



Prevalence, Milk Yield, Composition, and Treatment of Subclinical Mastitis in Crossbred Cows: Exploring Economic of Mastitis and Alternative Approaches beyond Conventional Antibiotics- A Field Study

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Abstract: Bovine sub-clinical mastitis (SCM) is a major constraint to the dairy industry throughout the world. SCM presents no clinical symptoms and unnoticed by the dairy owner. Early detection and treatment of SCM is of paramount importance to check spread of the disease into clinical form of mastitis. A study was undertaken to assess the effectiveness of herbal gel application in sub-clinical mastitis (SCM) and effect on milk quality. The study was carried out during the period from January 2020 to December 2024 in five small dairy units in the Jodhpur district of Rajasthan. Fifty lactating cross bred cows were selected in third to fifth lactation with milk yield ranging 15-20 L day⁻¹ from adopted villages of Krishi Vigyan Kendra, Jodhpur. Sub-Clinical Mastitis was diagnosed on the basis of Mastitis Detection Strip (MDS) on milk. Overall prevalence was reported 22.85%. As the condition progressed, milk yield declined significantly until treatment was administered. Average milk production increased by 12.1% after the treatment. In this study, a non-antibiotic topical herbal gel demonstrated a high efficacy of 84% in controlling subclinical mastitis in lactating cows. It is hypothesized that the herbal ingredients not only enhance natural immunity at the cellular level but also strengthen udder integrity and defence mechanisms. This may occur through the combined effects of cellular activation within the mammary glands, improved bacterial clearance by phagocytic cells, and regulation of acute inflammatory responses. Consequently, this investigation aimed to evaluate the field efficacy of the herbal topical gel as a non-antibiotic treatment for subclinical mastitis, facilitating its transfer as a practical management strategy.

Key words: Sub-Clinical Mastitis (SCM), cow, mastitis detection strip, alternative treatment.

Subclinical mastitis (SCM) remains a major constraint to the dairy industry due to its high prevalence, significant reduction in milk production, and substantial treatment costs

in affected lactating cows (Dutta *et al.*, 1995). In India, the dairy industry experiences annual economic losses of around Rs. 60532.1 million due to udder infections (Dua, 2001) of which losses attributed to subclinical mastitis range between Rs. 21,297.2 million (Sirohi and Sirohi, 2001) to Rs. 26,460 million (Dua, 2001). The primary causative agents are predominantly microbial pathogens, which are responsible for both clinical and subclinical forms of the disease. This condition significantly impacts economic productivity by decreasing milk yield and increasing treatment costs (Gomes and Henriques, 2016; Cheng and Han, 2020). Although various drugs are available for therapy, treatment outcomes are often inconsistent, primarily due to the emergence of antibiotic resistance resulting from the indiscriminate use of antibiotics (Pal and Verma, 1991). Clinical mastitis is one of the most dreaded diseases in dairy animals, responsible for considerable economic losses-reducing milk yield by up to 70% and increasing veterinary expenses by approximately 7% (Maiti *et al.*, 2006).

The limitations of antibiotic therapy include residual effects and failure to fully restore optimal milk production. Moreover, the efficacy of antibiotics is waning due to rising bacterial drug resistance, which poses a serious global health threat. Currently, an estimated 700,000 deaths annually worldwide are attributed to antimicrobial resistance, which is spreading rapidly across regions (Gajdacs *et al.*, 2021). Early detection and treatment of subclinical mastitis are crucial in preventing the progression to clinical disease and controlling its spread.

There is a growing need to raise awareness about alternative treatment options that promote health and sustainability for humans, animals, and the environment (Lancet, 2022). The presence of antibiotic residues in food products and the environment has raised consumer concerns, emphasizing the importance of reducing antibiotic use in animal health management (Lopes *et al.*, 2020; Rajamanickam *et al.*, 2020). In light of these issues, the present study was undertaken to evaluate the efficacy of herbal gel topical application as a non-antibiotic treatment for subclinical mastitis in field conditions, aiming to explore sustainable and safe alternatives for mastitis management.

