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Effect of Lactation Order on Morphological Traits of Teat and Udder in Murrah Buffaloes

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ABSTRACT

The present study was conducted to evaluate the effect of lactation order on morphological traits of teat and udder in Murrah buffaloes. A total of 59 buffaloes were selected for the study which were milked twice daily (morning and evening) by hand milking method. From date of calving to 7th month of lactation, the udder morphological traits viz. teat length, teat diameter, distance between teats, udder dimension, udder depth and height of udder from the ground were recorded fortnightly by using measuring tape and vernier calliper. The teat length (cm) of left fore quarter in 7th lactation order was significantly ($p<0.05$) higher (9.43 ± 0.19) than first (6.77 ± 0.11), second (7.93 ± 0.07) and third (7.91 ± 0.17) lactation orders. The teat diameter (cm) of left fore quarter in 1st lactation order was significantly ($p<0.05$) lower than all other lactation orders. The distance between right fore and left fore teats in 5th lactation order was significantly ($p<0.05$) higher than 8th lactation order. Further, the udder depth rear in 9th lactation order (20.05 ± 0.27) was significantly ($p<0.05$) higher than 8th lactation order (17.11 ± 0.32). The height of udder base from the ground was significantly higher in first lactation order than subsequent parity except for 2nd lactation order. It was concluded that udder morphological traits of Murrah buffaloes varied from lactation to lactation order as the age advanced which could be deciding factors for selection of precious dairy animals to maximize the profitability at farm.

Keywords: Teat length, Teat Diameter, Udder length, Udder depth, Murrah buffalo

Udder and teat anatomy and physiology differ slightly between dairy buffaloes and cows. Desirable dairy conformation involves functional traits associated with high milk production over a long and trouble-free productive life. The morphology of udder is one of the genetic characteristics and fundamental criteria of selecting animals of dairy type. The size and shape of udder are very important conformation traits which could play a vital role for the suitability of economical milk production and should be considered for selecting dairy animals (Bhuiyan *et al.,* 2004). The normal buffalo udder usually has four quarters with four teats projecting ventrally from the two halves of the udder. The fore and hind quarters of each half are seldom equal in Indian buffaloes (Bhalerao, 1985). Congenital abnormalities in the bovine udder include many structural defects viz. fusion of front and hind teats, very small short teats, improperly placed teats, cut up udders and supernumerary teats (Rahman and Gill, 1992). The size and form of udder and teats not only influence milk production, but also differ in their suitability for milking (Bardakcioglu *et al.,* 2011). A roomy udder is a pre-requisite for high milk production (Ahmed and Barbary, 2000) where as pendulous udders are more susceptible to injuries, mastitis and more difficult to milk through milking machine (Sagar, 2009). It is presumed that the size and morphology of udder varies greatly from individual to individual animal and between different lactation orders. Therefore the present investigation was carried out to study the effect of lactation order on morphological traits of teat and udder in Murrah buffaloes.

MATERIALS AND METHODS

The present study was conducted at Cattle and Buffalo Farm, Indian Veterinary Research Institute, Izatnagar, Uttar Pradesh from the period of August 2014 to March 2015. A total of fifty nine lactating and advance pregnant buffaloes were selected for the study. These animals were maintained as per the existing management practices and milked twice daily (morning and evening) by hand milking method under calf suckling system. From date of caving to 7th month of lactation, the udder morphological traits viz. teat length, teat diameter, distance between teats, udder dimension, udder depth and height of udder from the ground were recorded fortnightly by using measuring tape and vernier calliper.. The teat traits were defined as per International Committee for Animal Recording (ICAR), 2012. The teat length (cm) was measured as distance between base to the tip of teat for each quarter viz. Left Fore (LF), Left Rear (LR), Right Fore (RF) and Right Rear (RR). The teat diameter (cm) was measured at the midpoint of teat length by vernier callipers for each quarter separately. The distance between the two teats (cm) was taken from the midpoint of teat length. The udder length (cm) was measured as the distance between the rear and fore attachment of udder along the median line passing between the two halves of the udder between left and right teat. The udder width (cm) was measured as the distance between two lateral lines of attachment of udder to the abdominal wall, under the flank along the median line passing between front and rear teats. The udder circumference (cm) was measured by keeping a flexible tape around the base of udder. The udder depth (cm) was measured from ground floor to base of udder or teat attachment. The height of udder (cm) was measured from plain ground floor at different point's viz. udder base, teat base, teat tip and rear udder.

