

International Journal of Advanced Biochemistry Research



ISSN Print: 2617-4693
ISSN Online: 2617-4707
NAAS Rating (2026): 5.29
IJABR 2026; 10(1): 606-610
www.biochemjournal.com
Received: 07-10-2025
Accepted: 10-11-2025

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Correlation study on morphological traits of the teats with somatic cell count in Jaffarabadi buffaloes

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DOI: <https://www.doi.org/10.33545/26174693.2026.v10.i1h.7030>

Abstract

An investigation was carried out named Correlation study on morphological traits of the teats with somatic cell count in Jaffarabadi Buffaloes. A total of 40 for experimental Jaffarabadi buffaloes from Cattle Breeding Farm, Junagadh Agricultural University, Junagadh, Gujarat were selected. Teat morphology was studied and assessed for each animal. Duration of experiment was 3 months. All the teat measurements were taken prior to milking at monthly intervals. All milk samples were analyzed at fortnightly intervals. The SCC (Thousand cells/ml) means values were higher occurrence in pear shape of teats followed by bottle, conical, funnel and cylindrical shape of teats with 304.33 ± 107.90 , 232.67 ± 72.82 , 118.81 ± 20.37 , 115.07 ± 14.10 and 78.29 ± 17.71 thousand cells/ml, respectively. No significant difference was found in other teat measurements in experimental Jaffarabadi buffaloes. Buffaloes with pear and bottle shaped teats had significantly higher milk somatic cell count compared to funnel, conical and cylindrical shaped teats. This might be due to bottle and pear shaped had higher teat length and diameter. The higher infection rates of quarters with greater teat diameter of teat might be due to larger diameters of teat canal which would allow easy passage for the microbes to the mammary tissues.

Keywords: Teat morphology, somatic cell count, Jaffarabadi buffalo, teat shape, udder health

Introduction

The livestock sector plays an important role in India's economy; generates income, employment and foreign exchange earnings. Buffalo occupies an important place in livestock economy of Asian region including India because of their adaptability to harsh climatic conditions, tolerance to tropical diseases and ability to perform under poor managerial practices. Buffalo not only contributes milk and meat to human beings but also it has powerful draft power. That's why buffalo is also known as a triple purpose animal. Milk production in India during 2018-19 and 2019-20 was 187.75 and 198.40 million tonnes respectively, which shows 5.68 percent increase. The per capita availability of milk was around 406 grams/day in 2019-20 (Anonymous, 2021) [4]. In India as per latest livestock census total livestock population is 535.78 million and total bovine population is 302.79 million.

As per 20th livestock census the buffalo population in Gujarat is 10.5 million in 2019. In India, Jaffarabadi buffalo is the heaviest breed compared to other breeds of buffaloes. The native place of this breed is Saurashtra region of Gujarat around the Gir forest. This breed is also known as Bhavanagri, Gir or Jaffari due to its origin.

Mastitis incidence can be decreased in the population of the future by including desirable features of the udder and teats that are unfavorable to the disease in breeding programmes. According to Ahmed and Barbary (2000) [2], a pendulous udder is more prone to injuries and mastitis while a roomy udder is a requirement for good milk production. Mastitis is an infection of the mammary gland, a disease of great economic importance resulting in significant economic losses in the dairy industry. Physical characteristics of teats are important traits associated with incidence of sub clinical mastitis. Milk SCC is a key component of international and national regulations for milk quality and is an indicator of udder health and the prevalence of clinical and sub-clinical mastitis in dairy farming (Sharma *et al.*, 2011) [13]. Buffalo is considered to be less susceptible to mastitis than cattle (Mustafa *et al.*, 2013) [8].

The buffalo's long, thin teat canal is supposed to effectively keep germs out of the udder, which may explain why buffaloes eventually experience less mastitis than cattle (Uppal *et al.*, 1994) [16]. The SCC of normal milk is fewer than 2,00,000 cells/ml; higher SCC is regarded as abnormality in milk and indicates udder infection. Udder and teat morphology and other related characteristics are said to determine the susceptibility of animals to mastitis to a large extent. Hence, the present study was conducted to know teat biometry and its relation with somatic cell count in Jaffarabadi buffaloes with the following objectives.

1. To study the biometry of teats in Jaffarabadi buffaloes.
2. To study the relationship of teat biometry with somatic cell count in Jaffarabadi buffaloes.