Materials and Methods

The present study was conducted in five villages (Bakaliya, Manai, Lawari, Paladi, Rampura) of Jodhpur district and selected ten sub clinical mastitis infected crossbred cows from each village. On the basis of screening through mastitis detection strip (MDS), 50 animals were diagnosed for sub-clinical mastitis from the five dairy herd. Total 219 animals were screen out from the five dairy herd of selected villages. The cross breed animals were selected between three to five parity and whose of milk production ranged from 15 to 20 L day⁻¹ in previous lactation. For the treatment of subclinical mastitis, herbal gel topically applied on whole udder and teats after each milking (twice daily) along with sodium bicarbonate 50 gm and *Nimbu sat* (citric acid) 25 gm each animal for 7 days. The herbal gel contained *Glycyrrhizaglabra* (5 g), *Curcuma longa* (5 g), *Eucalyptus globules* (2 g), *Cedrusdeodara* (10 g), *Paedariafoetida* (5 g) and Sulphur (10 g) in each 50 g petroleum gel. The efficacy of the herbal gel drug was assessed on the basis of negative reaction of milk samples to MDS during treatment.

Fifty cows with subclinical mastitis were treated with application of topical herbal gel twice daily after each milking for 7 consecutive days. The effectiveness of therapy was observed after 5th day from start of treatment on milk samples collected from sub-clinical mastitis cows and was continued up to 15 days. MDS test was done in all the quarters. Milk quality was estimated using the protocols developed by FSSAI (2015). The data were statistically analyzed for mean and standard error using Microsoft Excel.

Result and Discussion

Milk samples were collected from 219 cross breed cows for subclinical mastitis test. In the present study, 22.85% cows suffered from subclinical mastitis. Krishnamoorthy *et al.*, 2021 had reported higher prevalence (45%) SCM in India. The reason for this vast difference between the two values could be use of California mastitis test (CMT) by Krishnamoorthy *et al.* (2021 which is known for higher accuracy than MDS test. The high incidence was recorded in hindquarter (72 to 75%) in comparison to forequarter (41 to 45%). The highest prevalence in hind quarter's

Table 1. Observation of treatment of subclinical mastitis in lactating cross bred cows

Name of village	No. cows per village	Available milk yield (L day ⁻¹)				No. of cows not cured and developed CM
		Normal	Pre treatment	Post treatment	Per cent change	
Bakaliya	10	17.0±0.74	14.0±0.63 ^a	16.5±0.86 ^b	17.9	2
Manai	10	18.5±1.14	16.0±0.69 ^a	18.0±0.95 ^b	12.5	1
Lawari	10	16.0±0.97	13.5±0.70 ^a	15.0±0.48 ^b	11.1	4
Paladi	10	20.0±1.01	18.0±1.33 ^a	19.5±1.31 ^b	08.3	1
Rampura	10	18.0±1.22	17.0±1.16 ^a	15.2±0.87 ^b	11.8	0
Average		17.91±0.48	15.32±0.44 ^a	17.24±0.47 ^b	12.1	

Note: a, b superscript differs among the treatment groups (rows) differ significantly. Values preceded by ± indicate standard error; CM=Clinical mastitis.

affection might be more due to continuous soiling of hind teats during defecation and urination. The no of SCM cases are higher (30/50) in summer season in comparison to winter (20/50). The present study season also corroborates with finding of Abdel-Rady and Sayed (2009) who noticed higher prevalence of subclinical mastitis in hot weather than in winter. High incidence of SCM attributed to hot climate, stress of high milk yield, breed predilection and non-implementation of strict hygienic measures for control of mastitis.

