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Research Article

Prevalence of Bovine Mastitis and Its Effect on Farm Economic Return in Dairy Farms in Holeta

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Abstract

A cross-sectional study was conducted from November 2014 to March 2015 to determine the prevalence, associated risk factors, and effect of bovine mastitis on economic return in dairy farms in Holeta, Ethiopia. It was carried out on 384 dairy cows based on a data collection questionnaire survey, clinical examination, and California Mastitis Test. The overall prevalence of mastitis was 65.1% (n=250); where 25.8% (n=99) and 39.3% (n=151) was clinical and subclinical cases, respectively. The prevalence among successive stages of lactation was 65.6%, 60.3%, and 68.9% in early, mid, and late lactation respectively and it was statistically significant (P<0.05). Mastitis prevalence in first, second, third, fourth, and more than fourth parities was 68.5%, 61.5%, 58.7%, and 71.5%, respectively. The prevalence of mastitis was 78.3%, 60.3% and 68.9% in cows of age greater than 8, 5-8 and less than 5 years respectively. Retrospective data related to treatment costs, discarded milk during the course of treatment, and culled cows due to chronic mastitis in Holeta from 2013 to 2014 was analyzed to estimate the annual economic loss due to mastitis in four dairy farms. The study estimated the annual economic loss of bovine mastitis from 10,044.18 - 15,280.28 birr. Out of this, the total economic loss per cow to treat mastitis was 63.29-139.00 birr and the cost due to discarded milk during the course of treatment was 128.00-535.95 birr per head of a cow. The economic loss due to culled cow and replacement was 9,500-14,666 birr. This study concluded that mastitis is a major health problem of dairy cows in Holeta which undoubtedly affect farm economic return of dairy farms and hence warrants serious attention.

Keywords: Cow; Mastitis; Economic loss; Prevalence; Holeta

Abbreviations: a.s.l: Above Sea Level; C°: Degree Centigrade; CMT: California Mastitis Test; CSA: Central Statistical Agency; Km^2: Kilometer Square; M: Meter; MmHg: Millimeters of Mercury; X^2: Chi-Square

Introduction

Livestock production has been considered as major economic sector and it will continue in the future in most parts of the world. Livestock and livestock products play a great role for the livelihood of society; serve as source of milk, meat, hide and skin [1]. Ethiopia has many livestock species suitable for livestock production. It is believed to have the largest livestock population in Africa. An estimate indicates that the country is a home for about 54 million cattle, 25.5 million sheep, 24.06 million goats and enormous amount of other animals. From the total cattle population 98.95% are local breeds and the remaining are hybrid and exotic breeds [2].

Ethiopia has great potential for increased livestock production, both for domestic use and for export. However, expansion of this sub-sector is constrained by inadequate livestock feed; high prevalence of infectious and non-infectious diseases; and inadequate support services in research and extension [3]. Udder is a productive organ of dairy animals; hence for better production it should be healthy. Because of its anatomical position the udder is subject to outside influences and is prone to both inflammatory and non-inflammatory conditions. Mastitis is one of the infectious diseases of a dairy cow and occurs throughout the world wherever dairy cows are found, which causes a huge

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loss in milk and milk products. Mastitis is a multietiological complex disease, which is defined as inflammation of parenchyma of mammary glands and is characterized by physical, chemical and usually bacteriological changes in milk and pathological changes in glandular tissues [4].

The continuing presence of the disease may be attributed to deficient management, improper milking procedures, faulty milking equipment, inadequate housing, and breeding for ever-increasing milk yield. All of these factors are probably involved, although herd investigations often fail to incriminate specific factors. It is important to recognize that mastitis is an infectious disease and that all methods of commercial milk production may provide suitable conditions for spreading mastitis organisms from cow to cow. A considerable body of evidence has accumulated suggesting that several management and environmental factors must interact together to increase exposure of cows to mastitis organisms, reduce the cows natural resistance to disease, or aid organisms in gaining entrance through the teat canal to milk secreting tissues of the udder where it cause infection [5].