Materials and Methods

The present study was carried out at Cattle Breeding Farm, Junagadh Agricultural University, Junagadh, Gujarat. A total of 40 experimental Jaffarabadi buffaloes were selected and isomanagerial practices were followed. Duration of experiment was 3 months. All the teat measurements were taken prior to milking at monthly intervals. All milk samples were analyzed at fortnightly intervals.

1. Teat

Teat measurements were taken from each experimental Jaffarabadi buffaloes three times in the first, second and third months of lactation. These measurements were teat length, teat diameter and distance between teats. All teat shapes were recorded three times during the experiment period.

2. Teat Length (TL)

The length of the teat (cm) was measured from the upper part of the teat where it hangs perpendicularly from the udder to the tip. Teat length was measured to the nearest 0.01 cm using vernier caliper

3. Teat Diameter (TD)

Teat diameter (cm) was measured at the middle of the teat by vernier caliper to the nearest of 0.01 cm. All four teats were measured individually.

4. Distance between Teats

The distance between fore teats, distance between rear teats and the distance between fore and rear teats were measured with vernier caliper to the nearest 0.1 cm, taking care not to touch the teat with the scale. DBTFF = Distance between Fore Fore Teats, DBTRR = Distance between Rear Rear Teats, DBTFL = Distance between Fore and Rear (left and right side) teats.

5. Somatic Cell Count (SCC)

SCC was performed by automatic SCC analyzer machine "Lactoscan combo" (Milktronic Limited, Bulgaria) at Dept. of Livestock Production Management.

Statistical Analysis

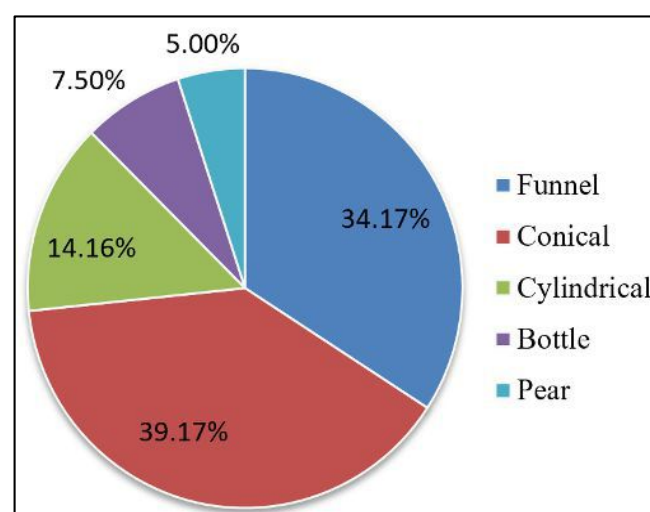
Statistical analysis of the data was carried out according to the procedures suggested by Snedecor and Cochran (1994) [15]. Means among different groups were compared by analysis of variance (One way ANOVA).

Results and Discussion

Shapes of Teat

In present study, different teat shapes were found viz., conical, funnel, cylindrical, pear and bottle shape of teats. Graphical representation of percentages of different teat shapes in Fig 1. The results indicated that among the different types of teats, the occurrence of conical shape of teats (39.17 percent) was the most common followed by funnel, cylindrical, bottle and pear shape of teats with 34.17 percent, 14.16 percent, 7.5 percent and 5 percent, respectively.

Prasad *et al.* (2010) [10], Raju, B. (2017) [11] and Ranjitha *et al.* (2021) [12] reported that cylindrical shaped teats were predominant over other shape in buffaloes and Ahmed *et al.* (2005) [3] reported, funnel shaped teats were prominent over other shapes in cows.



Teat Biometry According to Teat Shapes

Teat length

The mean values for teat length of fore left, fore right, rear left and rear right according to the teat shapes are presented in Table 1. According to the teat shapes, teat were divides into different groups viz. funnel, conical, cylindrical, bottle and pear shape of teat in experimental Jaffarabadi buffaloes. The present experiment revealed that the overall mean values of teat length of fore left, fore right, rear left and rear right were 8.29 ± 0.19 cm, 7.75 ± 0.18 cm and 8.53 ± 0.22 cm and 7.88 ± 0.19 cm, respectively.

