International Journal of Veterinary Sciences and Animal Husbandry

ISSN: 2456-2912
NAAS Rating (2026): 4.61
VET 2026;SP-11(1): 30-35

www.veterinarypaper.com
Received: 16-11-2025
Accepted: 18-12-2025

Dr. Pudoori Rajkumar
Postgraduate Scholar, Department of Livestock Production Management, College of Veterinary Science, P. V. Narasimha Rao Telangana Veterinary University, Rajendranagar, Hyderabad, Telangana, India

Dr. Suresh Rathod
Professor and Associate Dean, College of Dairy Technology, P. V. Narasimha Rao Telangana Veterinary University, Kamareddy, Telangana, India

Dr. M Ajay Kumar
II Year Postgraduate Scholar, Department of Livestock Production Management, College of Veterinary Science, P. V. Narasimha Rao Telangana Veterinary University, Rajendranagar, Hyderabad, Telangana, India

Dr. G Mounika
II Year Postgraduate Scholar, Department of Livestock Production Management, College of Veterinary Science, P. V. Narasimha Rao Telangana Veterinary University, Rajendranagar, Hyderabad, Telangana, India

Dr. P Siva Kumar
I Year Postgraduate Scholar, Department of Livestock Production Management, College of Veterinary Science, P. V. Narasimha Rao Telangana Veterinary University, Rajendranagar, Hyderabad, Telangana, India

Dr. Tejavath Sravan Kumar
I Year Postgraduate Scholar, Department of Livestock Production Management, College of Veterinary Science, P. V. Narasimha Rao Telangana Veterinary University, Rajendranagar, Hyderabad, Telangana, India

Corresponding Author:
Dr. Pudoori Rajkumar
Postgraduate Scholar, Department of Livestock Production Management, College of Veterinary Science, P. V. Narasimha Rao Telangana Veterinary University, Rajendranagar, Hyderabad, Telangana, India

Multivariate Analysis of Udder morphometric Traits Associated with Mastitis Incidence in Dairy Cattle

Pudoori Rajkumar, Suresh Rathod, M. Ajay Kumar, G. Mounika, P. Siva Kumar, Tejavath Sravan Kumar

DOI: https://www.doi.org/10.22271/veterinary.2026.v11.i1Sa.2922

Abstract
The present investigation was undertaken in Mancherial, Siddipet, and Rangareddy districts of Telangana State, representing the North, Central, and South agro-climatic zones, respectively. From each district, four mandals were selected, and three villages were chosen from each mandal. A field survey was conducted among dairy farmers to document prevailing milking and management practices related to milk production. Mastitis, being one of the most economically significant diseases of dairy animals, continues to cause substantial production and economic losses. The limited awareness among dairy farmers regarding scientific production and management practices underscores the need for capacity building and extension interventions aimed at mastitis mitigation. Evaluation of existing management practices is essential to identify strengths and constraints within the dairy production system and to formulate appropriate intervention strategies.
The influence of host-level risk factors on mastitis incidence was significantly higher ($p<0.05$) in cows (43.3%) compared to buffaloes (30.6%). A significantly greater incidence of mastitis ($p<0.05$) was observed in high-yielding animals producing more than 10 liters of milk per day (50%). Among udder conformations, trough-shaped udders were most prevalent (34.73%), followed by round (31.94%), pendulous (18.75%), and goaty (14.58%) types. The corresponding incidence of mastitis was 40.2% in round, 35.0% in trough, 57.41% in pendulous, and 31.0% in goaty udders. Furthermore, udder biometry revealed a significant increase ($p<0.05$) in mastitis incidence with increasing udder length (>57 cm), udder width (>67 cm; 49.1%), udder circumference (>96 cm), and udder depth (>20 cm). The higher susceptibility associated with larger udder dimensions may be attributed to increased contact of the udder with the floor during recumbency, leading to greater exposure to environmental contamination and, consequently, a higher risk of mastitis.

