Short communication: Removal of hair from the mammary gland: Recovery of bacteria from teat skin and milk

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ABSTRACT

It has been assumed that the presence of udder hair can interfere with safe milking practices and reduce the wholesomeness of milk relative to bacterial content. This study determined the effect of removal by singeing udder hair on the microflora of teat skin (total bacteria, coliform, and esculin-positive and esculin-negative streptococci) and milk (total bacteria, coliform, psychrotrophic, and thermotrophic counts) as opposed to not singeing udder hair, using different pre- and postmilking disinfection (predip, postdip, or both) combinations. The 4 different pre- and postmilking disinfection combinations were predip and postdip, postdip only, predip only, and no predip and no postdip. Differences in bacterial numbers recovered from teat skin and milk in singed and not singed glands were not significantly affected by treatment. Findings of this trial do not support the concept that udder hair removal results in improved milk quality as measured by bacterial content.

Key words: udder hair removal, teat disinfection, milk quality, bacteria

Short Communication

Regulations stipulate that milk intended for human consumption must be harvested from clean udders [European Council; 2004; Grade A Pasteurized Milk Ordinance (PMO), 2011], and specifically, from udders that have had their hair clipped or removed from areas around the udder and in particular, at the base of the teat [Grade A PMO, 2011]. The presumption is that hair removal will reduce the bacterial content associated with extra- and intramammary sources. Udder hair removal has been advocated in the control of IMI. Studies examining the association between herd management practices and low milk SCC indicated an association with the practice of regular removal of udder hair (Barkema et al., 1998; Elmoslemany et al.,

2010; Dufour et al., 2011). However, Silk et al. (2003), in a 1-yr study on the effect on milk quality after monthly hair removal, did not find a significant difference in the number and types of IMI compared with udder halves where hair was not removed. Yet these authors conjectured that premilking udder preparation techniques that included minimal use of water to clean teats and the use of a high concentration teat disinfectant (1% iodine) both before and after milking, might have adequately disinfected teats not affected by hair removal. It has been demonstrated that premilking teat preparation can influence the bacterial content of milk (Galton et al., 1984; Hubble and Mein, 1986) and the bacteria recovered from teat skin (Galton et al., 1984). Thus, the purpose of this study was to determine if various pre- and postmilking udder cleaning and disinfectant routines interacted with udder hair removal to affect bacteriological content of milk and teat skin microflora. The microflora tested were of 4 classes for milk and skin. For milk, bacterial classes were the total, psychrotrophic, thermophilic, and coliform counts. For skin, bacterial classes were the total, esculin-positive *Streptococcus* sp., esculin-negative *Streptococcus* sp., and coliform counts. These were similar classes studied by others (Galton et al., 1984; Hubble and Mein, 1986; Silk et al., 2003). Milk quality in the United States is officially assessed by standard plate count and coliform (PMO, 2011) and milk processors often require either the psychrotrophic or thermotrophic counts. We chose to assess streptococcal counts and coliform counts on teat skin because these pathogens were most likely to be reduced with predipping (Pankey et al., 1987).

Sixty cows at the Washington State University (WSU) Dairy Center were randomly selected from the pool of cows past 100 d in milk. Cows in this trial were managed in accordance with the Institutional Animal Care and Use Committee's regulations and the Committee approved the use of these animals in this trial. Cows were milked twice daily in a double 5 herringbone parlor that included automatic milking unit detachers (Boumatic LLC, Madison, WI). Cows were housed in a free stall barn where composted dairy waste solids were used as bedding. Visibly soiled bedding was removed

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and replaced daily and whole stall bedding replacement was done weekly. Udder and leg hygiene scores had been evaluated in a previous trial at the WSU with the scoring protocol used by Schreiner and Ruegg (2003).

Enrolled cows were randomly allocated to 1 of 4 groups. Groups differed by the method of premilking teat preparation (disinfection or no disinfection) and postmilking teat care (disinfection or no disinfection). Treatments groups were (1) premilking teat preparation, immersing the teat in a 0.1% iodine commercial (QuarterMate, WestAgro Inc., Kansas City, MO) disinfectant and removing the disinfectant with a moist towel followed by postmilking care with teat immersion in a 1% iodine commercial (Bovadine, WestAgro Inc.) disinfectant; (2) premilking teat preparation, cleaning with a moist towel followed by postmilking care with teat immersion in a 1% iodine commercial disinfectant (Bovadine, WestAgro Inc.); (3) premilking teat preparation, immersing the teat in a 0.1% iodine commercial (QuarterMate) disinfectant, and removing the disinfectant with a moist towel followed by no postmilking disinfection; and (4) premilking teat preparation, cleaning with a moist towel only, followed by no postmilking care. All towels were moistened with tepid tap water, and were clean, single service, and terry cloth. Udder hair had not been removed from enrolled cattle in the previous 3 mo. Prior to the start of the trial, the standard routine of premilking teat preparation included disinfection with QuarterMate and postmilking teat disinfectant with Bovadine. A preliminary acclimation period was established. Ten days before udder hair removal and the collection of samples, the standard routine was deferred and replaced with the described 4 treatments. All 4 teats of cows in each group received their respective treatment.

