Haryana Vet. (June, 2021) **60(1),** 104-107

Research Article

HOSPITAL OCCURRENCE OF BOVINE MASTITIS AND CORRELATED RISK FACTORS IN AND AROUND PALAMPUR AREA OF HIMACHAL PRADESH

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Received: 26.10.2020; Accepted: 19.12.2020

ABSTRACT

A cross sectional study was conducted to determine hospital occurrence of bovine mastitis and its associated risk factors at Palampur, Himachal Pradesh. A total of 575 bovines (498 cows and 77 buffaloes) presented to the College Veterinary Clinics, Palampur were screened for mastitis using California mastitis test (CMT) which revealed 90 bovines (80 cows and 10 buffaloes) and 230 quarters (200 quarters of cows and 30 quarters of buffaloes) positive for mastitis. Overall prevalence of mastitis at animal-level and quarter-level was found to be 15.65% and 10%, respectively. Based on the severity, 23.33% and 76.67% were having subclinical and clinical mastitis, respectively. Five to eight years old bovines were most affected (64.44%) with most involvement of left hind quarter (29.13%). Warm and humid temperature increased the prevalence of mastitis to highest as 40% of the affected cases were observed during monsoon. Bovines in their 3rd parity, early lactation stage and having daily milk yield of more than 12 kg per day were most affected with prevalence of 38.89%, 62.22% and 38.89%, respectively. Poor hygienic status of animals, pendulous udder conformation and less than twice a day cleaning frequency of shed floor (χ^2 = 28.78, 15.04 and 11.97, respectively; $p<0.01$) were major management factors for increased incidence of mastitis in current study and strong association between these risk factors and outcome was seen.

Keywords: California Mastitis Test, Cross sectional study, Management, Risk factors

How to cite: Bhardwaj, K., Sharma, P. and Wadhwa, D.R. (2021). Hospital occurrence of bovine mastitis and correlated risk factors in and around Palampur area of Himachal Pradesh. *Haryana Vet.* **60(1)**: 104-107.

Bovine mastitis is second most important disease after Foot and Mouth disease considering the economic losses faced by dairy farmers. It is the inflammation of mammary gland parenchyma which results in altered physical, chemical and bacteriological quality of milk. It is broadly classified into subclinical and clinical forms based on absence or presence of visible changes in gland and milk. Prevalence of mastitis is fairly affected by various risk factors such as season, age, breed, parity, lactation stage, milk yield and many other factors related to anatomy of mammary gland (Compton *et al.*, 2007). The controlled study in the organised dairy farm of Palampur has shown the overall prevalence of subclinical mastitis of 40% and 17.48% at cow and quarter level, respectively (Sharma *et al.*, 2020). However, there is a lack of information regarding hospital prevalence of bovine mastitis and its related risk factors, as this occurrence may vary depending upon the management practices implemented by the farmers. In order to fulfil this gap in the knowledge, the present cross-sectional study to estimate hospital occurrence of bovine mastitis and its associated risk factors was undertaken in the cases presented to the College Veterinary Clinics, Palampur.

MATERIALS AND METHODS

Location: The study was conducted from October, 2018 to March, 2020 on the cases presented to the Department of Veterinary Medicine, DGCN COVAS, CSK HPKV Palampur from in and around Palam Valley (32.12 °N 76.53 °E; located in North western Himalayas) for complaint of altered quality and quantity of milk as well as abnormality of mammary gland.

Screening of animals: Animals were screened for mastitis using California Mastitis test (CMT) as per Schalm and Noorlander (1957). Data related to breed, parity, stage of lactation, number of affected quarters, peak milk yield and duration and managerial practices were recorded. Thorough physical examination of udder and teats was done by visually observing the symmetry of glands by palpation. Gross abnormalities in milk such as flakes, discoloration, clots and ropiness in milk were observed against a dark background and accordingly the cases were categorized into clinical and subclinical mastitis. Visible changes in the milk associated with inflammatory signs of the udder were considered as clinical mastitis and normal milk with no clinical signs was considered as subclinical mastitis. Further categorization of clinical forms as peracute, acute, subacute and chronic was done based on duration of existence of mastitis and severity of the inflammatory response (Argaw, 2016).