Bovine mastitis remains a major cause of economic losses in dairy herds and the industry [6] and it is still one of the three main diseases that affect the profitability of dairy farmers, lameness and fertility are the other two [7]. Mastitis is of great economic importance to milk producers, because the disease has negative impact on several important aspects of cow and herd performance. Incurred costs are of both direct and indirect nature. Direct costs include veterinary costs, increased labor requirement, discarded milk (during the course of treatments), and reduced milk yield and quality. Indirect costs are those that are not always obvious to the milk producer, and are therefore referred to as hidden costs. Indirect costs include increased risk of subsequent disorders, reduced fertility (extra services per conception and, as a result of this, an extended calving interval), increased risk of culling, and, occasionally, mortality. The total cost of mastitis can, consequently, be much higher than the direct cost. The cost associated with each component is likely to vary between herds; partly because of differences in performance parameters (yield level, fertility, etc.) and partly because of different preferences of farmers influencing, for instance, inclination to contact a veterinarian when mastitis is detected [8].

Mastitis has been the most economically important dairy cow disease in Ethiopia due to either direct or indirect costs but studies are still sparse particularly those that determine the effect of mastitis on farm economic return. Therefore, the objectives of the study were:

- To determine the prevalence of mastitis and association of some potential risk factors in dairy farms in Holeta.
- To assess the economic loss associated with clinical and subclinical mastitis in Holeta dairy farms.

Materials and Methods

Study Area

This study was conducted in Holeta Oromia National Regional State from November 2014 to March, 2015. Holeta is located between 9º3' north latitude and 38º30' east longitudes and located at 40 km from Addis Ababa. The elevation of the city measures 2400 meter above sea level. The annual average temperature is 19°C with a temperature range of 16°C -22°C and the average annual rain fall is 1100 mm. The highest rainfall concentration occurs from June to September and the mean monthly relative humidity varies from 60% in August to 40% in December [2] (Figure 1).

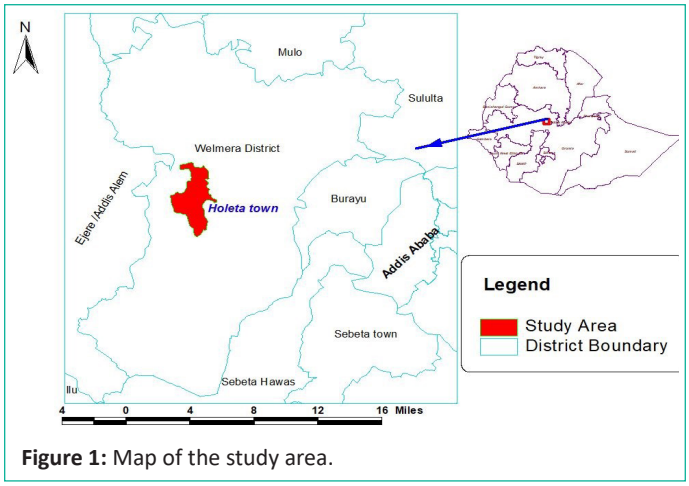

Figure 1: Map of the study area.

Study Population

The study animals were all lactating dairy cows found in four main dairy farms in Holeta town which are kept under semi intensive husbandry practice.

Study Design

An individual cow based cross-sectional study was conducted from November, 2015 to March, 2015 in lactating dairy cows using structured questionnaire, clinical findings for clinical mastitis and CMT for sub-clinical mastitis.

Sample Size Determination

The required sample size for this study was estimated by considering 50% mastitis prevalence. Thus, the sample size for this study was calculated using the formula described by [9].

$n=1.96^2*p*(1-p)/d^2$

Where n= sample size

P=expected prevalence

d=desired absolute precision

1.96 = Z-value for 95% confidence level

Thus the desired sample size for P= 0.5, N= 384

Data Collection

Questionnaire survey: A structured questionnaire was prepared and information regarding farm attributes and cow mastitic attributes was collected. The cow attributes includes age, parity, stage of lactation, breed, body condition and other relevant information related farm attributes includes herd size, farm hygiene and hygienic practices before, during and after milking and others.

Retrospective Data

The occurrence of the economic loss due to mastitis in dairy cow was determined by gathering data about treatment cost, discarded milk during the course of treatment and cows culled due to chronic mastitis from the data recorded by the farms. A retrospective data were taken from four dairy cows in Holeta town from the mastitis case record book registered from 2013 to 2014 years.

Physical Examination of Milk and Mammary Gland

Physical examination was performed by inspection and palpation of the mammary gland and the udder was observed for the clinical signs of mastitis such as swelling, pain, hotness, hardness, asymmetry, blindness of teats and the milk sample was observed for physical alterations (the presence of pus, clot, blood or change in consistency of milk) [10].

