Evaluation of breed, milk production, and udder characteristics on somatic cell count and udder pathogens in lactating Holstein and Jersey cows*

Britney Brown, Dr. Jessica Carter, and Dr. Maegan Hollis

School of Agriculture, Middle Tennessee State University

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ABSTRACT

Somatic cell count (SCC) is an indicator of the health and cleanliness of dairy cattle and is directly related to incidence of mastitis. The effects of cow breed (n = 10/breed, Holstein & Jersey) on milk yield, milk quality, SCC, bacterial cultures, and hygiene scores were compared over a 6-wk period. Milk Samples with a SCC >350,000 cells/ml were cultured. Holstein cows produced significantly more milk than Jerseys (*P* = 0.0181) and had a greater conductivity (*P* = 0.0005). SCC measurements were not significantly different. Jerseys had lower hygiene scores indicating that they were cleaner than Holsteins in their udder and flank area. There were no significant differences in leg scores by breed or bacterial species cultured. The results insinuate that Jerseys are cleaner overall, and that conductivity is related to milk yield.

INTRODUCTION

Somatic cell count (SCC) of dairy cattle is a direct indicator of the dairy animal's health, wellbeing, and comfort in her environment. SCC is indicative of subclinical or clinical mastitis. Mastitis is the presence of any bacteria in the udder. Pathologic invasion of the mammary gland via the teat sphincter and teat cistern will inevitably result in inflammation of the udder when left untreated. The ramifications from heightened SCC include economic losses and lowered milk production. Once SCC levels exceed 750,000 cells/ml in the United States, the bulk tank will be dumped, and the farm will lose hours of work and profit. Studies show that breeds with a higher daily milk yield have consistently higher SCC. When compared to Friesian and Jersey cows, Holstein cows yield 12-19% more milk (Coffey et al., 2016). Since Holsteins have superior milk production compared to other breeds, they may be at risk for heightened SCC compared to their lower-producing counterparts. Hygiene is also an SCC indicator. The amount of mud, dirt, and debris on the udder and in the near vicinity of the udder is a proven indicator of heightened SCC (Cook and Reinemann, 2006).

OBJECTIVE

The objective of this study was to examine the impact of cow breed on milk yield, udder depth, hygiene scores, somatic cell count, and bacterial cultures in the MTSU dairy herd.

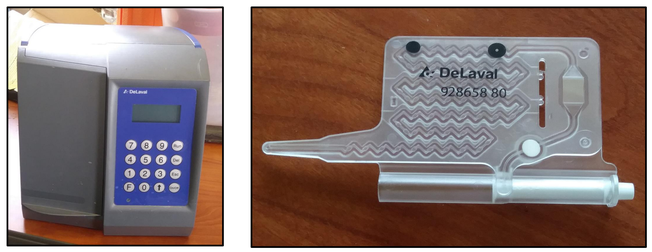

Figure 1. DeLaval Cell Counter (left) and cartridge used for SCC sample testing (right).

MATERIALS AND METHODS

Two groups of cattle (10 Holstein and 10 Jersey; 20 total) were evaluated for a 6-week period (**Figure 2**). SCC on the cows were measured each week by collecting a milk sample while cows were in the parlor for their routine milking schedule. The DeLaval Cell Counter (**Figure 1**) was used to measure SCC. If SCC of the milk sample was greater than 350,000 cells/ml, the sample was cultured to determine which bacteria were present. Milk samples were placed on a Tri-plate agar media (**Figure 5**); the three agar mediums on the Tri-plate were as follows: Factor TM media, MacConkey media, and MTKT TM media. These determined if the species cultured after 48 hours was *Staph. aureus*, another *Staph*. species, a *Strep*. species, or a gram negative species. The cows also were evaluated using a multi-zone hygiene scoring system for cleanliness as they came into the parlor (Cook, 2002; 1= very clean and 4= very dirty). Udder measurements were taken the first week using a tape measure and included teat length, distance between teats, and total length of intramammary groove. Other measurements, such as conductivity, daily milk yield, and milking speed, were taken from the Afimilk database. Data was compiled over this 6-week period into a mixed model with repeated measures using breed as the main effect, and analyzed using SAS software (SAS Institute Inc, Cary, NC).

RESULTS

There was a significant correlation between breed and milk yield (kg/d; **Table 1**). Holsteins produced more milk than Jerseys, with an average of 37.6 and 26.5 kg/d, respectively (*P* = 0.0004). Differences in conductivity (mS/cm) according to breed were significant (**Figure 4**; *P* = 0.0005). Likewise, the differences in conductivity according to breed by week remained significant (*P* = 0.0457). Holstein milk averaged a higher conductivity, at 9.70 mS/cm. Interestingly, Jersey milk had an average conductivity of 8.81 mS/cm, which was significantly lower than that for Holsteins. In considering the overall hygiene scores according to breed (**Figure 3**), more Jersey cows tended to have scores of 1 in the flank and udder areas. The udder and flank areas are the only two areas where the difference between the two breeds was found to be significant (flank: *P* = 0.0001; udder: *P* = 0.0003). 35% of Holsteins were cultured as compared to 25% of Jerseys (*P* = 0.2320) using the Triplate agar (**Table 2**). There was no significant difference in correlation (*P* = 0.2320) according to breed. Similarly, the bacterial species that grew were not significant between the breeds (*P* = 0.2911) after 48 hrs (**Figure 5**). This indicated a possible environmental correlation rather than a breed correlation.