Data analysis: Data were analyzed using In Stat from Graph Pad software, 2008 for analysis. Possible association of diseases with risk factors was analyzed using Chi-square test and predictive value (P-value) by considering $p<0.05$ as statistically significant and $p<0.01$ highly significant.

RESULTS AND DISCUSSION

In this cross-sectional study, 575 bovines presented to Clinics were screened and overall prevalence of mastitis at animal-level and quarter-level was found to be 15.65%

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and 10%, respectively. This finding was higher than the previous finding of Kaushik (2010) who reported 12.83% as overall prevalence of bovine mastitis in and around Palam Valley of Himalayan region. On the basis of the type of mastitis, 23.33% (21/90) of the bovines were having subclinical form of mastitis and 76.67% (69/90) bovines were having clinical form. Among clinical mastitis cases, chronic form of mastitis (31.11%) was most frequently observed (Table I). These findings contrasted the results of Kaushik (2010) where subacute mastitis cases were mostly seen in the study conducted on mastitis cases brought from University livestock farm and field. Regular hygienic managerial practices performed at the livestock farm generally decrease the incidence of chronic mastitis which could be the reason for these variations in mastitis occurrence. Moreover, the present cross-sectional study was done to estimate only hospital occurrence of bovine mastitis and its associated risk factors in the field cases presented to the College Veterinary Clinics, Palampur. Increasing occurrence of chronic mastitis might be attributed to indiscriminate use of antibiotics, incomplete course of antibiotics in the field level leading to emergence of antibiotic resistance among microbial strains. In our study, quarter wise occurrence of subclinical mastitis (26.95%) was less than the clinical mastitis (73.04%) which was comparable to the findings of Kachhawa *et al.* (2019) who reported quarter-wise prevalence of 27.31% and 76.67% in subclinical and clinical mastitis in local Veterinary Hospitals of Bikaner, respectively. These variations in observation of subclinical and clinical mastitis could be because of different managerial practices and dissimilar environmental conditions. Moreover, due to lack of clinical signs, subclinical mastitis cases were being frequently missed by the animal owners and hence presented late on the appearance of clinical mastitis to the Veterinary clinics.

Season/month-wise occurrence: Highest occurrence of mastitis was found in monsoon season (40%) in comparison to autumn (27.78%), summer (20%) and least in winter season (12.22%). Similar findings of 43.40% in rainy season have been reported by Suarez *et al.* (2019). Higher occurrence of mastitis during monsoon season may be attributed to warmer and humid environment which is quite suitable for pathogenic microbes to flourish in the environment and cause infection in the mammary glands and teats in bovines (Shahtele, 2009).

Age-wise occurrence: The higher occurrence of mastitis was recorded in 5 to 8 years old cows (65%) followed by 9 to 12 years (20%), 1 to 4 years (14.44%) and least incident in age group of 12 years and above (1.11%) which is in accordance with Maheshwari *et al.* (2016) who observed highest occurrence of mastitis in cows of age 5 to 7 years (36.36%). Another study done by Shaikh *et al.* (2018) showed that highest prevalence of mastitis was in adult cows belonging to age group of 6 to 8 years (39.44%). Less efficient immune response, anatomical changes in mammary gland and more exposure to milking practices in adult and old animals makes them more susceptible to get affected by mastitis.

Parity-wise occurrence: In this study, bovines were mostly affected at third parity (33.33%) followed by second and fifth and above (18.89%), fourth parity (17.78%) while least affected at first parity (11.11%) agrees to the observation of Maheshwari *et al.* (2016) who reported 41.83% animals typically affected in their third parity and Kachhawa *et al.* (2019) reported highest prevalence of mastitis in fourth parity. This may be because the mammary gland becomes pendulous and milk yielding capacity increases with increasing parity which increases the chances of pathogen's entry and better survivability in gland (Saini *et al.*, 1994).