California Mastitis Test (CMT)

California mastitis test was carried out as screening test for subclinical mastitis. For this purpose 2 ml of milk from each quarter was squired into shallow cups in the CMT paddle after discarding the fore milk and an equal amount of the commercial CMT reagent was added to each cup. A gentle circular motion was applied to the mixture in horizontal plane for 15 seconds. Finally, the reaction was interpreted [11].

Data Processing and Analysis

Collected data were first entered into a Microsoft Excel spread sheet and analyzed using Stata 11 software. Descriptive statistical analysis was used to summarize and present the data collected. The existence of association between the risk factors and mastitis was assessed using the Pearson Chi-square (χ^2) test. Significant values were considered at P<0.05.

Results

A total of 384 cross-bred (n=184) and exotic cows (n=200) from four dairy farms were examined for both clinical and subclinical mastitis and out of which 250 (65.1%) cows were found to be affected with clinical and sub clinical mastitis based on the clinical diagnosis and CMT results. Likewise, CMT positive for the subclinical mastitis were found to be 151 (39.3%) (Table 1).

Prevalence of mastitis related to specific risk factors were determined as the proportion of affected cows out of the total examined. Breed of the cow, age, parity, and lactation stage were found to have significant difference on the prevalence of bovine mastitis (P<0.05) (Table 2). Cows at age group of less than five, five up to eight and greater than eight had an infection rate of 68.9%, 60.3% and 78.3%, respectively. Higher infection rate (68.9%) was recorded during the late lactation stage as compared to mid and early lactation stage that accounted for 60.3% and 65.6%, respectively.

Table 1: Prevalence of clinical and sub clinical mastitis.

Forms of mastitis	Cows examined	Total affected	Prevalence (%)
Clinical	384	99	25.8
Sub-clinical	384	151	39.3
Total	384	250	65.1

Table 2: Prevalence of bovine mastitis in relation to breed, age, stage of lactation and parity.

Risk factors	examined animal	affected animal	Prevalence	Chi-square $(x)^2$	p-value
Age					
<5 years	109	76	68.90%		
5-8 years	229	138	60.30%	x^2=21.3	p=0.00
>8 years	46	36	78.30%		
Lactation stage					
Early (< 4 month)	134	88	65.60%		
Mid (5-7 Month)	121	73	60.30%	x^2=13.0	p=0.011
Late (> 8 Month)	129	89	68.90%		
Parity Number					
Cow with 1 calf	115	79	68.50%		
Cows with 2 calves	96	59	61.50%	x^2=17.6	p=0.007
Cows with 3 calves	64	37	57.80%		
Cows with>4 calves	109	78	71.50%		
Breed					
Cross	184	118	64.10%	x^2=0.29	p=0.86
Exotic	200	132	66%		

Table 3: Estimated annual losses due to mastitis in four farms.

Reason for economic loss		Loss per cow in	farm	
Farms	A	B	C	D
Treatment	78.6	63.29	78.3	139
Discarded milk	465.58	128	535.95	388.7
Replacement	9,500	12,5000	14,666	12,000
Total	10,044.18	12,691.29	15,280.25	12,527.7

A retrospective data about treatment cost, discarded milk during the course of treatment and culled cow due to chronic mastitis from the data recorded by the farms were taken from four dairy farms in Holeta town from 2013 to 2014 year to estimate the annual economic loss due to mastitis in dairy farm. This study estimated the annual economic loss of bovine mastitis from 10044.18-15280.25 birr per cow per lactation, out of this, the total economic loss incurred per cow to treat mastitis during this period of time due to mastitis was 63.29-139 birr per cow and the cost due to discarded milk during the course of treatment was 128-535.95 birr per head. The economic loss due to culled cow and replacement was 9,500-14,666 birr (Table 3).

Discussion

Mastitis is one of the most prevalent diseases in Ethiopia causing reduced economic efficiency of dairy farms. In this study the prevalence of mastitis based on CMT and clinical examinations findings was high and this finding is in agreement to the findings by [3]. Additionally, [12] also reported similar findings in and around Assella. The present study reported higher prevalence of mastitis compare to the finding of [13] and [14] which might be related to the high number of exotic breed composition of the present study animals. However, the prevalence reported in this study is lower than the previous report by [15] from Addis Ababa, [16] from Dire-Dawa and [17] in Holeta.