Milk yield and milk composition: The average milk production from non SCM affected cows was recorded TO BE 17.91±0.48 l cow⁻¹ day⁻¹ in selected villages. The average milk production in SCM infected cows was 15.32±0.44 which increased to 17.24±0.47 L cow⁻¹ day⁻¹ after treatment, an increase of 12.1%. In spite of the treatment eight cows developed in clinical mastitis, which is 16%. Higher incidence of mastitis was observed in Lawari due to unhygienic barn and not proper milking method adopted by the farmers. Low incidence was observed in Manai and Paladi due to proper milking and hygienic condition maintain in bran. In villages Manai and Paladi, dairy farmers were cleaning the shed two time morning and evening. So that chances of infection were minimum through adoption of scientific practices through training conducted by KVK.

Changes in milk composition was recorded in fat, total solids, SNF, pH before and after treatment is presented in table 2. It is evident from the data that application of herbal gel helped in restoration of quality of milk also. Supplementation of curcuma and cumin helps in restoration of milk to normal and minimise the mastitis reported earlier author (Nurdin *et al.*, 2011). Alkaloid, saponin, flavonoid

Table 2. Milk composition of subclinical mastitis in lactating cross bred cows

Parameter	Before treatment	After treatment
FAT	03.85±0.08 ^a	04.00±0.05 ^b
Total solids	11.35±0.34 ^a	11.55±0.26 ^b
SNF	07.43±0.29 ^a	07.7±0.27 ^b
pH	06.85±0.03 ^a	06.73±0.03 ^b

Note: a, b superscript differs among the treatment groups (rows) differ significantly. Values preceded by ± indicate standard error

and triterpenoid present in curcuma and in cumin are known to possess antioxidant and anti-inflammatory compounds which help in increase permeability of udder alveolar cells and increase body defence mechanism.

The disease prevention in the current study might be due to the immune-potentiating activity of herbal drugs that might have enhance the body's defence mechanism along with udder immunity, thereby keeping all sort of intra-mammary infections. The constituent herbal ingredients of biotherapy are used in alternative medicine for their anti-bacterial, anti-inflammatory, analgesic, anti-histaminic and immune-modulatory properties. The efficacy of the herbal gel is due to the combined action of the ingredient herbs. Inorganic sulphur had also been used as one of the active ingredients in an externally applied non antibiotics gel treatment found effective against bovine clinical mastitis (Bhatt *et al.*, 2014). The use of *nimbu sat* and Sodium bicarbonate help to stabilize the milk pH, improve milk quality and act as buffering agent. In SCM, the pH of milk is increased, the citric acid being an acid helps in neutralizing the alkalinity and also helps in preventing growth of bacteria responsible in alkaline media. Milk production of treated animals recorded a gradual increasing trend by average 1.5-2 L day⁻¹ after treatment of 5 to 7

Table 3. Components of losses in clinical mastitis in cross bred cow

Types of losses	Cost (Rs.)	Per cent expenditure
(A) Production loss (1 cow ⁻¹ @ Rs. 40 l ⁻¹)	422.20	10.33
(i) Milk yield loss day ⁻¹	229.20	05.60
(ii) loss from discarded milk	193.00	04.72
(B) Veterinary expenses	3119.99	76.36
(i) Medicine (antibiotics, anti-inflammatory and intramammary etc.)	2046.66	50.09
(ii) Services/fee	1073.33	26.27
(C) Hygiene	85.48	02.09
(i) Stall/bran hygiene	36.35	00.88
(ii) Milk hygiene	49.13	01.20
(D) Miscellaneous	457.99	11.20
(i) Additional labor	191.33	04.68
(ii) Equipment	226.66	05.54
Total expenses (A+B+C+D)	4085.66	-