Udder hair was removed at the start of the trial. Udder hair surrounding the teats was removed by singeing with a handheld, modified, propane torch as described (Silk et al., 2003). In brief, an oxygen-starved flame was waved over one side of the udder, right or left. The udder half side chosen to receive singeing treatment was a function of the cow's identification number. Even numbered cows had teat hairs singed on the right side and those with odd-numbered identification numbers were singed on the left. The side not singed was considered the control side. Twenty-four hours after singeing, milk and teat skin swabbing solutions were collected immediately before a milking. Teats were prepared for milking following treatment group specifications. Following cleaning, teat skin swabbing solutions were collected from the teat end and lateral sides of the teat, by rolling the areas with sterile cotton tipped swab moistened with 0.2% thiosulfate quench solution. A new swab was

used for each teat, and 2 swabs from each side were returned to the same tube of quench solution (5 mL). Milk from udder halves was separated during the milking process by diversion into separate buckets. Milk from each udder half was thoroughly mixed, and 50 mL was collected into a sterile container. Each bucket was rinsed, cleaned, rinsed, and sanitized after each cow milking using solutions prepared in accordance with manufacturers' instructions (Ridstone, Dynemate, and Mega-San, WestAgro Inc.). From skin swabbing solutions, the total bacteria and coliform counts were determined as described (Silk et al., 2003), and esculin-positive and -negative streptococci were enumerated on Columbia Blood Agar with esculin (Hardy Diagnostics, Santa Maria, CA). From milk, the total bacterial, coliform, psychrotrophic, and thermophilic counts were determined (Silk et al., 2003). General linear model procedure (SAS software 9.2, SAS Institute Inc., Cary, NC) was used to determine the dependent effects of treatment (hair removal or control) and cow (replicate) by group on the independent variables of log₁₀ bacterial counts (teat skin and milk).

The log₁₀ bacterial counts in milk and skin for singed and control mammary quarters are summarized in Table 1. In milk, the total, psychrotrophic, thermophilic, and coliform bacterial counts for teats that were singed and then immersed in iodine disinfectant before and after milking (group 1) tended to be lowest compared with counts on control-treated teats, but differences were not significant ($P > 0.05$). No significant effect of singed treatment was observed in a reduction in total psychrotrophic, thermophilic, and coliform bacterial counts compared with controls with any treatment ($P > 0.05$).

The total bacterial counts recovered from skin differed little when comparisons were made within group between treatments; mean count differences were not significant ($P > 0.05$). It appears that counts between groups were also very similar. Similar observations could be made within and between groups for the esculin-positive streptococci recovered from skin, mean count differences were not significant ($P > 0.05$). It appeared that coliform counts recovered from skin of control teats was much greater than for singed teats for teats that were immersed in iodine disinfectant before and after milking; however, differences were not significant ($P > 0.05$). Mean coliform counts recovered from singed teats in group 4 appeared to be much greater than counts associated with control skin, but again, means were not significantly different ($P > 0.05$).

The purpose of the study was to determine if removing udder hair around the teats by singeing would influ-

Table 1. Mean¹ bacterial counts in milk and from skin of udder halves where hair was removed by singeing (treated) versus halves where hair was not removed (control) as affected by pre- and postmilking preparation (group)

