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Seasonal incidence of subclinical mastitis in indigenous and crossbreed cattle

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Abstract

The present investigation evaluated the seasonal incidence of mastitis in indigenous and crossbreed cattle at Division of Animal Husbandry and Dairy Science, College of Agriculture, Pune, during 2024–2025 across *rainy*, *winter*, and *summer* seasons. Monthly and seasonal analyses revealed highest monthly SCM incidence in crossbreeds which occurred in the months of August and May (33.33%), with overall prevalence of 18.18% in *summer* and 15.38% in *rainy* seasons, compared to lower values of 1.56% and 7.02% in indigenous breeds for the same seasons, respectively and comparatively modest monthly peaks. THI monitoring revealed the highest mean THI, indicating the highest thermal stress during *summer* (71.72), moderate in *rainy* (67.85), and minimal in *winter* (66.86). Evaluation of SCC, yield, and composition in SCM-positive animals confirmed that mastitis significantly elevated SCC and reduced milk solids, particularly in crossbreeds. The study concluded that indigenous breeds demonstrated higher disease resilience and greater adaptability to environmental fluctuations leading to climatic stress, maintaining better udder health and milk quality, whereas crossbreeds require enhanced management interventions, particularly during high-THI periods.

Keywords: Subclinical mastitis, seasonal incidence, indigenous cattle, crossbreed cattle, somatic cell count

1. Introduction

Livestock has become a central driver of India's agricultural economy, supporting nutritional security, rural livelihoods, and economic growth. As of 2023–24, livestock contributed 31.2% of agriculture and allied sector GVA and 5.5% of India's total GVA (NSO, 2025; BAHS, 2024) [27, 13]. India maintains the world's largest livestock population, exceeding 537 million animals (Livestock Census, 2019) [11], and remains the leading global milk producer, accounting for nearly 25% of world output (BAHS, 2024) [13]. Per capita milk availability reached 471 grams per day in 2023–24, substantially above the global average, with sector growth driven by breed improvements and sustainability initiatives (FAO, 2023; BAHS, 2024; MoFAHD, 2024) [14, 13, 12].

The dairy sector faces persistent challenges due to climatic stress, which significantly impacts animal health and milk productivity. Increased temperature and humidity, often quantified using the Temperature Humidity Index (THI), can reduce milk yield and alter composition (fat, protein, SNF, lactose). Studies confirm that high THI values elevate somatic cell count (SCC) and increase the risk of mastitis, particularly subclinical forms that are more prevalent and economically damaging than clinical mastitis (Bouraoui et al., 2002; Hammami et al., 2013; Lambertz et al., 2014; Sharma et al., 2012; BAHS, 2024; MoFAHD, 2024) [8, 18, 23, 30, 13] [12]. Dairy breeds differ in their susceptibility to heat stress, with indigenous breeds valued for their disease resilience and ability to sustain production under adverse climatic conditions, while crossbred cattle, despite higher yields, often exhibit greater vulnerability (Aggarwal & Singh, 2009; Herbut et al., 2018; BAHS, 2024) [2, 20, 13].

Mastitis remains the most prevalent and costly disease in dairy cattle, accounting for major losses due to reduced yield, lower milk quality, and increased veterinary costs (Radostits et al., 2000; Sharma et al., 2012; BAHS, 2024; MoFAHD, 2024) [29, 30, 13, 12]. SCC monitoring is an

essential tool for early detection of udder health issues, with elevated SCC serving as a reliable indicator for both clinical and subclinical mastitis (Zhao et al., 2015; Alhussien & Dang, 2018) [37] [4]. Maintaining climate resilience and udder health is thus critical for sustaining productivity and profitability in the Indian dairy sector (Berghof et al., 2019; Strandberg, 2009) [7] [35]. This study emphasizes resilience as a key trait for sustainable dairy farming, the research highlights the need for integrated management approaches—including heat-stress mitigation, disease prevention, and breed selection—to address growing environmental challenges and secure India's leadership in the global dairy industry.

2. Materials and methods

Lactating cattle of each indigenous and cross breeds were randomly selected from the Division of Animal Husbandry and Dairy Science, College of Agriculture, Pune. The milk samples from respective indigenous and crossbred cattle were collected on a weekly basis, during 2024-25, for three seasons, namely rainy, winter and summer using sampling bottles of about 50 ml capacity for quality and quantity analysis.

