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Udder and teat morphology and their relation with incidence of sub-clinical and clinical mastitis in Sahiwal, Karan Fries cows and Murrah buffaloes

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Abstract

The present investigation was carried out in lactating Sahiwal, Karan Fries cows and Murrah buffaloes, maintained at Livestock Research Centre, ICAR-NDRI, Karnal, to evaluate different udder and teat shapes and their relation with incidence of sub-clinical and clinical mastitis. The shape of udder and teats was determined through visual appraisal method. The udder morphology was categorized into four different types as, trough, round, goaty and pendulous. Similarly, shape of teats was also grossly categorized into four types, as cylindrical, funnel, bottle and pear-shaped teats. Milk samples were tested for mastitis by CMT test. The frequencies of trough (bowl), round, goaty and pendulous type udder were 50.00%, 19.12%, 17.65% and 13.24% in Sahiwal cows; 41.56%, 24.68%, 23.38%, and 10.39% in Karan Fries crossbreed cows and 47.73%, 25.00%, 11.36% and 15.91%, in Murrah buffaloes, respectively. The trough udder was observed in higher frequency, followed by round, goaty and pendulous type in all the three breeds studied. The frequencies of cylindrical, funnel, bottle and pear type teat shape were 17.65%, 58.82%, 8.82%, and 14.71% in Sahiwal cows; 25.97%, 46.75%, 7.79%, and 19.48% in crossbred Karan Fries cows and 40.91%, 15.91%, 25.00%, and 18.18% in Murrah buffaloes, respectively. Among various shapes of the udder examined in the present study, pendulous shaped udder was having highest incidence of mastitis, including both clinical and subclinical, in Sahiwal cows and Murrah buffaloes (88.89% and 71.43%, respectively) followed by goaty (83.33% and 40.00%), round (38.46% and 18.18%) and trough (31.43% and 9.52%) shaped udder. However, in case of crossbred Karan Fries cows, incidence was highest in goaty (77.78%) followed by pendulous (75.00%), round (36.84%), and trough (21.88%) shaped udder.

Keywords: Teat morphology, sub-clinical, clinical mastitis, Sahiwal, Karan Fries cows and Murrah buffaloes

Introduction

Role of livestock sector especially dairy animals, towards the rural economy and livelihood security is immense and unquestionable especially for the small and marginal farmers^[1]. India is producing 165.4 million tons milk annually, and is contributing (9.5%) significantly to the world's total milk production^[2]. One of the major challenges to dairy industry in India is the drastic increase in incidence of sub-clinical and clinical mastitis. Mastitis is one of the most expensive diseases with regard to production loss across the world with defined parenchyma and connecting tissues inflammation, characterized by physical, chemical and bacteriological changes in milk, and pathological changes in glandular tissues^[3]. In India, the prevalence of sub-clinical mastitis is more (10-50% in cows and 5-20% in buffaloes) as compared to clinical mastitis (1-10%)^[4]. Due to mastitis, dairy industry annual losses are calculated to be approximately INR 7165.51 crores in India, while from sub-clinical mastitis INR 4151.16 crores with total loss of 57.93% due to mastitis^[5]. Thus, early identification of sub-clinical and clinical mastitis, various factors contributing to it, and implementation of effective management interventions can improve profit through an increase in milk production and quality premium, whereas, a decrease in milk dumped and expenses due to treatment and subsequent economic losses^[6,7].

Udder and teat morphology and other related characteristics are said to determine the susceptibility of animals to mastitis to a large extent. Kamboj *et al.*^[8] reported very high incidence of subclinical mastitis in pendulous shaped udder followed by unbalanced, goat

type, round and trough-shaped udders in Karan Fries cows. Uzmay *et al.* [9] reported cows with pendulous udder shape had the highest risk and cows with trough-shaped udders had the lowest risk of sub-clinical mastitis. Apart from this, George *et al.* [10] reported that the risk of mastitis was maximum in goaty udders in crossbred cows. Further, animals with smaller teats are said to be more prone to mastitis than the ones with medium and larger teats because shorter teat canal is enabling the microbes to move upward without much hindrance in comparison to large teat canal. These studies make it evident that udder and teat morphology does affect the occurrence of mastitis in dairy animals.

Materials and methods

Ethical approval

The present study was conducted after getting necessary approval from the Institute's Animal Ethics Committee.

Animal Selection and Management

The experiment was performed in milch breeds of Indigenous Sahiwal cattle (n=68), crossbred Karan Fries (Tharparkar X Holstein Friesen) cattle, (n=77) and Murrah Buffaloes (n=44) maintained under uniform management condition at Livestock Research Centre (LRC) of National Dairy Research Institute, Karnal, Haryana, India. Animals were maintained under loose housing management system. The paddock, which housed the animals under investigation, was large, open and brick paved. Milking was done in semi-automatic herringbone milking parlour system. The animals were fed ad lib green fodder (Berseem, Maize and Jowar) as per the maintenance requirement and production. The concentrate mixture with 70% TDN and 20% CP was fed as per the milk yield at the rate of 1 kg for every 2.5 kg of milk taking average 4% fat.