Keywords: Mastitis, Udder Morphology, Prevelence of mastitis

Introduction
The dairy sector plays a vital role in strengthening the rural economy and serves as a major source of livelihood for crores of people across the globe. In India, livestock rearing and milk production have been an integral part of the culture for thousands of years, shaping the unique structure of the country's dairy industry. Unlike many developed nations, India's dairy sector is driven largely by small and marginal farmers. It is often described as a system of "production by the masses" rather than "mass production," as most dairy farmers own only one to three animals. The sustained efforts of these smallholders, along with their livestock, have enabled India to emerge as the largest milk-producing country in the world.
At present, the dairy sector provides employment to more than eight crore families in India. Its distinct strengths lie in the active participation of small farmers, the cooperative framework, and the contribution of indigenous cattle breeds, all of which together form the backbone of the sector. Milk production in India is growing at a rate exceeding 6 percent annually, compared to about 2 percent globally, and the per capita availability of milk in the country is also considerably higher than the world average.
Mastitis, derived from the Greek words *mastos* meaning breast and *itis* meaning inflammation, is a complex, multi-etiological disease defined as inflammation of the parenchyma of the

mammary gland. It is characterized by physical, chemical, and usually bacteriological changes in milk, along with pathological alterations in glandular tissues. The incidence of mastitis is influenced by a range of animal, environmental, managemental, and nutritional factors. In the present work, emphasis has been placed on animal-related factors, particularly udder morphology and biometry, including udder width, height, and length, in relation to mastitis occurrence. Differences between cows and buffaloes, as well as between indigenous and crossbred cows, were examined, as udder shape and morphological traits play a significant role in predisposing animals to mastitis.

Studies done previously

Patel (2014) reported that the incidence of mastitis was highest in cows with goaty udders (80.00%), followed by pendulous (60.61%), trough (46.02%), and round-shaped udders (35.90%). With respect to udder measurements, he observed that the highest proportion of mastitis-positive cases occurred in cows having medium udder length (48–68 cm; 49.32%), smaller udder width (<55 cm; 51.52%), and greater udder depth (>28 cm; 64.00%).

Bharti *et al*. (2015) observed significantly higher mean somatic cell counts (SCC) in cows with pendulous udders (6.393±0.037) compared to those with normally shaped udders (5.120±0.034). They further noted that mean SCC values were highest in flat teats (6.189±0.105), followed by inverted (5.850±0.068) and pointed teats (5.030±0.035).

Modh *et al*. (2017) [7], in a study conducted on Gir cows, reported mastitis incidence rates of 47.05% in trough-shaped udders, 51.51% in round, 63.15% in goaty, and 55.55% in pendulous udders.

Ahmad (2011) [5] studied the various shapes of udders and incidence of mastitis and reported that, trough shape of udder was most prevalent (56.80%), followed by round (28.5%), pendulous (12.62%), and goaty udders (2.0%). Further, the incidence of mastitis was higher in pendulous shaped (53.13%), followed by goaty (30%), round (28.97%) and trough shaped udders (19.10%). Regarding udder width, higher incidence (53.03%) of mastitis was found in the udder with udder width >73 cm as compared to udder width < 56 cm. (18.39%). With respect to the udder depth, higher incidence (41.18%) of mastitis was found in the udders with udder depth of <53 cm and lower (21.31%) in the udders with udder depth >65 cm.

Sinha *et al*. (2022) [9] studied the udder and teat morphometric traits with the occurrence of mastitis in Karan Fries and Sahiwal cattle. The rear udder height, rear udder width, udder width and fore udder attachment were found to be the important udder morphometric traits associated with the occurrence of mastitis

Materials and methods

Location of the study and Research design

The study was conducted in the Mancherial, Siddipet, and Rangareddy districts of Telangana State, representing the North, Central, and South agro-climatic zones, respectively. From each district, four mandals were selected, and three villages were chosen from each mandal for the study. A list of dairy farmers for whom dairying served as a major or subsidiary source of income was obtained from local milk cooperative societies and personnel of the Animal Husbandry Department. From each selected village, eight dairy farmers were randomly selected, resulting in a total sample size of 288 respondents.