2.1 The following observations were recorded during investigation

2.1.1 Somatic cell count

Somatic Cell Count was used as an indicator for incidence of subclinical mastitis. It was analysed seasonally (rainy, winter, summer) using Everest Milk Somatic Cells Analyzer EKOMILK SCAN, for the collected milk samples, following the manufacturer's protocol. The milk analyzer Ekomilk Scan measures the flowing time of the milk with prime solution through the sample mixer capillary and determines the number of somatic cells in accordance with this time. There is proportional relation between the viscosity of mixture (milk – Ekoprim) and number of somatic cells of the tested milk.

For the preparation of 100 ml prime solution, 3.5 g ekoprim powder was weighed on weighing balance and then dissolved in 100 ml distilled water.

2.1.2 THI

The Temperature Humidity Index (THI) was assessed monthly and seasonally using the Phule Amrutkal application.

THI was calculated using the NRC 1971^[26] formula:

$$THI = (1.8 \times T + 32) - [(0.55 - 0.0055 \times RH) \times (1.8 \times T - 26.8)]$$

Where T is the ambient temperature ($^{\circ}\text{C}$) and RH is the relative humidity (%).

Phule Amrutkal is a Temperature Humidity Index based livestock advisory web and mobile application, available on Google Playstore for Android devices as well as on Apple Store for iOS devices, developed by ICRTC, Mahatma Phule Krishi Vidyapeeth, Rahuri that offers several benefits to farmers. It provides real-time updates on weather conditions and THI levels in their area or even in animal sheds, helping to make informed decisions about livestock feed and health management. It helps predict heat stress in animals due to changing seasonal conditions in real time and at a specific location and subsequently provides advisory services for livestock management by using real-time sensors placed on the farm and open-source APIs. It is a valuable tool for Indian farmers facing the challenges of climate change, as with its help, farmers can adapt to changing environmental conditions and ensure the well-being of their livestock.

2.2 Statistical Method

Incidence calculations were done animal-wise and also seasonal incidence rates (%) for subclinical mastitis were calculated.

3. Result and discussion

3.1 Month-wise incidence of SCM

The incidence of subclinical mastitis (SCM) displayed significant fluctuations throughout the year, with a pronounced increase during the monsoon months and varied by breed, with a generally higher incidence noted in crossbred cattle. In indigenous cattle, peak incidence was observed in August (15.38%), July (7.69%), and October (10.53%), while in crossbreeds, higher rates were seen in August (33.33%), May (33.33%), and October (28.57%). Notably, zero incidence was recorded from November through February in both breeds. The trend suggested that the environmental factors such as humidity and temperature during the rainy months increase the risk of subclinical mastitis. (Table)

Table 1: Monthly incidence of subclinical mastitis in cattle

Sr. No.	Season	No. of indigenous cattle			No. of crossbreed cattle		
		Tested	Positive	Incidence (%)	Tested	Positive	Incidence (%)
1.	June	16	1	6.25	6	1	16.67
2.	July	13	1	7.69	7	0	0.00
3.	August	13	2	15.38	6	2	33.33
4.	September	15	0	0.00	7	1	14.29
5.	October	19	2	10.53	7	2	28.57
6.	November	20	0	0.00	7	0	0.00
7.	December	22	0	0.00	7	0	0.00
8.	January	21	0	0.00	7	0	0.00
9.	February	19	0	0.00	5	0	0.00
10.	March	17	0	0.00	6	1	16.67
11.	April	16	0	0.00	5	1	20.00
12.	May	12	1	8.33	6	2	33.33
	Overall	203	7	3.45	76	10	13.16

These observations align with results observed by Aggarwal and Singh (2009) [2], Ahmad et al., (2018) [3], and Sharma et al., (2023) [31], who reported seasonal peaks in mastitis linked to high humidity and bacterial load. Hammami et al., (2013) [18] and Aatralarasi et al., (2021) [1] observed maximum SCM

prevalence during the monsoon. Das et al., (2016) [10] also reported crossbreeds being more prone to SCM during heat-humidity cycles. Similar results were observed by Maurya et al., (2020) [25], noted higher resistance in local breeds and reported a sharp rise in mastitis cases during periods of high

rainfall and humidity, owing to increased microbial proliferation and udder contamination.

However, contradictory results were observed by Ghavi Hossein-Zadeh et al., (2013) ^[17] and Costa et al., (2019) ^[9], who found non-seasonal incidence patterns in zero-grazing systems, highlighting management influence. Lambert et al., (2014) ^[23] and Toghdory et al., (2022) ^[36] suggested that mastitis incidence can be minimized through effective hygiene and milking practices.

