The Pharma Innovation Journal 2022; SP-11(3): 1249-1253

www.ThePharmaJournal.com

The Pharma Innovation

ISSN (E): 2277- 7695
ISSN (P): 2349-8242
NAAS Rating: 5.23
TPI 2022; SP-11(3): 1249-1253

www.thepharmajournal.com
Received: 17-01-2022
Accepted: 20-02-2022

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Epidemiological studies on clinical mastitis in bovines from Thrissur district, Kerala

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Abstract
Bovine mastitis is a disease occurring worldwide causing tremendous economic loss. Region to region variation persists and epidemiological studies aid in the understanding of the various risk factors. Fifty-one animals with the signs of clinical mastitis over a period of one year was included in this study. Data regarding various factors including age, breed, stage of lactation, parity, quarter affected, previous history of mastitis and seasonal occurrence. Varying results were obtained for each factor, with animals with 4 – 6 years of age mostly affected (52.94 per cent). Breed wise predisposition was observed for crossbred of Holstein Friesian (45.10 per cent) when compared to Jersey crossbreds. The highest occurrence of mastitis was observed in late lactation (41.18 per cent) and in first two parities (39.22 per cent each). In this study, the hind quarters (53.85 per cent) were more affected in which right hind teat (32.31 per cent) was found to be most affected by mastitis compared to all other quarters. The season in which most clinical cases of mastitis were observed was in monsoon season (41.18 per cent). This study showed varying results for various factors which could aid in the prevention and control of the disease.

Keywords: Bovine, clinical mastitis, epidemiology

Introduction
Mastitis as a common and widespread disease prevalent worldwide and stated as an endemic disease affecting dairy herds. In dairy industry worldwide, mastitis emerged as a major challenge to dairy farmers, being the cause for severe wastage of milk and undesirable milk quality. Epidemiological studies on mastitis in cows found that more than 90 per cent of high yielding crossbred dairy cattle in India were found to be affected by mastitis (Sharma 2003) [20]. Sharman *et al.* (2012) [23] compared the varying loss of milk yield and the treatment cost for mastitis and concluded that there was considerable influence of seasonal changes on mastitis and its economic loss. Waller (2000) [28] remarked that the increased occurrence of mastitis in dairy herds could be associated with the genetic selection of animals for higher milk production, which had also increased the risk to mastitis due to lowered resistance to diseases by these animals. Kurjogi and Kaliwal (2014) [12] performed an epidemiological study on bovine mastitis and found that there was a clear association between subclinical mastitis and factors like age, environmental factors, and lactation of the cow whereas, in case of clinical mastitis the most important factor includes breed of the cow and environmental conditions. They have also reported that bovine mastitis was seen in later stages of lactation and the incidence was higher in exotic breeds. Biffa *et al.* (2005) [5] linked the incidence of mastitis with the age of animals and reported that older cows ageing more than 10 years were more susceptible to subclinical mastitis, when compared to younger animals in which clinical mastitis was more common. It was also observed that as the parity increases, the risk of infection also increases as high as 13 times, when compared to those animals with lower number of calvings. Season to season variation was observed in the occurrence of mastitis since growth of pathogenic organism depends on the temperature and relative humidity. Sudhan and Sharma (2010) [22] stated that in India, there was high incidence of mastitis in summer and rainy season as compared to winter season. This could be associated with increased multiplication of organisms and environmental stress, which altered the immune system. Effective and successful treatment of mastitis was dependent upon factors like pathogen involved, age, stage of lactation, parity, history of mastitis and other concurrent infection. Due to the diverse agricultural and farming practices within our state, it is of paramount importance to conduct epidemiological studies to diagnose, control and prevent mastitis. The varying occurrence rates of various epidemiological factors helps in understanding the measures to be taken within a geographical area.

