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An Insight into the Clinico-Epidemiological Profile of Mastitis in Dairy Animals: A Retrospective Analysis

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ABSTRACT

This retrospective study investigated the clinico-epidemiological characteristics of mastitis in dairy animals at TVCC, DUVASU, Mathura. The study analyzed medical records from June 2021 to May 2022, focusing on dairy animals diagnosed with clinical mastitis. Data on animal demographics, clinical presentation, and antibiotic usage were extracted and statistically analyzed. The prevalence rate of clinical mastitis in the hospital was 10.269% (2600/267), with cows being the most affected species, followed by buffalo and goats. Udder swelling and hot redness were commonly observed udder abnormalities, while teat blockage was a frequent teat abnormality. Clotted milk was consistently found among milk abnormalities during the study period. These findings provide valuable insights into the clinico-epidemiological characteristics of mastitis in dairy animals. The study emphasizes the importance of proper diagnosis and targeted treatment for effective management, and it can contribute to the development of preventive measures and control strategies to reduce the impact of mastitis on animal health and dairy industry productivity.

HIGHLIGHTS

- Overall prevalence of clinical mastitis in dairy animals was 10.27%.
- Variations were observed based on age, season, udder and teat affections.

Keywords: Mastitis, udder swelling, hot, redness, teat blockage, clotted milk

Mastitis poses a significant challenge to the dairy industry worldwide, impacting udder health and the economic viability of farmers (Sharma *et al*., 2013). Mastitis is a common inflammatory condition that affects the mammary gland and leads to qualitative and quantitative changes in milk production (Sharma *et al*., 2018). Clinical mastitis is characterized by visible signs such as redness, swelling, heat, and pain of the udder (Sarker and Samad, 2011). It renders productive animals unproductive for extended periods, leading to economic losses due to reduced milk production, compromised milk quality, early culling of cows, expenses for veterinary care and drugs, and increased labor costs for farmers (Khate and Yadav, 2010). Developing a needs-based strategy for the diagnosis and sustainable management of mastitis is crucial. A comprehensive study that examines various factors such as age, species, breed, parity, seasonal variations, and types of udder affection can provide valuable data on the occurrence of mastitis. Understanding the epidemiological characteristics and clinical patterns of mastitis is essential

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for the development of effective prevention and control strategies, ultimately improving udder health and the overall profitability of dairy farming. This study aims to investigate the epidemiological characteristics and clinical patterns of mastitis in dairy animals, including cows, buffaloes, and goats, as mastitis is a common inflammatory condition that affects the mammary gland and leads to qualitative and quantitative changes in milk production.

MATERIALS AND METHODS

Study Area

The study was conducted at the Teaching Veterinary Clinical Complex (TVCC), DUVASU, Mathura, situated in a subtropical region of India. The coordinates of the study area are 27.28°N and 77.41°E, with an average elevation of 174 meters. Mathura district, particularly the Brij area, has a long-standing reputation for dairy animals and their high-quality products, dating back to ancient times. The subtropical climate of the region is characterized by hot summers with high temperatures and moderate winters. The area experiences distinct seasons, including a rainy season, autumn, summer, and winter, which may have an impact on the prevalence and pattern of mastitis in dairy animal.

Data collection

The data collection for this retrospective analysis was conducted from June 2021 to May 2022 at the Medicine Outpatient Department (OPD) of TVCC, DUVASU, Mathura. A total of 8,408 registration cards were collected during this period. To focus specifically on dairy animals, the cards pertaining to other animal species like dogs, cats, horses, rabbits, and birds were segregated. Out of the collected registration cards, 2,600 were related to dairy animals. These cards were further categorized based on the species of the animals, with 800 cards for cows, 1,485 cards for buffaloes, and 315 cards for goats.

Epidemiological Data

Epidemiological characteristics data were compiled for each mastitic animal, including information on age, breed, season, and parity. For cows and buffaloes, the data were analyzed separately in three age groups: 2-4 years, 5-8 years, and above 8 years. For goats, three age groups were considered: 1-2 years, 2-4 years, and above 5 years. Seasonal variation was assessed by organizing the available data into four successive subtropical seasons of India: rainy, autumn, summer, and winter. The data were also organized based on the parity of cows and buffaloes to assess the most affected parity time interval. Clinical data relevant to mastitis in dairy animals were recorded from the registered cards.

