RESEARCH ARTICLE

Studies on Prevalence and Risk Factors Associated with Subclinical Mastitis in Goat Farms in Ayodhya and Amethi District of Uttar Pradesh

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Abstract

Subclinical mastitis (SCM) significantly reduces goat production and adversely affects both the quality and quantity of milk, resulting in huge financial losses. The risk factors and causes of goat mastitis in India remain largely unidentified, complicating efforts to manage the disease. This study aims to determine the prevalence of SCM based on California mastitis test (CMT) results, and identify associated risk factors in goats. A total of 360 lactating goats from 38 organized and unorganized farms in the Amethi and Ayodhya districts of Eastern Uttar Pradesh were screened for SCM. The overall prevalence of SCM was found to be 37.50% (135/360), with 40% of goats tested positive in Amethi and 35% in Ayodhya district. Additionally, unorganized farms recorded a higher prevalence (66.14%) compared to organized farms (21.88%). The prevalence of SCM increased with age; the differences in prevalence among age groups (≤ 3, 3-5, and ≥ 5 years) were highly significant ($p<0.01$). Furthermore, breed, lactation stage, and parity demonstrated a significantly higher association ($p<0.01$) with SCM. At the farm level, the type of rearing system emerged as a potential risk factor associated with SCM ($p<0.01$). The highest prevalence (78%) of SCM was observed in goats in cachectic condition compared to those in poor and fair body score conditions, although this association was not statistically significant ($p=0.065$). Additionally, teat shape showed a highly significant association with SCM at the udder level in lactating goats. This study suggests actionable measures that local farmers can implement to mitigate the impacts of subclinical mastitis in goats.

Key words: BCS, Goats, Parity, Prevalence, Risk factors, Subclinical mastitis.

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Introduction

Quantity and quality of milk along with physical, chemical, microbiological and pathological changes in the milk and udder are affected by mastitis (Mishra *et al.,* 2018). This condition imposes a substantial economic burden on dairy animals, impacting not only India but also countries around the world (Sharma *et al.,* 2010). Economic losses arise from reduced milk production, the disposal of substandard milk, early culling of animals, veterinary costs, decreased exports of milk and its products, and additional management expenses (Thompson-Crispi *et al.,* 2014). Similar to cattle and buffaloes, mastitis in goats is also economically significant disease worldwide (Zamin Ali *et al.,* 2010). Mastitis in goats results in considerable economic losses among goat farmers, primarily in subclinical form (Bourabah *et al.,* 2013). Subclinical mastitis (SCM) is the most common type of mastitis in goats, occurring 15 to 40 times more frequently than the clinical form. In SCM, the milk appears normal, with no visible abnormalities in the mammary tissue. It typically occurs before clinical form of mastitis and acts as a reservoir for healthy animals and source of infection to kids (Thompson-Crispi *et al.,* 2014).

Subclinical mastitis cannot be diagnosed through routine physical examinations, including palpation and organoleptic assessment (Bourabah *et al.,* 2013), but can be identified indirectly through various diagnostic methods, like California mastitis test (CMT), the modified Whiteside test, Somatic cell count (SCC), pH measurement, milk electrical conductivity tests etc. The SCC and CMT are the primary tests used for

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diagnosing mastitis in dairy goats (Mahlangu *et al.,* 2018), the CMT being most practical, efficiency, and reliable field test (Bourabah *et al.,* 2013). The incidence of SCM is influenced by number of associated risk factors such as age, breed, stage of lactation, body condition score (BCS), teat end shape, farm management etc, in dairy goats (Mungube *et al*., 2004; Razi *et al.,* 2012; Akter *et al.,* 2020). However, the influence of these risk factors associated with SCM in goats has not been investigated in India. Therefore, the aim of this study was to evaluate the prevalence of SCM and identify manageable risk factors associated with SCM in goats.

