



## Evaluation of Management Practices as Potential Risk Factors for Mastitis in Goats in Bharatpur, Chitwan, Nepal

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### ABSTRACT

A study was conducted to determine the effect of the managerial factors on the prevalence of mastitis in goats in Bharatpur Chitwan. Altogether 200 samples were collected from 15 small farms containing 1-15 lactating goats and 12 houses containing 2-4 goats. From the list of goat farms made available by different ward offices, simple random sampling was done. The samples were collected from 13 different wards of Bharatpur. The samples were tested for subclinical mastitis using California mastitis test. The questionnaire survey was done to know about the different managerial practices people applied in their herd. The data was entered and tabular and graphical representation was done in MS-excel. Results revealed that 40% of the samples were positive for CMT. The managerial factors taken were rearing system, bedding material, use of veterinary service, previous history of mastitis in the herd, mixed with other ruminants, floor type, cleaning and hygiene. There was no significant association between the occurrence of mastitis and any of the factors.

### HIGHLIGHTS

- CMT test for Subclinical mastitis.
- No significant between mastitis occurrence and other factor.

**Keywords:** Mastitis, goat, prevalence, floor, hygiene

Asia is generally considered to be the home of goats, given that it hosts around 60% of the entire world's total number of goats, numbering over 1 billion (Liang and Paengkoum, 2019). Most of the goats, including dairy breeds, in Asia are mainly handled by small-scale farmers, many of whom are resource poor and landless (Devendra and Liang, 2012). There has been a trend towards commercial goat farming in Nepal over the last ten years, with the number of goats increasing from 9.5 million in 2011/12, producing 53,956 metric tons, to 13.99 million in 2021/22, producing 7,424 metric tons, a 27.3% improvement in production over the period (Kadel *et al.*, 2023). Several challenges

face goat farming, one of which is that infectious disease is a serious problem in dairy goat farming. One of the most serious of these is mastitis, which has a deleterious effect on milk yield and overall health of the herd (Kabui *et al.*, 2024).

Mastitis is one of the most prevalent and economically significant disease conditions in dairy goats throughout

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the world (Jabbar *et al.*, 2020). Mastitis is mammary gland inflammation that results in a decrease in milk yield, milk composition, and an increase in somatic cell count (SCC), often resulting in milk rejection for human use (Lima *et al.*, 2018). Mastitis not only compromises animal health but also is a serious problem for farmers, predominantly those in smallholder dairy systems in which goats provide milk supply (Novac and Andrei, 2020). The ability to manage the risk of mastitis using better management practices would be a key to preventing its ill effects to a great extent, ensuring better welfare of animals in addition to farm profitability (Sharun *et al.*, 2021). In places such as Bharatpur, Chitwan, Nepal, goat farming is a primary agriculture sector of the agritourism economy. However, despite dairy goat farming's increasing popularity in this place, mastitis is a serious problem that is yet to be eradicated (Dhakal *et al.*, 2021). These challenges include poor veterinary services accessibility, varying farm management knowledge, and environmental factors such as high temperatures and poor housing. Consequently, these factors contribute to a high prevalence of mastitis in the region, emphasizing the need for context-sensitive management interventions (Aavash *et al.*, 2023). Farm management practices, more precisely hygiene during milking, housing, and treatment of animals in general, are extensively documented risk factors for mastitis in dairy goats (Gökdağ *et al.*, 2020). Inadequate milk hygiene, such as poor udder cleaning prior to milking or using dirty milkers, has been established as a primary cause of mastitis (Ahmed *et al.*, 2022). Similarly, housing conditions such as overstocking, poor ventilation, and unclean living spaces can lead to udder infections and subsequently mastitis (Kaskous, 2021). Additionally, the diet of goats, which can impact their immunity, plays a significant role in their susceptibility to mastitis (Panchal *et al.*, 2024). All of these factors, combined with regional practices and infrastructure limitations, worsen the situation in Bharatpur. While studies on mastitis in goats have been

conducted in various parts of the world, including South Asia (Akter *et al.*, 2020; Bari *et al.*, 2022; Saleem *et al.*, 2019), there is a knowledge gap in the Chitwan area. Understanding the specific risk factors linked to local management practices is essential for developing targeted strategies to control and prevent mastitis (Hasan *et al.*, 2016). While earlier studies have identified general risk factors, a more localized investigation is needed to determine how specific farming practices in Bharatpur contribute to mastitis. By focusing on this region, the study aims to fill that gap by evaluating the role of management practices—such as milking hygiene, feeding, housing, and disease control measures—as risk factors for mastitis in dairy goats (Tiezzi *et al.*, 2019).