Observational Data Collection

This included observations of significant changes in the udder, such as swelling, heat, redness, fibrosis, necrosis, and gangrene. Additionally, the most commonly encountered teat abnormalities were documented, including teat blockage, increased teat canal thickness, and teat injuries. Instances of milk abnormalities, such as clotted, yellowish, reddish, and watery milk secretion, were also recorded, along with the number of affected quarters

STATISTICAL ANALYSIS

Out of these mastitis-positive records were assembled according to total number as well as species wise and calculated the overall prevalence as well as species prevalence by the following formula:

$$OP = \frac{\text{Total positive animals (cows + buffalos + goats)}}{\text{Total papulation}} \times 100$$

All data were statistically analyzed and prevalence was calculated as per described in (Thrusfield 2007).

RESULTS

Epidemiological characteristics of mastitis

Overall prevalence of mastitis in dairy animals

The study conducted at TVCC Medicine OPD from June 2021 to May 2022 aimed to assess the prevalence of clinical mastitis among dairy animals. A total of 8,404

registered cases were examined during this period, out of which 2,600 were related to dairy animals. Among the dairy animal cases, 267 were diagnosed with clinical mastitis, resulting in an overall prevalence rate of 10.269%. Comparing the prevalence rate of clinical mastitis observed in this study (10.27%) is consistent with findings reported by other researchers in different parts of India. Bhat *et al*. (2017), Krishnamoorthy *et al*. (2021), and Rai *et al*. (2022) reported similar prevalence rates of 11.5%, 18%, and 8.14%, respectively. However, regional variations have been observed, with prevalence rates in India ranging from 3.77% to 23%.as reported by Riekerink*et al*. (2008), Sharma *et al*. (2012), and Ghose (2000).These variations highlight the impact of regional factors on mastitis prevalence.Further analysis revealed variations in the prevalence rates among different species of dairy animals. Dairy cows exhibited a higher susceptibility to clinical mastitis, with a prevalence rate of 15.125% (121 out of 800). Buffaloes had a prevalence rate of 8.754% (130 out of 1,485), while goats had a lower prevalence rate of 5.079% (16 out of 315). Similar alarming results regarding the higher susceptibility of crossbred and exotic breeds of cows to clinical mastitis have been reported by previous studies, including Yadav *et al*. (2019), Swami *et al*. (2017), and Saini *et al*. (1994). The results of this study highlight the significant economic and genetic losses faced by the dairy industry due to clinical mastitis. The higher prevalence rate in dairy cows compared to buffaloes and goats might be attributed to the loss of disease-resistant native breeds of cows, while buffaloes may have a lower chance of infection due to anatomical factors such as thick and compact epithelium, a thick keratin layer, and a thick muscle sphincter in the streak canal of the udder.

Age-wise prevalence of clinical mastitis in dairy animals

The analysis of age groups among cows, buffaloes, and goats revealed the most affected age group among cows and buffaloes were found to be the 5-8 years category, with over 90% of animals in this group diagnosed with clinical mastitis. Similarly, in goats, the most affected age group was the 3-5 years category. Detailed data can be found in Table 1. The study's results are in agreement with previous findings by Qayyum *et al*. (2016) and Tripathy *et al*. (2018). These findings indicate a higher susceptibility to clinical mastitis in animals of middle age. It might be due age-related factors such as weakened immune systems, physiological changes in udder structure, increased body weight, and relaxation of teat sphincter muscles contribute to this increased susceptibility.

