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UDDER TEAT MORPHOLOGY AND BODY MEASUREMENTS AND THEIR RELATIONSHIP WITH MILK YIELD AND MILKING TRAITS IN GIR COWS

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ABSTRACT

An investigation was undertaken to study the udder, teat and body measurements as affected by parity and their relationship with milk yield and milking traits in 100 Gir cows at Cattle Breeding Farm, JAU, Junagadh. Mean udder length, width and depth were found to be (cm) 45.99 ± 2.07, 20.51 ± 0.99 and 20.29 ± 1.04, respectively and were significantly (P < 0.01) affected according to different orders of lactations. Positive and significant correlations were observed among all the udder measurements. However, the correlation was significant among Udder length, Udder width and daily milk yield (kg) (P<0.05). The average teat length (cm) and diameter (cm) in the present study were 7.07 ± 0.42 and 3.49 ± 0.21 cm respectively. A positive correlation existed between the average daily milk yield and the various teat measurements such as teat length, teat diameter, but the correlation was significant (P<0.05) only between the average teat diameter (cm) and the average daily milk yield (kg). Teat lengths and diameter were significantly (P<0.01) increasing with parity with respect to different shapes of teat. Overall body length, height at withers and heart girth were 126.24 ± 1.37 cm, 130.60 ± 1.65 cm and 165.13 ± 1.67 cm respectively. Body length (P< 0.05) and heart girth (P < 0.01) were significant with respect to different shapes of udder.

Gir cows in third parity were found to have higher average daily milk yield of 6.06 ± 0.91 kg followed by second, fourth and first group as 5.45 ± 0.54, 5.21 ± 0.53, and 4.25 ± 0.30 kg. Second group was found to have higher average milking time (min.) of 2.90 ± 0.18 followed by third, first and fourth group as 2.72 ± 0.28, 2.71 ± 0.16 and 2.63 ± 0.18, respectively. Milk flow rate (kg/min.) was found lower in first group (0.73 ± 0.04) and higher in fourth group (1.01 ± 0.09). Milk SNF (%) ranged from 8.48 ± 0.05 to 8.57 ± 0.05 in fourth to first group, which is in decreasing order but Fat% did not show any trend. Protein% was also significantly (P<0.05) affected by lactation number.

Keywords : udder measurements, teat measurements, body measurements, parity, milk yield, milking traits, Gir cows.

Gir is one of the important milch breeds in India with an average total lactation milk yield of about 2149.87 litre per lactation and average 300 days lactation yield is about 1867.96 litre[3]. In the absence of these records, milch animal is judged based on mammary gland characteristics and body conformation to arrive at its milk production potential. It was reported that both morphological and physiological mammary properties affect the milk yield in cattle[2]. Milk production increases with

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lactation number and is maximized in the fourth or the fifth lactation. This is a result of the increasing development and size of the udder and the increasing body size over that of the first lactation animal[6]. There was an increase in size and diameter of teats from the first to third lactation[1]. Udder height and udder depth were increasing with increasing lactation number ($P < 0.05$)[13]. Order of lactation affects milk flow rate ($P < 0.05$) but not milking time ($P > 0.05$). In Gir cows, parity had no significant effect on let down time, but significantly affected ($P<0.01$) actual milking time and amount of milk drawn and milker's efficiency. Milk flow is influenced by stage of lactation, lactation number, udder health, milking equipment, milking routines and under which conditions the machine milking is taking place[5]. Hence, an attempt was made to study the udder, teat and body dimensions in Gir cows in different lactations and their relationship with milk yield and milking traits.

MATERIALS AND METHODS

The experimental study was carried out at Cattle Breeding Farm, Junagadh Agricultural University, Junagadh (01-11-2010 to 31-01-2011) on 100 lactating Gir cows. The udder shapes were classified in to Bowl, Pendulous, Round and Trough. Teat shapes were classified as Bottle, Pear, Cylindrical and Funnel. Physical measurements included udder length, udder width and udder depth, teat length and teat diameter. Body measurements included body length, height at withers and heart girth.