## MATERIALS AND METHODS

### Study area and sample population

The study was conducted in about 13 wards of Bharatpur district under the guidance of the Department of Anatomy, Physiology and Biochemistry, Agriculture and forestry University, Nepal during the period of September 17 to October 9. Research was conducted on different 13 wards of Bharatpur district. A total number of 200 sample collected from apparently healthy milch goat were randomly selected for this study. Before taking the milk sample, a teatful of milk was milked into a tube and later discarded. This was to flush out any bacteria that might be present in the teat canal. The teat and teat tips were disinfected with a swab soaked in 70% alcohol. Milk samples were collected aseptically from the udder at the time of morning milking. All the milk collected vials were labeled with the identification number of cow (and others symbol). Immediately after collection the samples were subjected to CMT. (McDougall *et al.*, 2010). According to the Weizur mastitis test kit the score of mastitis was analyzed (Table 1).

**Table 1:** Score of mastitis WEIZUR INDIA PRIVATE LIMITED CMT kit (Johri *et al.*, 2024)

| Presence of Gel                                                                                                                             | Colour       | Score | Interpretation    |
|---------------------------------------------------------------------------------------------------------------------------------------------|--------------|-------|-------------------|
| No thickening of mixture                                                                                                                    | Grey         | 0     | Normal milk       |
| Slight thickening of mixture. Thickening may disappear after rotating the paddle for 10 seconds                                             | Light purple | 1     | Weak positive     |
| Distinct thickening of mixture. Thickening may disappear after rotating the paddle for 20 seconds                                           | Purple       | 2     | Distinct positive |
| Gel is formed and the surface of the mixture becomes elevated. Central peak remains projected even after the CMT paddle rotation is stopped | Dark purple  | 3     | Strong positive   |

### Data collection and analysis

It will include the California Mastitis Test of each quarter of the goat. The data was collected from the survey using a well design questionnaire. Owners of the selected farms were interviewed face to face. Both open and close-ended questionnaires asked to the owners. The data entry will be computed in MS Excel 20. The computed data will be imported into the IBM SPSS Statistics version.

### Questionnaire survey

A structured questionnaire was developed to assess the risk factors associated with subclinical mastitis in goats. The questionnaire included details on the rearing system, categorizing goats as stall-fed, grazing, or under controlled grazing management. Farmers were asked whether they used bedding material in the housing system to evaluate its role in udder hygiene. Information on veterinary service usage was collected, classifying it as regular, irregular, or not yet received, to assess its impact on disease prevalence. The history of mastitis in the herd was recorded to determine whether past cases influenced current infections. The type of farming system was also considered, distinguishing between farms that kept only goats and those with integrated management, where goats were raised alongside other ruminants. Floor type was documented as either wooden or earthen to examine its association with mastitis risk.

Cleaning and manure management practices were assessed based on cleaning frequency, categorized as weekly, fortnightly, daily, or irregular. The overall hygiene level of the farm was classified as poor, fair, or good to determine its relationship with mastitis occurrence. This questionnaire was designed to analyze management, housing, and health-related factors contributing to subclinical mastitis in goats.

## RESULTS AND DISCUSSION

### Results

Table 2 presents the distribution of subclinical mastitis (SCM) cases among 200 examined goats based on a scoring system. The scores range from 0 to 3, indicating varying degrees of infection severity. A score of 0

represents goats with no signs of subclinical mastitis, while scores of 1, 2, and 3 denote increasing severity of the condition. Among the studied population, 120 goats (60%) were categorized as score 0, indicating a healthy udder with no signs of SCM. A significant proportion of goats, 62 (31%), were assigned a score of 1, suggesting mild subclinical infection. A smaller group, 16 goats (8%), had a score of 2, reflecting a moderate level of subclinical infection. Only 2 goats (1%) exhibited the most severe form of subclinical mastitis, as indicated by a score of 3. The data indicate that while a majority of the goats were free from infection, a substantial number exhibited mild to moderate subclinical mastitis. The low percentage of severe cases (score 3) may suggest early-stage infection detection or relatively effective management practices in the herd. However, the presence of 31% of cases with a score of 1 and 8% with a score of 2 highlights the need for improved monitoring and veterinary interventions to prevent progression to more severe forms of mastitis.

