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Screening of Bovine Mastitis in Lactating Dairy Cows in and around Debra TSIGE Town, North Ethiopia

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Abstract

Mastitis is an inflammation of the mammary gland caused by pathogenic microorganism, occurs in all mammalian species but particularly important in dairy cattle. A cross sectional study design was conducted from June 2015 to September 2015 to screening bovine mastitis in randomly selected dairy farms in and around D/Tsige town. About 384 (118 cross, 153 Exotic, 113 local breed) of lactating cows were included in the study. Prevalence of the clinical mastitis was determined through examination of abnormalities of milk and udder of cows; and California mastitis test to diagnose sub-clinical mastitis. The overall prevalence of clinical mastitis was 9.64% and 9.63% at cow and quarter level respectively. Of the 1536 quarters examined, prevalence of clinical mastitis, sub clinical mastitis and blind quarters (non-functional teats) were found to be 9.63%, 33.85% and 1.2%, respectively. On cow basis, out of 384 lactating cows, 167 (43.49%) cows had abnormalities in their udder, teats and milk as evidence of clinical mastitis. The prevalence of mastitis at cow level was higher in exotic breeds (39.8%) and those were found in late lactation stage (42.2%), parity number was found to be statistically significant (P<0.05). In the present study, there was high prevalence of sub clinical mastitis that result losing of milk production and cause economic lose to the dairy farm. In view of this, the routine test of dairy cows, and preventive and control measures are recommended to reduce the prevalence of clinical and sub clinical mastitis in dairy farms in and around D/Tsige town.

Keywords: Clinical mastitis; CMT; D/ Tsige; Prevalence; Sub clinical mastitis

Introduction

Dairying is a component of livestock production is an important economic activity in sub Saharan Africa. For instance, the share of the locally produced milk in the value of all locally produced livestock food products in sub Saharan African has averaged well over 50% since the beginning of 1970s [1]. However, sub Saharan Africa as a region has not performed satisfactorily in terms of achieving self-sufficiency in dairy products over the last two or so decades. As a result, the level of dairy imports into the region, either on commercial terms or as food aid, has continued to increase relatively fast since the 1960s [2].

Ethiopia is the nation that possesses the largest livestock population among African continent with an estimated 30-33 million cattle [3,4]. However, compared to other countries in Africa, Ethiopians consume less dairy products. Moreover, the quality and quantity of milk in the country deteriorates because of various causes. Mastitis is an inflammation of the parenchyma of mammary gland and commonly associated with intra mammary bacterial infection. It is considered as one of the most important disease among diseases of the dairy animals; it is characterized by physical, chemical, bacteriological changes in milk, and pathological changes in glandular tissues [5].

Mastitis is generally considered the costliest disease of dairy cows [6]. In addition to this, there public health implication of the consumption of milk from mastitis cows and other products derived from such milk. In rare cases mastitis milk carries bacteria that can cause severe human illness [7]. Tuberculosis and streptococcal sore throat may be spread of human to human [7]. Toxic shock syndrome toxin produced by Staphylococcus aureus was detected by [7] in 25 of 126 isolates from farm bulk milk [8].

Micro-organisms are responsible for the infection, but for them to enter the mammary gland and establish themselves to the point that they cause an infection, a multitude of factors may be involved. There are many factors acting simultaneously, and the disease generally involves interplay between management practice and infectious agents but with other factors, such as genetics, udder shape or climate [9,10].

The occurrence of disease is an outcome of interplay between three major factors: infectious agents, host, and environmental factors [11]. Mastitis is a global problem as it adversely affects animal health, quality of milk and the economics of milk production, affecting every country, including developed ones and causes huge financial losses [12].

Mastitis could be classified as clinical or sub clinical. Clinical mastitis refers to inflammation of mammary gland with grossly visible changes on the udder and milk. It is characterized by abnormalities such as discoloration of milk, redness, increased temperature, pain and disturbance of function of the udder [13]. Sub clinical mastitis on the other hand refers to inflammation of mammary gland in the absence of visible changes in the udder and it has major cost implications chronic mastitis but presence of pathogenic organisms in the milk and can only be diagnosed with indirect screening tests or laboratory culturing [14].

The severity or degree of mastitis is dependent on the nature of the causative pathogen and on the age, breed, immunological health and lactation state of the animal. Currently, milk quality payments are based on somatic cell counts (SCCs), and elevated levels result in reduced payments. This, in addition to reduction in milk volume and treatment costs, significantly affects farm incomes [15].