Occurrence of mastitis in relation to lactation stage: Bovines in early stage of lactation (62.22%) suffered most from mastitis, followed by late lactation (25.56%) and lowest in mid lactation stage (12.22%). Physiological, nutritional and hormonal changes that occur during early stage of lactation might be responsible for altering the immune status of the animal and hence higher prevalence of mastitis is evident in this stage. A greater susceptibility to mastitis in early stage of lactation might be related to high physiological stress such as peak milk yield, high oxidative stress and low antioxidant defence during this period (Sharma *et al.*, 2011).

Occurrence of mastitis in relation to milk yield: The occurrence of mastitis increased as the milk yield increased. Most frequently mastitis was found in bovines having milk yield 12 kg per day and above (38.89%), followed by 8 to 12 kg per day (35.56%), 5 to 8 kg per day (22.22%), while least occurrence of mastitis was found in bovines with milk yield less than 5 kg per day (3.33%). These findings were in compliance with the findings of Zhang *et al.* (2016) which indicated that high daily milk yield directly increases the chances of intramammary infections. Milk serves as an essential medium for microbial growth and high yielder's teat sphincter might remain open for longer duration due to milk load, even without milking (Madut *et al.*, 2009).

Breed wise occurrence: The breed wise prevalence of bovine mastitis showed 75% in crossbred, 20% in zebu and 5% in pure bred cows. Crossbred cows had highest chances of getting affected by mastitis; similarly Kaushik (2010) reported that crossbred cows were most prone to get affected by mastitis. This is because local breeds of cattle have better developed innate immunity as compared to crossbred and exotic breeds. Also, milk yield is more in case of crossbred which has its direct effect on increasing chances of intramammary infections (Radostits *et al.*, 2010).

Table 1

Occurrence of mastitis in bovines on the basis of type of mastitis

Type	Cow	Quarters affected	Buffalo	Quarters affected	Total bovine	Total quarters
Per-acute	7 (8.75)	20 (10.00)	1(10.00)	4 (13.33)	8 (8.89)	24 (10.44)
Sub-acute	15 (18.75)	35 (17.50)	3 (30.00)	7 (23.33)	18(20.00)	42 (18.26)
Acute	13 (16.25)	25 (12.50)	2 (20.00)	4 (13.33)	15(16.67)	29(12.60)
Chronic	27 (33.75)	70 (35.00)	1(10.00)	3 (10.00)	28(31.11)	73 (31.73)
Sub-clinical	18 (22.50)	50 (25.00)	3 (30.00)	12(40.00)	21(23.33)	62 (26.95)
Total	80 (100.00)	200 (100.00)	10 (100.00)	30 (100.00)	90 (100.00)	230 (100.00)