The collected data during study period was pooled and analysed as per standard statistical procedure (Snedecor and Cochron, 1994) using Statistical Analytical System (SAS) 9.2 version software. The one way Analysis of Variance (ANOVA) was applied to see the significant variation between lactation orders and multiple comparisons were performed using Tukey's test.

RESULT AND DISSCUSSION

Teat length

The teat length (cm) in different lactation orders of Murrah buffaloes has been presented in Table1. In Left Fore (LF) teat, 1st lactation order had significantly lower teat length than all other lactation orders. The teat length in 7th lactation order was significantly ($p<0.05$) higher than 1st, 2nd and 3rd lactation orders, however it was non-significantly different from 4th lactation onwards. In Left Rear (LR) teat, the length was significantly ($p<0.05$) higher in 6th lactation order than 1st and 2nd lactation order. In Right Fore (RF) teat, 1st lactation order had significantly ($p<0.05$) lower teat length than other all lactation orders. The teat length in 9th lactation order was significantly ($p<0.05$) higher than 1st, 2nd, 3rd 4th, 7th and 8th lactation orders. In Right Rear (RR) teat, 9th lactation order had significantly ($p<0.05$) higher teat length than all other lactation orders. The teat length in Murrah buffaloes showed an increasing trend in almost all quarters except few lactation orders. The increase in length of teat might be due to increase in size of udder as per synthesis of mammary tissues with advancement of age (Antalik and Strapak, 2010). The present findings were in agreement with the findings of Singh *et al.* (2010) who observed an increasing trend of udder and teat measurements up to the 5th parity. Prasad *et al.* (2010) also found that milk vein had positive and significant correlation ($P<0.01$) with the average teat length and diameter in lactating Nili-Ravi buffaloes.

Teat diameter

The teat diameter (cm) in different lactation orders of Murrah buffaloes has been presented in Table1. The teat diameter in LF teat in 1st lactation order was significantly ($p<0.05$) lower than all other lactation orders. The teat diameter in 6th lactation order was significantly ($p<0.05$) higher than all the lactation orders except 9th lactation order. In LR teat, the diameter was significantly ($p<0.05$) higher in 9th lactation order than 1st, however, it was non-significantly different from other lactation orders. In Right Fore (RF) teat, 1st lactation order had significantly ($p<0.05$) lower teat diameter than other all lactation orders. The teat

Table 1. Lactation order wise means (±SE) for teat length and teat diameter of Murrah buffaloes