The disease is worth studying due to the financial loss involved as a result of reduced milk yield, discarded milk following antibiotic

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therapy, easily culling of cows, veterinary costs, drug costs, increased labor, death of per acute cases and replacement costs. Additional economic incentives to control mastitis include consumer's' acceptance and product shelf- life factors [16]. The limited studies showed that bovine mastitis as a disease has received little attention in Ethiopia so far, especially the sub clinical form. Efforts have only been concentrated on the treatment of clinical cases. There is no study was conducted previously in Derba Tsige areas. Therefore, the present study will have the following main objectives:

• To determine the prevalence and association risk factors of bovine mastitis in selected dairy farms in and around Debre-Tsige.

Materials and Methods

Study area

This study was conducted in and around Debre-Tsige town in North showa zone of Oromia, Ethiopia. Debre- Tsige town is located 9° 48N and 38° 44E at about 89 km north of Addis Ababa. The altitude of the district is between 1500-2700 m a.s.l, its minimum and maximum temperature varies from 19°C to 23°C. It gets bimodal rain fall that ranges from 800-1200 mm. Two agro ecologies are found in the area and mixed agricultural activities are performed. There are about 80,796 head of cattle, 4507 goats, 23,723 sheep, 10,899 equines, and 75,305 poultry in the districts of Debre-Libanos district. All of these livestock species are reared mainly by smallholder farmers under intensive, semi intensive and extensive production system. From Debre-Tsige town around 13,000 liters of milk is collected (Debre-Libanos district Agricultural and Rural development office, personal communication).

Study population

The study populations were selected farms which were large, medium and small-scale dairy farms. The study populations in selected farms were selected by simple random sampling technique; and all was lactating cows. All of these lactating cows were indigenous Zebu breed, cross (hoistain vs Zebu) breed and exotic breeds. The farms that were included in this study were market-oriented small holder, medium–sized dairy farms and large dairy farms. Classification was based on [16] by considering as smallholder (<5 heads of dairy cow), medium sized (6-50 heads of dairy cow) and large (>50 heads of dairy cow). Individual animal was selected randomly and tested for mastitis using CMT and clinical examinations.

Study design

A cross sectional study was conducted from June 2015 to September 2015 G.C on milking dairy cows in and around Debre-Tsige town.

Sample size determinations

The sample size for this study was calculated according to Thrusfield [17], since no previous study was conducted in the areas. So that the following formula were used to calculate the sample size

n=1.962Pexp(1-Pexp)/d2=1.962 0.5(1-0.5)/0.052=384

where n=Sample size required

1.96=The value of Z at 95% confidence interval

Pexp=Expected prevalence

d=Desired absolute precision

Accordingly; the calculated sample size was give us 384 sample sizes.

Study methodology

A total of 384 lactating cows; 153 exotic, 118 cross and 113 local breeds were sampled from the randomly selected dairy farms. Individual animals were selected using simple random sampling method. Age, parity, lactation stage and breed were considered as risk factors. Age of the cows was determined by observing their dentition characteristics and grouped into <5 years, 5-8 years and >8 years categories. Parity was categorized into 1-2 calves, 3-4 calves and >4 calves. Lactation stage of the cow was also categorized into early stage lactation (1-4 months), mid lactation (5-8 months) and late lactation (above 8 months). Physical visualization and manual palpation of udder and teat were used to examine clinically the udders. The presence of mastitis was determined based on clinical manifestation for clinical positive and indirect test (California mastitis test) for sub clinical mastitis. The presence of inflammation of udder (heat, pain, redness, swelling, loss of function) considered as clinical mastitis.

Milk samples were collected from individual quarters of apparently healthy lactating cows according to the procedures recommended by National Mastitis Council [18]. Washing should be started sufficiently in advance of milking to allow the udders to drain dry before collection of the samples. After the udders, especially teats were cleaned and dried; the first 3-4 streams of milk were discarded. After withdrawing of the first two or three streams of milk about 2 ml of the foremilk was collected from each quarter and mixed thoroughly in a plastic container. Two ml of composite milk was placed in a cup if the paddle to which an equal amount of CMT reagent was added. Then, the paddle was rotated gently in a circular pattern for 10 seconds so that the milk and reagent mixed well. Immediately the reactions were scored, and the paddle was rinsed and shaken of excess moisture. The CMT reactions were scored and interpreted according to Quinn et al. [19]. Both 0 (negative) and T (Trace) scored and interpreted absence of intra mammary infection, while CMT scores 1, 2 and 3 was considered as positive indicators of the infection.

Data management and analysis

The data were entered and managed in Microsoft Excel sheet. All the data analysis was done by Statistical Package for Social Science (SPSS) software version 20. Descriptive statics such as percentages and frequency distribution were used to describe the nature and the characteristics of data. The association of different risk factors with prevalence of bovine mastitis was computed by logistic regression.

Results

From a total of 384 lactating cows examined, 130 (33.9%) and 37 (9.64%) were found to be positive for California Mastitis Test (CMT) and clinical examination respectively. Therefore, the overall prevalence of bovine mastitis was found to be 43.49% at cow level. From the total of 1536 quarters examined, 18 (1.20%) of them were found blind and non-functional (Tables 1 and 2).