**Table 2:** Prevalence of Subclinical Mastitis Cases Based on Scoring System

| Score        | Total (no) of cases | Total no. of cases in percentage |
|--------------|---------------------|----------------------------------|
| 0            | 120                 | 60                               |
| 1            | 62                  | 31                               |
| 2            | 16                  | 8                                |
| 3            | 2                   | 1                                |
| <b>Total</b> | <b>200</b>          | <b>100</b>                       |

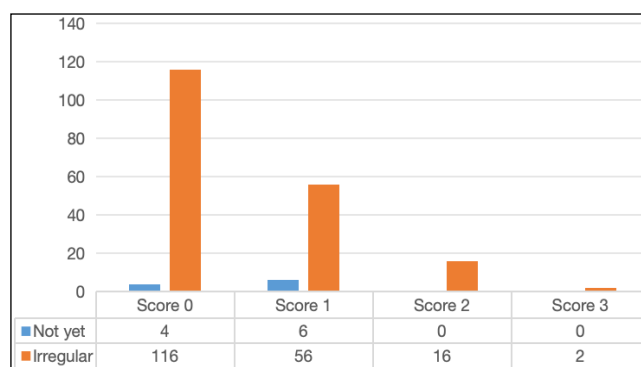
The association study was conducted between various management and environmental factors with subclinical mastitis (SCM) prevalence in goats (Table 3). Among the factors analyzed, floor type showed a significant association with SCM ( $P = 0.006$ ), with the highest prevalence observed in goats housed on bamboo (80%) and earthen floors (60%). The rearing system also showed a notable trend, with controlled grazing goats having a higher prevalence (61.90%) compared to stall-fed ones (37.43%), though not statistically significant ( $P = 0.062$ ). Goats that never received veterinary services had a higher SCM prevalence (60%) compared to those with irregular services (38.94%), but the association was not significant ( $P = 0.225$ ). Other factors, including previous mastitis history, mixed rearing, bedding material, cleaning frequency, and

**Table 3:** Association of Various Management and Environmental Factors with Subclinical Mastitis Prevalence

| Sl. No. | Variable Level                      | No. of cases | Affected (no.) | Affected (%) | P- value | Chi square |
|---------|-------------------------------------|--------------|----------------|--------------|----------|------------|
| 1       | <b>Rearing system</b>               |              |                |              | 6.755    | 0.062      |
|         | Controlled grazing                  | 21           | 13             | 61.90        |          |            |
|         | Stall feed                          | 179          | 67             | 37.43        |          |            |
|         | Grazing                             | 0            | 0              | 0.00         |          |            |
| 2       | <b>Bedding material</b>             |              |                |              |          |            |
|         | Yes                                 | 0            | 0              | 0.00         |          |            |
|         | No                                  | 200          | 80             | 40.00        |          |            |
| 3       | <b>Use of veterinary service</b>    |              |                |              | 4.505    | 0.225      |
|         | Not yet                             | 10           | 6              | 60.00        |          |            |
|         | Regular                             | 0            | 0              | 0.00         |          |            |
|         | Irregular                           | 190          | 74             | 38.94        |          |            |
| 4       | <b>Previous history of mastitis</b> |              |                |              | 2.256    | 0.621      |
|         | Yes                                 | 72           | 26             | 36.12        |          |            |
|         | No                                  | 128          | 54             | 42.18        |          |            |
| 5       | <b>Mixed with other ruminants</b>   |              |                |              | 2.2267   | 0.355      |
|         | Goat only                           | 188          | 76             | 40.42        |          |            |
|         | Integrated                          | 12           | 4              | 33.33        |          |            |
| 6       | <b>Floor type wooden</b>            | 150          | 54             | 36.00        | 23.346   | 0.006      |
|         | Earthen                             | 10           | 6              | 60.00        |          |            |
|         | Cement                              | 30           | 12             | 40.00        |          |            |
|         | Bamboo                              | 10           | 8              | 80.00        |          |            |
| 7       | <b>Cleaning</b>                     |              |                |              |          |            |
|         | Weekly                              | 0            | 0              | 0.00         |          |            |
|         | Fortnightly                         | 0            | 0              | 0.00         |          |            |
|         | Daily                               | 200          | 80             | 40.00        |          |            |
|         | Irregular                           | 0            | 0              | 0.00         |          |            |
| 8       | <b>Hygiene</b>                      |              |                |              |          |            |
|         | Poor                                | 0            | 0              | 0.00         |          |            |
|         | Fair                                | 0            | 0              | 0.00         |          |            |
|         | Good                                | 200          | 80             | 40.00        |          |            |