Data were collected through personal visits using a pre-structured and pre-tested interview schedule. A survey was undertaken to assess udder morphology, including udder biometry parameters such as length, width, and depth, along with their characteristics, and to study the incidence of mastitis based on the distribution of different udder shapes and their association with mastitis occurrence. A semi-structured questionnaire, common to all respondents, was designed to capture information related to dairy cattle management practices. The enrolled farmers, who owned dairy cows and buffaloes, were evaluated for mastitis incidence using recommended diagnostic tests. The study adopted an exploratory research design with a simple random sampling technique. Rapport was maintained with the farmers throughout the investigation to ensure accurate responses, and data were collected through informal and friendly interactions at their homes and farms during the early and late hours of the day. The collected data were analyzed using appropriate standard statistical procedures to draw meaningful conclusions.

Udder morphology with their characteristics

Udder shape

Shape of udder were determined through visual appraisal method adopted by Cerkascenko (1958), accordingly categorized into different types, viz., trough, round, goaty and pendulous.

Trough shape udder Goaty udder

Pendulous udder Round Udder

Biometry of udder (length, width and depth)
Udder length, width and depth were measured one to two hours before evening milking after securing the animals properly in a standing position on a leveled floor for the accuracy. All the measurements were recorded in centimeters.

Udder length: The udder length was measured from the rear attachment of the udder, near the escutcheon, to the front of the udder where it blends smoothly with the body

Udder width: The udder width was measured as a distance between two lateral lines of attachment of the udder to abdominal wall, beneath the flank.

The measuring tape was kept in position on one side of the animal, under flank, near the stifle joint and it was passed over in between fore and rear teats to the other side.

Udder depth: The udder depth was measured by subtracting distance from the barn. floor to the udder floor and distance from the barn floor to the base of the udder

The following udder measurements of dairy cattle under study were recorded. Average score was worked out based on the distribution. Average score for udder length, width, depth and circumference were grouped into three categories.

Udder categories based on biometry

Udder length(cm)	Udder width(cm)	Udder circumference(cm)	Udder depth(cm)
Small (less than 57)	Small (less than 54)	Small (less than 80)	Small (less than 15)
Medium (57-68)	Medium (54-67)	Medium (80-96)	Medium (15-20)
Larger (more than 68)	Large (more than 67)	Large (more than 96)	Large (more than 20)

Results and discussion
Distribution of different udder shapes and incidence of mastitis
The data on percent distribution of different udder shapes are presented in Table 5.1 and Fig. 1. The results of the table read that, the trough-shaped udder was the most frequent (34.73%), followed by round (31.94%), pendulous (18.75%) and goaty (14.58%). Further, slightly higher degree of pendulous udder shape was observed in dairy cattle which might be due to the increasing age and parity that weaken the median suspensory ligament of the udder.

Udder shape and incidence mastitis

Udder shape	Frequency (N)	Percentage (%)
1. Trough shape	100	34.73
2. Round shape	92	31.94
3. Goaty shape	42	14.58
4. Pendulous shape	54	18.75
Total	288	100

Udder shape and incidence mastitis

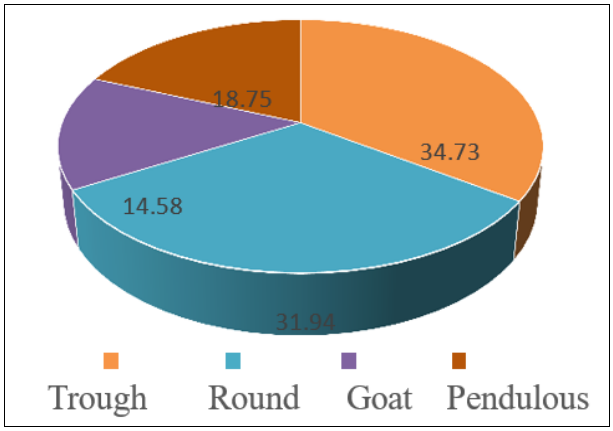

Fig 1: Udder shape and incidence mastitis

The results of the table 4.15 shows that, the percent incidence of mastitis was 40.22%, 35%, 57.41% and 31% among round, trough, pendulous and goaty shape of udders respectively. Further the table also revealed that the shape of udder had only 40.0 percent influence on incidence of mastitis.

