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Research Article

ASSOCIATION BETWEEN UDDER MORPHOLOGY AND MILK SOMATIC CELL COUNTS IN HOLSTEIN FRIESIAN × SAHIWAL DAIRY COWS

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ABSTRACT

To identify whether udder morphology was associated with somatic cell counts (SCC), we conducted a cross-sectional study (herds=12, Holstein Friesian×Sahiwal crossbred dairy cows =256). Udder shapes were classified as normal, primitive, pendulous, udder in thighs, goat like, abdominal and stepped by comparing with reference photographs. SCC were estimated using automatic analyser and absolute values were log transformed (log_{10}SCC). Most prevalent udders were normal shaped (47%) followed by pendulous udders (21%). The mean absolute values of SCC ($\times 10^3$cells/ml) were higher in cows with pendulous udders (1405±0.61) followed by udder in thighs (872±0.61) and stepped udders (638±0.61). Analysis of variance results showed that mean log_{10}SCC (cells/ml) for pendulous udders was significantly higher ($P<0.01$) as compared with normal (5.84±0.61), primitive (5.84±0.61), goat like (5.84±0.61) and abdominal (5.84±0.61) shaped udders. Present study identified udder morphology as one of the risk factors for higher SCC. Therefore, selection toward more optimal udder morphological traits may reduce milk SCC and help improve udder health in HF×Sahiwal crossbred dairy cows.

Key words: Frieswal, dairy cow, somatic cell count, udder morphology, udder health

Somatic cell counts (SCC) in milk are related with udder health because it reflects an immune response elicited due to an inflammation of the udder parenchyma as a result of invasion of bacterial pathogen into the mammary gland. Detection of sub-clinical mastitis (SCM) is based on measurement of SCC in milk collected from individual mammary gland quarters or composite milk sample that is a mixture of milk from all functional glands of an individual cow (Sharma *et al.,* 2011). Udder and teat conformational traits are among the important cow factors that contribute to SCC variability (Seykora and McDaniel, 1986; Juozaitiene *et al*., 2006; Compton *et al*., 2007; Singh *et al*., 2014). Kamboj *et al*. (2007) found significant correlation coefficients of udder length, udder width and udder depth with SCC.

Crossbreeding has been widely used to improve the genetic makeup of the indigenous cattle. One of the various crossbred strains, Holstein Friesian (HF)x Sahiwal crossbred cow capable of producing 4000 kg milk with 4% butter fat in a mature lactation of 300 days is being developed in a large number by the Project Directorate on Cattle, Meerut, Uttar Pradesh. A number of studies have been undertaken to investigate the production potential of crossbred cattle being evolved through exotic and Indian breeds (Singh *et al.,* 2000; Upadhyay *et al.,* 2002; Akhter *et al.,* 2003). The information on udder morphological characteristics is, however, scanty in the crossbred cattle. The present investigation was undertaken to examine the potential association between udder morphology and SCC in Frieswal cattle.

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MATERIALS AND METHODS

Animals and Farm Management: The study was conducted at 12 dairy herds from the seven districts of Punjab, India. The criteria for inclusion of farm were willingness to participate in the study, agreement to allow access to all the animals and presence of lactating cows in the farm. Though the farms were conveniently selected, selection of participating cows from each farm was done randomly. All farms involved in the study were small-scaled commercial dairy farms. Animals were maintained under semi-loose housing system. The target animals were apparently healthy lactating cows within the farms ranging from 12-30 cows. The enrolled cows were without any evidence of clinical mastitis (milk with normal consistency and no pathological changes in the mammary gland like swelling, redness, pain, fibrosis, etc.). A total of 256 HF×Sahiwal crossbred cows were included in the study. The cows were milked twice daily (morning 4 am and evening 3 pm) with the help of milking machines. On most of the farms, pre-milking udder preparation included washing of the teats with water before applying cluster. After the completion of milking, clusters were removed manually. Post-milking teat dipping

was not done on regular basis on most of the farms.

Udder Morphology: Udder shapes were observed in the afternoon just before milking and classified into normal, primitive, pendulous, udder in thighs, goat like, abdominal, and stepped by comparing with reference photos as per criteria used by Rosenberger (1979).

