The Pharma Innovation Journal 2021; SP-10(9): 507-510

www.ThePharmaJournal.com

The Pharma Innovation

ISSN (E): 2277- 7695
ISSN (P): 2349-8242
NAAS Rating: 5.23
TPI 2021; SP-10(9): 507-510

www.thepharmajournal.com
Received: 25-07-2021
Accepted: 27-08-2021

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Risk factors associated with bovine coliform mastitis in small holder system

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Abstract
Epidemiological risk factors influencing the incidence of clinical coliform mastitis among dairy cattle reared under the small holder system of the state were investigated in this study. Occurrence of clinical mastitis was found to be more among animals in early stage of lactation having low average milk production, being reared under intensive system of rearing and animals kept on concrete floor. Higher the parity, more were the chance for coliform mastitis. Most of the animals were belonged to younger age and had no previous occurrence of mastitis. The practice of udder washing, absence of pre milking teat dipping and post milking disinfection favoured higher incidence of mastitis. Small holder livestock system is the backbone of the dairy industry in India. Coliform mastitis among dairy cows reared under this system is of foremost economic importance.

Keywords: mastitis, coliforms, risk factors

Introduction
Bovine mastitis, an inflammation of the mammary gland, one of most important production disease and major economic burden confronted by the global dairy industry. The losses caused by clinical mastitis arise mostly from reduced milk yield, cost of veterinary services and premature culling. The presence of mastitis in food producing animals has a negative impact on the cow's health and may lead to indiscriminate use of antibiotics for treatment posing a significant public health threat for foodborne transmission of drug resistant pathogens and residual level of antibiotics. Among the various infectious agents, coliforms are known to be widely distributed in the environment of dairy cows, constituting threat to mammary gland. Several risk factors are known to play significant role in the incidence of clinical mastitis including pathogen, host, and environment. The persistent occurrence of the disease in spite of extensive research and the implementation of various mastitis control strategies over the decades may be attributed to negligence of the owners towards these risk factors. Hence the present study was conducted to investigate potential risk factors associated with incidence of coliform mastitis in dairy cows reared under small holder system.

Materials and Methods
The present study was conducted in 25 lactating dairy cows with coliform mastitis reared by small and marginal farmers. Epidemiological data regarding age, parity, stage of lactation, milk yield and other management parameters were obtained by interacting with the farmer. Animal sheds were examined to record the details regarding housing of the animal.
Milk samples were collected aseptically from each animal using separate sterile screw capped vials. Isolation of bacteria was done from individual quarter samples by direct streaking of the milk on to brain heart infusion agar (Himedia, India) followed by incubation of the plates at 37oC for 24 h. The isolates were identified based on morphological characterisation using Grams staining, cultural characteristics on selective media and biochemical characterisation as per Barrow and Feltham (1993) [1] and Quinn *et al*. (2013) [2].

Results and Discussion

The number of affected animals exposed to each risk factor is given in Table 1.

Table 1: Cow level risk factors of coliform mastitis

Risk factors	Category	No. of animals	Percentage
Age (years)	3-5	19	76
	More than 5	6	24
Parity	First	5	20
	Second	14	56
	Third	6	24
Stage of lactation	Early	11	44
	Mid	8	32
	Late	6	24
Herd size	1-5	20	80
	More than 5	5	20
Milk yield (in litres)	Less than 8	14	56
	8-12	11	44
	More than 12	0	0
Occurrence of mastitis in previous lactations	Present	10	40
	Absent	15	60

In the present study young age cows was found to be most affected with mastitis which was in agreement with Revathi (2018) [3], who stated that immunity developed from mild inapparent infection of environmental pathogen like *E. coli* lead to lowered occurrence.

of mastitis in aged cows. But on the contrary, Mekibib *et al.* (2010) [4] reported that the incidence of mastitis was two times more in older cows than in younger cows.

Most of the animals with coliform mastitis in this study were in the second and the third parity which was in agreement with the report of Biffa *et al.* (2005) [5]. The increased occurrence of mastitis in multiparous animals may be attributed to change in conformation and depth of the udder and callosity of the teat end, loosening of sphincter, wider teat canal and change in permeability of mammary epithelium due to increased frequency of milking, than in primiparous cows (Taponen *et al*., 2017) [6]. Furthermore, relaxation of supporting median ligaments of udder, higher milk yield and impairment of leukocyte functions in older cows makes them more susceptible to mastitis.