3.2 Seasonal incidence of SCM

Table 2: Seasonal incidence of subclinical mastitis in cattle

Sr. No.	Season	No. of indigenous cattle			No. of crossbreed cattle		
		Tested	Positive	Incidence (%)	Tested	Positive	Incidence (%)
1.	Rainy	57	4	7.02	26	4	15.38
2.	Winter	82	2	2.44	28	2	7.14
3.	Summer	64	1	1.56	22	4	18.18
	Overall	203	7	3.45	76	10	13.16

Similar observations were made by Aggarwal and Singh (2009) ^[2], Harikumar (2017) ^[19], Karzis et al., (2017) ^[21] and Sharma et al., (2020) ^[32], who found rainfall and heat to be key contributors to mastitis prevalence. Gaafar et al., (2011) ^[16] and Ambade et al., (2012) ^[5] reported that native breeds maintained low SCC even under challenging seasonal changes. Maurya et al., (2020) ^[25] also observed seasonally elevated mastitis in high-yielding breeds when exposed to fluctuating THI.

Forsbäck et al., (2009) ^[15] and Kul et al., (2019) ^[22] found similar SCM rates across seasons, but attributed this to consistent hygiene and feed practices. Matei et al., (2010) ^[24] and Beheshti et al., (2010) ^[6] observed lower seasonal variation in semi-intensive housing.

3.3 Mean SCC, milk yield and milk components in SCM-positive cattle during different seasons

Table 3: Mean SCC, milk yield and milk components in SCM-positive cattle.

Breed	Season (n)	SCC ($\times 10^3$) (cells/ml)	Average Milk Yield (kg)	Fat (%)	SNF (%)	Protein (%)	Lactose (%)
Indigenous	Rainy (04)	429.21	5.80	3.78	8.66	3.24	4.71
	Winter (02)	367.47	6.26	3.87	8.75	3.36	4.79
	Summer (01)	272.12	5.68	3.81	8.72	3.28	4.75
Crossbreed	Rainy (04)	451.98	8.70	3.15	7.98	3.01	4.28
	Winter (02)	393.39	10.55	3.22	8.14	3.09	4.43
	Summer (03)	449.97	7.22	3.19	8.01	3.01	4.36

Similar results were observed by Singh et al., (2001) ^[33], who reported higher SCC in exotic and crossbreed animals due to higher milk production stress and lower immunity. Sharma et al., (2012) ^[30] and Sinha et al., (2021) ^[34] observed the maximum SCC in the rainy season for both breeds, possibly due to increased humidity and wet conditions that favour pathogen proliferation and infection risk.

Pawar et al., (2013) ^[28] found that heat stress during summer lowered milk yield in SCM positive cows. Sharma et al., (2020) ^[32] reported reduced lactose as an early indicator of SCM.

4. Conclusion

SCM prevalence was highest during the rainy season for both breeds, with the month of August recording the highest monthly incidence, with crossbreeds being more affected. Indigenous cattle showed minimal SCM cases during the

In indigenous cattle, the highest incidence occurred during the rainy season (7.02%), followed by winter (2.44%) and summer (1.56%). For crossbreed cattle, incidence was highest in the summer season (18.18%), similar to indigenous breeds. However, rainy season (15.38%) also showed high rates, which suggested a marked breed-related difference in susceptibility and a reduced adaptability of crossbreeds to hot and humid environments. The overall pattern indicated that rainfall and humidity significantly contributed to increased mastitis prevalence, especially in less adapted crossbreeds. (Table 2)

In indigenous cattle, the highest SCC (429.21×10^3 cells/ml) was recorded during the rainy season, followed by winter (367.47×10^3 cells/ml), and the lowest in summer (272.12×10^3 cells/ml). Correspondingly, average milk yield varied slightly, with the highest in winter (6.26 kg), followed by rainy (5.80 kg), and lowest in summer (5.68 kg). The milk composition (fat, SNF, protein, and lactose) also showed modest seasonal variation.

In crossbreed cattle, SCC remained consistently high across seasons, which peaked during the rainy (451.98×10^3 cells/ml) and summer (449.97×10^3 cells/ml) seasons, and was relatively lower during winter (393.39×10^3 cells/ml). Milk yield was highest in winter (10.55 kg), followed by rainy (8.70 kg), and lowest in summer (7.22 kg). Fat and SNF percentages were lower in crossbreeds compared to indigenous cattle across all seasons. Results are presented in Table 3.

summer season, highlighting genetic resistance and the beneficial effects of favorable climatic conditions. These results emphasize that indigenous breeds possess adaptive advantages under tropical environmental stressors, while crossbreeds require focused management strategies during hot and humid periods to mitigate mastitis risk.

Conflict of Interest

Not available

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Not available

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