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# Incidence of clinical mastitis in Vrindavani herd

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**Abstract**
The study was carried to evaluate the prevalence rate per lactation (PRL) and lactation incidence risk (LIR) of clinical mastitis (CM) in the Vrindavani herd. The data contains 7683 calving of 2528 cows over a 32-year period (1989-2020). The overall PRL and LIR on the farm was 27.68% and 40.26%, respectively. Higher PRL (36.06%) in fifth lactation and LIR (54.26%) in six lactation were found. Recent period (2017-2020) reported highest PRL (36.66%) and LIR (61.89%) in this herd. Rainy season had higher PRL (29.32%) and LIR (43.22%) than other seasons. The results of this investigation showed that CM occurred most often in the multiparous old cows. Recent period and rainy season showed more CM prevalence because of the favourable environment for pathogens to grow and spread in the herd. Thus, to reduce the CM occurrence, more thrust needs to be paid on older cows and those, which calved in rainy season.

**Keywords:** Incidence, non-genetic factors, clinical mastitis, Vrindavani

## 1. Introduction
Clinical Mastitis (CM) is defined as visual appearances of abnormal signs and symptoms such as hot and swelled udder and reddish milk with clots. CM is a multifactorial udder or mammary gland illness that is chronic in nature and economically unsustainable for the dairy industry. Even with the greatest management and environmental practices in place, most herds have CM infection, which results in the involuntary culling of dairy animals. Bloemhof *et al.* (2009) [8] reported that more emphasis were given on milk production traits, which causes the degradation of udder health in dairy cattle. As per DAHD Annual Report (2020-21), India is a leader in milk production (198.40 MT) and Biffa *et al.* (2005) [7] reported higher incidence of CM in crossbred and exotic breeds (29 to 57%) of cattle as compared to Indigenous breeds (30%). Bansal and Gupta (2009) [4] reported 7000 crore annual economic losses in India, whereas, Viguier (2009) [28] reported 2 billion annual losses due to this devastating disease in USA.

Mastitis is mainly caused by three different ways- I) Infection through contagious mastitis *i.e.* from infected animals, II) By infectious agents residing in teat canal and causes opportunistic infection and III) By environmental source. Total number of CM cases for 100 dams within a specified year calculates year wise incidence of CM in a herd. Fukushima *et al.* (2020) [13] reported prevalence and incidence risk of CM in well-managed dairy farm as 22-28%. Smith *et al.* (1985) reported 30-35% CM incidence due to the Gram-negative bacteria such as E. *coli* and Klebsiella species whereas 25-40% of CM incidence is due to Gram-positive bacteria such as streptococci and staphylococcus species. Incidence risk of CM in heifer is varied from 30-75% prepartum and 15-45% postpartum (Fox, 2009).

Mastitis in bovine is defined as "an inflammatory condition of the udder tissue in response to injury, which helps to terminate and nullify pathogens and stimulate healing and return to normal function" (National Mastitis Council, 1996). Oliver *et al.* (2005) [22] suggested that presence of bacteria in milk is concern with contamination of food products and public health, which may cause disease in human. Moreover, in modern dairy sector, the reducing cost of production along with increasing income is need of an hour. With increase in milk production, consumers expects high quality milk and its product to come from healthy cows. Thus, Gomes and Henriques (2016) [14] suggested, frequent usage of antibiotics to treat CM infection in dairy animals are major concern in developing antibiotic resistance with risk of its residues in milk is foremost public health threat worldwide. To maintain the confidence of milk consumer, important pathway like genetic basis of disease control and improved farm management are gold standard in this decade.

Bovine mastitis is principally a managemental complication, which may be effectively controlled when prevention of disease program is appropriately followed. There are curative methods against clinical form of mastitis to elude further economic loss to farmers. A foremost priority such as prevention and control of disease should be implemented in best suitable ways required for production of mastitis free clean milk. There should be a great significance for dynamic study of bovine mastitis and its correlations with other important traits within the herd. The challenges of mastitis if appropriately observed can resolve to a great extent preventing economic losses and disappointments of the dairy sectors.

The two most fundamental measurements of disease occurrence are prevalence and incidence. Prevalence is defined as 'proportion with a disease at specific point of time/period' and incidence is defined as 'the number of new cases during a certain period of time' Thrusfield *et al.* (2018) [27]. In this study, we analyzed incidence risk and prevalence rate of clinical mastitis data along with effect of various factors from 1989 to 2020 in Vrindavani cattle.