In this study, the prevalence of subclinical mastitis is higher than clinical mastitis which is supported by reports of several investigators [18,19] and [20]. Similarly, the prevalence rate for clinical mastitis reported in this study area was comparable with the finding of [21] in Addis Ababa, Ethiopia. However, the present finding was higher than the report made by [22] in Modjo state owned dairy farm, and [14] around Holeta area, Ethiopia.

In this study, the prevalence rate of clinical mastitis reported was comparable with the finding of [21] from Addis Ababa, Ethiopia. However, the present finding was higher than the report made by [22] from Mojo state owned dairy farm and [14] around Holeta area, Ethiopia. The increased incidence of mastitis with age reported in this study is in agreement with the findings of [23]. Also [5] have explained that older cows have largest teats and more relaxed sphincter muscles, which increase the accessibility of infectious agent in the cows' udder.

A statistically significant incidence rate was documented in the present study among the lactation stages (P<0.05) which is similar with the report of [24] and [25]. This high risk of masti-

tis incidence in the late stage of lactation might be related to the physiologic change in the glandular tissue at this stage. In the late stage of lactation there is decrement of neutrophil concentration when the cows reach to dry off [21]. The increased prevalence of mastitis in cows with increased parity in this study is supported by [24], which could be associated with the decreased immune status of the cows with an increased parity.

Previous estimates of the cost of mastitis show large variation [26]. The high economic loss due to mastitis in this study is comparable with that of [27] from Canada. However, the economic loss reported here higher than the finding that was reported by [28] in the United States and by [29] from Addis Ababa. Some reasons for this variation in the reports seem to be origin of data, definition of mastitis, differences in sources of loss included, and analytical approach applied. Furthermore, studies have been conducted in different spatiotemporal contexts, which can be assumed to influence the results as circumstances of production and price levels vary between countries and over time [30].

Conclusion and Recommendations

Mastitis is one of the most economically important diseases of dairy cows which negatively affect the farm economic return and individual cow and herd performance. Mastitis should be thoroughly evaluated in dairy farms in order to understand the most important and probable risk factors. From the finding of the present study it is clear that breed, age, parity and stage of lactation are important risk factor to mastitis. The overall prevalence is high in this study compare to most of previous studies in different part of Ethiopia and is a major health problem of dairy cows in Holeta farms. Mastitis undoubtedly adversely affects the farm economic return due to costs lost to treat the udder, milk loss during treatment and culled cows as a result of chronic mastitis. In this study subclinical mastitis has been found to be higher than clinical mastitis. This is because farmers and herd manager are only concerned with clinical form of mastitis and often are unaware of subclinical infection.

Based on the above conclusion the following recommendations are forwarded:

- Farmers should be aware of the impact of the disease and practice hygienic milking and culling of chronic mastitis carriers.
- Periodic monitoring of infection status of the udder should be under taken as well as positive animals treated accordingly.
- Dry cow therapy should be practiced to decrease subclinical mastitis for economic and efficacy reason.
- Mastitis preventive strategies should be strictly followed to decrease farm economic losses associated to treatment cost, discarded milk and cost of culled cows with chronic mastitis cases.

Author Statements

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Conflict of Interests

No conflict of interest.

