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Effects of Tail Shaving on Milk Quality and Udder Cleanliness in a Dairy Farm

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Abstract: The objective of this study was to assess effects of tail shaving on milk quality and udder cleanliness in a dairy farm. About 216 Holstein dairy cows equally divided to tail shaved: S and intact: C group. After 30 days, quarter milk lactose concentration, SCC, CMT, udder cleanliness and teat end scores were recorded. Tail shaved cows were cleaner ($p = 0.047$) than C group for the udder cleanliness score. The teat end scores for the S group were significantly lower ($p = 0.001$) than C group. Total CMT score significantly ($p = 0.01$) declined in S group compared with C group while SCC did not show significant difference ($p = 0.940$) between S and C groups. Milk lactose concentration was significantly higher ($p = 0.01$) in S group than that in C group. Results suggest that tail shaving can improve udder hygiene indices and can be considered routinely during lactation period. However, its long-term effects need to be investigated.

Key words: Mastitis, cleanliness, dairy cows, tail shaving, routinely, Iran

INTRODUCTION

Mastitis, either clinical or sub-clinical is recognized as a cause of major economic loss to the dairy industry (Seegers *et al*., 2003; Halasa *et al*., 2009). Mastitis causes a reduction in the quantity/quality of milk output (Hogan, 2005) increased veterinary expenses due to excessive use of medications (Stott and Kennedy, 1993), increased risk of residues in the milk/meat and consequently the possibility of damage to public health (Beck *et al*., 1992; Friedman *et al*., 2004; Hogan, 2005), premature culling of genetically superior cows and reduced genetic improvement (DeGraves and Fetrow, 1993; Leslie and Dingwell, 2000), reduction of weaning weights in calves with infected dams (Watts *et al*., 1986; Newman *et al*., 1991) changes in the hygienic and compositional quality of milk and impairment of the technological properties of milk (Paape *et al*., 2000; Wielgosz-Groth and Groth, 2003) and decreased reproductive performance (Schrick *et al*., 2001; Gunay and Gunay, 2008).

Additional loss to the producer is results from confiscation of suspected milk followed by imposition of heavy penalties (Friedman *et al*., 2004). Bovine mastitis is broadly classified as either contagious or environmental based on their epidemiological association with the disease (Rossitto *et al*., 2000). The primary reservoir for contagious pathogens is the udder of infected cows and the primary route of transmission is through contact with contaminated milking equipment, hands of the milker or towels used to clean teats of multiple cows (Schreiner and Ruegg, 2002a). Therefore, it is likely that the mastitis situation could be improved by improving milking procedures and hygiene (Haltia *et al*., 2006). The reservoirs for environmental pathogens are water, manure and dirt present in the environment. Cows often come in contact with environmental mastitis pathogens in their walkways or housing areas. When the teats and udder are allowed to become wet and dirty, large numbers of these bacteria have the opportunity to infect the udder (Schreiner and Ruegg, 2002a).

Some farmers and researchers believe that shortening tails improves milking hygiene and allows for more thorough premilking udder preparation. The use of tail docking as a routine dairy farm management tool apparently originated in New Zealand and 35% of Victorian dairy farms responding to a survey reported that

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they routinely docked tails (Barnett *et al*., 1999). Many dairy farmers have adopted the use of tail docking because of the belief that it improves milking hygiene and milker comfort during milking (Tom *et al*., 2002). To date, these perceptions have not been scientifically validated. Tucker *et al*. (2001) evaluated the effect of tail docking on cow cleanliness and Somatic Cell Count (SCC) in a single herd, housed in free stalls over an 8 weeks period. They found no differences in cleanliness scores and SCC between docked and intact animals. In another broad investigation in eight Wisconsin farms, Schreiner and Ruegg (2002a) did not identify differences in udder or leg hygiene, SCC and the rate of sub-clinical mastitis caused by contagious, environmental or minor mastitis pathogens or milk quality that could be attributed to tail docking.