days. Early detection of infection and prompt treatment are of paramount importance in control of sub-clinical mastitis (Grodkowski *et al.*, 2022). Antibiotic treatment of sub clinical mastitis is a common practice but recovery rate is variable with different drugs. In addition, several undesirable aspects of antibiotics treatments are cost, drug resistant, drug residues, milk discards and other adverse effects. Therapeutic efficiency of topical gel containing oil of *Glycyrrhiza glabra*, *Curcuma longa*, *Eucalyptus globulus*, *Cedrus deodara*, *Paedaria foetida*, *haridraghanstoa* and Sulphur has been found very promising against sub-clinical mastitis reported by various author (Verma and Nauriyal, 2009). Burungale *et al.* (2013) opined that herbs such as *Withaniasomnifera*, *Asparagus racemosus*, *curcuma amanda* and *Ocimum sanctum* possess anti-inflammatory, analgesic and antibacterial properties. Poly Herbal Gel constituent helped in elimination of pathogen due to Anti-inflammatory and soothing effect, analgesic action, anti- microbial activity and strengthening of udder tissue defence barrier. Milk yield also decreased substantially as the sub-clinical mastitis advanced till eventual treatment. It helps in mediating natural immunity, strengthening the udder integrity and enhanced bacterial clearance by phagocytic cell populations and regulates inflammatory reaction. Similar study was reviewing the potential application of herbal extracts and essential oils for managing mastitis treatment (Sonal *et al.*, 2024).

Economic inference of mastitis: Mastitis is an expensive disease of dairy cow and has

large difference in economic losses between the farmers. Economic costs of mastitis as with other disease consist of losses, such as loss of milk production, antibiotics, veterinary services, hygiene and labor.

The treatment cost of subclinical mastitis cow was only Rs. 400, which is ten times lower cost of treatment in comparison to clinical mastitis. It is highly beneficial to the farmer for early detection and low cost of treatment. The production losses of milk is minimum in SCM through herbal gel application.

Economic losses from mastitis in crossbred cows were estimated at about Rs. 4085.66 per incidence. The majority of these losses resulted from a decline in milk yield, accounting for 10.33%, followed by veterinary expenses, which constituted nearly 76.36% of the total. The higher veterinary costs in crossbred cows can be attributed to the expensive medicines, rearing, and intensive management practices required for their care. The other components such as additional labor charges and hygiene maintenance also contributed to the overall economic loss. Earlier reports highlighted similar findings. Janzen (1970) observed milk loss in mastitis-affected cows ranging from 0.34 to 2.66 kg per quarter per day (9.0–43.3%). Wilson *et al.* (2004) estimated losses of around 700 kg of milk in the first lactation and up to 1200 kg in later lactations due to clinical mastitis. On average, the overall loss per lactation was calculated at Rs. 1390, with nearly half (49%) arising from reduced milk production, followed by veterinary costs (37%). Studies on

subclinical mastitis also revealed significant losses. Rathod *et al.* (2017) estimated total losses ranging from Rs. 21,677 to Rs. 88,340 per lactation, depending on the animal's condition. Losses from discarded milk were reported to be comparable to those from decreased production. However, since discarded milk is already produced, feed and maintenance costs for that quantity must be included, making the economic damage from discarded milk greater than from unproduced milk. Crossbred cows generally incurred heavier losses because of their higher milk production potential, which is severely affected during infection periods. Other studies reported similar results, though with regional and breed-specific variations. Sinha *et al.* (2014) found overall losses of about Rs. 1390 per lactation, while Das *et al.* (2018) reported a monthly loss of Rs. 7824 per cow. Differences across studies may be due to variations in agro-climatic conditions, species, breed, and production levels. These economic losses can be minimized through proper prevention and control measures. Key practices include maintaining strict sanitation during milking, ensuring hygienic housing, preventing cows from lying down immediately after calving, using teat dipping, and allowing animals to stand for 5–10 minutes post-milking to reduce microbial contact with the udder. In addition, supplementation with antioxidants such as vitamins E and C, selenium, zinc, copper, and herbal preparations can enhance udder immunity and help reduce mastitis incidence.

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Conflict of interest

All authors declare no conflict of interest.

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