Table 5.2: Incidence of mastitis based upon distribution of different udder shapes

Udder shape	Frequency (N)	Uninfected (N)	Percentage (%)	Infected (N)	Percentage (%)
1.Trough	100	65	65.00	35	35.00
2. Round	92	55	59.78	37	40.22
3. Goaty	42	29	69.00	13	31.00
4. Pendulous	54	23	42.59	31	57.41
Total	288	172	59.72	116	40.28

Udder morphological risk factors associated with the incidence of mastitis in dairy cattle

Observation of Table 4.16, indicate that, the incidence of mastitis was 27.7, 36.4 and 51.3 percent in dairy animals with small (less than 57cm), medium (57-68cm) and large (more than 68cm) udder length, respectively. As the length of udder increased above 57cm (medium and large) the incidence of mastitis was recorded significantly higher ($P<0.05$). Similarly, a higher incidence of mastitis was observed in udder width greater than 67cm (49.1%) as compared to udder width medium (41%) and smaller than 54cm (26.7%).

With respect to the circumference of the udder, higher incidence (50%) of mastitis was found in the animals with udder circumference more than 96 cm as compared to animals having medium (44.2%) and less than 80 cm udder circumference (30.6%).

Similarly, with respect to the udder depth, higher incidence (51%) of mastitis was found in the animals with larger udder depth (more than 20 cm) compared to medium (38.1%) and lower udder depth (30.6%). The chi-square analysis of udder morphological risk factors associated with mastitis in dairy cattle revealed that, there was significant effect in relation to udder length, width, udder circumference and udder depth (Table 4.16). The width of udder showed a significant($P<0.05$) effect on the incidence of mastitis.

Table 5.3: Distribution of udder morphology and incidence of mastitis in dairy cattle

Udder morphology	Incidence of mastitis				
	Distribution (N)	Uninfected (N)	Percentage (%)	Infected (N)	Percentage (%)
1. Udder length(cm):					
Small (less than 57)	65	47	72.3	18	27.7
Medium (57-68)	110	70	63.6	40	36.4
Larger (more than 68)	113	55	48.7	58	51.3
2. Udder width(cm):					
Small (less than 54)	75	55	73.3	20	26.7
Medium (54-67)	105	62	59.0	43	41.0
Large (more than 67)	108	55	50.9	53	49.1

3. Udder circumference(cm):					
Small (less than 80)	85	59	69.4	26	30.6
Medium (80-96)	95	53	55.8	42	44.2
Large (more than 96)	108	54	50.0	54	50.0
4. Udder depth(cm):					
Small (less than 15)	85	59	69.4	26	30.6
Medium (15-20)	105	65	61.9	40	38.1
Large (more than 20)	98	48	49.0	50	51.0

Table 5.4 Udder morphological risk factors associated with the incidence of mastitis in dairy. cattle

Variables		Distribution (N=288)	Positive (N)	χ^2 Value	p-value
1.Udder shapes (cm):	Trough	100	35	9.26	0.025
	Round	92	37		
	Goaty	42	13		
	Pendulous	54	31		
2. Udder length (cm):	Small (less than 57)	65	18	10.72	0.005
	Medium (57-68)	110	40		
	Larger (more than 68)	113	58		
3. Udder width (cm):	Small (less than 54)	75	20	9.27	0.0097
	Medium (54-67)	105	43		
	Large (more than 67)	108	53		
4. Udder Circumference (cm):	Small (less than 80)	85	26	7.53	0.023
	Medium (80-96)	95	42		
	Large (more than 96)	108	54		
5. Udder depth (cm):	Small (less than 15)	85	26	8.227	0.016
	Medium (15-20)	105	40		
	Large (more than 20)	98	50		