The mean values of fore left (FL) teat lengths for conical, funnel, cylindrical, bottle and pear were 7.86 ± 0.23 , 8.72 ± 0.39 , 7.51 ± 0.28 , 10.11 ± 0.83 and 8.25 ± 0.53 cm, respectively. The mean values of fore right (FR) teat lengths for conical, funnel, cylindrical, bottle and pear were 7.20 ± 0.25 , 8.04 ± 0.33 , 7.50 ± 0.42 , 9.94 ± 0.80 and 7.58 ± 0.57 cm, respectively. The mean values of rear left (RL) teat lengths for conical, funnel, cylindrical, bottle and pear were 8.48 ± 0.38 , 8.66 ± 0.37 , 8.24 ± 0.33 , 10.33 ± 0.40 and 6.08 ± 0.71 cm, respectively. The mean values of rear right (RR) teat lengths for conical, funnel, cylindrical, bottle and pear were 7.69 ± 0.32 , 8.01 ± 0.39 , 8.12 ± 0.36 , 8.06 ± 0.46 and 7.58 ± 0.62 cm, respectively.

Contrast findings, Patel *et al.* (2016) [9], who found cylindrical shape of teat had significantly ($p < 0.05$) higher teat length compared to other shape of teats.

Singhai, S.K. (2012) [14] reported that teat length was higher in cylindrical shape of teat compared to other type of teats. The mean values of teat length was significantly ($p < 0.05$)

higher in bottle shape of teats followed by funnel, cylindrical, conical and pear shape of teats in experimental Jaffarabadi buffaloes. We observed teat length of fore left and rear left were significantly higher ($p<0.05$) in bottle shape of teats than conical, cylindrical and pear shape of

teats. However, length of bottle shaped teat was at par with funnel shape of teats.

Whereas, fore right teat diameter was significantly ($p<0.05$) higher in bottle shaped teats as compared to other shape of teats. No any significant difference was found in rear right teat length among various teat shapes.

Table 1: Mean values for various teat lengths (cm) in experimental Jaffarabadi buffaloes according to teat shapes

Teat shape	Teat length (cm)				Mean teat length (cm)
	Fore left	Fore right	Rear left	Rear right	
Funnel	8.72 ^{ab} ±0.39	8.04 ^a ±0.33	8.66 ^{bc} ±0.37	8.01±0.39	8.36 ^{ab} ±0.30
Conical	7.86 ^a ±0.23	7.20 ^a ±0.25	8.48 ^b ±0.38	7.69±0.32	7.81 ^a ±0.25
Cylindrical	7.51 ^a ±0.28	7.50 ^a ±0.42	8.24 ^b ±0.33	8.12±0.36	7.84 ^a ±0.29
Bottle	10.11 ^b ±0.83	9.94 ^b ±0.80	10.33 ^c ±0.40	8.06±0.46	9.61 ^b ±0.49
Pear	8.25 ^a ±0.53	7.58 ^a ±0.57	6.08 ^a ±0.71	7.58±0.62	7.38 ^a ±0.45
Overall	8.29±0.19	7.75±0.18	8.53±0.22	7.88±0.19	8.11±0.16

Means with different superscripts within a column (a, b, c) differ significantly ($p<0.05$)

Teat diameter

In the present study, it was found that the overall mean values of teat diameter for fore left, fore right, rear left and rear right were 3.30±0.06 cm, 3.20±0.07 cm, 3.27±0.06 cm and 3.07±0.06 cm, respectively. The perusal of the data in Table 2. Revealed that the mean values of teat diameter ranged from 3.01±0.10 cm in cylindrical shaped teats to 3.93±0.10 cm in bottle shaped teats. The mean teat diameter was significantly ($p<0.05$) higher in bottle shape of teat followed by pear, conical, funnel and cylindrical shape of

teats. However, teat diameter of fore left, fore right and rear left were also significantly ($p<0.05$) higher in bottle shaped of teats compared to other shape of teats. The present experiment has revealed that the mean teat diameter for funnel, conical, cylindrical, bottle and pear were 3.13±0.06 cm, 3.20±0.09 cm and 3.01±0.10 cm, 3.93±0.10 cm and 3.22±0.33 cm, respectively. The mean values of fore left (FL) teat diameter for funnel, conical, cylindrical, bottle and pear shaped teats were 3.20±0.09, 3.28±0.10, 3.03±0.14, 4.29±0.15 and 3.48±0.28 cm, respectively.