California Mastitis Test (CMT) result indicated that 129 (8.39%), 168 (10.94%) and 237 (15.40%) quarters were CMT score strong positive (+3), distinct positive (+2) and weak positive (+1), respectively as shown in Table 3.

California Mastitis Test (CMT) result found that 35 (9.1%), 64 (16.7%), and 68 (17.7%) in local, cross and exotic breeds respectively. The prevalence of bovine mastitis in relation to age indicated that 68 (17.7%), 35 (9.1%) and 64 (16.7%) in >8, 5-8 and 3-5 age of lactation cows respectively; and it was found that the association of bovine

Tested teat	Number of animals and quarter tested	Positive (%)
Clinical mastitis		
Cow level	384	37 (9.64)
Quarter level (functional teat)	1536	148 (9.74)
Non-function (Blind) teat	1536	18 (1.2)
Sub-clinical mastitis		
Cow level	384	130 (33.85)
Quarter level	1536	520 (33.85)
Overall prevalence		
Cow level	384	167 (43.49)
Quarter level	1536	668 (43.48)
Blind	1536	18 (1.2)

Table 1: Prevalence of mastitis at cow and quarter level of lactating dairy cows.

Numbers and types of quarters examined	Blind, clinical and subclinical mastitis result at quarter level		
	Blind (N%)	Clinical mastitis (N%)	Sub-clinical mastitis (N%)
Right front	6 (33.30)	24 (22.97)	143 (27.50)
Left front	3 (16.60)	25 (16.89)	130 (25.00)
Right rear	7 (38.88)	42 (28.38)	134 (25.77)
Left rear	2 (11.1)	47 (31.76)	113 (21.73)
Total	18	148	520

Table 2: Prevalence and distribution of udder mastitis and blocked teat cases across the four quarters.

Types of quarters examined	Severity of infection (Positive)		
	Weak n%	Distinct n%	Strong n%
Right front	70 (29.54)	27 (16.07)	27 (20.93)
Left front	64 (27.00)	30 (17.86)	32 (24.81)
Right rear	53 (22.36)	55 (32.74)	41 (31.78)
Left rear	50 (21.09)	56 (33.33)	29 (22.48)
Total	237	168	129

Table 3: Prevalence and distribution of udder mastitis cases across the four quarters.

Risk factors	Category	No. of cows examined	No. of cows affected	Prevalence (%)	Odds ratio (95 % CI)	P-value
Kebeles	Sale	96	37	9.6	0.59 (0.33-1.05)	0.07
	Xumano	96	53	13.8	1.16 (0.66-2.04)	0.62
	G/wartu	97	28	7.3	0.38 (0.21-0.69)	0.00
	D/jibbo	95	49	12.8	-	-
Age in years	>8	153	68	17.7	0.11 (0.68-0.42)	0.11
	5-8	113	35	9.1	0.38 (0.22-0.65)	0.00
	3-5	118	64	16.7	-	-
Breed	Cross	118	64	16.7	0.68 (0.42-1.09)	0.00
	Local	113	35	9.1	0.38 (0.22-0.65)	0.00
	Exotic	153	68	17.7	-	-
Parity level in numbers	1-2	144	64	16.7	1.03 (0.65-1.61)	0.91
	3-4	78	32	8.3	0.90 (0.52-1.54)	0.68
	>4	162	71	18.5	-	-
Lactation stage in month	Early (1-4)	144	53	13.8	0.63 (0.39-0.99)	0.04
	Mid (4-8)	78	36	9.4	0.92 (0.05-1.59)	0.77
	Late >8	168	78	20.3	-	-

Table 4: Association of the prevalence of bovine mastitis with different breeds of dairy cows.

mastitis in relation to age of lactation was highly statistically significant ($P<0.05$).

The association of the prevalence of bovine mastitis with different risk factors was assessed; and different factors were considered as potential risk factors for bovine mastitis (Table 4).

Discussion

Mastitis is an economically important disease of dairy cattle worldwide causing a significant reduction in milk yield and sometimes posing public health hazard. In the present study, a total of 384 cows (113 local zebu, 153 exotic and 118 cross breeds) from small holder, medium and large sized dairy farms were investigated to determine the prevalence of clinical and sub-clinical mastitis and associated risk factors. One hundred sixty-seven (43.49%) of the examined animals had abnormalities in their udder, teats, and milk as evidences of mastitis. This finding was lower than, the previously overall prevalence of bovine mastitis from different part of Ethiopia by Takele, Tesfaye, Mungube,

Tadesse and Musse [20-24] who had reported the prevalence of bovine mastitis 53.0%, 53.30%, 52.20%, 50.30%, and 48.6% respectively. This difference may be due to difference in the intrinsic factors such as the breed of animals examined and extrinsic risk factors prevailing in the environment of animals or in the immediate production conditions on the farms, the abnormalities in the udders and the sampling techniques and test method used in the studies.