Other researchers have examined several potential adverse affects of tail docking (Stull *et al*., 2002). Important welfare issues that have been examined have included pain caused by tail docking and changes in fly avoidance behavior, immune responses and the levels of circulating plasma cortisol (Petrie *et al*., 1995; Eicher *et al*., 2000, 2001; Schreiner and Ruegg, 2002b; Tom *et al*., 2002). Cows can use their tails to control flies (Matthews *et al*., 1995; Phipps *et al*., 1995; Eicher *et al*., 2001) and to communicate information to other cattle and handlers (Albright and Arave, 1997). However, cows sometime defecate directly onto their tails and tails can also become contaminated with feces and other debris when cows lie down. Tail hair that becomes contaminated with manure may cross-contaminate the body and udder of the cow and her herdmates. Clipping the large portion of the body hairs especially the hairs of udders and tail is thought to keep cows cleaner but this idea has never been objectively tested. The objective of this study was to determine the effect of tail shaving on SCC, California Mastitis Test (CMT) and udder cleanliness in a commercial dairy herd.

MATERIALS AND METHODS

An Iranian dairy producer who had decided to shave tails of his Holstein herd agreed to participate in this study. The cows were housed as a single group in a barn with free stalls. Cows had access to a small, concrete-floored covered outdoor area.

Bedding was replaced once a week and a flush system was used to clean the barn. This study was reviewed and approved by the University of Razi Animal Care and Use Committee. Total 216 Holstein cows were assigned to two treatments; control (C; unshaved, n = 108) and shaved (S; n = 108). The tails of animals allocated to S were brushed and the hair was clipped completely. Tails of animals allocated to C remained intact. The mean lactation number, milk yield and preshaving SCC, CMT and teat end score did not differ in shaved and unshaved cows. This suggests the sample of shaved and unshaved cows were biologically indistinguishable. After 30 days, quarter milk samples were collected by university personnel and sent to the National milk quality control laboratory (Mabna Lab, Karaj, Iran) for assaying lactose and SCC while CMT was done during sampling. Concentration of lactose was determined by infra-red spectroscopy (Milko-Scan 605; Foss Electric, 3400 Hillerod, Denmark). The SCC were determined by the fluoro-opto-electronic method (Fossomatic; Foss Electric, 3400 Hillerod, Denmark).

The CMT was conducted as described by Schalm and Noorlander (1957). Scores were recorded based on a scale: 0: negative or trace; 1: weak positive; 2: distinct positive or 3: strong positive depending upon the degree of precipitate or gel formation. Individual quarters were considered positive if they scored either one and two or three. A cow was considered positive if one or more of her quarters scored two or three. However, all cows with blind quarters were deleted before calculating percent positive reaction by individual quarters.

Cow cleanliness was assessed weekly during 4 visits to the farm after tail shaving. During each visit, two trained researcher assessed udder cleanliness scores during the collection of milk samples according to the method of Schreiner and Ruegg (2002a). Udders were each given a subjective score based upon the following criteria: 1: completely free of dirt or has very little dirt; 2: slightly dirty; 3: mostly covered in dirt; or 4: completely covered, caked on dirt.

Scoring of teat end condition was performed by means of palpation and visual inspection and was completed immediately after milking and before postmilking teat disinfection weekly throughout the experiment. Teat end score was evaluated on quarter level for all cows based on the scoring system that proposed by the Teat Club International for research purposes (Mein *et al*., 2001). Teat ends were scored in following categories and scored continuously on a 4 point scale. A score of 1 was considered smooth with no ring; 2, smooth or slightly rough ring; 3, raised and rough ring; 4, very rough ring.

The same persons evaluated cleanliness and teat end condition throughout the study and were trained before the study period. A high correlation was found between scores of two observers (B. Sohrabi and R.A. Rahmati Asl; Pearson's correlation, r = 0.95). Recommended mastitis control programs were in effect in this farm which had a weighted SCC average of 210,000 cells mL^{-1}. The major causes of mastitis in these herds tended to be environmental pathogens. All herds practiced pre- and postmilking teat dipping with a sanitizing solution. All

Table 1: Descriptive statistics by treatment at the beginning of the experiment

Prameters	Shaved tail group	Control group	p-value
Milk production	9.50±0.43	12.60±0.24	0.062
DIM	65.35±6.86	73.62±2.20	0.080
Parity	2.44±0.09	2.25±0.10	0.190

cows were infused with a dry cow antibiotic preparation at the time of drying off. All cows in the study were milked in parlors with automatic take-offs.