Lactation Order	Teat length(cm.)				Teat Diameter (cm.)			
	LF	LR	RF	RR	LF	RF	LR	RR
1	6.77±0.11^{d}	8.31±0.16^{fg}	6.50±0.10^{ef}	8.13±0.14^{e}	2.54±0.04^{h}	2.52±0.04^{g}	2.79±0.04^{b}	2.92±0.18^{cde}
2	7.93±0.07^{bc}	8.97±0.19^{ef}	7.96±0.08^{cd}	9.45±0.14^{cd}	2.89±0.05^{efg}	2.88±0.04^{def}	3.43±0.27^{abc}	3.14±0.05^{bcde}
3	7.91±0.17^{c}	10.31±0.20^{bcde}	8.16±0.15^{c}	10.61±0.18^{b}	3.00±0.05^{cde}	2.98±0.06^{cdf}	3.47±0.05^{abc}	3.70±0.21^{abc}
4	8.66±0.19^{ab}	11.04±0.20^{abc}	8.39±0.27^{bc}	10.40±0.24^{bc}	2.97±0.04^{def}	2.87±0.06^{def}	3.67±0.05^{ac}	3.60±0.06^{abc}
5	8.28±0.21^{abc}	10.64±0.29^{abcdef}	9.13±0.21^{abc}	10.55±0.14^{bc}	2.92d±0.06^{efg}	3.18±0.07^{abcd}	3.57±0.09^{abc}	3.55±0.08^{abcde}
6	9.31±0.13^{a}	12.78±3.01^{ab}	8.67±0.17^{abc}	10.13±0.19^{bcd}	3.83±0.15^{a}	3.61±0.13^{a}	3.88±0.10^{abc}	4.01±0.15^{abc}
7	9. 43±0.19^{a}	11.00±0.22^{abc}	7.97±0.32^{cd}	10.80±0.26^{b}	3.24±0.04^{bcd}	2.94±0.06^{cdef}	4.26±0.55^{a}	4.39±0.57^{a}
8	9.37±0.29^{a}	10.94±0.23^{abcd}	8.06±0.26^{cd}	11.46±0.26^{b}	3.23±0.08^{bcd}	3.05±0.05^{bcd}	3.60±0.07^{abc}	3.64±0.09^{abcd}
9	9.11±0.20^{a}	12.70±0.31^{a}	9.78±0.20^{a}	13.43±0.22^{a}	3.41±0.08^{ab}	3.41±0.08^{ab}	4.28±0.27^{a}	4.20±0.08^{ab}

Means bearing different superscripts differ significantly ($p<0.05$) within the column
Where LF= left fore; LR = left rear; RF= right fore; RR= right rear

diameter in 6th lactation order was significantly ($p<0.05$) higher than 1st, 2nd, 3rd 4th, 7th and 8th lactation order. In Right Rear (RR) teat, 7th lactation order had significantly ($p<0.05$) higher teat diameter than all other lactation orders. The teat diameter in Murrah buffaloes showed an increasing trend as the lactation order advanced. The increase in teat diameter might be due to proportional increase in teat length of the respective quarter with the advancement of age (Rahman and Gill, 1992). The present finding is comparable with the findings of Tilki *et al.* (2005) who reported that all the udder measurements were affected by lactation number as the udder tissues continuously develop up to 6th parity with the advancement of age.

Distance between two teats

The lactation order wise distance (cm) between two teats of Murrah buffaloes has been presented in Table 2. The

Table 2. Lactation order wise means (±SE) for inter teat distance (cm) of Murrah buffaloes

Lactation Order	Distance between teat (cm)					
	RF-LF	RR-LR	LF-LR	RF-RR	LF-RR	RF-LR
1	15.12±0.24^{a}	10.59±0.18^{a}	9.33±0.18^{bcd}	10.29±0.91^{ab}	14.11±0.23^{abc}	13.85±0.23^{bcd}
2	14.67±0.21^{ab}	10.05±0.22^{abcd}	8.94±0.17^{bcd}	9.12±0.15^{b}	13.65±0.31^{bcde}	13.80±0.27^{cde}
3	14.85±0.26^{a}	10.29±0.18^{abc}	10.06±0.58^{abc}	9.95±0.14^{ab}	14.06±0.22^{abcd}	14.03±0.20^{bc}
4	13.95±0.20^{abcd}	9.58±0.17^{bcde}	9.10±0.15^{bcd}	9.13±0.16^{b}	13.52±0.18^{bcdef}	14.05±0.20bc
5	15.67±0.55^{a}	11.07±0.33^{a}	11.70±0.50^{a}	12.30±0.57^{a}	15.85±0.66^{a}	15.50±0.72^{ab}
6	15.39±0.35^{a}	10.79±0.36^{ab}	9.71±0.27^{abcd}	10.43±0.27^{ab}	15.71±0.38^{a}	16.57±0.31^{a}
7	13.80±0.34^{abcde}	9.32±0.22^{bcdef}	8.74±0.23^{cd}	8.79±0.18^{abcde}	12.71±0.26^{defg}	13.33±0.33^{cdef}
8	12.21±0.28^{ef}	8.30±0.32^{f}	9.20±0.25^{bcd}	9.00±0.22^{ef}	12.39±0.32^{efg}	12.25±0.28^{fg}
9	14.65±0.23^{abc}	9.08±0.14^{abc}	10.68±0.34^{ab}	10.83±0.27^{abc}	14.45±0.28^{abd}	14.80±0.25^{abc}