Table 2: Mean values for various teat diameters (cm) in experimental Jaffarabadi buffaloes according teat shapes

Teat shape	Teat diameter (cm)				Mean teat diameter (cm)
	Fore left	Fore right	Rear left	Rear right	
Funnel	3.20 ^a ±0.09	3.15 ^a ±0.09	3.15 ^a ±0.10	3.04±0.08	3.13 ^a ±0.06
Conical	3.28 ^a ±0.10	3.13 ^a ±0.14	3.29 ^a ±0.10	3.12±0.10	3.20 ^a ±0.09
Cylindrical	3.03 ^a ±0.14	3.12 ^a ±0.11	3.02 ^a ±0.12	2.89±0.12	3.01 ^a ±0.10
Bottle	4.29 ^b ±0.15	4.01 ^b ±0.12	4.33 ^b ±0.12	3.08±0.34	3.93 ^b ±0.10
Pear	3.48 ^a ±0.28	3.05 ^a ±0.33	3.10 ^a ±0.31	3.26±0.50	3.22 ^a ±0.33
Overall	3.30±0.06	3.20±0.07	3.27±0.06	3.07±0.06	3.21±0.05

Means with different superscripts within a column (a, b, c) differ significantly ($p<0.05$)

The mean values of fore right (FR) teat diameter for funnel, conical, cylindrical, bottle and pear were 3.15±0.09, 3.13±0.14, 3.12±0.11, 4.01±0.12 and 3.05±0.33 cm, respectively. The mean values of rear left (RL) teat diameter for funnel, conical, cylindrical, bottle and pear were 3.15±0.10, 3.29±0.10, 3.02±0.12, 4.33±0.12 and 3.10±0.31 cm, respectively. The mean values of rear right (RR) teat diameter for funnel, conical, cylindrical, bottle and pear were 3.04±0.08, 3.12±0.10, 2.89±0.12, 3.08±0.34 and 3.26±0.50 cm, respectively.

Similar findings, Singhai, S.K. (2012) [14] reported that the overall mean teat diameter was 3.49±0.21 cm in Gir cows. They observed bottle shape of teat had significantly ($p<0.05$) higher teat diameter. Patel *et al.* (2016) [9] in Crossbred cows observed teat diameter was significantly ($p<0.05$) higher in bottle shape of teat compared to other shape of teats. Contrast findings, teat diameter of bottle shaped teats in present study was lesser than teat diameter of bottle shape of teat 4.08±0.07 as reported by Khatri *et al.*

(2017) [7] in water buffaloes.

Distance between teats

The mean values for distance between fore teats, between rear teats, distance between fore and rear teats according the udder shape are presented in Table 3. According to the teat shapes, the overall mean values of distance between teats for fore and fore, rear and rear, fore rear left, fore rear right were 12.39±0.28 cm, 6.58±0.17 cm, 8.74±1.08 cm and 7.54±0.18 cm, respectively. We observed no significant difference in distance between teats according to teat shapes except distance between right fore rear was significantly ($p<0.05$) higher in cylindrical shape of teats compared to bottle and pear shape of teats. Distance between teats in cylindrical shape of teats was significantly ($p<0.05$) higher. This might be due to cylindrical shape of teat had long teat length and small teat diameter so increase space between teats. I could not find any relevant literature of distance between teats according teat shapes.

Table 3: Mean values for various distances between teats (cm) in experimental Jaffarabadi buffaloes according to teat shapes

Teat shape	Distance between teats				Mean distance between teats (cm)
	Fore fore	Rear rear	Left fore rear	Right fore rear	
Funnel	12.01±0.47	6.45±0.31	7.33±0.30	7.53 ^{ab} ±0.28	8.33±0.23
Conical	12.28±0.38	6.68±0.23	10.52±2.73	7.35 ^{ab} ±0.31	9.21±0.69
Cylindrical	13.88±0.98	6.82±0.48	9.18±0.57	8.85 ^b ±0.37	9.68±0.48
Bottle	11.56±0.92	5.89±0.63	6.83±0.65	6.50 ^a ±0.24	7.69±0.45
Pear	12.92±1.10	6.92±1.08	5.98±1.02	6.92 ^a ±1.18	8.18±1.03
Overall	12.39±0.28	6.58±0.17	8.74±1.08	7.54±0.18	8.81±0.30

Means with different superscripts within a column (a, b, c) differ significantly ($p < 0.05$)

Effect of Teat Morphology on Milk Somatic Cell Count

According to the teat shapes in experimental Jaffarabadi buffaloes, the mean values of somatic cell count are presented in Table 4. The SCC (Thousand cells/ml) means values were higher occurrence in pear shape of teats followed by bottle, conical, funnel and cylindrical shape of teats with 304.33±107.90, 232.67±72.82, 118.81±20.37, 115.07±14.10 and 78.29±17.71 thousand cells/ml, respectively.