Collection of Milk Samples and Somatic Cells Estimation: From each cow at the end of milking, approximately 20 ml of cow composite milk (CCM) was collected from a bucket in a plastic container at afternoon milking. Samples were stored in a cool box and transferred to the laboratory for further analysis. Milk samples were thawed at room temperature and somatic cells were estimated using DeLaval cell counter (DeLaval, Tumba, Sweden). Results were expressed as number of cells $\times 10^3$per ml.

Statistical Analysis: Data was stored in Microsoft Excel and analysed by MINITAB statistical software (release 14.2). SCC data were log transformed to base 10 ($\log_{10}$SCC cells/ml) to make it normally distributed. Descriptive statistics were calculated to establish frequencies and percentage distribution. One-way ANOVA was used to determine the statistical significance for log transformed SCC according to udder shape. Comparison between the udder shapes were made by Tukey's method and results were expressed as statistically significant at $P < 0.05$.

RESULTS AND DISCUSSION

Figure 1 shows percentage distribution of various udder shapes observed in the present study. Most frequently recorded udder shapes were normal (47.3%) followed by pendulous (21.1%) and udder in thighs (8.6%). On the other hand, least commonly recorded udder shape was goat like (4.6%). Present finding is in agreement with the findings of Klaas *et al.* (2005) and Bhutto *et al.* (2010). Klaas *et al.* (2005) found 66.4% of cows with normal udder shapes followed by 13.6%, 9% and 10.8% of cows with deep, small and other udder shapes types, respectively.

The result of analysis of variance aimed at determination of an influence of udder shape on CCM SCC is given in Table 1. Overall, cows with pendulous, stepped and udder in thighs type of udders had absolute SCC more than 600×10^3 cells/ml with levels being higher

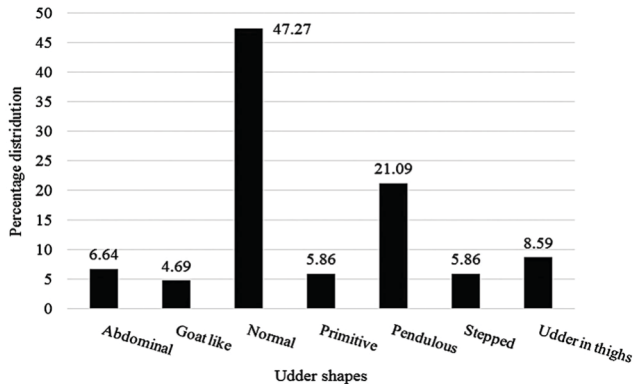

Fig. 1: Distribution (%) of udder shapes observed in the present study

in cows with pendulous type of udder (1405×10^3 cells/ml). On the other hand, cows with primitive, normal, abdominal and goat like udders had SCC levels generally less than 550×10^3 cells/ml. Although the $\log_{10}$SCC values were also higher in cows with pendulous, stepped and udder in thigh type of udders but significantly ($P<0.01$) higher mean values were only found with respect to pendulous udders ($\log_{10}$SCC: 5.84±0.08cells/ml) as compared with other udder types. Several recent studies have identified udder and teat conformation as risk factors for higher SCC and reduced udder health (Nakov *et al*., 2014; Singh *et al*., 2014; Sharma *et al*., 2016). Pendulous udders, which mean a low udder or teat to floor distance, are related to higher SCC (Rogers *et al*., 1991; Faye *et al*., 1998), and also higher risk of SCM (Singh *et al*., 2014) and clinical disease (Slettbakk *et al*., 1995; Nakov *et al*., 2014). On the other hand, a shallow, tightly attached udder with short and closed teats is genetically associated with lower values of somatic cell score and mastitis incidence (Seykora and McDaniel,