Group ²	Bacteria class	Milk, means (SD)		Bacteria class	Skin, means (SD)	
		Treated	Control		Treated	Control
1	Total	2.9 (1.6)	3.7 (2.0)	Total	3.8 (0.8)	3.9 (0.6)
2		4.0 (1.4)	3.4 (1.9)		3.8 (0.6)	3.8 (0.7)
3		3.4 (1.6)	3.6 (2.0)		3.9 (0.6)	3.9 (0.7)
4		3.6 (2.0)	3.4 (1.9)		4.0 (1.0)	3.9 (0.9)
1	Psychrotrophic	2.3 (1.1)	2.8 (0.9)	Coliform	0.03 (0.2)	0.18 (0.4)
2		2.7 (0.9)	2.6 (1.5)		0.28 (0.7)	0.21 (0.7)
3		2.4 (0.8)	2.4 (1.3)		0.06 (0.4)	0.08 (0.3)
4		2.3 (1.1)	2.7 (1.1)		0.22 (0.5)	0.08 (0.3)
1	Thermotrophic	1.6 (1.8)	2.4 (2.0)	Esculin +	2.1 (1.0)	2.1 (1.0)
2		2.1 (2.1)	2.3 (2.0)		2.3 (1.0)	2.1 (1.1)
3		2.1 (1.8)	2.6 (2.0)		2.1 (1.0)	2.2 (0.9)
4		2.4 (2.1)	1.7 (1.9)		2.3 (1.1)	2.0 (1.2)
1	Coliform	2.0 (1.2)	2.7 (1.2)	Esculin –	0.4 (0.8)	0.4 (1.0)
2		2.8 (0.9)	2.8 (1.5)		0.9 (1.2)	0.6 (1.1)
3		2.3 (1.0)	2.6 (1.2)		0.2 (0.7)	0.4 (1.0)
4		2.1 (1.3)	2.3 (1.5)		0.4 (0.9)	0.3 (0.8)

¹Mean bacterial counts (log₁₀ cfu/mL) from milk and skin swabbing solutions, within a row, were not significantly different ($P > 0.05$).

²Groups were (1) premilking teat preparation, immersing the teat in a 0.1% iodine commercial (QuarterMate, WestAgro Inc., Kansas City, MO) disinfectant and removing the disinfectant with a wet towel followed by postmilking care with teat immersion in a 1% iodine commercial (Bovadine, WestAgro Inc.) disinfectant; (2) premilking teat preparation, cleaning teat with a wet towel followed by postmilking care with teat immersion in a 1% iodine commercial disinfectant (Bovadine, WestAgro Inc.); (3) premilking teat preparation, immersing the teat in a 0.1% iodine commercial (QuarterMate, WestAgro Inc.) disinfectant and removing the disinfectant with a wet towel followed by no postmilking care; and (4) premilking teat preparation, cleaning with a wet towel followed by no postmilking teat care.

ence the recovery of bacteria from teat skin and milk as affected by pre- and postmilking teat disinfection. Such removal of hair is required in some milk markets globally, and all markets in the United States. Bacteria of interest were those associated with mastitis and milk quality and associated with the environment. The total, psychrotrophic, thermotrophic, and coliform counts of milk were similar from udder halves that were singed as compared with the milk of control halves. Likewise, the total, coliform and esculin-positive and -negative bacterial counts in teat skin swabbing solutions were apparently not affected by hair removal. These findings were consistent with all treatments tested, indicating that hair removal had little influence on the bacterial content of the milk, confirming the results of a previous study (Silk et al., 2003). None of the treatment types interacted with singeing to produce disparate results. It would be risky to interpret these findings to suggest that the fourth treatment where no teat disinfectant was applied before and after milking was equally preferable to treatments where disinfectant application was done. Postmilking teat dip has been shown to be effective in control of mastitis and associated with lower herd milk SCC (Barkema et al., 1998). It should be noted that cleanliness of the cow can influence milk quality (Schreiner and Ruegg, 2003). The mean udder and leg hygiene scores determined in a previous study at the WSU dairy (unpublished results, 2014) were 1.8 (± 0.5) and 2.4 (± 0.5), scores which were associated

with the lowest milk SCC (Schreiner and Ruegg, 2003). The average udder score at the WSU dairy would have been the lowest score in the Wisconsin study (Schreiner and Ruegg, 2003). This suggests that cows housed at the WSU dairy were less likely to have udder contamination by bacteria than the average dairy, and the effect of udder singeing on teat skin and milk bacterial content might be different in herds where cows had higher hygiene scores.

Rules specified by regulatory bodies that govern the sale of food of animal origin are designed to protect the consumer from consumption of unwholesome products (European Council, 2004). The PMO specifies that hair should be removed from udders and teats to facilitate cleaning and that a sanitizing solution should be applied to all teats before milking. It could be argued that hair removal would be associated with reduced mastitis (Barkema et al., 1998; Dufour et al., 2011). If the practice of udder hair removal reduces mastitis, then milk quality should be improved and this would be justification for regulating this practice. Yet Silk et al. (2003), in a 1-yr study on a university dairy farm, demonstrated that singeing of udder hair was not a variable that influenced a reduction in IMI. It has been a long-held belief that hair on udders should be short to improve reduce the bacterial content of milk. But direct evidence to date does not support the contention that udder hair removal is associated with a reduction of bacteria in milk.

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