All the milch cows were stimulated for milk ejection by manually massaging the udder after washing. Washing of udder was practiced before and after milking. Morning, noon and evening milk yields of individual cow were recorded to arrive at the total daily milk yield. The data obtained on various udder, teat and body parameters were analyzed using an SPSS statistical package (version 12.0.1) to obtain mean and standard error (S.E) values of various udder and teat measurements in different lactations. The significance of differences in various measurements in different lactations was tested using Duncan's Multiple Range test. The correlation coefficient was estimated between udder, teat and body measurements and the average daily milk yield and milking traits (Snedecor and Cochran, 1989).

RESULTS AND DISCUSSION

Udder, teat morphology and biometry : Overall mean values of udder and teat characteristics and body measurement are presented in Table 1. Udder length, width and depth obsered in the present study were similar to those observed by Qureshi et al. (1984) for Gir cows and Prasad et al. (2010) for Murrah buffaloes. Udder length, width and depth were significantly ($P < 0.01$) affected according to different orders of lactations[4,10]. The mean teat lengths in Gir cows were increasing order from first to fourth lactation; whereas, teat diameter was increasing order from first to third lactation (Table 1) and is in the range[18]. Teat lengths and diameter were significantly ($P<0.01$) increasing with parity with respect to different shapes of teat. The body length and heart girth were in increasing order with parity, while, body height was increasing up to third lactation (Table 1). Body length ($P<0.05$) and heart girth ($P<0.01$) were significant with respect to different shapes of udder[9&16].

Milk yield, milking time and composition of milk : Gir cows in third parity were found to have higher average daily milk yield followed by second, fourth and first lactation (Table 2). Average daily milk yield of animals were higher in third lactation (Table 2). Cows in second parity were found to have higher average milking time followed by third, first and fourth lactation. Milk flow rate was found lower in first group and higher in fourth group which is in increasing order with lactation number (P<0.05). Among different milk components milk fat and protein percent did not follow any trend; however, SNF percent was in decreasing order from first to fourth lactation (Table 2). Milk protein% was significantly (P< 0.05) higher in first lactation. Fat% and SNF% were non significant (P>0.05) which is in agreement with previous report[5,12,13&16].

There was a positive correlation between the udder measurements and the daily milk yield (Table 3) were in line with those reported[4,10&19]. However, the correlation was significant among Udder length, Udder width and daily milk yield (P<0.05)[15]. Although, a positive correlation existed between the average daily milk yield and the various teat measurements, such as teat length and teat diameter but correlation was significant (P<0.05) only between the average teat diameter and the average daily milk yield. These results are in agreement with previous reports[1,18&22]. Body measurements (except height at withers) were positively and significantly (P<0.05) correlated with udder measurements and teat measurements (except Teat diameter). Body measurements are not correlated with milking traits as average daily milk yield, milking time, milk flow rate and milk constituents which is in agreement with previous workers[8,9&11].

The correlation of milk flow rate with daily milk yield and milking time was significantly positive (P < 0.01). The findings are similar to other reports[11&13]. Consequently, milk flow rate increased with the increasing in milk yield. All milk constituents (Fat%, SNF% and Protein %) are positively correlated with Milking time and negatively correlated with daily milk yield (except Fat %) and milk flow rate.

From the results of the present study, it is evident that udder, teat and body measurements are reliable criteria while selecting buffaloes for milk production[7]. Average udder length, teat length, body length, heart girth and milk flow rate were continuously increasing with parity, while, udder width, udder depth, teat diameter and body height were higher in third parity. Average daily milk yield of dairy cattle was maximum in third lactation. It can be concluded that there is an increase in udder and teat measurements with increase in parity and these measurements especially udder width, length, teat diameter and milking traits and milk flow rate may be used for selection of buffaloes for milk production at the field level, in view of their significant positive correlation with milk yield.

Table 1. Various udder, teat and body measurements (mean ±S.E.) in Gir cows according to order of lactation