Table 1
Cow composite milk somatic cell counts according to udder shape

Udder shape	n	Cow composite milk SCC (Mean ± SE)		95% CI (Log_{10}SCC)
		Absolute SCC ($\times10^3$ cells /ml)	Log_{10}SCC*	
Abdominal	17	461±185	5.23±0.15^b	4.96 - 5.49
Goat like	12	557±315	5.27±0.16^b	4.96 -5.59
Normal	121	437±50	5.35±0.05^b	5.25 - 5.45
Primitive	15	184±38	5.09±0.11^b	4.81 - 5.37
Pendulous	54	1405±193	5.84±0.08^a	5.69 - 5.98
Stepped	15	638±211	5.45±0.16^{ab}	5.17 - 5.73
Udder in thighs	22	872±225	5.63±0.12^{ab}	5.40 - 5.86
Overall	256	683±60	5.46±0.04	4.18 - 6.68

1986; Klein *et al*., 2005; Samore and Groen, 2006; Ptak *et al*., 2011). According to Uzmay *et al*. (2003), Holstein cows with trough-shaped udders have the lowest risk of SCM, whereas cows with pendulous udders had the highest risk for SCM. Kamboj *et al.* (2007) found significantly ($P<0.05$) higher levels of SCC (cells per ml milk) in Karan Fries cows with pendulous shaped udders as compared to goat, unbalanced, trough and round udders. In addition to being more prone to injuries, deep and pendulous udders may also alter the gait of cow. Moreover, cows with undesirable udder and teat conformational traits may be difficult to be milked with machines, and are associated with increased incidence of liner slip and manual adjustment, thus, making a cow more susceptible to mastitis (Rogers and Spencer, 1991). In contrary to above studies, Bhutto *et al*. (2010) were not able to show significant association of udder shape with quarter SCC. However, they show some association between IMI with bacteria and udder shape. Large and pendulous udders are more prone to injuries and help the pathogens to grow. Coben *et al*. (2009) found higher mean log SCC for pendulous udders, but overall, udder shapes were not found to be significantly associated with mean log SCC.

The inconsistency in the results of above discussed findings might be related to the variability in the methods of subjective or objective measurements of udder morphology. In addition, criteria of defining udder health, breed, individual cow physiological status, management practices followed, adaptation of mastitis control programmes, and geographical locations also influences the outcome of results. However, the results of the different studies indicate that selection towards optimum udder and teat characteristics could help improve udder health and welfare of the animal. In India, further improvement of mastitis-resistant animals may be expected if selection programmes include information on SCC and udder conformation traits.

REFERENCES

Akhter, J., Singh, H., Kumar, D. and Sharma, R.K. (2003). Factors effecting economic traits in crossbred cattle. *Indian J. Anim. Sci.* **73**: 464-465.

Bhutto, A.L., Murray, R.D. and Woldehiwet, Z. (2010). Udder shape and teat-end lesions as potential risk factors for high somatic cell counts and intramammary infections in dairy cows. *Vet. J.* **183**: 63-67.

Compton, C.W., Heuer, C., Parker, K. and McDougall, S. (2007). Risk factors for peripartum mastitis in pasture-grazed dairy heifers. *J. Dairy Sci.* **90**: 4171-4180.

Faye, B., Perochon, L., Dorr, N. and Gasqui, P. (1998).Relationship between individual-cow udder health status in early lactation and dairy cow characteristics in Brittany, France. *Vet. Res*. **29**: 31-46.

Green, M.J., Bradley, A.J., Newton, H. and Browne, W.J. (2006). Seasonal variation of bulk milk somatic cell counts in UK dairy herds: Investigations of the summer rise. *Prev. Vet. Med.***74**: 293-308.

Juozaitiene, V., Juozaitis, A. and Micikeviciene, R. (2006). Relationship between somatic cell count and milk production or morphological traits of udder in Black- and- White cows. *Turkish J. Vet. Anim. Sci*. **30**: 47-51.

Kamboj, M.L., Singh, A. and Prasad, S. (2007). Effect of udder and teat shapes and their measurements on somatic cell counts in milk of Karan Fries cows. *Indian J. Dairy Sci.* **60**: 435-440.

Klein, D., Flock, M., Khol, J.L., Franz, S., Stuger, H.P. and Baumgartner, W. (2005). Ultrasonographic measurement of the bovine teat: Breed differences, and the significance of the measurements for udder health. *J. Dairy Res*. **72**: 296-302.