Means bearing different superscripts differ significantly ($p<0.05$) within the column
Where LF= left fore; LR = left rear; RF= right fore; RR= right rear

Table 3. Lactation order wise means (±SE) of udder traits of buffaloes

Lactation Order	Udder dimensions (cm)			Udder depth (cm)		Height from ground (cm)			Udder rear height (cm)
	UL	UW	UC	Rear	Fore	Udder base	Teat base	Teat tip	
1	33.79±0.48^{abc}	21.26±0.26^{bc}	97.21±1.40^{ab}	18.38±0.71^{abc}	15.76±0.25^{e}	70.55±0.29^{bc}	59.20±0.41^{a}	52.43±0.48^{a}	54.82±0.22^{abc}
2	35.27±0.45^{ab}	21.93±0.26^{abc}	102.47±1.06^{a}	19.37±0.31^{ab}	17.17±0.26^{d}	69.16±0.32^{cd}	56.43±0.43^{bd}	48.68±0.47^{bcd}	55.65±0.41^{a}
3	34.75±0.54^{ab}	22.66±0.30^{a}	101.59±1.20^{a}	19.33±0.24^{ab}	17.15±0.28^{d}	68.07±0.32^{d}	54.15±0.38^{c}	46.30±0.47^{e}	54.68±0.35^{abc}
4	34.70±0.36^{ab}	22.44±0.24^{ab}	98.65±1.15^{ab}	18.67±0.24^{abc}	16.86±0.21^{de}	65.43±0.42^{de}	52.53±0.36^{e}	44.13±0.52^{ef}	55.95±0.43^{a}
5	38.53±0.87^{a}	21.33±0.53^{abc}	104.67±1.25^{a}	18.80±0.35^{abc}	16.67±0.47^{de}	65.37±0.41^{ef}	51.20±0.67^{efg}	42.92±0.62^{efgh}	53.97±0.47^{abcde}
6	33.68±0.52^{abc}	21.75±0.40^{abc}	95.32±1.18^{abc}	17.86±0.51^{abc}	16.57±0.43^{de}	67.86±0.69^{ef}	55.25±0.98^{bcd}	45.93±0.95^{def}	53.71±0.51^{abcdef}
7	37.39±3.41^{a}	21.15±0.47^{abc}	97.53±1.37^{ab}	17.97±0.44^{abc}	17.50±0.41^{cd}	63.45±0.59^{f}	49.82±0.49^{g}	40.46±0.56^{h}	55.09±0.36^{abc}
8	33.23±0.72^{abc}	20.80±0.38^{bc}	95.59±1.59^{abc}	17.11±0.32^{bc}	15.93±0.31^{de}	64.71±0.51^{f}	52.59±0.44^{cef}	43.39±0.67^{fgh}	55.64±0.39^{ab}
9	36.20±0.51^{ab}	22.25±0.39^{abc}	103.05±1.24^{a}	20.05±0.27^{a}	17.05±0.25^{de}	64.28±0.56^{f}	49.85±0.61^{fg}	40.71±0.50^{gh}	55.58±0.44^{abc}

Means bearing different superscripts differ significantly ($p<0.05$) within the column
Where UL= udder length; UW= udder width; UC= u

distance between RF and LF teats in 5th lactation order was significantly ($p<0.05$) higher than 8th lactation order but it was non-significant from other orders. The distance between RR and LR teats showed similar trend as the distance between RF and LF.