References

1. Banerjee G Oxf and IBH Publ comp. Textbook of animal husbandry. 8th ed. New Delhi, India; 2010.
2. Central Statistical Agency. Agricultural sample survey; Report on livestock and livestock characteristics, Addis Ababa, Ethiopia. 2009.
3. Lakew M, Tolosa T, Tigre W. Prevalence and major bacterial causes of bovine mastitis in Asella, South Eastern Ethiopia. Trop Anim Heal Prod. 2009; 41: 1525-30.
4. Radostits D, Blood D, Gay C. Veterinary Medicine: A Textbook of Diseases of cattle, sheep, pigs, goats and horses. 8th ed. London, UK: Bailliere Tindall. 2000; 501-50.
5. Radostits O, Gay C, Hinchcliff W, Constable D. Mastitis in Veterinary Medicine: A Text book of disease of cattle, sheep, pigs, goats, and horses. 10th ed, Ballier. Tindall, London. 2007; 674-762.
6. Petzer IM, Karzis J, Watermeyer JC, Van Der Schans TJ, Van Reenen R. Trends in udder health and emerging mastitogenic pathogens in South African dairy herds. J S Afr Vet Assoc. 2009; 80: 17-22.
7. O'Rourke D. Nutrition and udder health in dairy cows: a review. IRI Vet Journ. 2009; 62: 15-20.
8. Kossaibati MA, Esslemont RJ. The costs of production diseases in dairy herds in England. Vet J. 1997; 154: 41-51.
9. Thrusfield M. Vet Epidemiol. 3rd ed. Blackwell Publishing; 2007.
10. Quinn P, Carter M, Markey B, Carter G. Clin. Vet Microbiol. 2002: 331-44.
11. Quinn P, Carter M, Markey B, Carter G 1999. Clin Vet Microbiol. London, Mos. by International Limited.
12. Bedada B, Hiko A. Mastitis and antimicrobial susceptibility test at Asella, Oromia Regional state. Eth Journ Microb. 2011; 2: 228-32.
13. Sori H, Zerihun A, Abdicho S. Dairy cattle mastitis in and around Sebeta, Ethiopia. Int J Appl Res Vet Med. 2005; 3: 332-8.
14. Delelesse G. Study on prevalence of bovine mastitis on cross breed dairy cow around Holeta areas, West Shoa Zone of Oromia, Ethiopia. Glob Vet. 2010; 5: 318-23.
15. Zerihun T. A study on bovine mastitis at stela dairy farm, Ethiopia [DVM thesis]. Faculty of Veterinary Medicine, Ethiopia: Addis Ababa University; 1996.
16. Nesru H. A survey of bovine mastitis around Sebeta [DVM thesis]. Ethiopia: Faculty of Veterinary Medicine, Addis Ababa University; 1986.
17. Mekibib B, Furgasa M, Abunna F, Megersa B, Regassa A. Bovine mastitis: prevalence, risk factors and major pathogens in dairy farms of holeta town, central Ethiopia. Vet World. 2010; 3: 397-403.
18. Takele S. A study of the prevalence of bovine mastitis in different cooperative dairy farms in Chilalo Awraja, Arsi Region [DVM thesis]. Ethiopia: Faculty of Veterinary Medicine, Addis Ababa University; 1987.
19. Tolossa A. Study on the incidence of bovine mastitis in Kalu province [DVM thesis]. Ethiopia: Faculty of Veterinary Medicine, Addis Ababa University; 1987.
20. Lemma D. Study on bovine mastitis in smallholder dairy farms in Degam district, central Ethiopia [DVM thesis]. Ethiopia: Faculty of Veterinary Medicine, Addis Ababa University; 2005.

21. Workineh S, Bayleyegn M, Mekonnen H, Potgieter LND. Prevalence and aetiology of mastitis in cows from two major Ethiopian dairies. Trop Anim Heal Prod. 2002; 34: 19-25.

22. Alemnew M. Epidemiological and bacteriological investigation bovine mastitis at Modjo State owned dairy farm [DVM thesis]. Ethiopia: Addis Ababa University; 1999.

23. Adane B, Guyo K, Tekle Y, Taddele H, Bogale A, Biffa D. Study on prevalence and risk factors of bovine mastitis in Borana pastoral and agro-pastoral settings of Yabello District, Borana Zone, Southern Ethiopia. Am-Eurasi Journ Agric Environ Sci. 2012; 12: 1274-81.

24. Zeryehun T, Aya T, Bayecha R. Study on prevalence, bacterial pathogens and associated risk factors of bovine mastitis in small holder dairy farms in and around addis Ababa, Ethiopia. Journ Ani Pla Sci. 2013; 23: 50-5.

25. Fekadu A, Petros A, Dabash H. Prevalence and Identification of Bacterial pathogens Causing Bovine Mastitis from Crossbred of Dairy Cows in North Showa Zone of Ethiopia. Glob Vet. 2014; 13: 189-95.

26. Halasa T, Huijps K, Østerås O, Hogeveen H. Economic effects of bovine mastitis and mastitis management: a review. Vet Q. 2007; 29: 18-31.

27. Kirk J, Bartlett P. Economic impact of mastitis in Michigan holstein dairy herds using computerized records system. Journ Vetmed Assoc. 1988; 3: 1152-8.

28. Blosser TH. Economic losses from and the National Research Program on Mastitis in The United States. J Dairy Sci. 1979; 62: 119-27.

29. Mungube O. Freie Universität Berlin and Ababa University; 2001.

30. Hogeveen H, Osteras O. Mastitis management in an economic framework. In: Hogeveen H, editor. Proceedings of the 4th IDF international dairy conference: mastitis in dairy production -Current knowledge and future solutions. Wageningen Academic Publishers. 2005; 41-52.