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Study on Prevalence of Mastitis and its Associated Risk Factors in Lactating Dairy Cows in Batu and its Environs, Ethiopia

[1]*Benta Duro Bedacha and* [2]*Habtamu Taddele Menghistu*

[1]Medda Wolabu Veterinary Clinic, Shashamane, Oromia Regional State, Ethiopia
[2]Mekelle University College of Veterinary Medicine, P.O. Box: 1436, Mekelle, Ethiopia

Abstract: A cross-sectional study was conducted from November 2010 to April 2011 to determine the prevalence of bovine mastitis and assess contribution of major risk factors for the occurrence of mastitis. A total of 278 lactating local (boran and arsi breed) (n=134) and cross (Holstein Friesian breed) (n=144) cows were included in the study. An overall prevalence of 56.5% (157/278) mastitis was reported where 5.3 (15/278) and 40.6% (113/278) of cows showed clinical and subclinical mastitis, respectively. The rest 10.4% (29/278) cows were having blind teat. The quarter level prevalence was found to be 31.4% (349/1112). Risk factors such as breed ($p < 0.001$, $\chi^2 = 27.540$), lactation stage ($p < 0.001$, $\chi^2 = 18.491$), tick infestation ($p < 0.001$, $\chi^2 = 24.710$), teat lesion ($p < 0.001$, $\chi^2 = 14.660$) and floor type ($p < 0.001$, $\chi^2 = 17.849$) showed statistically insignificant association with the occurrence of mastitis. However, risk factors like age ($p = 0.833$, $\chi^2 = 0.022$), parity ($p = 0.907$, $\chi^2 = 0.200$) and body condition ($p = 0.336$, $\chi^2 = 0.927$) didn't show statistically significant association with the occurrence of mastitis. The present study also showed the contribution of managemental factors (housing system and milking practice) for the occurrence of mastitis. Therefore, reduction of the prevalence of the disease by improved milking hygiene, prevention of skin lesions, culling of chronic mastitis carriers and treating of clinically infected cows should be practiced.

Key words: Batu · Dairy Cow · Mastitis · Prevalence · Risk Factors

INTRODUCTION

Dairy production is a biologically efficient system that converts feed and roughages to milk. Milk is one of the most important foods of human beings. It is universally recognized as a complete diet due to its essential components [1, 2]. Milk is a very nutritional food that is rich in carbohydrate, proteins, fats, vitamins and minerals [3]. FAO [4] estimated that 42% of the total cattle herds, for the private holdings are milking cows. However, milk production often does not satisfy the country's milk requirements due to a multitude of associated factors. Health risk to consumers can be associated with milk, due to the presence of zoonotic pathogens and antimicrobial drug residues [5].

Mastitis, inflammation of the mammary gland, is a highly prevalent problem in dairy cattle and is one of the most important threats affecting the world's dairy industry [6]. Mastitis has been known to cause a great deal of loss or reduction of productivity, influence the quality and quantity of milk yield and cause culling of animals at an unacceptable age [7]. Moreover, due to its latent form, heavy financial losses and great nutritional and technological impacts can be resulted [8]. Because valuable components of the milk like lactose, fat and casein are decreased while undesirable components like ions and enzymes are increased making the milk unfit for processing technology [9].

The disease generally involves interplay between management practice and infectious agents. It is recognized that if this disease is diagnosed in early stages, the greater portion of this loss can be avoided [7].

Compared to developed countries, mastitis is a major problem in the dairy industry of developing countries like Ethiopia. Several studies in the country have documented prevalence ranging from 1.8 to 21.1% for clinical and 22.3 to 46.6% for subclinical mastitis with significant economic losses associated with the disease [2, 10-15]. Mastitis is one of the major diseases of crossbred cows in Addis Ababa milk shed next to reproductive associated

Corresponding Author: Habtamu Taddele Menghistu, Mekelle University College of Veterinary Medicine, P.O. Box: 1436, Mekelle, Ethiopia.

problems [16]. Mungube *et al.* [14] and Tesfaye *et al.* [17] estimated the economic losses from mastitis in the urban and periurban areas of Addis Ababa, to be US$ 58 and 78.65 per cow per lactation, respectively. In Ethiopia, even though the disease of mastitis has been known locally, it has not been studied systemically, making information available on the prevalence of the disease and associated economic loss inadequate on country basis [13].