Nakov, D., Hristov, S., Andonov, S. and Trajchev, M. (2014). Udder-related risk factors for clinical mastitis in dairy cows. *Veterinarski Arhiv*. **84**: 111-127.

Nash, D.L., Rogers, G.W., Cooper, J.B., Hargrove, G.L. and Keown, J.E. (2003). Heritability of intramammary infections at first parturition and relationships with sire transmitting abilities for somatic cell score, udder type traits, productive life, and protein yield. *J. Dairy Sci*. **86**: 2684-2695.

Nyman, A.K., Persson Waller, K., Bennedsgaard, T.W., Larsen, T. and Emanuelson, U. (2014). Associations of udder-health indicators with cow factors and with intramammary infection in dairy cows. *J. Dairy Sci.* **97**: 5459-5473.

Ptak, E., Jagusiak, W., Zarnecki, A. and Otwinowska-Mindur, A. (2011). Heritabilities and genetic correlations of lactational and daily somatic cell score with conformation traits in Polish Holstein cattle. *Czech J. Anim. Sci*. **56**: 205-212.

Rogers, G.W. and Spencer, S.B. (1991). Relationships among udder and teat morphology and milking characteristics. *J. Dairy Sci.* **74**: 4189-4194.

Rogers, G.W., Hargrove, G.L., Lawlor, T.J.J. and Ebersole, J.L. (1991). Correlations among linear type traits and somatic cell counts. *J. Dairy Sci.* **74**: 1087-1091.

Rosenberger, G. (1979). Clinical Examination of Cattle.Paul Parey, Berlin and Hamburg, Germany.

Samore, A.B. and Groen, A.F. (2006). Proposal of an udder health genetic index for the Italian Holstein Friesian based on first lactation data. *Italian J. Anim. Sci*. **5**: 359-370.

Schepers, A.J., Lam, T.J., Schukken, Y.H., Wilmink, J.B. and Hanekamp, W.J. (1997). Estimation of variance components for somatic cell counts to determine thresholds for uninfected quarters. *J. Dairy Sci.* **80**: 1833-1840.

Seykora, A.J. and McDaniel, B.T. (1986). Genetics statistics and relationships of teat and udder traits, somatic cell counts, and milk production. *J. Dairy Sci.* **69**: 2395-2407.

Sharma, A., Sharma, S., Singh, N., Sharma, V. and Pal, R.S. (2016). Impact of udder and teat morphometry on udder health in Tharparkar cows under climatic condition of hot arid region of Thar Desert. *Trop. Anim. Hlth. Prod*. **48**: 1647-1652.

Sharma, N., Singh N.K. and Bhadwal, M.S. (2011). Relationship of somatic cell count and mastitis: An overview. *Asian-Aust. J. Anim. Sci*. **24**: 429-438.

Singh, K., Khanna, A.S., Kanaujia, A.S. and Singh, K. (2000). Factors affecting lactation performance and persistency in crossbred cattle. *Indian J. Dairy Sci.* **53**: 354-360.

Singh, R.S., Bansal, B.K. and Gupta, D.K. (2014). Udder health in relation to udder and teat morphometry in Holstein-Friesian × Sahiwal crossbred dairy cows. *Trop. Anim. Hlth. Prod*. **46**: 93-98.

Slettbakk, T., Jerstad, A., Farver, T.B. and Holmes, J.C. (1995). Impact of milking characteristics and morphology of udder and teats on clinical mastitis in first and second lactation Norwegian cattle. *Prev. Vet. Med*. **24**: 235-244.

Upadhyay, P.K., Tiwari, R.P. Dwivedi, H.B., Dwivedi, P. and Prasad, M. (2002).Factors influencing first lactation and lifetime production traits in Holstein-Friesian x zebu cattle. *Progressive Agri.* **2**: 145-147.

Uzmay, C., Kaya, Y., Akbas, Y. and Kaya, A. (2003). Effects of udder and teat morphology, parity and lactation stage on subclinical mastitis in Holstein cows. *Turkish J. Vet. Anim. Sci*. **27**: 695-701.

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