1: Numbers of ewes in SCC categories during three milkings after weaning

RESULTS AND DISCUSSION

The effect of OM on all studied parameters is shown in Table 1. The most significant changes throughout three milkings were recorded for fat ($p < 0.001$) and lactose ($p < 0.01$) content. Fat level rapidly increased from 3.07 % at first milking to 7.30 % at third one. After two weeks during control milking the fat level slightly decreased. Low fat content at first milking after lamb weaning may be caused by the lack of transfer of milk fat from the alveoli to the cistern due to possible stress from weaning of lambs (McKusick *et al.*, 2001, Antonič *et al*., 2013) and/or from new milk removal (Tančin and Bruckmaier, 2001). The stress effect on ewe's response during first three milking is evident from TMY changes, when compared with control milking (Table 1). Explanation may be related to the stress effect causing the inhibition of oxytocin release during first milking as shown in ewes (McKusick *et al.*, 2001, Kulinová *et al*., 2012) or cows (Tančin *et al*., 2001). Inefficient removal of milk from alveoli significantly reduced total fat content in milk (Antonič *et al*., 2013).

SCC during first milking after lamb removal can be considered as an indicator of health status of the udder during the period of suckling only. There were 64 % of ewes classified to low SCC category, 8 % to middle and 28 % to high SCC category at first milking after weaning (Fig. 1 – column 1st milking). The average SCC was $5.40 \pm 0.69 \log_{10}.ml^{-1}$. At second milking there was increase in SCC to $5.66 \pm 0.73 \log_{10}.ml^{-1}$, with next increase at third milking to $5.68 \pm 0.65 \log_{10}.ml^{-1}$ (Fig. 1). The trend of increase in SCC was also observed at the end of sucking (Margetín *et al*., 1995; McKusick *et al*., 2001) and milking periods (Margetín *et al.*, 1995). At control milking SCC decreased to $5.27 \pm 0.61 \log_{10}.ml^{-1}$ (Table 1). It may indicate the adaptation of ewes to machine milking – increase in number of ewes at low SCC category (Fig. 1).

From the health point of view the healthy udders regularly show a SCC value lower than 500 000 cells per ml ($5.7 \log_{10}.ml^{-1}$) without the effect of lactation period (Bergonier and Berthelot, 2003). The above mentioned authors pointed out that subclinical or chronically infected udder usually exceed one million cells per ml.

Table 1: The effect of order of milking on studied parameters

		Descriptive		ANOVA	
	Order of milking	Mean	Std. Dev.	F	*p-value*
TMY [l]	1st	0.65	0.34	2.259	0.084
	2nd	0.62	0.27		
	3rd	0.53	0.24		
	control	0.70	0.27		
Fat [%]	1st	3.07a	1.96	40.626	0.000
	2nd	5.43b	2.00		
	3rd	7.30c	1.92		
	control	6.84c	1.12		
Proteins [%]	1st	5.15	0.49	1.361	0.257
	2nd	5.19	0.43		
	3rd	5.30	0.57		
	control	5.35	0.44		
Lactose [%]	1st	5.27a	0.23	13.498	0.000
	2nd	5.25a	0.24		
	3rd	5.07b	0.25		
	control	4.97b	0.21		
SCC [$\log_{10}$]	1st	5.39	0.70	3.181	0.026
	2nd	5.66	0.74		
	3rd	5.68	0.66		
	control	5.27	0.61		

a,b,c – values within the same column with different letters are different at the level $p < 0.00$

Thus, our data demonstrate relatively high percentage of ewes with probably infected udder immediately after lamb weaning and during the period of shift to machine milking, but SCC was decreased during control milking. Our conclusion is coming from the results of Lafi (2006), who reported that from infected mammary gland only 9 % of samples had SCC less than 1×10^6 cells/ml, other ones had SCC over 10^6 cells/ml.

