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The effect of teat cup liner type on the teat condition of Holstein primiparous cows

Tina BOBIĆ[1]*, Dario ANDRAŠIĆ[2], Pero MIJIĆ[1], Maja GREGIĆ[1], Mirjana BABAN[1] and Vesna GANTNER[1]

[1]Josip Juraj Strossmayer University of Osijek, Faculty of Agrobiotechnical Sciences Osijek, Vladimira Preloga 1, 31000 Osijek, Croatia, *correspondence: tbobic@pfos.hr

[2] Belje d.d., Svetog Ivana Krstitelja 1a, 31 326 Darda, Croatia

Abstract

The objective of this study was to test the effect of two different teat cup liners (difference in: head diameter, length, body shape and with / without of air vent) on the teat condition score after milking (hyperkeratosis, color and swellings) and somatic cell count (SCClog) on the Holstein primiparous cows. The cows in control group had significantly ($P<0.0001$) better teat condition, and lower somatic cell count compering to the cows in experimental group. The obtained results indicate that liner type affects teat skin condition and somatic cell count, and therefore the risk of mastitis.

Keywords: Holstein, primiparous cows, somatic cell count, teat condition, teat cup liner types

Introduction

The mechanical forces during machine milking result in changes in teat-end tissue (Neijenhuis, 2004). Therefore, it is crucial to achieve high-quality machine milking that will not cause congestion and edema on the teat tissue of the cow's udder. Upper recommended limit for the milking induced changes is 5% of the thickening or thinning of the teat tissue thickness (Hamann and Mein, 1990; Zeccone et al., 1992). The changes in teat tissues, particularly in the skin of the teat-end, increase the risk of new mastitis infections (Hamann et al., 1994). Somatic cell count (SCC) as the subclinical mastitis indicator, also could be indicator of cows' health and milk quality (Tsenkova et al., 2001). Reinemann (2001) stated that the teat condition scoring could be a valuable, cost effective tool for dairy management optimization. Quick detection and removal of the cause of the poor teat condition will enable the reduction of the somatic cell counts and frequency of the clinical mastitis, simultaneously saving time and treatment costs (Taylor, 2006). Teat condition (hyperkeratosis) is related to the type of mechanical milking conditions applied to the teat and to the length of time per day that teat cups are attached to teats (Mein et al., 2003). Furthermore, the teat cup liner is the only part of the milking machine that has direct contact with the cow, and liner compression have a role in increasing milking

speed by reducing teat tissue congestion during milking (Davis et al., 2000; Gleeson et al., 2004; Reinemann et al., 2008). In order to assess the effects of milking machines, milking management or environment on teat tissue as well as on the risk of new intra-mammary infections classification of bovine teat condition could be used (Reinemann et al., 2001). Therefore, objective of this study was to test the effect of two different liners on the teat condition score after milking (hyperkeratosis, color and swellings) and somatic cell count (SCClog).