## 2. Materials and Methods

The data on Clinical Mastitis (CM) during last 32 years (1989-2020) collected and compiled from history sheets of animals as well as treatment records maintained at the Livestock Production and Management Section and Cattle and Buffalo Farm Dispensary, ICAR-Indian Veterinary Research Institute, Izatnagar. Vrindavani cattle are crossbreds, which are developed over seven generations of inter-se mating. Ahmad *et al.* (2020) [1] reported that Vrindavani population has more than 70% exotic taurine inheritance from Holstein, Jersey, and Brown Swiss cattle with 39.5, 22.9, and 10.7% total ancestry, respectively, whilst indicine ancestry from Hariana cattle accounts for 26.9% of total ancestry. The data included pedigree information, date of birth, date of calving, date of drying, parity and date of mastitis diagnosis.

The data of clinical mastitis was considered in binary form (0/1) indicating its presence or absence in a lactation. Nakov *et al.* (2012) [20] used prevalence and incidence term in their investigation to know prevalence rate per lactation (PRL) and lactation incidence risk (LIR). PRL was estimated in percentage as the ratio of number of lactations with CM and total observed lactations. Whereas, LIR in percent was determined as the ratio of total number of CM cases and total observed lactations.

$$\text{Prevalence rate per lactation (PRL) (\%)} = \frac{\text{Number of CM affected lactations}}{\text{Total number of lactations}} \times 100$$

$$\text{Lactation incidence risk (LIR) (\%)} = \frac{\text{Total number CM cases}}{\text{Total number of lactations}} \times 100$$

PRL and LIR were also assessed according to lactation number, period of calving and season of calving. Categorization of lactation number was done into six groups *viz*., one, two, three, four, five and six and subsequent lactations. The data of 32 years was grouped into total eight periods of calving (each period consisting of four years duration). Similarly, the season of calving denoted three seasons yearly such as winter (November-February), summer (March-June) and rainy (July-October). In same animal, CM case was considered new after termination of previous case with minimum gap of 7 days.

## 3. Results and Discussion

Recent study involve records of 7683 calvings of 2528 Vrindavani cows born to 1521 dams and 125 sires and spread over a period of 32 years (1989–2020). An overall prevalence rate per lactation (PRL) and lactation incidence risk (LIR) of clinical mastitis in Vrindavani herd was 27.68 and 40.26%, respectively. Percentage PRL increased over lactations from first to fifth and slightly decreased in sixth and above lactation (Table 1). LIR also showed an increasing trend over lactation from 1st to 6th lactation (27.94, 36.15, 49.05, 51.60, 53.64 and 54.26%), respectively in the Vrindavani herd (Table 1; Fig. 1).These results showed that as age of the dam increases the percentage of PRL and LIR increases. Bhat *et al.* (2017) [6], Elmaghraby *et al.*(2017) [12] and Sinha *et al.*(2021) [25] revealed similar results in multiparous and high yielding cows. They suggested higher incidence of CM in older cows due to enlarged udder size and widened teat canal that increases possibility for entry of mastitis causing pathogens. Whereas, Dego and Tareke (2003) [10] and Elmaghraby *et al.* (2017) [12] suggested that higher prevalence and incidence in older cows were due to deteriorated defense mechanism that reduces tolerance to disease as compared to younger cows.

**Table 1:** Lactation wise PRL and LIR in Vrindavani herd

| Particulars | Prevalence rate per lactation | Lactation incidence risk |
|---|---|---|
| L1 | 20.85% | 27.94% |
| L2 | 26.29% | 36.15% |
| L3 | 32.18% | 49.05% |
| L4 | 34.15% | 51.60% |
| L5 | 36.06% | 53.64% |
| L6 | 33.62% | 54.26% |

Period from 2017-20, 2001-04 and 2013-16 had higher percentage of PRL and it was the lowest in first (1989-1992) period (Table 2; Fig 2). The highest LIR was observed in the recent period from 2017-20, 2013-16 and 2001-04 and the lowest was observed in first period (1989-1992) (Table 2; Fig 2). Our results showed the highest PRL and LIR during recent period because of presence of high yielding multiparous cows in the herd. Whereas, Rajala-Schultz *et al.* (1999) [23], Koivula *et al.* (2005) [18] reported that milk production has unfavourable positive correlation for occurrence of mastitis. Moreover, Jingar *et al.* (2014) [16] and Lacetera (2019) [19] revealed higher incidence risk of CM because of the adverse climatic conditions in recent decades. Elbably *et al.* (2013) [11] also noticed similar results in their investigation during a period of four years from 1992 to 1995, wherein year 1995 showed the highest effect. Whereas, Boujenane *et al.* (2015) [9] in a study on 1725 Holstein cows in Morocco (for the year 2008-2012) observed a higher incidence risk of CM in 2009 and 2010 as compared to 2008 and 2012. Riekerink *et al.* (2007) [24] suggested periodical variation for mastitis infection in the milk of HF and Dutch Friesian cows maintained in Netherland.