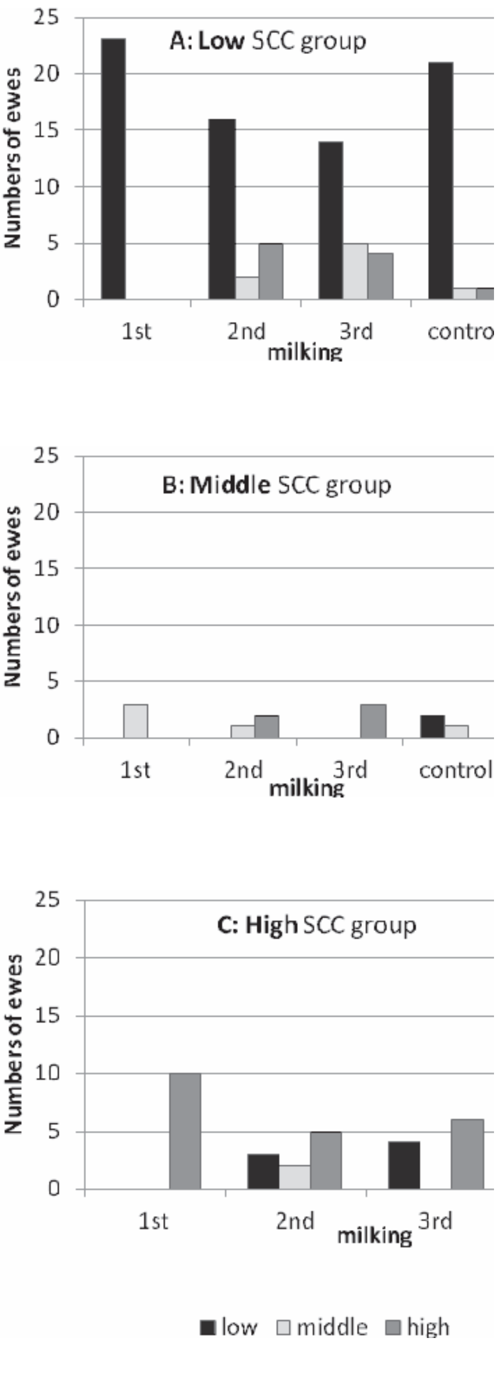

Fig. 2: Frequency of distribution of SCC categories within the groups differed by SCC during first milking

First milking could be considered as certain status of udder health during suckling period. Increase in SCC during next two milking could be related to stress response. As compared with short period of milking after weaning, the SCC status was improved two weeks later. Even the number of ewes in low category was higher during control milking than during first milking.

The changes in SCC within the each group formed at first milking (Fig. 1) are shown in Figures 2 (A-C). There were 23 animals in low SCC group at first milking (Fig. 2 A). During next two milkings the SCC was changed in the negative direction – the number of animals with low SCC was reduced. The fact that at control milking the number of ewes with low SCC increased again probably indicates stress effect from lamb weaning at the beginning. Three ewes were found out in the middle SCC group (Fig. 2 B) and 10 ewes were in the high SCC group (Fig. 2 C). Similarly, as it was in the low SCC category, there were also changes in SCC during second and third milking. It is not easy to explain the changes in SCC within each group because no bacterial evaluation of samples was done. The minimal changes in SCC within middle and high groups during first three milkings and at control milking could indicate possible problems with udder health caused by suckling. It was found out that almost 21 % of duct samples and 8 % of milk from udder cisterns are contaminated by bacteria during the period of suckling (Mavrogianni *et al.*, 2007), which could influence the further development of the udder after lamb weaning. The colonisation of teat duct could be eliminated by the immune system of ewes, but under the stress response the immunity of ewes (machine milking and lamb removal) is weaker, what could cause the health problem of the udder during second and third milking. As is shown on the 4^{th} column in each Figure 2 A-D, the SCC within each group changed in the positive direction in control milking – the numbers of ewes with middle and high SCC were reduced.

Albenzio *et al.* (2003) have found that within 4 week lasting experiment there was higher SCC at machine milking of ewes when compared to suckled ones, as a consequence of higher bacterial positive samples at machine milking. On the other hand, in some cases lamb suckling could be responsible for increased SCC (Bergonier *et al.*, 1994; McKusick *et al.*, 2001). The risk is mainly related to "milk-robber" lambs, as they can spread microorganisms by suckling more ewes (Bergonier and Berthelot, 2003).

Although, regression analysis between OM and SCC ($r = 0.167$; $p = 0.085$) (Fig. 3 A) and ANOVA results ($p = 0.164$) did not significantly confirm increase in SCC during first three milkings, on the basis of analysis of regression lines between OM and lactose ($r = -0.319$; $p < 0.001$) (Fig. 3 B), SCC and lactose ($r = -0.467$; $p < 0.001$) (Fig. 3 C) we can indicate some problem