The distance between LF and LR teats in 5th lactation order was significantly ($p<0.05$) higher than 1st, 2nd, 4th, 7th and 8th lactation orders. The distance between RF and RR teats in 5th lactation order was significantly ($p<0.05$) higher than 2nd, 4th and 8th lactation orders. The distance between LF and RR teats in 5th lactation order was significantly ($p<0.05$) higher than 2nd, 4th 7th and 8th lactation orders. The distance between RF and LR teats in 6th lactation order was significantly ($p<0.05$) higher than 1st, 2nd, 3rd, 4th, 7th and 8th lactation orders but non-significant from 5th and 9th lactation orders.

The higher inter teat distances were found increasing till 5th parity order which indicated the growth of udder tissues. The present findings are in agreement with Fielder *et al.* (1979) who reported positive genetic correlations of milk yield with teat length, teat circumference, the distance between front and rear teats. Saini and Gill (1988) and Redekar *et al.* (2003) reported that the distance between teats play an important role in determining the milk production of buffaloes and the correlations of distance between front, rear and lateral teats were positive with total milk yield and 100 days milk yield.

Udder dimension

The lactation order wise udder dimension (cm) viz. Udder length (UL), udder width (UW) and udder circumference (UC) of Murrah buffaloes has been presented in Table 3. The UL was highest in 5th lactation order but not significantly different among other lactation orders. The UW in 3th lactation order was significantly ($p<0.05$) higher than 1st and 8th lactation order but it was non-significant than other lactation orders. The UC was higher in 9th lactation order but not significantly different among other lactation orders. The present findings is also supported by Bhuiyan *et al.* (2004) who found that udder length was lesser in 1st lactation and gradually increased up to the 6th lactation order. The udder length, diameter and width increased in size as the lactation number increased in Murrah buffaloes (Prasad *et al.*, 2010).

Udder depth

The lactation order wise udder depth (cm) of Murrah buffaloes has been presented in Table 3. The udder depth rear (UDR) in 9th lactation order was significantly ($p<0.05$) higher than 8th lactation order non significant from other lactation orders. The udder depth fore (UDF) in 7th lactation order was significantly ($p<0.05$) higher than 1st lactation order but it was non-significant from other orders. Saxena and Prabhu (1970) in Murrah buffaloes also reported positive correlations between udder measurements (udder

length, depth and width) and daily milk yields. Similar to the present findings, Tilki *et al.*, (2005) and Antalik and Strapak (2010) reported that stage of lactation had no significant effect on depth of rear udder. The udder circumference, length and udder capacity before milking in the morning milking were higher than those in the noon milking which could be attributed to the milk forming duration that was longer for morning milking than noon milking.

Height of udder from the ground

The lactation order wise udder height from the ground (cm) of Murrah buffaloes has been presented in Table 3. The udder base height from ground in 1th lactation order was significantly ($p<0.05$) higher than 3rd, 4th, 5th, 6th, 7th, 8th and 9th lactation order but it was non-significant from 2nd lactation order. The teat base height and teat tip from ground in 1th lactation order was significantly ($p<0.05$) higher than all other lactation orders. The udder rear height in 4th lactation order was significantly ($p<0.05$) higher than 1st lactation order, The higher distance of udder base, teat base and teat tip from the ground in 1st lactation might be due to lesser udder size in 1st parity. The size of udder has indirect relation with the distance from the ground and udder base (Rahman and Gill, 1992). The present findings are in agreement with the findings of Saxena (1973) who reported significant partial correlations between one of the udder measurements and test milk yield keeping one variable constant in Murrah buffaloes.

CONCLUSION

From the present study, it could be concluded that udder morphological traits of Murrah buffaloes varied from lactation to lactation order as the age advanced. The teat length and teat diameter increased up to 6th lactation order and had positive correlation with udder dimension. The parity order could be one of the major deciding factors for selection of precious dairy animals for maintaining high yield at organized or small scale farm levels.

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