Materials and Methods

The study was conducted on selected backyard and smallholding goat farms in the Amethi and Ayodhya districts of Eastern Uttar Pradesh, India. These districts are geographically situated at 26°9'N & 81°49'E for Amethi and 26°8'N & 82°6'E for Ayodhya. In this region, goats are raised using semi-intensive and free-ranging system for primary or supplementary source of income. Investigation was conducted from March 2024 to August 2024 and involved screening 360 lactating goats from 38 organized and unorganized farms in the Amethi and Ayodhya districts. A stratified random sampling technique was employed to obtain accurate data. Two blocks were chosen from each district, and within those blocks, three villages were selected. A total of 360 milk samples (30 samples from each village) were analyzed using the California mastitis test to assess the prevalence of SCM in goats.

A structured questionnaire was utilized to gather information pertaining to farmers' and farm demographics, farm characteristics, management practices and risk factors to SCM through face-to-face interviews of farm owner. This questionnaire collected information on factors such as age, parity, lactation stage, breed, and rearing system, categorizing goats into three groups: stall-fed, grazing dependent, or managed under controlled grazing conditions. The teat shape was classified following the criteria established by Samad (2003). During each visit, udder cleanliness scores were evaluated while collecting milk samples at the time of milking in accordance with the method described by Schreiner and Ruegg (2003).

Collection of Milk Samples

Aseptic collection of milk samples was performed from both halves (composite milk) of apparently healthy goats, in accordance with the protocol recommended by the National Mastitis Council (Hogan *et al.,* 2009). The teats were sanitized using swabs soaked in 70% ethanol, and the collected milk samples (3-4 mL) were analyzed for CMT following the methodology described by Gebrewahid *et al.* (2012). Samples with CMT scores of 0 and +1 were categorized as negative, while those with scores of +2 or +3 were considered positive (Gebrewahid *et al.* (2012).

Statistical Analysis

Data was gathered by systematic questionnaire, and results of CMT was compiled and assessed for consistency prior to being analyzed. The descriptive statistics were used and the results were expressed in both percentages and frequencies. The prevalence of SCM across all levels obtained were further analyzed based on a variety of potential risk factors with the use of Pearson's Chi-square Test (χ^2). Statistical analyses were conducted using the SPSS (Version 14) software, and the differences were deemed to be statistically significant at $p<0.05$.

Results and Discussion

Prevalence of Subclinical Mastitis

The overall prevalence of subclinical mastitis among 360 goats was 37.50%. In Amethi, 40.00% of the goats tested positive, while the prevalence in Ayodhya district was observed 35.00%. Higher prevalence was recorded in unorganized farms (66.14%), compared to organized farms (21.88%)(Table 1). The prevalence of subclinical mastitis in lactating goats observed in current study was higher than 19.89% (36/181) reported by Mishra *et al.* (2018), and lower than 50.9% reported by Akter *et al.* (2020) in lactating goats. The discrepancies in mastitis prevalence across studies have been attributed to variations in host and management factors that influence intramammary infections in goats (Amin *et al*., 2011).

Table 1: Prevalence of subclinical mastitis according to CMT at different levels in goats of Ayodhya district of Uttar Pradesh, India

Level (Farm/ District)	No. of goats screened	No. of SCM +ve (≥ 2 CMT)	Prevalence (%)
Ayodhya	180	63	35.00
Amethi	180	72	40.00
Organized	233	51	21.88
Unorganized	127	84	66.14
Overall	**360**	**135**	**37.50**

Our study noted a higher prevalence of subclinical mastitis (SCM) in Amethi compared to Ayodhya district, and in unorganized than organized farms due to poor udder hygiene observed in animals over there. These findings aligned with Schreiner and Ruegg (2003) and Singh *et al.* (2019), who emphasized that inadequate hygiene and contaminated environments significantly increase the risk of mastitis.

Risk Factors for SCM

The prevalence of SCM increased with age, and significant differences were observed among age groups (≤ 3, 3-5, and ≥ 5 years) ($p<0.01$; Table 2). Additionally, breed, lactation stage, and parity number demonstrated a significantly higher association with SCM ($p<0.01$). At the farm level, rearing systems emerged as a potential risk factor related to SCM,

also at p<0.01 (Table 2). The highest prevalence of SCM (78%) was found in goats in cachectic condition compared to those in poor and fair body score conditions, though the difference was not statistically significant (p>0.05). Furthermore, at the udder level, teat shape showed a highly significant association with SCM in goats (Table 2).