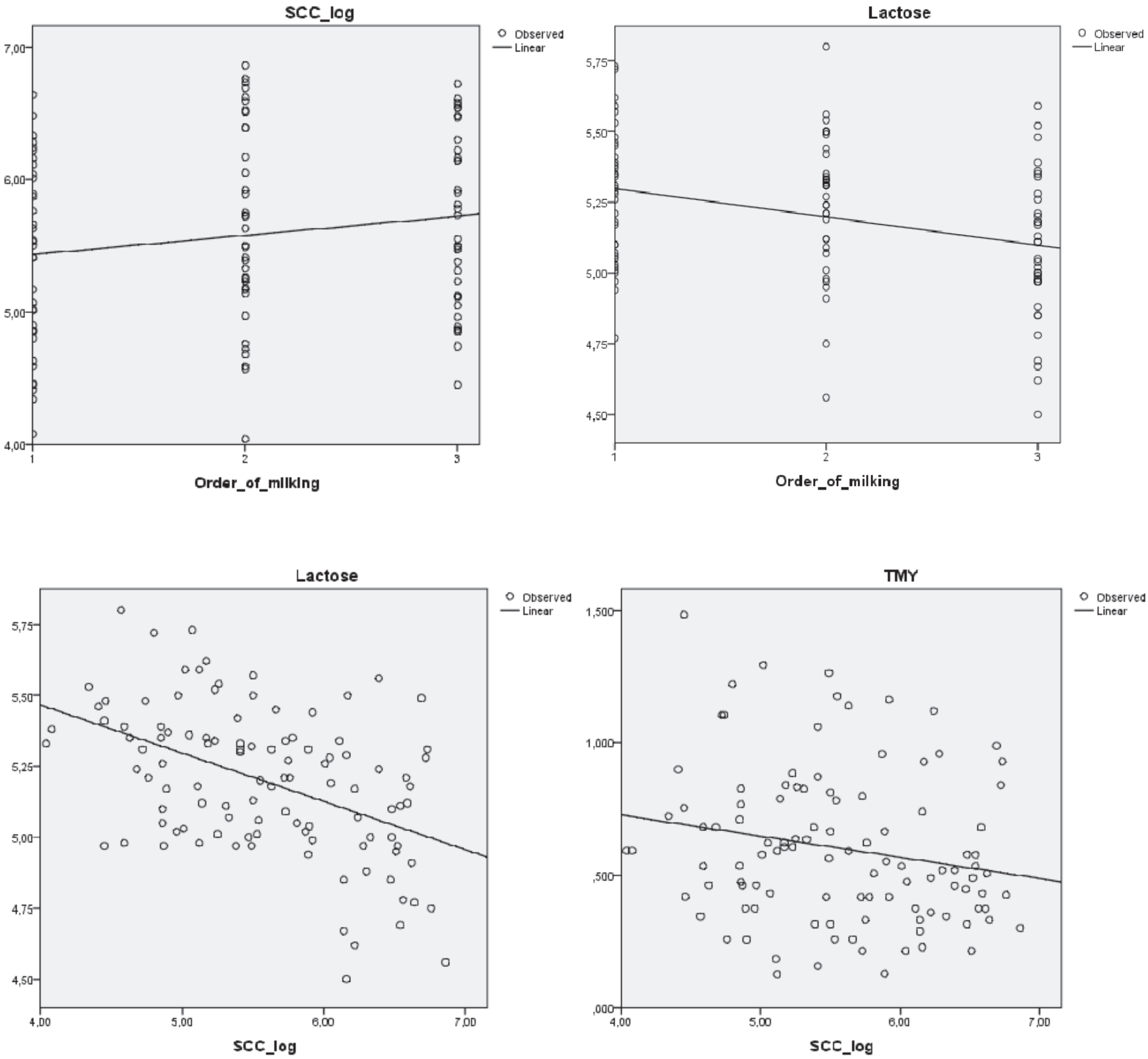

Fig. 3: Regression lines between OM and SCC (A) and Lactose content (B), and between SCC and Lactose content (C) and TMY (D)

with udder health. SCC had significant effect on TMY (r = - 0.196; $p < 0.05$) (Fig. 2 D). Similar correlation between SCC and lactose and TMY was found by Margetín *et al.* (1994, 1996) during milking period of TS and IV. According to El-Tahawy and El-Far (2010) and Gonzalo *et al.* (2002), an increase in SCC caused a decrease in daily milk production and elevated risk of subclinical mastitis.

CONCLUSION

In conclusion, immediately after weaning there was relatively high percentage of ewes with high SCC indicating health problem of the udder during suckling period. Increase in SCC during next two milkings could by caused by stress from weaning and starting of machine milking. The SCC in milk during control milking supports this conclusion.

ACKNOWLEDGEMENT

This study was funded by the Operational Program for Research and Development, project "MLIEKO 26220220098" of the European Regional Development Fund.

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