Order of lactation	No. of animals (n)	Udder measurement (cm)			Teat measurement (cm)		Body measurement (cm)		
		Udder length	Udder width	Udder depth	Teat length	Teat diameter	Body length	Height at wither	Heart girth
1	33	40.92^{a} ± 1.36	19.02^{a} ±0.76	17.86^{a} ±0.77	6.23^{a}±0.30	3.09^{a} ±0.15	123.59^{a} ±1.25	128.12^{a} ±1.34	159.52^{a} ±1.16
2	26	43.68^{a} ±2.29	18.65^{a} ±0.92	17.41^{a} ±0.87	6.33^{a}±0.44	3.29^{a} ±0.25	126.35^{b} ±1.30	131.06^{a} ±2.17	165.04^{b} ±1.21
3	15	51.26^{b} ±2.99	24.59^{b} ±1.52	24.11^{b}±1.22	8.13^{b} ±0.56	3.99^{b}±0.35	126.06^{c} ±2.14	135.30^{a} ±1.53	168.67^{bc} ±3.16
4+	26	51.71^{b} ±1.73	21.90^{ab} ±0.89	24.03^{b} ±0.82	8.27^{b} ±0.39	3.90^{b} ±0.14	129.59^{d} ±1.08	130.58^{a}±1.43	170.31^{c} ±1.29
Over all	**100**	**45.99±2.07**	**20.51±0.99**	**20.29±1.04**	**7.07±0.42**	**3.49±0.21**	**126.24±1.37**	**130.60±1.65**	**165.13±1.67**

Means with similar superscripts do not differ significantly (P>0.05)

Table 2. Average Daily milk yield (kg) and Various Milking traits (mean ±S.E.) in Gir cows according to Lactation number.

Order of lactation	No. of animals (n)	Daily milk yield (kg)	Milking time (minute)	Milk flow rate (kg/min.)	Fat (%)	SNF (%)	Protein (%)
1	33	4.25^{a} ±0.30	2.71^{a} ±0.16	0.73^{a} ±0.04	4.57^{a} ±0.07	8.57^{a} ±0.05	3.93^{a} ±0.04
2	26	5.45^{a} ±0.54	2.90^{a} ±0.18	0.86^{a} ±0.07	4.46^{a} ±0.06	8.55^{a} ±0.03	3.78^{b} ±0.04
3	15	6.06^{a} ±0.91	2.72^{a} ±0.28	0.90^{ab} ±0.09	4.72^{a} ±0.08	8.49^{a} ±0.05	3.86^{b} ±0.03
4+	26	5.21^{a} ±0.53	2.63^{a} ±0.18	1.01^{b} ±0.09	4.49^{a} ±0.05	8.48^{a} ±0.05	3.79^{b} ±0.04
Overall	**100**	**5.08±0.50**	**2.74±0.18**	**0.86±0.07**	**4.54±0.06**	**8.53±0.04**	**3.85±0.04**

Means with similar superscripts do not differ significantly (P>0.05)

Table 3.
Phenotypic correlations among various udder, teat and body measurements, Av. daily milk yield (kg), milking traits and milk constituents in Gir cows.

Properties		Udder Measurements			Teat Measurement		Body Measurements			Milking traits & Milk constituents					
		Length	Width	Depth	Length	Diameter	Length	Height	Heart girth	Daily milk yield	Fat %	SNF %	Protein %	Milking time	Milk flow rate
Udder Measurements	Length	1.00	0.63**	0.72**	0.50*	0.42*	0.27*	-0.17	0.38*	0.33*	0.07	-0.08	-0.13	0.15	0.20
	Width		1.00	0.66**	0.45*	0.48*	0.08	0.13	0.21*	0.28*	0.07	-0.02	-0.03	0.12	0.12
	Depth			1.00	0.53*	0.48*	0.24*	0.06	0.44*	0.17	0.11	-0.06	-0.10	0.03	0.19
Teat Measurement	Length				1.00	0.55*	0.24*	0.17	0.40*	0.16	0.09	-0.16	-0.04	0.01	0.07
	Diameter					1.00	0.17	0.34*	0.38*	0.27*	-0.07	0.07	-0.13	0.10	0.14
Body Measurements	Length						1.00	0.01	0.48*	0.12	0.08	-0.13	-0.18	0.02	0.11
	Height							1.00	0.28*	0.00	0.01	-0.14	0.01	-0.05	-0.07
	Heart girth								1.00	0.09	0.02	-0.11	-0.06	-0.09	0.14
Milking traits & Milk constituents	Daily milk yield									1.00	0.05	-0.08	-0.04	0.68**	0.56*
	Fat%										1.00	-0.17	0.16	0.08	-0.11
	SNF%											1.00	0.33*	0.01	-0.18
	Protein%												1.00	0.01	-0.13
	Milking time													1.00	0.02
	milk flow rate														1.00

** Correlation is highly significant at the 0.01 level (2-tailed). * Correlation is significant at the 0.05 level (2-tailed).

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