**Table 2:** Period wise PRL and LIR in Vrindavani herd

| Period | Prevalence rate per lactation | Lactation incidence risk |
|---|---|---|
| P1 | 14.93% | 21.62% |
| P2 | 18.94% | 24.42% |
| P3 | 29.80% | 38.92% |
| P4 | 35.96% | 55.22% |
| P5 | 24.42% | 36.14% |
| P6 | 23.89% | 30.11% |
| P7 | 35.76% | 55.53% |
| P8 | 36.66% | 61.89% |

Higher PRL and LIR were found during rainy season followed by winter and summer season (Table 3; Fig. 3). These results indicated that pathogens remain in dormant phage in udder and express the disease under suitable climatic conditions. However, during rainy season, bacterial load increases due to favorable climatic conditions and results in higher incidence risk as compared to other seasons. Our results are in well accordance with the findings of other studies, conducted in India. Sinha *et al.* (2019) reported the highest incidence risk of CM in Karan Fries cattle (30.5%) and Sahiwal (30.4%) during the rainy season. Joshi and Gokhale (2006) [17] revealed significant influence of season on occurrence of CM and reported higher incidences during monsoon than winter and summer seasons. On contrary, Riekerink *et al.* (2007) [24] found higher incidence risk during December and January in Holstein cattle maintained at Netherland. Various seasons significantly affected incidence of mastitis. Summer (36.25%) and winter (31.82%) showed higher incidence risk than autumn (17.65%) and spring (31.60%) (Elbably *et al.*, 2013) [11]. Whereas, Vitali *et al.* (2016) [29] reported that occurrence of mastitis is critical during summer due to their capacity to resist the temperature.

**Table 3:** Season wise PRL and LIR in Vrindavani herd

| Season | Prevalence rate per lactation | Lactation incidence risk |
|---|---|---|
| S1 | 27.03% | 39.04% |
| S2 | 26.23% | 37.71% |
| S3 | 29.32% | 43.22% |