Similar to other parts of the country, high yielding cattle breeds are being introduced to households and small businesses to satisfy the increasing demand for dairy and dairy products. On the other hand, with intensification of dairy cows mastitis could be an early warning for a coordinated epidemiological surveillance systems. Therefore, the present study was designed to determine the prevalence of mastitis and its associated risk factors in lactating dairy cows of smallholding farms in Batu and its environs.

MATERIALS AND METHODS

Study Animals and Animal Husbandry: Indigenous zebu (Boran and Arsi breed) and crossbred (Holstein Friesian) lactating cows owned by smallholder farmers were included in the present study. The average herd size was 2 and the maximum were 12 and 17 lactating cows of Abernosa and Ethio-flora dairy farms, respectively. One hundred twenty six market oriented households were included in the study and most of them use family labour. All of them practice hand milking. The main livestock feed source in the area is natural pasture and supplemental feeds including hay and crop residues like maize and 'teff' straw. The predominant housing style in the area was concrete floor with shed and wooden wall. A total of 278 lactating dairy cows; 144 crossbred and 134 indigenous zebu with healthy or inflamed udder were examined for the presence of mastitis and associated risk factors.

Animals were categorized based on age, parity, lactation stage and presence or absence of risk factors (teat or udder lesions, blind teat, herd size, the clinical state of mammary gland, milking routine and management types).

Prevalence Study: Physical examination of the udder and milk for gross abnormalities was undertaken to diagnoses clinical form of the disease. This included inspection and palpation of the udder for the presence of swelling, pain, hotness, asymmetry, indurations, firmness and blindness and inspection of milk for discoloration, consistency and presence of clots. The California mastitis test (CMT) was conducted to diagnose the presence of subclinical mastitis. This screening test was performed according to the procedure given by Quinn *et al.* [18]. The prevalence of clinical and subclinical mastitis was determined at cow and quarter level.

Risk Factors: A semi-structured questionnaire was prepared and filled to evaluate the effect of selected potential risk factors on the occurrence of mastitis. Risk factors considered were breed (cross/zebu), age, parity, stage of lactation (early, middle and late), quarter location (front/rear), body condition score, the presence/absence of tick or lesion on udder skin or teat and season as dry (November to February, i.e. part of the dry season) and wet or rainy season (February to April i.e. part of the rainy season). The stage of lactation was categorized in three levels as 1-120 days post partum (early lactation), 121-240 days (middle lactation) and days greater than 240 (late lactation). Age of the study animals was determined from birth records and categorized as young adults (>3 to 5 years), adults (>6 to 9 years) and old (>9). Parity was also categorized as few (with 1-3 calves), moderate (4-6 calves) and many (>7 calves). Additionally, the managemental factors such as housing and milking were recorded. Data on each sampled cow was collected.

Data Analysis: Risk factors were analyzed based on CMT score results. A univariate logistic regression was run using STATA 7 software package for the risk factors. For significant factors having levels, to identify the occurrence of significant difference between levels Chi square was used. In all chi-square test applications, a probability level of $P < 0.05$ was considered statistically significant. The degree of association between risk factors and the prevalence of mastitis was analyzed using odds ratio (OR). In all the analysis, the level of significance was set at 5%.

RESULTS

Prevalence: Of the total 278 lactating dairy cows examined during the study period 157 (56.5%) of the cows were positive for mastitis using the screening test, CMT and clinical examination of the udder. Out of these cows 5.3 (15/278) and 40.6% (113/278) showed clinical and subclinical mastitis, respectively. The rest 10.4% (29/278) cows were having blind teat. The quarter level prevalence was found to be 31.4% (349/1112); from which 23.9 (266/1112) and 4.1% (45/1112) were found to be of subclinical form and blind teat, respectively. The

remaining 3.4% (38/1112) were of a clinical form revealing active cases of mastitis with visible signs of inflammation on the udder and changes in milk consistency. From the total of 157 cows found positive for mastitis 29.9 (47/157), 45.2 (71/157), 17.8 (28/157) and 7% (11/157) were found positive for single, two, three and four quarters, respectively. Among the 29 cows with blind teat 58.6 (17/29), 27.6 (8/29) and 13.8% (4/29) were found positive for single, two and three quarters, respectively.