Data analysis: Randomization of the animals was checked by comparing mean production data, parity and DIM prior to the start of the study between groups using Wilcoxan test. The four measures of cow cleanliness and teat end score were analyzed by least squares analysis of variance using the General Linear Model (GLM) procedure of SAS version 8.02 (SAS Institute Inc., Cary, NC). Teat end score and udder cleanliness data were analyzed using a Wilcoxan test. Comparisons between group means of SCC, CMT and lactose concentration were made using Wilcoxan test analysis. Results are expressed as mean±standard error of the mean (SEM) (Table 1). Pearson's correlation coefficients (r) as indicators of the strength and direction of linear relationships among different variables were considered. All analysis was carried out using SAS version 8.02 (SAS Institute Inc., Cary, NC) and the probability of 0.05 or below was considered to be statistically significant.

RESULTS AND DISCUSSION

Udder cleanliness was affected significantly following shaving. Tail shaved cows were cleaner by a full point on a four point scale ($p = 0.047$) than Control cows for the udder cleanliness (Fig. 1 and Table 2). The distribution of teat end scores was 72.03 and 43.73% (score 1); 7.57 and 15.59% (score 2); 3.10 and 5.04% (score 3) and 0.77 and 1.07% (score 4) for S and C group, respectively. Mean teat end scores were significantly ($p = 0.001$) decreased in S group in comparison to C group (Table 2). Among of all udder hygiene indices, teat end score ($p = 0.003$) and CMT score ($p = 0.05$) showed significant positive correlation with udder cleanliness score (Table 3). The former was more strongly correlated to udder cleanliness score.

Total CMT score significantly ($p = 0.01$) declined two times in S group compared with C group while SCC did not show significant difference between S and C groups. The CMT scores of total 427 quarters in S compared with C groups were negative (88.5 ver. 80.0%), one (6.0 ver. 11.5%) and two or three (4.9 ver. 11.5%), respectively. Milk lactose concentration was significantly higher in S group than that in C group ($p = 0.01$). No significant correlations were observed between SCC and milk lactose concentration with udder cleanliness score ($p>0.05$; Table 3). Highly significant correlations were recorded between CMT score and teat end score with the SCC ($p = 0.001$; Table 3). Overall, the cows studied in this experiment showed no indications of pain, discomfort or any other stereotypies associated with clipping of hairs of their tails during the study. Tail shaving provided cleanliness or udder health benefits to dairy cattle in this experiment. The tail shaved cows were cleaner than control indicating that long hairs of tail in cows may play an important role in spreading manure and soiling backs, rump and udder areas. However, Tucker *et al.* (2001) in an experiment that being done following tail docking concluded that cow cleanliness is not strongly influenced by the tails.

Most mastitis infections are caused by pathogens gaining entry to the mammary gland via the streak canal. Therefore, teat-end shape may play an important role in the prevention of bacterial access to the streak canal (Chrystal *et al.*, 2001). Many studies concluded that teat-end shape is highly heritable (e.g., Chrystal *et al.*, 1999, 2001) and some kinds of teats are more predisposed to mastitis (Chrystal *et al.*, 1999) but environmental insults such as cold, wet, windy and muddy condition induce structural and functional changes in teat that breaks its defensive mechanisms and make it susceptible to some kinds of mastitis (Fox, 1995; Nickerson, 1998). For example, mud as it dries, draws moisture from the skin with a consequent loss of elasticity of the teat skin (Mein *et al.*, 2001). In the present investigation, the teat end scores for the tail-shaved cows were significantly lower than control group. Since the teat end score showed significant positive correlation with cleanliness score, it could be concluded that tail shaving improved teat end health by maintaining it cleaner.