The results of the study indicated that trough-shaped udders were the most prevalent (34.73%), followed by round (31.94%), pendulous (18.75%), and goaty (14.58%) types. The corresponding incidence of mastitis was 40.22% in round, 35% in trough, 57.41% in pendulous, and 31% in goaty udders. The observed higher frequency of trough- and pendulous-shaped udders aligns with the findings of Singh (2005) in Karan Fries cows, who reported 45.94% and 19.47%, respectively. Comparable distributions of trough-shaped udders have also been reported by Patel and Trivedi (2018) in crossbred dairy cattle (56.5%), Ziaullah *et al*. (2018) in Sahiwal cows (50%), Karan Fries (41.56%), Murrah buffaloes (47.73%) by Ahlawat (2007), Sahiwal cows (44.44%) by Uzmay *et al*. (2003), and Holstein cows (55.9%) by Sharma (1967). The slightly higher incidence of pendulous udders observed in this study may be attributed to advancing age and parity, which can weaken the median suspensory ligament of the udder.

Regarding udder dimensions, mastitis incidence increased with udder size. Animals with small udder length (<57 cm) exhibited 27.7% incidence, medium length (57–68 cm) 36.4%, and large length (>68 cm) 51.3%, with the increase in mastitis for medium and large udders being statistically significant ($P<0.05$). Similarly, higher mastitis incidence was recorded in animals with udder width greater than 67 cm (49.1%) compared to medium (41%) and small (<54 cm) widths (26.7%).

With respect to udder circumference, animals with more than 96 cm had a 50% incidence of mastitis, compared to medium (44.2%) and small (<80 cm) circumference (30.6%). For udder depth, larger udders (>20 cm) had a higher mastitis incidence (51%) relative to medium (38.1%) and shallow udders (30.6%). Chi-square analysis confirmed that udder length, width, circumference, and depth were significant morphological risk factors for mastitis in dairy cattle, consistent with observations by Kamboj *et al*. (2008) and Patel (2014). The higher susceptibility in animals with larger udders may be due to increased chances of injury and contamination, as the udder spreads on the floor when the animal lies down, making it more prone to infection.

Conflict of Interest
Not available

Financial Support
Not available

Reference

1. Kamboj MS, Singh G, Singh H. Effect of udder and teat morphology on incidence of mastitis in dairy cows. Indian Journal of Animal Sciences. 2008;78(3):279–281.
2. Patel D, Trivedi P. Relationship between udder morphology and mastitis incidence in crossbred dairy cattle. Veterinary World. 2014;7(4):218–222.
3. Singh D. Study on udder morphology and its association with mastitis in Karan Fries cows. Indian Journal of Dairy Science. 2005;58(6):354–358.
4. Uzmay S, Kaya O, Ozturk E. Association between udder conformation and subclinical mastitis in Holstein cows. Journal of Veterinary Medicine Series A. 2003;50(7):343–347.
5. Ahmad M. Study on udder morphology and its association with mastitis incidence in dairy cattle. Indian Journal of Animal Research. 2011;45(2):123–127.
6. Bharti VK, Singh S, Kumar R. Effect of udder and teat morphology on somatic cell count in dairy cows. Veterinary World. 2015;8(8):1013–1017.
7. Modh DS, Patel JB, Parmar KS. Udder conformational traits and their association with mastitis in Gir cows. Journal of Livestock Science. 2017;8:52–57.
8. Patel D. Association of udder morphology with mastitis incidence and udder measurements in dairy cattle. International Journal of Animal Science. 2014;9(3):210–216.

9. Sinha A, Singh R, Yadav P. Udder and teat morphometric traits associated with mastitis occurrence in Karan Fries and Sahiwal cattle. Journal of Dairy Research and Development. 2022;10(1):45–50.

How to Cite This Article
Rajkumar P, Rathod S, Ajay Kumar M, Mounika G, Siva Kumar P, Sravan Kumar T. Multivariate Analysis of Udder morphometric Traits Associated with Mastitis Incidence in Dairy Cattle. International Journal of Veterinary Sciences and Animal Husbandry. 2026;SP-11(1): 30-35.