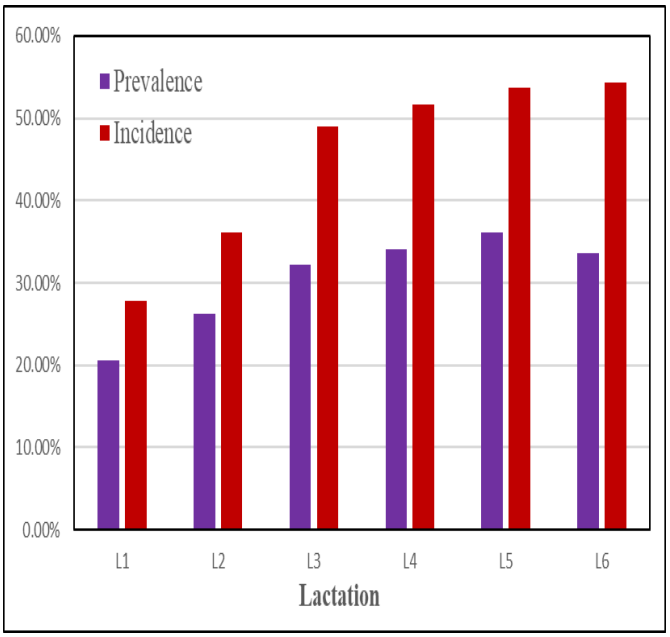


**Fig 1:** Lactation wise PRL and LIR

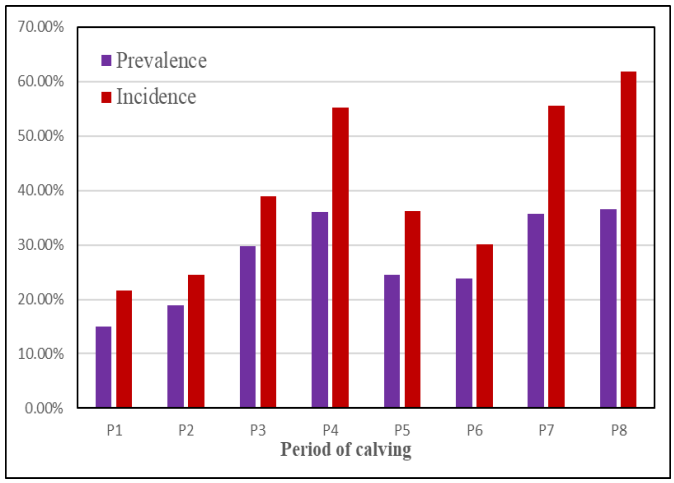


**Fig 2:** Period wise PRL and LIR

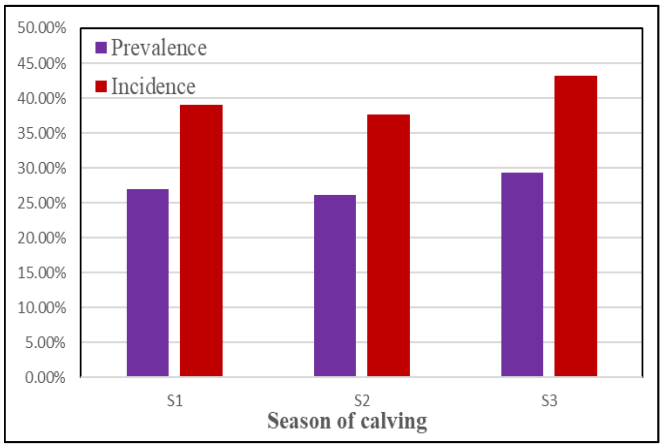


**Fig 3:** Season wise PRL and LIR

The occurrence of CM once, twice and thrice occurred in 70.33, 19.89 and 5.97% cows, respectively during the entire period of study. This suggests that the highest number of cows affected with CM once followed by twice and thrice in entire study period. Bar *et al.* (2008) [5] reported similar results that 3,036, 758 and 288 lactations affected 1st, 2nd and 3rd time out of 16,145 lactations during first ten months of calving. Average number of CM episodes in first, second, third, fourth, fifth and sixth lactation was 1.35, 1.38, 1.52, 1.51, 1.49 and 1.61, respectively. Wolfová *et al.* (2006) [30] also found similar results indicating that there was an increase in number of CM episodes in Holstein cattle from the Czech Republic with increase in lactation order from first to third (0.35, 0.45 and 0.57). Average incidence reported for first, second, third, fourth, fifth, sixth, seventh and eighth period was 1.45, 1.29, 1.31, 1.54, 1.48, 1.26, 1.55 and 1.61, respectively. Number of episodes reported was 1.44, 1.43 and 1.47 for winter, summer and rainy season, respectively. In our study, 6.81% primiparous cows had at least one CM case in lactation as compared to 20.88% multiparous cows. Our studies are in well agreement with the results of Hertl *et al.* (2010) [15]. They reported higher incidence risk in multiparous cows than primaparous cows.

## 4. Conclusion

Climatic conditions and age of the cow showed increased risk of CM occurrence. Rainy season from July to October showed highest incidence of CM. As the cow's age advances, the risk to CM exposure in the herd increases. Advance age or lactation number indicated improved milk yield, enlarged

udder and widening of teat canal. This increases chances of getting injury and favorable condition for pathogen entry and its development in udder. Multiparous cows had higher CM episodes as compared to primiparous Vrindavani cows. These results suggest implementation of better management practices to improve mastitis tolerance in Vrindavani herd and to limit financial losses due to treatment cost with ensuring animal and human welfare.