Association of Risk Factors with the Occurrence of Mastitis: The association of the different potential risk factors and the occurrence of mastitis in smallholder dairy farms of Batu area are shown in Table 1. Accordingly, the risk factors such as breed ($p < 0.001$, $\chi^2 = 27.540$), lactation stage ($p < 0.001$, $\chi^2 = 18.491$), tick infestation ($p < 0.001$, $\chi^2 = 24.710$), teat lesion ($p < 0.001$, $\chi^2 = 14.660$) and floor type ($p < 0.001$, $\chi^2 = 17.849$) showed statistically insignificant association with the occurrence of mastitis.

Table 1: Univariable logistic regression analysis of the association of different potential risk factors with the occurrence of mastitis

Risk factors	Total No	No (%) positive	χ^2	*p*-Value	OR (95% CI)
Breed			**27.540**	**0.000**	
Local	134	54 (40.3)			1
Cross	144	103 (71.5)			3.722 (2.191, 6.340
Age (years)			**0.022**	**0.833**	
3-5	68	39 (57.4)			1
6-9	151	85 (56.3)			0.958 (0.515, 1.777)
>9	59	33 (55.9)			1.015 (0.529, 1.943)
Parity			**0.200**	**0.907**	
1-3	159	89 (56.0)			1
4-7	112	63 (56.3)			0.989 (0.590, 1.658)
>7	7	5 (71.4)			0.514 (0.066, 3.182)
Lactation stage			**18.491**	**0.000**	
Early	83	34 (41.0)			1
Middle	88	46 (52.3)			1.578 (0.824, 3.028)
Late	107	77 (72.0)			3.699 (1.929, 7.127)
Body condition score			**0.927**	**0.336**	
Good	182	99 (54.4)			1
Poor	96	58 (60.4)			0.781 (0.458, 1.331)
Tick infestation			**24.710**	**0.000**	
Negligible	130	54 (41.5)			1
Moderate	35	19 (54.3)			1.671 (0.740, 3.785)
Too much	113	84 (74.3)			4.077 (2.277, 7.330)
Teat lesion			**14.660**	**0.000**	
Present	14	11 (78.5)			1
Absent	1098	338 (30.8)			8.245 (2.123, 37.439)
Floor type			**17.849**	**0.000**	
Muddy	93	69 (74.2)			1
Concrete	185	88 (47.6)			3.169 (1.774, 5.689)

Table 2: Summary of questionnaire survey and personal observation in 126 smallholder dairy farms

	Scores in No (%)				
Management type	Very good	Good	Poor	Yes	No
Housing					
Drainage system	16 (12.7)	73 (57.9)	37 (29.4)		
Ventilation in the house	24 (19)	67 (53.2)	35 (27.8)		
Daily house cleaning				107 (85)	19 (15)
Immediate dung removal				72 (57.1)	54 (42.9)
Washing cows				21 (16.7)	105 (83.3)
Milking system					
Hand washing and disinfection before milking				93 (73.8)	33 (26.2)
Udder and teat washing and disinfection before milking				27 (21.4)	99 (78.6)
Use of towel for drying teats				11 (8.7)	115 (91.3)
Use of one towel for one cow (n = 11)				1 (9.1)	10 (90.9)

Cross breeds [OR = 3.722 (2.191, 6.340)], cows at late stage of lactation [OR = 3.699 (1.929, 7.127)], cows with much tick infestation [OR = 4.077 (2.277, 7.330)], cows with teat lesion [OR = 8.245 (2.123, 37.439)] and cows kept under muddy floor were more prone to mastitis compared to local breeds, cows at early stage of lactation, cows with negligible tick infestation, cows with no teat lesion and cows kept under concrete floor, respectively. However, risk factors like age ($p = 0.833$, $\chi^2 = 0.022$), parity ($p = 0.907$, $\chi^2 = 0.200$) and body condition ($p = 0.336$, $\chi^2 = 0.927$) didn't show statistically significant association with the occurrence of mastitis.