Materials and Methods

The animals included in this study were 51 cows affected with clinical mastitis from Thrissur district. The study was conducted over a period of one year from the year February 2020 to September 2021. Data regarding various factors including age, breed, stage of lactation, parity, quarter affected, previous history of mastitis and seasonal occurrence. The occurrence among each chosen epidemiological factor and was calculated.

Age - wise occurrence

The animals affected with clinical mastitis range from 2 years to 7.5 years of age. The animals were divided into three study groups. The first group included animals of 2 – 4 years of age, second group 4 – 6 years of age and third group, more than 6 years of age. The age wise occurrence was calculated.

Breed - wise occurrence

In this study the animals presented with clinical case of mastitis were crossbred cattle of Holstein Friesian (HF) and Jersey breeds (JY) of cattle and breed wise occurrence was evaluated.

Stage of lactation - wise occurrence

The animals with clinical mastitis, were categorized according to the stage of lactation into three groups and occurrence was recorded. The period of lactation was categorised as, early lactation until 100 days, mid lactation from 100 – 180 days of lactation and late lactation from 180 days and above.

Parity - wise occurrence

The samples collected included animals which were primiparous up to a maximum of 5 calving. The occurrence in each parity was estimated.

Quarter - wise occurrence

Out of the 51 animals, it was observed that 9 animals had more than one quarter affected. In the nine animals, five animals were found to have three quarters affected in different combinations and four animals had two of their quarters affected. Therefore, out of the 51 animals, 65 quarters were affected and quarter wise prevalence was recorded.

Previous history of mastitis

The data regarding any previous history of mastitis in the affected animals was also collected and evaluated

Seasonal occurrence

According to the season in which clinical mastitis was observed, the occurrence was calculated. The seasons were categorized as summer (March, April, May), monsoon (June, July, August, September), post monsoon (October, November) and winter (December, January, February).

Results and Discussion

Age

The age wise occurrence is tabulated in table 1. It was observed that highest occurrence was seen in animals in the age group 4 – 6 years of age (52.94 per cent) followed by 2 -4 years of age (29.42 per cent).

Table 1: Age wise distribution of clinical mastitis in this study

Sl. No	Age	Number of animals	Percent of animals
1.	2 – 4 years	15	29.42
2.	4 - 6 years	27	52.94
3.	> 6 years	9	17.64
Total		51	100

In the present study, there was higher incidence of mastitis in cows above four years of age (70.6 per cent) which showed that older animals were affected with mastitis compared to younger animals, i.e., less than four years of age (29.42 per cent). Similar findings were observed by Bhat *et al*. (2011) [4] who reported higher incidence of mastitis in age group of 4 – 6 years of age when compared to the age group of 2 – 4 years of age. The increased incidence of mastitis in older animals could be attributed to factors like, anatomical and physiological changes in teat and udder due to advancing age, suppression of host immune response, indiscriminate use of antibiotics and due to long term milking practices (Tegegne *et al*., 2020) [24]. Rathish (2014) [18] in his study reported an incidence as high as 46 per cent in case of younger animals and this could be because of already existing sub clinically affected animals in the herd.

Breed

Out of the 51 animals, 28 animals (54.90 per cent) were crossbred of Holstein Friesian and 23 animals (45.10 per cent) were Jersey crossbreds. The data is depicted in Fig 1. It was observed that exotic and crossbred animals were more susceptible to mastitis when compared to indigenous or native breed of cattle. Assefa (2021) [3] reported a strong association between occurrence of mastitis and breed in the epidemiological study wherein crossbreds were more affected by mastitis in comparison to local breeds. In our study, only crossbred cattle of HF and JY breed was present and a higher occurrence was found in HF crossbreds in comparison to JY crossbred. Many studies has shown a higher prevalence in HF crossbred, followed by JY crossbreds and least in native breeds. (Rahman *et al*., 2009, Biffa *et al*., 2005, Kurjogi and Kaliwal, 2014) [16, 5, 12]. The epidemiological studies performed in case of bovine mastitis include a mixed population of purebreds, crossbreds and native breeds and no information on prevalence among crossbreds could be found.