Table 1: Age wise prevalence of clinical mastitis

Age (years)	Cow (%)	Buffalo (%)	Goat (%)
1-4	6.61	6.15	93.75
5-8	91.74	90.00	6.25
>8	1.65	3.85	0.00

Breed wise prevalence of mastitis in dairy animals

The data analysis highlights the presence of both native and exotic/crossbreed cows in the Indian dairy population. The study findings indicate that native breeds of cows, buffaloes, and goats have a higher resistance to clinical mastitis compared to exotic and crossbreed cows. The majority of recorded cases of clinical mastitis were observed in the crossbred and exotic breeds of cows, indicating their higher susceptibility to mastitis. This aligns with previous studies by Yadav *et al*. (2019), Swami *et al*. (2017), Saini *et al*. (1994), and Uppal *et al*. (1994) reported similar results as higher susceptibility of crossbred and exotic breeds that breed plays a significant role in mastitis occurrence. One possible explanation for this pattern is that native breeds, particularly cows, have adapted to local environments and developed inherent resilience against mastitis over generations.

Parity wise prevalence of mastitis in dairy animals

The study revealed a parity-wise risk of mastitis in dairy animals, particularly cows and buffaloes. Animals in their third to sixth lactation cycles were found to be more susceptible to mastitis compared to those in lower (less than 3) or higher (more than 6) parities. The reasons behind this pattern could be influenced by factors such as udder stress due to peak milk production at these parity intervals, age-related compatibility, physiological changes in the udder, hormonal fluctuations, weakening the immune system or management practices. It is important to note that data regarding parity-wise risk in goats was insufficient in the study, and further research is needed to explore the relationship between parity and mastitis in goats.

Season wise prevalence of mastitis in dairy animals

The study area's subtropical climate exhibits significant seasonal variations in temperature and humidity, which have an impact on the prevalence of mastitis. The highest overall prevalence of mastitis was observed during the rainy season, followed by the summer and winter seasons. Table 3 indicates that the rainy season had the highest prevalence of mastitis in cows and buffaloes, with rates of 19.20% and 12.66% respectively.

Table 2: Season wise prevalence of mastitis in dairy animals.

Season	Cow (%)	Buffalo (%)	Goat (%)	Overall (%)
Rainy	19.20	12.66	6.91	13.61
Autumn	9.17	4.72	2.55	6.32
Winter	12.00	6.47	3.85	7.71
Summer	14.01	6.67	8.86	9.35

However, in goats, the prevalence of caprine mastitis was slightly higher during the summer season compared to the rainy season, as shown in Table 4. These findings align with previous studies by Khate and Yadav (2010) and Paranjape and Das (1986). Moist and hot weather conditions during the rainy season provide a favorable environment for the growth of mastitis-causing pathogens. Additionally, the environmental stress associated with high humidity increases the chances of udder exposure to unhygienic conditions, further contributing to the occurrence of mastitis. Studies by Singh *et al*. (2001) and De and Mukherjee (2009) support the idea that climatic factors play a role in mastitis development.

Common Clinical presentation of mastitis in dairy animals

Frequency of common visual udder abnormalities

The study examined the frequency of common visual udder abnormalities in cows, buffaloes, and goats. The graphs showed the frequency rates of various udder abnormalities observed in the study population. Udder swelling was found to be the most persistent abnormality, with prevalence rates of 47.71% in cows, 47.90% in buffaloes, and 12.5% in goats. Udder fibrosis, another significant abnormality, was reported at considerable levels, with prevalence rates of 19.27% in cows, 18.49% in buffaloes, and 12.5% in goats. The frequency of hot udder, characterized by increased temperature, was recorded as 14.68% in cows, 10.92% in buffaloes, and 12.5% in goats. Redness of the udder, indicating inflammation, was observed at rates of 12.84% in cows, 10.92% in buffaloes, and 50.0% in goats. Gangrene of the udder, a severe condition involving tissue death, was more prevalent in goats compared to cows and buffaloes, with prevalence rates of 3.67% in goats, 6.72% in buffaloes, and 12.5% in cows. On the other hand, the frequency of udder necrosis, characterized by the death of udder tissue, was relatively lower, with rates of 1.83% in cows, 5.04% in buffaloes, and 0% in goats. These findings are consistent with previous studies conducted by Oliveira *et al*. (2013), Seplveda *et al*. (2016), and Goulart (2022). The observed prevalence rates of udder abnormalities highlight the importance of monitoring udder health in dairy animals and implementing appropriate management practices to minimize the occurrence and impact of these conditions.