Table 1. Differences according to breed for milk yield (kg/d), somatic cell score, and conductivity.

Measure	Jersey	Holstein	*SEM*	*P*-value
No. of cows	10	10		
Milk yield, kg/d	26.5	37.6	3.01	0.0181
Somatic cell score[a]	14.1	13.4	0.556	0.4417
Conductivity	8.81	9.70	0.15	0.0005*

[a] Somatic cell count data was transformed using the following formula: SCS = log2(SCC/100) + 3.
* Significant difference at $p < 0.05$.

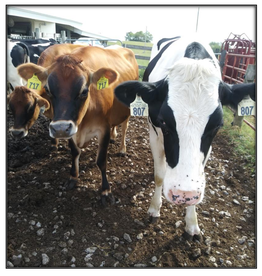

Figure 2. Holstein and Jersey Dairy heifers side by side (left). Conducting weekly hygiene scoring in the milking parlor (right)

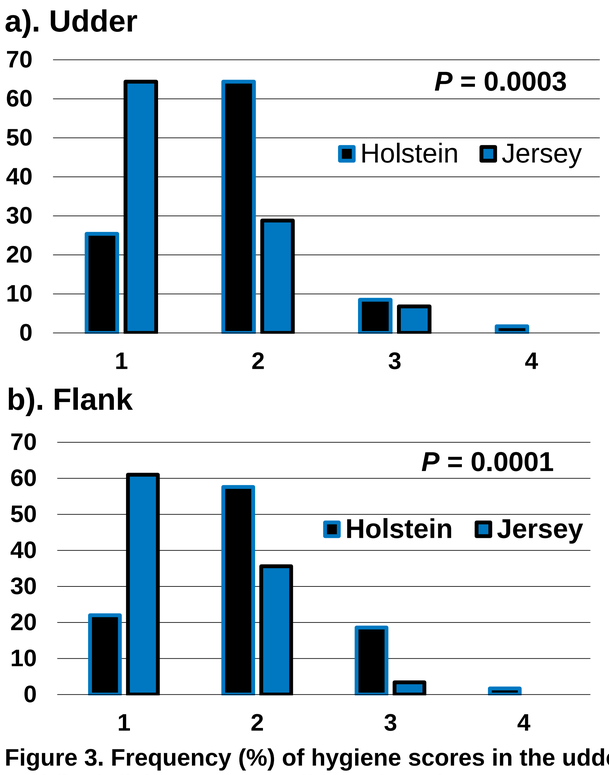

Figure 3. Frequency (%) of hygiene scores in the udder (a.) and flank (b.) areas according to breed.

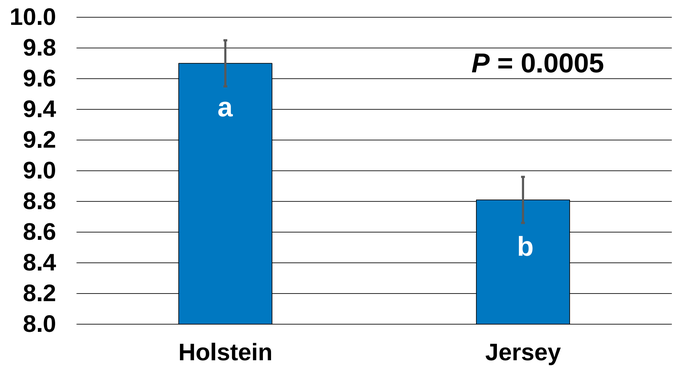

Figure 4. Differences in conductivity (mS/cm) by breed.

Table 2. Frequency (%) of cows cultured and frequency (%) of bacterial species cultured compared by breed.

SCC Readings	Holstein, %	Jersey, %	*P*-Value
Cows not Cultured[a]	65.0	75.0	
Cows Cultured	35.0	25.0	0.2320
Type of Bacteria			0.2911
No bacterial growth	1.7	1.7	
***Staph. aureus* identified**	5.0	6.7	
Other *Staph*. species	21.7	16.7	
***Strep*. species**	6.7	0	

[a] Milk samples were collected and cultured when SCC reading was ≥ 350,000 cells/ml.

(a)

(b)

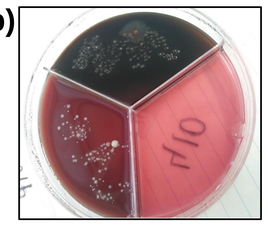

Figure 5. a) tri-plate culture medium showing *Staphylococcus aureus* growth and b) tri-plate culture medium showing *Streptococcus* species growth.

CONCLUSION

This study found that the impact of breed on hygiene score in the udder and flank areas is significant when the animals are housed in a compost bedded pack barn. As expected, Holsteins had a significantly greater milk yield than Jerseys, when studied and averaged over a period of weeks. Average conductivity of the Holstein milk was higher, indicating a relationship between breed and SCC. However, there were no significant differences in SCC by breed. When cultured, the milk samples indicated no correlation between cow breed and the bacterial species grown. This implies that an environmental component may have caused the ascertained bacterial species.

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