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## 6. References

1. Ahmad SF, Panigrahi M, Chhotaray S, Pal D, Parida S, Bhushan B *et al*. Revelation of genomic breed composition in a crossbred cattle of India with the help of Bovine50K BeadChip. Genomics 2020;112(2):1531-1535.
2. Annual Report. Department of Animal Husbandry, Dairying and fisheries. New Delhi: Ministry of Agriculture, Government of India. 2020-21.
3. https://dahd.nic.in/sites/default/filess/Annual%20Report%202020-21%20%28English%29_30.06.21%5D.pdf. 12-08-2021.
4. Bansal B, Gupta DK. Economic analysis of bovine mastitis in India and Punjab-A review. Indian journal of dairy science 2009;62(5):337-345.
5. Bar D, Gröhn YT, Bennett G, González RN, Hertl JA, Schulte HF *et al*. Effects of repeated episodes of generic clinical mastitis on mortality and culling in dairy cows. Journal of dairy science 2008;91(6):2196-2204.
6. Bhat AM, Soodan JS, Singh R, Dhobi IA, Hussain T, Dar MY *et al*. Incidence of bovine clinical mastitis in Jammu region and antibiogram of isolated pathogens. Veterinary world 2017;10(8):984.
7. Biffa D, Debela E, Beyene F. Prevalence and risk factors of mastitis in lactating dairy cows in Southern Ethiopia. International journal of applied research in veterinary medicine 2005;3(3):189-198.
8. Bloemhof S, de Jong G, de Haas Y. Genetic parameters for clinical mastitis in the first three lactations of Dutch Holstein cattle. Veterinary microbiology 2009;134(1-2):165-171.
9. Boujenane I, El Aimani J, By K. Effects of clinical mastitis on reproductive and milk performance of Holstein cows in Morocco. Tropical animal health and production 2015;47(1):207-211.
10. Dego OK, Tareke F. Bovine mastitis in selected areas of southern Ethiopia. Tropical animal health and production 2003;35(3):197-205.
11. Elbably MA, Emeash HH, Asmaa NM. Risk factors associated with mastitis occurrence in dairy herds in Benisuef, Egypt. World's Veterinary Journal 2013;3(1):5-10.
12. Elmaghraby MM, El-Nahas AF, Fathala MM, Sahwan FM, Tag EL-Dien MA. Incidence of clinical mastitis and its influence on reproductive performance of dairy cows. Alexandria Journal for Veterinary Sciences 2017;54(2).
13. Fukushima Y, Kino E, Furutani A, Minamino T, Mikurino Y, Horii Y *et al*. Epidemiological study to investigate the incidence and prevalence of clinical mastitis, peracute mastitis, metabolic disorders and peripartum disorders, on a dairy farm in a temperate zone in Japan. BMC Veterinary Research 2020;16(1):1-10.
14. Gomes F, Henriques M. Control of bovine mastitis: old and recent therapeutic approaches. Current microbiology 2016;72(4):377-382.
15. Hertl JA, Gröhn YT, Leach JD, Bar D, Bennett GJ, González RN *et al*. Effects of clinical mastitis caused by gram-positive and gram-negative bacteria and other organisms on the probability of conception in New York State Holstein dairy cows. Journal of dairy science 2010;93(4):1551-60.
16. Jingar SC, Mehla RK, Singh M. Climatic effects on occurrence of clinical mastitis in different breeds of cows and buffaloes. Archivos de zootecnia 2014;63(243):473-482.
17. Joshi S, Gokhale S. Status of mastitis as an emerging disease in improved and periurban dairy farms in India. Annals of the New York Academy of Sciences 2006;1081(1):74-83.
18. Koivula M, Mäntysaari EA, Negussie E, Serenius T. Genetic and phenotypic relationships among milk yield and somatic cell count before and after clinical mastitis. Journal of Dairy Science 2005;88(2):827-833.
19. Lacetera N. Impact of climate change on animal health and welfare. Animal Frontiers 2019;9(1):26-31.
20. Nakov D, Trajcev M, Andonov S, Ostojic Andric D. Relationship between milk yield of dairy cows and incidence of clinical mastitis during lactation. In Book of Proceedings of The 1st International Symposium on Animal Science Book I 2012, 778-789.
21. Bramley A. Methods of controlling mastitis in dairy cows. Current Concepts of Bovine Mastitis 1996.
22. Oliver SP, Jayarao BM, Almeida RA. Foodborne pathogens, mastitis, milk quality, and dairy food safety. In NMC Annual Meeting Proceedings 2005, 1.
23. Rajala-Schultz PJ, Gröhn YT, McCulloch CE, Guard CL. Effects of clinical mastitis on milk yield in dairy cows. Journal of dairy science 1999;82(6):1213-1220.
24. Riekerink RO, Barkema HW, Stryhn H. The effect of season on somatic cell count and the incidence of clinical mastitis. Journal of dairy science 2007;90(4):1704-15.
25. Sinha R, Sinha B, Kumari R, MR V, Verma A, Gupta ID. Effect of season, stage of lactation, parity and level of milk production on incidence of clinical mastitis in Karan Fries and Sahiwal cows. Biological Rhythm Research 2021;52(4):593-602.
26. Smith KL, Todhunter DA, Schoenberger PS. Environmental mastitis: cause, prevalence, prevention. Journal of dairy science 1985;68(6):1531-1553.
27. Thrusfield M. Veterinary epidemiology. John Wiley & Sons 2018.
28. Viguier C, Arora S, Gilmartin N, Welbeck K, O'Kennedy R. Mastitis detection: current trends and future perspectives. Trends in biotechnology 2009;27(8):486-493.
29. Vitali A, Bernabucci U, Nardone A, Lacetera N. Effect of season, month and temperature humidity index on the occurrence of clinical mastitis in dairy heifers. Advances in Animal Biosciences 2016;7(3):250-2.
30. Wolfová M, Štípková M, Wolf J. Incidence and economics of clinical mastitis in five Holstein herds in the Czech Republic. Preventive veterinary medicine 2006;77(1-2):48-64.