SCM prevalence increased with age was consistent with global reports (Sharma *et al.,* 2010; Zamin Ali *et al*., 2010; Gebrewahid *et al.,* 2012; Mahlangu *et al*., 2018; Singh *et al*., 2019; Nisha *et al*., 2023). These studies suggest that older animals are more susceptible to the mastitis due to prolonged pathogen exposure, reduced immunity, and anatomical changes such as teat canal widening. Parity was identified as a major risk factor, with the highest prevalence in third-parity goats. This agreed with studies of Razi *et al*. (2012), Mahlangu *et al*. (2018), Singh *et al*. (2019), and Akter *et al*. (2020), which reported increased SCM with advancing parity and lactation. However, Mishra *et al*. (2018) found no significant association, indicating some variability across studies.

Higher SCM prevalence during late lactation was also observed, consistent with findings of Stuhr *et al*. (2013), and Akter *et al*. (2020). Increased somatic cell count (SCC) with advancing lactation, as reported by Matuozzo *et al*. (2020) and Petridis and Fthenakis (2019), supports this observation. Susceptibility towards breed varied, with Jamnapari goats showing higher SCM prevalence. This agreed with Akter *et al*. (2020), who linked higher susceptibility to increased milk yield and longer lactation. Amin *et al*. (2011) also highlighted that genetic factors, production levels, and management practices influence breed differences.

The management system played a crucial role in occurrence of mastitis in goats under study, goats in extensive systems and unorganized farms showed significantly higher SCM prevalence. Similar trends were reported by Kakati *et al*. (2024). Body condition score (BCS) showed no significant association in this study, contrasting with earlier reports (Mungube *et al*., 2004; Megersa *et al*., 2010; Tolosa *et al*., 2015) that identified poor or high BCS as risk factors, suggesting inconsistent findings across studies. Teat morphology was significantly associated with SCM, with flat and conical teats posing higher risk. This supported the findings by Melvin *et al*. (2019), Wieland *et al*. (2018, 2024), which demonstrated that teat shape and size influence pathogen entry, SCC levels, and susceptibility to infection.

Conclusion

The prevalence of subclinical mastitis (SCM) among goats in the Ayodhya and Amethi districts of Uttar Pradesh is notably high. Factors such as age (≥5 years), third parity, and the third stage of lactation are associated with the higher prevalence of SCM. Jamnapari and non-descriptive goat breeds, along with does that have flat and conical teat shapes, are significant factors linked to SCM at the individual goat level. Goats with higher body condition scores show a lower prevalence of SCM compared to those with cachexia; however, this relationship did not achieve statistical significance. This study highlights

Table 2: Association of various risk factors with subclinical mastitis prevalence in goats

Risk factors	Category	No. of goat screened (N)	Goats with SCM	Prevalence (%)	χ^2 value	p-value
Age (years)	≤ 3	150	43	28.66	11.25 (df=2)	0.0036
	3 to 5	109	42	38.53		
	≥ 5	101	50	49.5		
Parity by number	I	79	18	22.78	29.20 (df=3)	0.00002
	II	120	34	28.33		
	III	87	51	58.62		
	IV & above	74	32	43.24		
Lactation stages	Early (1-60 day)	115	28	24.34	18.65 (df=2)	0.00089
	Mid (60-120 day)	114	37	32.45		
	Late (>120 days)	141	70	49.64		
Breeds	Barbari	105	33	31.42	9.56 (df=3)	0.0227
	Jamnapari	62	20	32.25		
	Sirohi	35	9	25.71		
	Others (ND)	158	73	46.2		
Rearing system	Intensive	102	28	27.45	17.99 (df=2)	0.00012
	Semi-Intensive	190	67	35.26		
	Extensive	68	40	58.82		
BCS	Poor & fair	125	38	30.40	3.67 (df=1)	0.065
	Cachectic	235	97	41.27		
Teat shape	Pencil	105	26	24.76		
	Flat & conical	72	43	59.72	10.87 (df=1)	0.00098
	Bottle	183	66	36.06		

the need for control programs to improve udder health in goats in India and emphasizes the importance of educating farmers on selecting breeds with better udder and teat characteristics.

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