Early stage of lactation was found to influence incidence of mastitis when compared to mid and late stage. These results are consistent with Elbably *et al.* (2013) [7] and Tezera and Ali (2021) [8]. More than 50 per cent of early lactation coliform clinical mastitis was due to infection carried from dry period. Moreover, immunosuppression associated with increasing oxidative stress and lower efficiency of antioxidant defense mechanisms at the start of lactation and sudden changes in environmental, management conditions and influence of hormonal and metabolic changes during periparturient period exposes them to high risk (Bradley and Green, 2004) [9]. In the contrary, Haftu *et al.* (2012) [10] recorded higher prevalence of mastitis in cows towards late stage of lactation.

The current study also reported a higher prevalence of mastitis among unorganized dairy farms with small herds and this concurs with the report of Bhat *et al.* (2017) [11]. It could be due to area covered under this study mostly comprised of dairymen having small herds of 1-5 heads/herd and unscientific management practices followed by farmers.

Milk yield of affected animals prior to infection was mostly less than eight litres. Similar findings were reported by Rathish (2014) [12] in the same study area. This might be because of the area under study mainly consists of animals with low average milk production. Most animals had no occurrence of mastitis in previous lactation and it might be due to the animals selected in this study mainly belonged to younger age and in their second or third

parity and high rate of culling among cows with clinical mastitis.

Table 2: Management level risk factors of coliform mastitis

Risk factors	Category	No. of animals	Percentage
Frequency of milking	Once	2	8
	Twice	23	92
	More than two	0	0
Type of milking	Thumping	3	12
	Stripping	2	8
	Standard	20	80
Method of milking	Owner	14	56
	Professional milker	3	12
	Milking machine	8	32
Type of udder preparation	Washing	16	64
	Washing followed by drying	3	12
	No preparation	6	24
Post milking disinfection	Present	4	16
	Absent	21	84
Pre milking teat dipping	Present	6	24
	Absent	19	76

Method of drying	Slow	23	92
	Abrupt	2	8
Type of housing	Intensive	14	56
	Semi intensive	11	44
	Extensive	0	0
Type of floor	Concrete	21	84
	Muddy	4	16

Management level risk factors and the number of animals affected are given in Table

2. The study determined the increasing prevalence of mastitis in animals milked by standard type full hand milking and are in close co-ordination with the results of study by Bhakat *et al.* (2017) [13] who reported higher prevalence of mastitis in hand milked animals and it might be due to entry of organism through breach in protective streak canal barrier of teat and constant exposure of animals to the pathogens during hand milking resulting in bacterial colonisation. This study also determined high prevalence of mastitis with wet milking followed by no preparation of udder and dry milking and is probably due to use of contaminated water for
udder washing which increase milk bacterial counts. The present results were in accordance with the results of Tewari *et al*. (2018) [14].

The practice of premilking teat dipping and disinfection after milking with potassium permanganate lotion was not practiced in majority of affected animals in the study. Mostly coliforms are found attached to the teats from dirt and faeces in the environment and teat dipping before milking will reduce chance of udder bacterial contamination from the environment (Dufour *et al*., 2011) [15]

With regard to the association of type of housing with mastitis prevalence, majority of animals were reared in intensive system and this high prevalence may attributed to lack of hygienic environment inside the shed and defective milking conditions. Similar observation of lower prevalence of mastitis in semi intensive system was recorded by Marimuthu *et al*. (2017) [16] and Kebebew and Jorga (2016) [17].

From the present study, it was found that animals reared on concrete floor are more susceptible to mastitis than on muddy floor. Moist cracked floor and lack of proper cleaning and removal of manure and bedding that can promote the bacterial growth may be the possible reason for this finding. High prevalence of mastitis was reported by Mekbib *et al*. (2010) [4] in cows maintained in concrete floor which is consistent with the findings of the current study. On the contrary, Sharma *et al*. (2018) [19] and Abera *et al*. (2012) [20] recorded higher prevalence of mastitis in soil floor compared to concrete floor.

Conclusion

The potential risk factors associated with mastitis prevalence and severity includes cow itself and their surrounding environment particularly farm and milking hygiene procedure. The animal, environment and management factors and their combination have substantial impact on the epidemiology of mastitis. For the effective management of the coliform mastitis we need to encourage farmers to pay attention to these factors with special emphasis on improvement of environmental management.

Ethical approval and consent statement

Verbal consent was taken from the owner of the animals before treating them. There is no specific law in India that requires permission from ethics committee for collecting milk samples and treating the animals presented to veterinary hospitals by a qualified veterinarian.

Acknowledgement

The authors are thankful to the Kerala Veterinary and Animal Sciences University for providing the facilities needed for carrying out the research.

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