Udder and Teat Conformation

Classification of udder and teat conformation of all the experimental animals were done by the physical examination and categorized accordingly. The shape of udder was determined through visual appraisal method and categorized into four different types, viz., trough, round, goaty and pendulous. Similarly shape of teats was examined grossly and categorized into four types, viz., cylindrical, funnel, bottle and pear-shaped teats as per the visual appraisal method followed by Ovesen (1972) [11].

California Mastitis Test (CMT) for mastitis detection

California Mastitis Test (CMT), for the detection of mastitis, was performed using DeLaval California Mastitis Test (CMT) Kit. The CMT paddle cups were marked A, B, C and D to identify the individual quarter from which the milk was obtained, in the corresponding cup of the plastic paddle, one to two strips of milk (approx 3 mL) was taken from each teat, the extra milk was removed, and it was ensured that, the milk should level inside between edges of the cup and ring and equal amount (3 mL) of CMT solution was added to each cup of the paddle, the paddle was rotated in a circular motion for maximum 10 seconds to mix the milk and CMT solution thoroughly. The test was read quickly, as the visible reaction can disintegrate after about 20 s and grading of sub-clinical and clinical mastitis was done based on gel formation.

Results

Udder and teat shapes of Sahiwal, Karan Fries cows and Murrah buffaloes

The percentage occurrence of various udder and teat shapes of Sahiwal, Karan Fries cows and Murrah buffaloes, observed are as presented in Table 1.

The observation revealed that, the frequencies of trough (bowl), round, goaty and pendulous type udder were 50.00%, 19.12%, 17.65% and 13.24% in Sahiwal cows; 41.56%, 24.68%, 23.38% and 10.39% in Karan Fries crossbreed cows and 47.73%, 25.00%, 11.36% and 15.91%, in Murrah buffaloes, respectively. The incidence of trough udder was higher followed by round, goaty and pendulous type in all the three breeds studied (Table 1). It was further observed that the percent occurrence of trough (bowl) type udder was maximum in all lactating cows. The study revealed that, the frequencies of cylindrical, funnel, bottle and pear type teat shapes were 17.65%, 58.82%, 8.82% and 14.71% in Sahiwal cows; 25.97%, 46.75%, 7.79% and 19.48% in crossbred Karan Fries cows and 40.91%, 15.91%, 25.00% and 18.18% in Murrah buffaloes, respectively. Besides this, in Sahiwal and Karan-Fries cows, the incidence of funnel-shaped teat was higher followed by cylindrical, pear and bottle shape (Table 1). However, presence of cylindrical type teats was maximum in buffalo followed by bottle, pear and funnel shape.

Table 1: Frequency of different udder and teat shapes in Sahiwal, Karan Fries cows and Murrah buffaloes

Udder morphology	Sahiwal cows			Karan Fries cows			Murrah buffaloes		
	n	Frequency	%	n	Frequency	%	n	Frequency	%
Various shape of udder									
Trough	68	34	50.00	77	32	41.56	44	21	47.73
Round	68	13	19.12	77	19	24.68	44	11	25.00
Goaty	68	12	17.65	77	18	23.38	44	5	11.36
Pendulous	68	9	13.24	77	8	10.39	44	7	15.91
Various shape of teats									
Cylindrical	68	12	17.65	77	20	25.97	44	18	40.91
Funnel	68	40	58.82	77	36	46.75	44	7	15.91
Bottle	68	6	8.82	77	6	7.79	44	11	25.00
Pear	68	10	14.71	77	15	19.48	44	8	18.18

n is the number of observations

Relationship between udder morphology and incidence of sub-clinical and clinical mastitis

The results in this regard are as presented in Table 2. Among various shape of the udder examined in the present study, pendulous shaped udder was having highest incidence of

mastitis in Sahiwal cows and Murrah buffaloes, (88.89 and 71.43% respectively) followed by goaty (83.33 and 40.00%), round (38.46 and 18.18%) and trough (31.43 and 9.52%) shaped udder. However, in case of crossbred Karan Fries cows, incidence was highest in goaty (77.78%) followed by

pendulous (75.00%), round (36.84%) and trough (21.88%) shaped udder (Table 2). Further, it was observed that incidence of subclinical mastitis was comparatively higher as

compared to clinical mastitis. Incidence of mastitis was also seen higher in cows compared to buffaloes.