Prevalence of subclinical mastitis (33.85%) is higher than that of clinical mastitis (9.64%) in the present study, which is agreement with several earlier reports from different parts of Ethiopia [25-30] since, environmental factors play significant role, the prevalence of subclinical mastitis varies in different dairy farms [31].

Additional agreement to other reports; clinical mastitis is far lower than subclinical mastitis [10,32,33]. This could be attributed to little attention given to subclinical mastitis, as the infected animal shows no obvious symptoms and secrets apparently normal milk and farmers, especially small holders, are not well informed about invisible loss from subclinical mastitis. In Ethiopia, the subclinical forms of mastitis received little attention and efforts have been concentrated on the treatment of clinical cases [29].

In current finding, sub- clinical and clinical mastitis at cow level was found to be 43.49% which in line with the result reported by Mungube and Tadesse [22,23] who had reported 46.6% and 43.4% respectively. Additional, the present result (43.49%) had relative difference with the finding of Gizat, Berhanu and Bishi [8,33,34] who had reported 31.7%, 34.3%, 34.4%, respectively. This difference might be due to diagnosis techniques.

Quarter prevalence (43.48%) of mastitis found in this study was higher than the finding of Seid and Nessru et al. [25,35] in Ari, who reported the quarter prevalence 34.5%, and 37% respectively.

The occurrence of bovine mastitis regarding to lactation stage was higher in cows in late lactation stage followed by early and medium lactation stages. The finding is disagreement with previous reports of Seid [25] in Arsi. The late lactation stage infection might be due to the contamination of cow teat during milk period. On other hand, absence of dry cow therapy regime could possibly be the major factor contributing to high prevalence at early lactation and early infection associated with delayed diapedesis of neutrophils in to the mammary gland [36].

Additional it was found that the association of bovine mastitis in relation to stage of lactation was statistically significant difference (P= 0.04; OR=0.63(0.39-0.99, 95%CI) that means late lactation period was (1.6) more likely affected than early lactation period. On other side the result was found that the association of bovine mastitis in relation to parity had no statistical significant difference (P>0.05).

In this study as well as in other similar studies showed that the overwhelming cases of mastitis were sub-clinical as compared to that of clinical mastitis among the three breeds [30,37]. This because subclinical form of mastitis receives a little attention in our country and efforts have been concentrated on the treatment of clinical cases [38], while the high economic loss could come from sub clinical mastitis. So that considerable number of Ethiopia farmers especially smallholders must be informed about the invisible loss from sub – clinical mastitis [39].

In our study the association of bovine mastitis with different host risk factors was assessed. Among the host potential risk factors presumed to have significant association with bovine mastitis were age, breed, and lactation stage. The finding of this study indicated that high prevalence was recorded in parity of greater than 4 parity 71% followed by 1-2 (64%) and 3-4 parity (32%). The findings those were obtained in this study were in agreement with previous findings of Lamma and Tibeb-Silassie [16,40]. Their studies showed that older cows especially after 4 calves were more susceptible to bovine mastitis than the others; exotic breeds were more susceptible than others. Similar results are showed by Richard [41].

Conclusion and Recommendations

Mastitis especially sub-clinical mastitis is a problem, which threatens dairy farm owners usually by decreasing milk yield irrespective of adequate feed provision and deworming practices. Farmers are only concerned with clinical mastitis and often are unaware of the status of sub-clinical infection in their herds and no visible control strategies of mastitis are currently in most dairy farms. The present study showed that an overall prevalence of 43.5% bovine mastitis was recorded in the study area. The prevalence of subclinical mastitis (33.85%) is higher than that of clinical mastitis (9.64%). Several risk factors such as breed, parity number, and lactation stage were found to be associated with mastitis, indicating the potential opportunities for improved management conditions of the farms and the subsequent economic returns that can be obtained with the reduced losses.

In view of the above conclusion, the following points are recommended:

1. Introduction of hygienic standards at the time of milking like proper washing, drying, and pre- and post-milking dipping, using detergents like soap is recommended.

2. Information concerning factors such as previous mastitis history and parity number of cows should be known prior to introduction of the animals to a farm.

3. Routine test of dairy cows through regular screening should be performed to identify sub clinical cases.

4. Cows with chronic mastitis should be culled after repeated screening test and follow up.

5. Farmer's awareness of the disease must be promoted by implementing short-term training about good dairy management and hygienic practices and prevention of bovine mastitis through the control of veterinarian and animal husbandry expertise.

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