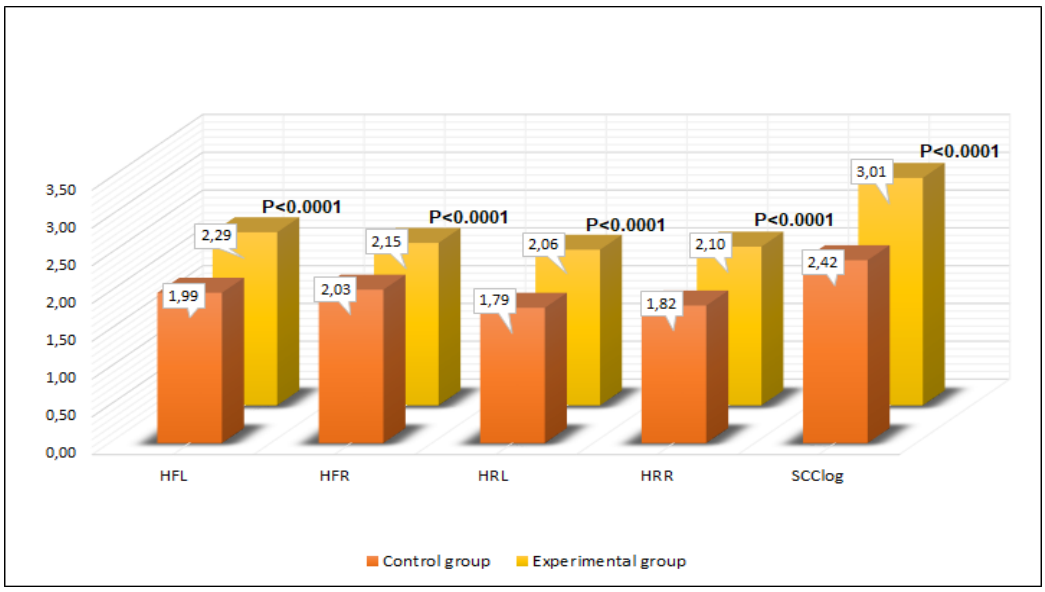
Materials and methods

Research was done on the 64 Holstein primiparous cows in the commercial dairy farm with voluntary robotic milking system, from November, 2016 to March 2017. From the first day of lactation and until the end of the research (5 months), the cows were separated into two groups (control, n = 31 and experimental, n = 33). Cows in each group were milked with two milking robots with pulsation ratio 60:40, vacuum level 45-47 kPa, and automatic clusters removing when milk flow < 200 g per min (whole udder). The liner type I was used in control group, while the liner type II was used in experimental one. The liner type I had 20 mm bore width, head diameter 58 mm with air vent and total length 310 mm, shape of body was triangular. The liner type II had 20 mm bore width, head diameter 50 without air vent and total length 160 mm, shape of body was round. The evaluation of the teat condition (hyperkeratosis, colour and swellings) for all four teats was done every four weeks, few days before regular milk recording, in the first 10 seconds after removal of the cluster. The hyperkeratosis evaluation of the cows, for each teat (hyperkeratosis of the front left/right and rear left/right teats (HFL, HFR, HRL, HRR)) was made according Mein et al. (2003), cows without callous (keratin ring) received a score 1, those who had formed and clearly visible callous a score 2. Cows that have rough callous with hyperkeratosis received a score 3, while cows with very rough hyperkeratosis and radial cracking received score 4. Evaluation of swellings and color of the teats (swellings of the front left/right and rear left/right teats (SFL, SFR, SRL, SRR), color of the front left/right and rear left/right teats (CFL, CFR, CRL, CRR) made by Zecconi et al. (2005) and NMC (2007). Teat without the ring, little or no swelling received score 1, teat with visible swelling or palpable thickened ring received score 2. Teat with normal and pink skin after milking get score 1, and those who had red and irritated get score 2. The somatic cell count was collected in regular milk recording and logarithmic transformed (SCClog) according to Ali and Shook (1980). The effect of different type of liners on analysed traits was studied using the linear model. The significance of the differences between the means of the analysed traits within the analysed groups was tested by Scheffe's method of multiple comparisons using the MIXED procedure of SAS (SAS Institute Inc., 2000).

Results

The somatic cell count (SCClog) was significantly ($P<0.0001$) higher in the cows in experimental group compering to the cows in control group (Figure 1). The results of the analysis of the level of teat end hyperkeratosis are shown at Figure 1. The cows

in control group had significantly (P<0.0001) lower scores for each teat compering to the cows in experimental group.



HFL, HFR, HRL, HRR –hyperkeratosis of the front left/right and rear left/right teats; SCClog - somatic cell count on log scale.

Figure 1. Scores for teat-end hyperkeratosis and somatic cell count depending of study group

Table 1. Least square means (LSM) of teat condition (swelling and color) in regard to study groups

Trait	Control group	Experimental group	P
SFL	1.02	1.08	P<0.0001
SFR	1.09	1.21	P<0.0001
SRL	1.07	1.09	P<0.05
SRR	1.08	1.11	P<0.0001
CFL	1.02	1.08	P<0.0001
CFR	1.04	1.15	P<0.0001
CRL	1.07	1.17	P<0.0001
CRR	1.01	1.07	P<0.0001

SFL, SFR, SRL, SRR – swellings of the front left/right and rear left/right teats; CFL, CFR, CRL, CRR – color of the front left/right and rear left/right teats.

Also, front teats had higher level of teat end hyperkeratosis compering to rear teats in both study groups. In terms of the color and swelling traits of the teats, cows in control group had significantly ($P<0.0001$; $P<0.05$) better condition (lowest number swollen or rad and irritated teats) compering to the cows in experimental group (Table 1).

Discussion

Reinemann and Mein (2011) concluded that selection of a liner and appropriate vacuum level and pulsation settings are fundamental for balanced milking, which need to be quickly, gently and completely. Rasmussen et al. (1998) concluded that special attention should be given to first lactation cows when liner type is selected for a herd. Same authors, based on the analysis of the effect of two different liners, observed that the frequency of red and blue discolored teats immediately after milking was higher in the group of cows milked with liner mouthpiece cavity heights of 30 mm in comparison to the group of cows milked with liner mouthpiece cavity heights of 18 mm. In this research, the wider and longer body of the liner, and its triangular shape in liner type I, it seems that its appearance more suited to the cows in the control group. Similarly to results of this research, Schukken et al. (2006) determined that the level of hyperkeratosis of the teat ends in the cows milked with liners type I was lower than in the cows milked with liners type II. Neijenhuis et al. (2001) as well as de Pinho et al. (2012) concluded that increasing teat-end callosity thickness increases the incidence risk of clinical mastitis. Furthermore, Haghkhah et al. (2011) reported that the cows with injured teats have significantly higher SCC in comparison to the cows with normal teats. Similarly, Singh et al. (2014) determined significantly higher SCClog in the dairy bovines with discolored teat skin, cracked and with very rough teat ends in comparison to the dairy cows with teats with normal skin and smooth teat ends. Guarin et al. (2017) are also confirm the relationship between increases SCC in udder quarters with higher hyperkeratosis. Since a significantly ($P<0.0001$) lower level of hyperkeratosis and a lower SCClog also have been established in this research, thus confirming the results of the aforementioned authors. In this research, liner type II caused more swelling as well as more red and irritated teats in primiparous cows in comparison to liner type I. It seems that liner type I had better and preferred features for the teat tissue of the cows used in this study. The results indicate that using a liner type I can contribute to a better teat condition and a lower risk of mastitis.

Conclusions

The results from this research indicate that liner type significantly affects all analysed traits and consequently the risk of mastitis. As well, the results confirms the importance of preventing excessive keratin production and tissue damage of the cow's teats, which is directly related to somatic cells and mastitis risk.

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