Table 2: Incidence of mastitis in Sahiwal, Karan Fries cows and Murrah buffaloes with respect to different udder morphology

Udder shape	n	Healthy (%)	Sub-clinical mastitis (%)	Clinical mastitis (%)	Incidence of mastitis (%)
Sahiwal cows (N=68)					
Trough	34	65.71 (23)	11.43(4)	20.00 (7)	31.43
Round	13	61.54 (8)	23.08(3)	15.38(2)	38.46
Goaty	12	16.67 (2)	50.00(6)	33.33(4)	83.33
Pendulous	9	11.11(1)	55.56(5)	33.33(3)	88.89
Karan Fries crossbred cows (N=77)					
Trough	32	78.13(25)	12.50(4)	9.38(3)	21.88
Round	19	63.16(12)	21.05(4)	15.79(3)	36.84
Goaty	18	22.22(4)	44.44(8)	33.33(6)	77.78
Pendulous	8	25.00 (2)	50.00(4)	25.00(2)	75.00
Murrah buffaloes (N=44)					
Trough	21	90.48(19)	4.76(1)	4.76(1)	9.52
Round	11	81.82(9)	0.00(0)	18.18(2)	18.18
Goaty	5	60.00(3)	40.00(2)	0.00(0)	40.00
Pendulous	7	28.57(2)	57.14(4)	14.29(1)	71.43

n and values within parenthesis indicate the number of observation

Discussion

The present findings are in agreement with studies of Kamboj *et al.* [12] who observed the highest frequency of conical or funnel-shaped teats (48.27%) in Karan Swiss cows followed by cylindrical (37.42%) and bottle (14.31%) shaped teats. In the same line of study, Tripathi *et al.* [13] reported the overall frequency in descending order as, cylindrical (39.0%), funnel (36.5%) and bottle shaped teats (4.5%) in Gir cows. Prasad *et al.* [14] reported 10.5, 11.0, 18.0, 52.5 and 8.0 per cent conical, bottle, pear, cylindrical and funnel-shaped teats, respectively in Murrah buffaloes. The bowl-shaped udder was observed to be the most common (77.42%) followed by round (20.97%) udder in crossbreed (Jersey × Kankrej). It was also reported that 59.6% bowl-shaped udder in Gir cows [13]; 45.94% most frequent trough shaped udder followed by pendulous (19.47%), goaty (15.09%), round (11.94%) and unbalanced udders (7.51%) in Karan Fries cows [12]. Per cent occurrence of the bowl, round, goaty and pendulous shaped udder is also reported in crossbred milch cows as 35.48, 16.12, 6.45 and 41.43, respectively [15]. Gajbhiye *et al.* [16] reported that 53.64, 37.69 and 2.58 per cent udders are of globular, trough and pendulous shape in crossbred cows. However, in Murrah buffalo, 61.0, 17.0, 9.0 and 13.0 per cent udder were observed to be bowl, globular, goaty and pendulous shaped [14].

Regarding the incidence of mastitis in relation to udder and teat morphology, the findings of the current study are in agreement with the earlier reports of Kamboj *et al.* [8] who has reported very high incidences of subclinical mastitis in pendulous shaped udder (93.54%) followed by unbalanced (41.66%), goat type (33.33%), round (26.31%) and trough-shaped udders (10.95%) in Karan Fries cows. It is well studied that, cows with pendulous udder shape had the highest risk and cows with trough-shaped udders had the lowest risk of sub-clinical mastitis [9]. Apart from this, George *et al.* [10] reported the risk of mastitis was in the order of maximum in goaty (34.18%) and primitive shaped (31.60%) udders in crossbred cows. However, Hussain *et al.* [17] found the maximum incidence of mastitis in bowl (35.24%), round (27.69%) and cup shape (6.88%) udder of indigenous cattle. In the present study, in all the three breeds, animals with pendulous udder were found to be positive for mastitis with

high incidence. This may be due to the reason that long and pendulous udders get in contact and ground more frequently, which causes injuries and helps the pathogens to grow. Moreover, teat morphology too has a role to play, as smaller teats are often associated with mastitis than medium and larger teats because shorter teat canal is enabling the microbes to move upward without much hindrance in comparison to large teat canal. Thus it may be clearly concluded that morphology of teat and udder does have a relation with mastitis occurrence, and hence proper selection of dairy animals for required udder and teat morphological characteristics becomes essential. Also, regular monitoring of lactating animals with pendulous shaped udder could help in reducing the incidences of sub-clinical mastitis in cows and buffaloes.

Conclusion

Dairy animals possess different types of udder and teats with respect to morphology, shape and size. The trough shaped udder has comparatively higher frequency of occurrence, followed by round, goaty and pendulous type in all the three breeds studied. Udder and teat morphological characteristics affect the incidence of clinical and subclinical mastitis in dairy animals. Pendulous type udder is seen to be more prone to mastitis compared to other types. This makes selection of dairy animals for desired udder and teat morphological characters essential. Further it necessitates regular monitoring of lactating animals with pendulous shaped udder to reduce the incidences of sub-clinical and clinical mastitis in cows and buffaloes.

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