Figures in parenthesis indicate per cent

Table 2

Relationship of animal and management related factors with mastitis occurrence

Risk factor	Mastitis status				Sub clinical mastitis %	Clinical mastitis %	Overall %	Chi-square value (χ^2)	p-value
	Healthy (n=10)	Sub-clinical (n=21)	Clinical (69)	Overall mastitis (n=90)					
Hygienic condition									
Bad	2	18	64	82	85.71	92.75	91.11	28.778	0.000**
Good	8	3	5	8	14.28	7.24	8.88		
Previously affected by mastitis									
Yes	0	0	12	12	0	17.39	13.33	0.515	0.472
No	10	21	57	78	100	82.60	86.66		
Udder conformation									
High up	7	8	18	27	42.85	26.08	30.00	15.039	0.000**
Pendulous	3	13	51	63	61.90	73.91	70.00		
Animal housing									
Cemented	2	0	6	6	0	8.69	6.66	0.739	0.389
Muddy	8	21	63	84	100	91.30	93.33		
Floor									
Muddy	4	3	7	10	14.28	10.14	11.11	4.070	0.0437*
Cement and concrete	6	18	62	80	85.71	89.85	88.88		
Floor cleaning frequency									
<2 per day	3	17	60	75	80.95	86.95	85.55	11.972	0.000**
>2 per day	7	5	9	15	23.80	14.49	16.66		
Presence of ectoparasites									
Yes	2	5	52	57	23.80	75.36	63.33	5.310	0.021*
No	8	16	17	33	76.19	24.63	36.66		
Washing hands before milking									
Yes without soap	4	15	15	30	71.42	21.73	33.33	0.004	0.944
Yes with soap	6	6	54	60	28.57	78.26	66.67		
Bedding material used									
Yes	3	17	56	73	80.95	81.15	81.11	10.240	0.0014*
No	7	4	13	17	19.04	18.84	18.88		
Duration for which animal keeps on standing after milking									
<1hr	0	0	4	4	0	5.79	4.44	0.463	0.496
>1hr	10	21	65	86	100	94.20	95.55		
Mineral mixture									
Yes	6	9	11	20	42.85	15.94	22.22	4.857	0.027*
No	4	12	58	70	57.14	84.05	77.77		
Deworming									
Done	8	7	13	20	33.33	18.84	22.22	12.175	0.000**
Not done	2	14	56	70	66.66	81.15	77.77		
Teat dipping									
Yes	0	0	2	2	0	2.90	2.22	0.293	0.588
No	10	21	67	88	100	97.10	97.77		

* Significant at 5 % level; ** Significant at 1% level

Occurrence in relation to affected quarter: Position of the quarter and anatomy of the teats affect the prevalence of mastitis due to various reasons. Present study shows that left hind quarters were affected the most (29.13%) followed by right hind (27.82%), left fore (24.78%) and right fore (18.26%) quarters. Similar findings were observed by Shaikh *et al.* (2018) and they reported that left hind teat affected more in comparison to other quarters,

while Maheshwari *et al.* (2016) reported that among all the quarters, most affected quarters were right hind (13.35%). Hind quarters are more exposed to the faecal and urinary bacteria making them more vulnerable to mastitis as compared to forequarters. Variation in findings of more prone hind quarters may be attributed to the different management practices, for instance the order in which owner milks the quarters. In the present study, infection rate was higher in the hind quarters, which is well documented that hind quarters are always at higher risk to come in the direct contact of animal urine and uterine discharge, which is a rich source of infection (Joshi and Gokhle, 2006).

Management related risk factors: In the present study, various correlated factors found to be contributory in increasing prevalence of mastitis (Table 2). Threat factors such as hygienic condition of the animal, pendulous udder conformation, floor cleaning frequency per day and deworming status of the animals showed strong significant association between the factors and outcome among their variants (χ^2= 28.78, 15.04, 11.97 and 12.18, respectively; $p<0.01$). Etifu *et al.* (2018) had stated similar findings for the mastitis and association with given risk factors. Poor hygienic conditions such as hind limbs and udder smeared with dung and urine increases the occurrence of coliform mastitis. Pendulous udder is more prone to injuries hence more at threat of getting affected by mastitis. Risk factors such as lack of mineral mixture feeding, cemented flooring material, ectoparasitic infestation, bedding material used showed significant statistical difference among their variants ($p<0.05$). These findings were in line with the study done by Kour *et al.* (2020). Owner's management practices like not washing hands or udder before milking the animal or washing hands with tap water only (without soap) also increased the risk of bovine mastitis is in accordance with Belayneh *et al.* (2013). This could be due to existence of mastitis causing pathogens on skin of unwashed hands or udder. Similar to study conducted by Etifu *et al.* (2018), it was observed that teat dipping was not a common practice among most of the bovine owners in this study. All these factors also lead to poor immune response of the bovines to pathogens while bedding material served as a pool of pathogenic microbes which may cause infection of mammary glands.

In conclusion, lack of proper hygiene, inadequate care in early lactation stage, physiological stress of high milk yield, late diagnosis and inappropriate treatment were important factors contributing to high prevalence of mastitis at a current study area.

ACKNOWLEDGEMENT

The authors thankfully acknowledge the financial support from the Rashtriya Krishi Vikas Yojna, Government of India.

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