Frequency of common teat abnormalities

Graph 4, provides information on the most commonly encountered teat abnormalities in cows, buffaloes, and goats. In cows, the most frequently observed teat abnormality was teat blockage, with a prevalence rate of 25.69%. Teat canal thickness was recorded at a frequency of 7.34%, while teat enlargement and teat injury had prevalence rates of 6.42% and 4.59%, respectively. Among buffaloes, teat blockage was also the most common abnormality, with a prevalence rate of 19.33%. Teat canal thickness and teat injury occurred at rates of 2.52% and 9.24%, respectively. Teat enlargement had a higher prevalence rate of 18.49% in buffaloes compared to cows. For goats, teat blockage had a prevalence rate of 6.25%. Teat canal thickness and teat injury were observed at rates of 6.25% and 5.5%, respectively. This statement agreed with previous researcher [(Oliveira *et al.*, 2013, Sepúlveda *et al*., 2016, Goulart and Mellata, (2022)].

Table 3, provides information on the frequency of the number of affected quarters. It reveals that the majority of cows, buffaloes, and goats were affected in a single quarter, with rates of 31.19%, 36.97%, and 12.5%, respectively. Additionally, 14.68%, 18.49%, and 18.75% of cows, buffaloes, and goats were found to have two

affected quarters. Cows and buffaloes were also recorded with three or all quarters affected, with rates of 3.67%, 3.36%, and 8.26%, and 9.24%, respectively. This may be due to inflammation, growth, membranous partition and presence of lacteal calculi in the teat canal and occur very often as a sequel to recurrent mastitis and probably due to faulty milking practices (Tiwary, 2005).

Table 3: Frequency of quarter affected in dairy animals

Number of affected quarters	Cow (109)	Buffalo (119)	Goat (16)
	(%)	(%)	(%)
One	31.19	36.97	12.50
Two	14.68	18.49	18.75
Three	3.67	3.36	—
Four	8.26	9.24	—

Frequency of common milk abnormalities

The results obtained from Table 4, reveal the most common milk abnormalities reported by livestock holders in cows, buffaloes, and goats. The prevalence rates of these abnormalities are as follows: In cows, clotted milk was the most frequently reported abnormality, with a prevalence rate of 19.2%. This was followed by reddish color of milk, which had a prevalence rate of 21.8%. Yellowish color of milk was also observed, with a prevalence rate of 6.42%. Additionally, watery secretion was reported in 10.09% of cows. Among buffaloes, clotted milk was the most common abnormality, with a prevalence rate of 11.7%.

Table 4: Frequency of common milk abnormalities of cow, buffalo and goat

Dairy animals	Common milk abnormalities			
	Clotted flakes (%)	Yellowish (%)	Reddish (%)	Watery (%)
Cow	19.27	6.42	20.18	10.09
Buffalo	11.76	4.20	6.72	4.20
Goat	6.25	6.25	6.25	12.50

Reddish color of milk was reported at a rate of 6.72%, while yellowish color of milk had a prevalence rate of 4.20%. The occurrence of watery secretion was reported in 4.20% of buffaloes. In goats, clotted milk was the most prevalent abnormality, with a prevalence rate of 6.25%. Yellowish color of milk and reddish color of milk were both observed at a rate of 6.25%. Watery secretion was reported in 12.5% of goats. The impact of clinical mastitis on milk quality is well established in scientific literature. Various studies have provided evidence of the effects of mastitis on milk composition and quality (Kayano *et al*., 2018; Malik *et al*., 2018; Skarbye*et al*., 2018). Milk abnormalities, including the presence of clots, watery, yellowish, radish, or bloody secretions have been commonly observed in mastitic animals (Brandt *et al*., 2010).

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ETHICAL CONSIDERATIONS AND LIMITATIONS

The study followed ethical guidelines and ensured patient confidentiality and data privacy. However, it had limitations such as relying on incomplete medical records and being limited to a specific geographic region. Additionally, the focus on clinical mastitis cases at TVCC may not represent the complete picture of mastitis in the region's dairy animals.

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