Association of Manegmental Factors with the Occurrence of Mastitis: Table 2 summarizes the results of the questionnaire survey and personal observation assessed among the 126 smallholder dairy farms found in Batu district and its environs. The assessment included the housing system, milking practice, history of mastitis in the farm, diagnostic tools used to detect mastitis, etc. All the farms visited during the study period practice hand milking. Among the visited smallholder farms, only 37 of the farm owners were aware of mastitis and they detected it based on clinical signs. However, all the visited farms don't use screening test for the diagnosis of subclinical mastitis. In about 86.5% (109/126) of the farms, mastitic cows were milked without any order whereas 13.5% of them milked these cows at last.

DISCUSSION

The current study indicated a prevalence of mastitis of 56.5% (40.6 subclinical and 5.3% clinical mastitis and 10.6% blind teats) at cow level and 31.4% at quarter level. The overall prevalence reported in the present study is in close agreement with the results of various researchers in different corners of the country (52.8% by Hunderra *et al.* [13] in Sebeta and 49.7% by Enquebahir *et al.* [19] in Tigray). However, the results of the present study are higher than previous findings of other authors in different regions of Ethiopia like; 34.9% in Southern Ethiopia by Biffa *et al.* [12], 40% in Southern Ethiopia by Kerro and Tareke [11] and 44.1% Girma [2] and Abdelrahim *et al.* [20], who found a prevalence of 45.8% in Sudan. This finding is lower than previous findings by Kivaria *et al.* [21] in Tanzania who reported a prevalence of 90.3%. The difference in prevalence of mastitis in the present study and other reports could probably be due to differences in farm management practices, breeds, geographic location, level of production and study methods and instruments employed by the investigators [7].

This study showed higher proportion of subclinical mastitis compared to clinical form and this is supported by several reports [10-13, 22]. Sub-clinical mastitis has been reported to be higher than clinical mastitis owing to the defense mechanism of the udder, which reduces the severity of the disease [5]. In most developing countries including Ethiopia, the subclinical form of mastitis received little attention and efforts have been concentrated on the treatment of clinical cases [23]. According to Mungube *et al.* [14] losses associated with subclinical mastitis in crossbred dairy cows in the central highlands of Ethiopia was found to be US$38 for each cow per lactation. Of the 1112 quarters examined, 45 were blind. The presence of blind teat is an indication of a serious mastitis problem on the respective farms and of the absence of a culling program that can serve as a means to remove a source of these mammary pathogens for other cows.

In the present study the risk factors breed, stage of lactation, tick infestation, teat lesion and floor type showed statistically significant association with the occurrence of mastitis. The risk factors like breed, stage of lactation, tick infestation and floor type were reported by several investigators to have association with the occurrence of the disease [11-14, 22, 24, 25]. The significant difference between cross (Holestein-Friesian) and local breeds (Boran) may be associated with their high milk yield. Radostits *et al.* [7] stated that high yielding cows are more susceptible to mastitis than low-yielding ones. Cross bred cows have large udders which can easily be injured and the presence of injury is a predisposing factor for the occurrence of mastitis. Similarly, cross bred cows are more susceptible to tick infestation and this is a predisposing factor for mastitis.

Generally in this study it was possible to appreciate limited knowledge of the smallholder farmers on the importance of mastitis in the study area. As it is appreciated in the study, about 91.3% of the farms don't at all use towel for drying udder and teat. Udder and teat disinfection is not practiced in most of the farms. It is believed that the managemental factors (housing and milking practice) play a significant role in the incidence of mastitis [18]. It is observed that farms with poor housing and milking practice showed higher incidence of mastitis.

The present study showed that there was high prevalence of mastitis and association of different risk factors with the occurrence of mastitis. In order to reduce the higher prevalence of the disease, improved milking hygiene, prevention of skin lesions, culling of chronic mastitis carriers and treating of clinically infected cows should be practiced.

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