No significant difference was found in other teat measurements in experimental Jaffarabadi buffaloes. According teat shapes, milk somatic cell count for conical, funnel, cylindrical, bottle and pear were 118.81±20.37, 115.07±14.10, 78.29±17.71, 232.67±72.82 and 304.33±107.90 thousand cells/ml in experimental Jaffarabadi buffaloes. Buffaloes with pear and bottle shaped teats had significantly higher milk somatic cell count compared to funnel, conical and cylindrical shaped teats.

Similar findings, Ahlawat, K. (2007) ^[1] in Sahiwal cows, reported that bottle shaped teats had significantly higher SCC compared to other shape of teats. However, contrary to present findings, Uzmay *et al.* (2013) ^[17] reported in Holstein cows, he found that funnel shape of teat had higher milk SCC compared to other shape of teats. Kamboj *et al.* (2008) ^[6] in Karan-Fries cows, Hussain *et al.* (2013) ^[5] in buffaloes, Shinde (2019) in crossbred cows, reported that cylindrical shaped teats had higher milk SCC.

This might be due to bottle and pear shaped had higher teat length and diameter. The higher infection rates of quarters with greater teat diameter of teat might be due to larger diameters of teat canal which would allow easy passage for the microbes to the mammary tissues.

Teat diameter fore left was positively and significantly ($p < 0.05$) correlated with total daily milk yield ($r = 0.202$) and somatic cell count ($r = 0.213$).

Table 4: Milk somatic cell count in experimental Jaffarabadi buffaloes according to teat shapes

Teat shape	SCC (Thousand cells/ml)
Funnel	115.07 ^a ±14.10
Conical	118.81 ^a ±20.37
Cylindrical	78.29 ^a ±17.71
Bottle	232.67 ^b ±72.82
Pear	304.33 ^b ±107.90
Overall	129.61±13.02

Means with different superscripts within a column (a, b, c) differ significantly ($p < 0.05$)

Teat length fore left was negatively correlated with somatic cell count but it was non-significant ($p > 0.05$). Teat length fore left and right was positively correlated with SCC but it was non-significant ($p > 0.05$).

Teat length rear left was negatively correlated SCC but it was non-significant. Teat length rear right was negatively correlated with SCC but it was non-significant ($p > 0.05$).

Distance between fore fore teats was negatively correlated with SCC but it was non-significant ($p > 0.05$). Distance between rear rear teats was negatively correlated with SCC thousand cells/ml but it was non-significant ($p > 0.05$). Distance between fore rear right teats was negatively correlated with SCC but it was non-significant ($p > 0.05$). Distance between fore rear left teats was negatively correlated with SCC but it was non-significant ($p > 0.05$).

Conclusions

Buffaloes having bottle shaped teat had significantly ($p < 0.05$) higher mean teat length and teat diameter, teat lengths and diameters of fore left, fore right and rear left. Bottle shape of mean teat length and diameter were 9.61±0.49 cm, 3.93±0.10 cm, respectively. Distances between right fore rear teats was significantly ($p < 0.05$) higher in cylindrical shaped teats as compared to bottle and pear shaped teats.

According teat shapes, We observed significantly ($p < 0.05$) higher somatic cell count in bottle and pear shaped teats compared to other shaped teats.

The correlation coefficient of SCC with teat diameter fore left was positive and significant ($p < 0.05$).

The following conclusions were drawn from the present study.

1. The occurrence of conical shape of teats were highest followed by funnel, cylindrical, bottle and pear shape of teats in experimental Jaffarabadi buffaloes.
2. Teat length and teat diameter were significantly ($p < 0.05$) higher in bottle shape of teat. Distance between teats was significantly ($p < 0.05$) higher in cylindrical shape teats followed by conical, funnel, pear and bottle shape of teats.
3. Cylindrical shape of teat had significantly ($p < 0.05$) higher milk yield per milking and total daily milk yield but minimum somatic cell count; whereas, bottle and pear shape of teats had significantly ($p < 0.05$) higher somatic cell count and lower milk yield compared to other shape of teats.
4. Relationship of fore left teat diameter with total milk yield and somatic cell count were positive and significant ($p < 0.05$).

Thus, it is concluded that majority of experimental Jaffarabadi buffaloes have conical shaped teats. Experimental Jaffarabadi buffaloes with cylindrical teat produce more milk with low somatic cell count.

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