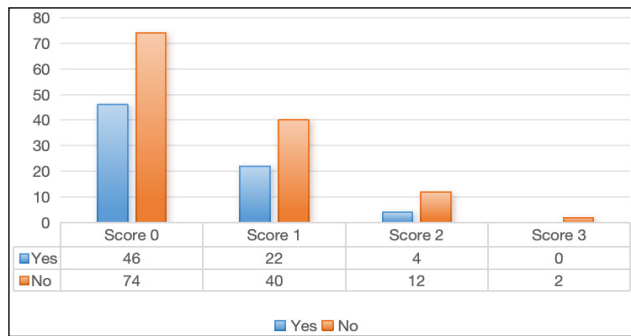
hygiene, did not show significant associations with SCM prevalence. These findings emphasize the importance of housing conditions and regular veterinary care in SCM prevention. Improved floor management and frequent health monitoring could help mitigate the disease burden in goat farming.

A total of 200 goats were assessed for SCM and categorized based on their history of veterinary service utilization. Of these, 10 goats had never received veterinary care, while 190 goats had received veterinary services irregularly. SCM prevalence was determined using appropriate diagnostic methods, and data were analyzed to assess the risk association.



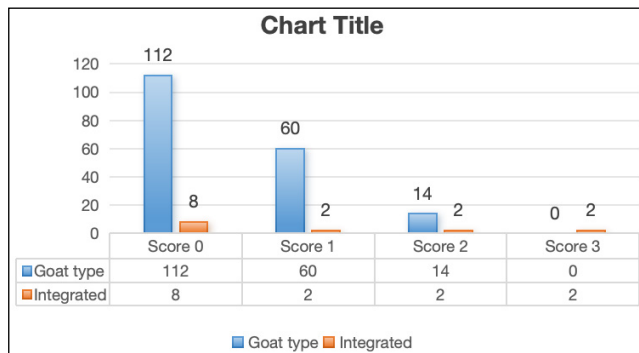
**Fig. 1:** Relationship between mastitis score and use of veterinary services

The results suggest that the absence of veterinary care significantly increases the risk of SCM, highlighting the crucial role of consistent veterinary interventions in preventing the disease. Inadequate veterinary care can lead to poor udder health management, increasing susceptibility to mastitis-causing pathogens.



**Fig. 2:** Distribution of Subclinical Mastitis Cases Based on Scoring System and Treatment Status

The bar chart illustrates the prevalence of subclinical mastitis (SCM) in goats categorized by a scoring system (0–3) and grouped based on whether they received treatment (Yes) or not (No).



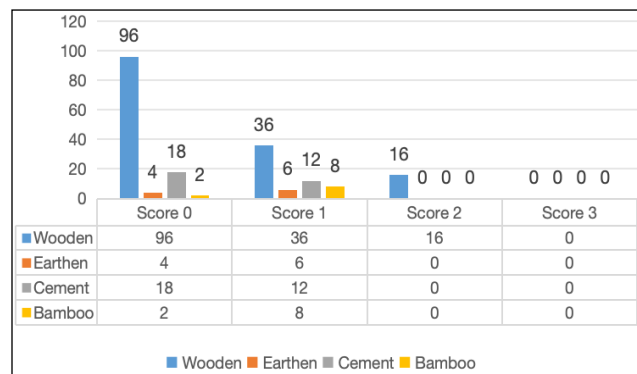
**Fig. 3:** Relationship between mastitis score and farming system

The distribution of higher proportion of untreated goats (74) remained unaffected compared to treated goats (46) in Score 1 (Mild SCM) the number of affected cases was higher in untreated goats (40) compared to treated ones (22), suggesting that veterinary intervention may reduce the incidence of mild SCM. More untreated goats (12) were affected than treated ones (4), indicating a potential benefit of treatment in reducing moderate infections. Only a small number of cases (2) were observed in untreated

goats, while no severe cases were recorded in treated animals, emphasizing the importance of intervention in preventing disease progression.