This study detected a relationship between SCC and teat-end shape, in agreement with some research (Appleman, 1973; Seykora and McDaniel, 1985) and in disagreement with other research (Bakken, 1981; Chrystal *et al.*, 1999, 2001). Teat end score showed significant positive correlation with SCC in the present study. The source of conflicting results are published in the literature may be related to different scoring systems that employed in these studies.

For example, the purpose of the teat end scoring system that we used in this study was according to the scoring system of Mein *et al.* (2001) that has been recommended to review non infectious factors affecting short or medium-term changes in teats in the commercial diaries. Whereas the greatest variation in SCC results from the presence or absence of an infection, a number of other factors influence variability including parity,

Fig. 1: Left animal was in the tail shaved group while right animal was in the control group

Table 2: The effect of tail-shaving on different indices of udder health and cow's cleanliness

Indices	Shaved tail group	Control group	p-value
Total CMT score	0.18±0.040	0.37±0.060	0.010
Teat end score	1.20±0.030	1.44±0.040	0.001
SCC (10^3 mL^{-1})	200.78±61.70	206.50±46.23	0.940
Lactose (g dL^{-1})	4.50±0.010	4.31±0.070	0.010
Cleanliness score	1.92±0.070	2.16±0.090	0.057

Table 3: Correlation coefficients (p-value) among different studied parameters in control group

Indices	CMT score	Teat end score	Cleanliness	Lactose (g dL^{-1})	SCC×10^3 mL^{-1}
CMT Score	1	0.60 (0.001)[a]	0.18 (0.05)[b]	-0.06 (0.47)	0.62 (0.001)[a]
Teat end score	0.60 (0.001)[a]	1	0.27 (0.003)	-0.11 (0.24)	0.68 (0.001)[a]
Cleanliness score	0.18 (0.05)[b]	0.27 (0.003)[a]	1	0.03 (0.71)	0.14 (0.12)
Lactose (g dL^{-1})	-0.06 (0.47)	-0.11 (0.24)	0.03 (0.71)	1	-0.10 (0.30)
SCC (10^3 mL^{-1})	0.62 (0.001)[a]	0.68 (0.001)[a]	0.14 (0.12)	-0.10 (0.30)	1

[a]Shows high significant ($p<0.01$); [b] Shows significant ($p = 0.05$) difference between two parameters

stage of lactation, time of day and season of the year (Laevens *et al*., 1997; Schepers *et al*., 1997; Green *et al*., 2006). The environment and the cows themselves were cleaner for herds that produced milk with lower SCC values compared with herds with higher bulk tank SCC values (Barkema *et al*., 1999). Exposure to manure in cow housing areas can influence the rate of clinical mastitis (Schreiner and Ruegg, 2003).

The SCC of cows with cleaner udders and lower rear legs was lower than SCC of cows with dirtier udders and legs (Reneau *et al*., 2003). The results did not significantly support this idea that tail shaving could decrease SCC. Also SCC did not show considerable correlation with cleanliness score. Management practices, including some dry period policies have been found to influence the magnitude of herd SCC throughout lactation (McDougall, 2003; Barnouin *et al*., 2004; Lievaart *et al*., 2007; Wenz *et al*., 2007; Green *et al*., 2008) and hygiene scoring systems have been used to assess the cleanliness of cows and the farm environment (Ward *et al*., 2002; Reneau *et al*., 2003; Schreiner and Ruegg, 2002a, b). The relationship between individual cow hygiene scores and Intramammary Infection (IMI) has not been reported. Fecal consistency, bedding management and stage of lactation have been previously suggested as contributing to herd differences in hygiene scores (Ward *et al*., 2002). Bartlett *et al*. (1992) were able to predict the occurrence of clinical coliform mastitis using an index of environmental sanitation. Farms with management styles characterized as quick and dirty were found to have higher bulk milk SCC values compared with farms with management styles characterized as clean and accurate (Barkema *et al*., 1999). It is hypothesized that CMT is an efficient cow-side proxy for SCC (Schalm and Noorlander, 1957) and that both tests are useful predictors of IMI in fresh cows. The CMT (Schalm and Noorlander, 1957) is based on the number of leucocytes in milk as a measure of infection of the udder. The importance of the various

CMT reactions has been a subject of controversy. However, CMT has gained wide acceptance as an aid in detection of mastitis particularly on the dairy farm. Physiological factors having the greatest effect on the CMT were parity, stage of lactation and the dry period (Sargeant *et al*., 2001). First lactation animals had a markedly lower number of positive quarters than older cows and positive reactions increased as cows passed mid-lactation (Braund and Schultz, 1963).