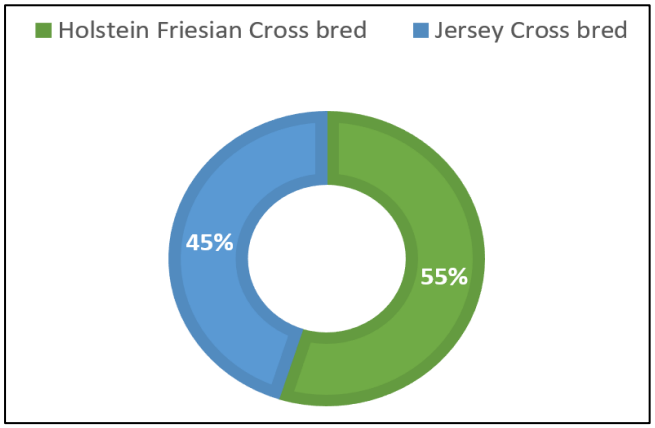

Fig 1: Breed wise distribution of clinical mastitis in this study

Stage of lactation

The animals with clinical mastitis, were categorized according to the stage of lactation and the results are tabulated below in table 2.

Table 2: Occurrence of mastitis with respect to stage of lactation

Sl. No	Stage of lactation	Number of animals	Percent of animals
1.	Early: Until 100 days	11	21.57
2.	Mid: 100 – 180 days	19	37.25
3.	Late: 180 days and above	21	41.18
Total		51	100

In this study, highest occurence was noticed, in the later stages of lactation (41.18 per cent) followed by mid lactation (37.25 per cent) and least in early lactation (21.57 per cent). This was in accordance with the findings of Asmare and Kassa (2017) [2] who reported high incidence of mastitis during late stage of lactation compared to mid and early stages of lactation. The risk of occurence was as high as 75 per cent in case of late stage of lactation when compared to mid (66.7 per cent) and early (42.9 per cent) lactation in the same study. Radostitis *et al*. (2000) [15] described that there was high prevalence of mastitis as the stage of lactation progresses. This could be attributed to intermittent milking performed during late stages of lactation, leading to incomplete milking and increased somatic cell count (Dohoo and Meek 1982) [6]. Moosavi *et al.* (2014) [14] reported high incidence of mastitis in late lactation during summer season attributing the incidence to heat stress leading to immunosuppression. Sharma *et al.* (2013) [21] observed similar findings to that of our study wherein high incidence was observed in late lactation (48.7 per cent). This was contradictory to the findings by Krupa (2020) [11] who found high incidence of mastitis in mid lactation (40. 96 per cent) during her study and Revathi (2018) [19] who reported incidence in early lactation (41 per cent) and lower incidence in case of late lactation in both studies. The discrepancy in the different studies could be attributed to factors like age, parity, season, and the causative agent.

Parity

The maximum number of cases were seen in animals which were in the first and second calvings (39.22 per cent each). The results are depicted in table 3.

Table 3: Occurrence of mastitis with respect to parity

Sl. No	Parity	Number of animals	Percent of animals
1.	First	20	39.22
2.	Second	20	39.22
3.	Third	5	9.80
4.	Fourth	5	9.80
5.	Fifth	1	1.96
Total		51	100

The results in this study was in accordance with the findings of Rathish (2014) [18], who found a high level of occurrence in the first parity, with 25.5 per cent, 33.5 per cent and 27 per cent in first, second and third parity respectively. This was not in accordance with Biffa *et al*. (2005) [5] and Mekibib *et al*. (2010) [13] who reported a high incidence in animals which were multiparous. In our study, animals might have acquired mastitis at an early age, probably due to improper milking management or due to the presence of mastitis affected animals within the herd which may act as reservoirs of infection.

Quarter affected

Out of the 65 quarters, the occurrence was varying in different quarters, with 35 quarters (53.85 per cent) being hind quarters and 30 quarters being fore quarters (46.15 per cent). The distribution is being tabulated in the table 4 below.