These findings suggest that veterinary intervention may play a role in reducing the severity of subclinical mastitis, highlighting the need for regular health monitoring and treatment to control the disease effectively. Further statistical analysis is recommended to validate the significance of these observations.

The figure compares mastitis severity in goats raised alone versus those integrated with other ruminants. Most isolated goats had low mastitis scores (Score 0: 112, Score 1: 60), while integrated goats had fewer cases (Score 0: 8, Score 1: 2). Higher scores (2 and 3) were rare in both groups. No significant association was found between farming system and mastitis occurrence. Of 112 isolated goats, 74 were CMT-positive, while 6 out of 8 integrated goats tested positive. This suggests that mastitis prevalence is not strongly influenced by the rearing system.



**Fig. 4:** Relationship between mastitis score and floor type

This figure illustrates the distribution of mastitis scores across different flooring types. Goats on wooden floors had the highest proportion of Score 0 (96) and Score 1 (36), while those on earthen, cement, and bamboo floors had lower numbers. Score 2 was recorded only for wooden floors (16), with no cases reaching Score 3. Out of 148 mastitis-positive samples, 52 were from wooden floors, 6 from earthen floors, 12 from cement floors, and 8 from bamboo floors. These results suggest that floor type may influence mastitis occurrence, but further investigation is needed.



## Discussion

The prevalence of mastitis showed a relationship with the floor type ( $p = 0.006$ ). According to this, highest prevalence was seen in goats raised in bamboo floor then on the wooden, earthen and a cemented floor. Prevalence of caprine subclinical mastitis was also found influenced by farm management system such as type of farming system and type of floor used to raise the goat in the studied area. This study found prevalence of subclinical mastitis higher in farms where goats were raised under traditional conditions and had an earthen floor (soil surface). Earthen floor has been reported to be an important risk factor for subclinical mastitis in goat as per (Muhammad *et al.*, 2012). This research shows that the goats raised in the earthen floor were kept in the wet bedding which harbour the bacteria and as per in our research there was no use of bedding material. So, this difference in the result may be due to the different managerial practices. The prevalence of mastitis was 40% which was different from the result given by (Akter, *et al.*, 2020) which shows the prevalence to be 50.9%. This discrepancy may be due to difference in location, sampling technique and climate and season. Higher prevalence of SCM was recorded in Jamunapari (48.21%) in comparison to crossbred (37.5%) and Black Bengal (33.33%) goats as per (Foysal, *et al.*, 2020). The prevalence of non-significantly higher sub clinical mastitis was seen in controlled grazing goats (61.90%) then stall feed (37.43%) and grazing which may be due to the reason that the goats which were allowed for grazing can get the bacterial contaminations through the pasture land (Patil *et al.*, 2014). Prevalence of non-significantly higher case of subclinical mastitis was noted in the goats where veterinary service had not been used yet (60%) than the goats in which veterinary service was used irregularly (38.54%) which was according to the research which showed that the animal receiving frequent treatments were rid of ticks and other external parasites which was also one of the causes of mastitis as the tick will cause skin lesion and bacteria may enter through that route (Jabbar *et al.*, 2020). Higher case of mastitis was seen in the herd where mastitis was not seen till now (42.18%) than the herd where previously mastitis had been seen (36.12%). Non significantly higher cases in goats were seen which are reared alone (40.42%) than the goats reared with other ruminants (33.33%) Table 3 Chi square value and Pearson value of different factors and

score. No statistics was computed for bedding material, cleaning and hygiene because they were a constant.

## CONCLUSION

This research will not only contribute to the scientific understanding of mastitis but will also provide practical, evidence-based recommendations for goat farmers in Bharatpur. Addressing these management factors is essential for improving the health and productivity of goats, which, in turn, supports the economic development of the region. Ultimately, this study aims to provide a comprehensive understanding of the role of management practices in the prevalence of mastitis and to suggest feasible interventions that can be adopted by local farmers to mitigate the impact of this disease.

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