In the present investigation, the samples of shaved and unshaved cows were biologically identical according to their milk yield, parity and Days in Milk (DIM). Total CMT score significantly decreased in the tail-shaved cows compared with control group and CMT score showed significant positive correlation with udder cleanliness score. Milk lactose is the main osmotic component in milk and therefore the lactose content is rather constant (Samuelsson, 1996; Paape *et al*., 2000). Wiley *et al*., (1991) evaluated the effect of diets made to induce or prevent weight loss before parturition and diets after calving with ruminally undegradable or degradable protein supplement. They found no effect of these four treatments on lactose content of milk from primiparous beef cows. However, Rodriguez *et al*. (1997) found that the lactose content of milk increased 1.4% with added fat and increased 1.6% with diets having high ruminally undegradable protein content in dairy cows. In a study done, Daley *et al*. (1986) found that mastitis had an effect on milk constituent percentages, reporting that cows that had mastitis in the tested quarter had a higher percentage of fat and protein in their milk but a decreased percentage of lactose. Among milk constituents, lactose could be used as a marker for evaluation of mastitis because its content decreases during mastitis (Tsenkova *et al*., 2001; Hamann, 2002; Pyorala, 2003; Sharif *et al*., 2007). In the present investigation, lactose concentration showed negative but non-significant correlation with SCC, CMT and teat end score.

Auldist *et al*. (1995) have reported decrease in lactose concentration in the milk of cows presenting high SCC. Klei *et al*. (1998) demonstrated that when SCC increases from 83,000-870,000 cells mL^{-1}, lactose concentration was reduced from 4.977-4.707%. The acceptable level of SCC, CMT and teat end score of cows in the study suggests that the studied herd has moderately udder's healthiness that prevented from considerable decline of lactose concentration. A threshold of 200,000 cells mL^{-1} in composite milk from all 4 quarters provides a useful guideline for the likely presence of an IMI in at least 1 quarter with a sensitivity and specificity of approximately 70% (Dohoo and Leslie, 1991; Schepers *et al*., 1997). According to Harmon (1994), the mastitis or elevated SCC is associated with a decrease in lactose because of reduced synthetic activity in the mammary tissue. Kukovics *et al*. (1996) found a negative correlation between SCC and lactose content. Schultz *et al*. (1978) noted decreasing concentration of lactose in cow milk resulting from increased permeability of tissues between milk duct of udder and blood. A negative relationship between Somatic Cell Counts (SCC) and lactose content was reported in previous studies (Ceron-Munoz *et al*., 2002; Fernandes *et al*., 2004).

Hirpurkar *et al*. (1987) found that lactose levels were reduced in milk samples positive for CMT. It must be remembered that milk yield and milk composition (fat, protein, casein and serum proteins but not lactose) are negatively correlated (Molina and Gallego, 1994; Fuertes *et al*., 1998; Shahbazkia *et al*., 2009). The milk bacteria such as *Streptococcus agalactia* (Morsi *et al*., 2000) and *Staphylococcus aureus* (Paape *et al*., 2000) cause a decrease in lactose content of milk. In the present study, the lactose content was significantly higher in tail shaved cows than that of controls. However, lactose content did not show significant correlation with cleanliness score.

CONCLUSION

This experiment describes short term effects of tail shaving on cow's cleanliness and udder hygiene. Though many research questions obviously remain, these data suggest that tail shaving of dairy cows during lactation could contribute to decrease of subclinical mastitis following improving cow's cleanliness.

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