Table 4: Quarter wise occurrence of clinical mastitis

Sl. No	Quarters	Number of animals	Percent of animals	
1.	Right Hind	21	32.31	53.85 per cent of Hind quarters
2.	Left Hind	14	21.54	
3.	Right Fore	16	24.61	46.15 per cent of Fore Quarters
4.	Left Fore	14	21.54	
Total		65	100	

In this study, it was observed that the hind quarters (53.85 per cent) were more affected than the fore quarters (46.15 per cent), and right hind teat (32.31 per cent) was found to be most affected by mastitis compared to all other quarters. This was similar to the findings by Tripathy *et al*. (2018) [26] who found a prevalence in hind quarters (57.14 per cent) higher compared to with right hind quarter (40 per cent). The findings could be attributed to the factors like contamination of hind legs by dung and urine, relaxed teat sphincters and anatomy of the udder i.e., lowered position of rear quarters. (Tripura *et al*., 2014, Guha and Guha, 2012) [27, 8]. Other supporting facts include higher milk production within hind quarters (Kocak, 2006) [10] and trauma to hind quarters while lying down might increase the incidence. (Ali *et al*., 2014) [1].

History of mastitis

The risk of mastitis increased when the animal had a history of previous occurrence of mastitis and the high prevalence of mastitis had been associated with history of mastitis by many researchers. In the present study, it was observed that in 51 animals, 29 animals (56.86 per cent) had the previous history of mastitis, and 22 animals (43.15 per cent) were affected with mastitis for the first time. Faris *et al.* (2021) [7] reported higher prevalence of mastitis in animals with history of mastitis (51.66 per cent) when compared to those which were not affected by clinical mastitis previously (37.98 per cent). In the same study animals with previous history of mastitis had higher odds as high as 1.8 times of acquiring mastitis when compared to animals with no previous history of mastitis. Similar findings were observed by Tezera and Ali (2021) [25] with an incidence as high as 66.30 per cent in animals with history of mastitis. This could be linked to persistent bacterial infection within the mammary gland, and compromised udder immunity and permanent physiological and anatomical damage to udder due to previous infection.

Seasonal occurrence

According to the season in which clinical mastitis was observed, the occurrence was calculated. The seasons were categorized as summer (March, April, May), monsoon (June, July, August, September), post monsoon (October, November) and winter (December, January, February). The data is tabulated in table 5.

Table 5: Occurrence of mastitis with respect to season

Sl.no	Season of the year	No of animals	Percentage
1.	Summer	10	19.61
2.	Monsoon	21	41.18
3.	Post Monsoon	1	1.96
4.	Winter	19	37.25
Total		51	100

In the present study highest incidence of mastitis was observed during monsoon season (41.18 per cent). Similar finding of highest prevalence of mastitis during monsoon was observed by Kurjogi and Kaliwal (2014) [12] and Khan *et al.* (2015) [9]. This was contradictory to the findings by Ranjan *et al*. (2011) [17] who found least prevalence during raining season (7.37 per cent). The high prevalence during monsoon season found in this study could be attributed to the temperature and humidity conditions which were favorable for proliferation of bacteria causing mastitis. The variation in the studies with respect to season and prevalence of mastitis is due to the varying agroclimatic conditions and geographical zones.

The present study showed that older animals which were crossbred HF in their late lactation were more affected with mastitis. The predisposition was observed in early parity indicating acquiring infection at an early age or infected animals within herd and most of the animals had a history of mastitis. The animals were affected in their hind quarters, majority in the right hind compared to other three quarters with most animals having clinical mastitis during the monsoon season. The results obtained in this study showed that various animal risk factors aid in better understanding of epidemiology within a geographical area. Studies in larger study group over a longer period of time, including more risk factors would help in better analysing and implementing the preventative and control measures necessary in a herd.

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