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Research Article

Prevalence and potential risk factors of bovine clinical mastitis in Bonke District, Gamo Zone, Southern Ethiopia

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Abstract

Ethiopia has the largest cattle population in Africa with an estimated population of 56.71 million. Among these, the cow represents the biggest portion of the cattle population of the country. Currently, around 20.7% of the total cattle heads are milking cows. 85-89 percent of milk is contributed from cattle out of the total annual national milk production in Ethiopia that ranges from 797, 9000 to 1, 197, 500 metric tons of raw milk equivalents.. However, this amount does not satisfy the national demand for milk and milk products in the country due to a number of complex and interrelated factors including inadequate feed and nutrition, widespread diseases, the poor genetic potential of local breeds, poor market chain, and inefficiency of livestock development. Concurrently, mastitis is one of the major and expensive diseases which can alter milk composition, reduce the quality and quantity of milk yield, and indeed cause the culling of dairy cows at their age of high productivity. Clinical mastitis is the types of mastitis emphasized in this study. A cross-sectional study was conducted on 384 lactating cows to assess the prevalence of bovine clinical mastitis and its potential risk factors in the study area. Out of these 41(10.7%) were found positive for clinical mastitis. All the potential risk factors considered in this study showed statistically significant difference ($P < 0.05$). The present study concludes that mastitis was a key health problem of lactating cows in the area. Therefore, deliberate control measures against the disease and regular reconnaissance measures are recommended.

Keywords: Bonke; Bovine clinical mastitis; Prevalence; Risk factor

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1. Introduction

Ethiopia, a country located in the tropical region, is greatly dependent on Agriculture. Livestock production represents a major national resource and forms an integral part of the Agricultural production system and livelihood of the society. Ethiopia has the largest cattle population in Africa with an estimated population of 56.71 million. Among this cow represents

the biggest portion of the cattle population of the country. Around 20.7% of the total cattle heads are milking cows (CSA, 2014).

Milk and milk products collected from these animals provide an essential dietary source for the majority of the rural population as well as a considerable number of the urban and peri-urban population. The total annual national milk production in Ethiopia ranges from 797, 900 to 1, 197, 500 metric tons of raw milk equivalents. Out of these, 85-89 percent of milk is contributed from cattle. However, this amount does not satisfy the national demand for milk and milk products in the country (FAO, 2003). This is associated with a number of complex and interrelated factors such as inadequate feed and nutrition, widespread diseases, the poor genetic potential of local breeds, problem of market , and inefficiency of livestock development (Solomon et al., 2003; Negassa et al., 2011). Mastitis is one of the major and expensive diseases in terms of production losses in dairy production (Abebe et al., 2016; Bardhan, 2013).

The study area is one of the residences of the cattle population in which bovine mastitis is a potential problem in milk production. Yet there are no sufficient studies conducted. Therefore, this study was designed with the intention of estimating the prevalence and assessing associated potential risk factors of bovine clinical mastitis in the study area.

2. Materials and Methods

2.1. The study area

The study was conducted in Bonke Ðistrict, Gamo Zone, Southern Ethiopia. Bonke is bordered in the South by the Geresse, in the West by Kamba, in the North by Dita, in the Northwest by Daramalo, and in the East by the Gacho Baba districts. The climatic condition of the study area included a long rainy season (beginning of May to November) and a short sunny season (December to April). The annual mean temperature and rainfall of Bonke is 13^0C and 1200mm, respectively. The minimum elevation of the district is 2500m.a.s.l. while the maximum elevation is 4200m.a.s.l. The dominant livestock species in the study area are cattle, sheep and poultry, but there are also some goats, mule, and donkeys.

2.2 Study population

The study population included lactating cows of different farmers and they were at different ages, lactation stages, parity and breeds. They were selected randomly from the cattle population present in the study area.

2.3. Study design

A cross-sectional study was conducted to estimate the prevalence of bovine clinical mastitis and assess risk factors in the study area. The study was carried out from June 2021 to November 2021 by collecting events associated with mastitis from owners of lactating cows.

2.4. Sample size and sample size determination

The simple random sampling technique was used for the study of the prevalence of bovine clinical mastitis and its risk factors in Bonke District, Gamo Zone Southwestern Ethiopia. If previous studies were available in the study area, total sample size of the new could be calculated from the value determined during the previous study.

However, since there was no previous work done on the prevalence of bovine clinical mastitis and its risk factors in the selected study area, the sample size was determined with 95% confidence interval and at 5% desired absolute precision, assuming the expected prevalence of the bovine clinical mastitis in the study area to be 50 % (Thrusfield, 2005). Therefore, the formula (Eq. 1) and total estimated results (Eq. 2) are shown here:

$$N = \frac{1.96^2 \, (Pexp) \, (1 - Pexp)}{d^2} \quad (1)$$

Where N is the required sample size, Pexp is the expected prevalence and d is the desired absolute precision.

$$N = \frac{1.96^2 \, (0.5) \, (1 - 0.5)}{0.05^2} = 384 \quad (2)$$

2.5. Clinical examination of mastitis

A clinical examination was conducted to determine the prevalence of clinical Mastitis. Udder was examined for visible abnormalities, symmetry, size, consistency, presence of lesions and/or ticks.

Clinical Mastitis was recognized by some pathology in udder, which is manifested by signs of inflammation like swelling, pain, redness and heat in case of acute mastitis. Whereas, hardening of the udder, blockage of the teats, atrophy or fibrosis and abscess formation were manifested in chronic Mastitis. Acute Mastitis was also recognized by changes in milk color, and the presence of flakes and clots (Moges et al., 2012).

2.6. Data analysis

The data was entered into a Microsoft excel spread sheet to create a database and transferred to the Stata Version 9 before analysis. The association between the prevalence of

bovine clinical mastitis and the assumed risk factors were tested with Pearson chi-square procedure. The prevalence of bovine clinical mastitis was calculated for all data as the number of infected cows divided by the total number of cows and multiplied by 100. Values were considered statistically significant when the P-value was less than 5%.

3. Results

3.1 Prevalence of bovine clinical mastitis

A total of 384 local and crossbreeds were included in the study. Out of these lactating cows 41(10.7%) were found to be affected with clinical mastitis. When bovine clinical mastitis was compared between local and crossbred cows, a higher prevalence was observed in crossbred cows, with a prevalence percentage of 75.6 (Table 1).

3.2. Prevalence of bovine clinical mastitis based on risk factors

Breed, age, parity and stage of lactation have significant influences ($P < 0.05$) on the prevalence of bovine clinical mastitis.

3.2.1. Breed

The effect of breed on the prevalence of bovine clinical mastitis was studied and analyzed and the result revealed that breed had a significant effect ($P < 0.05$). Among the breeds studied in the study area, crossbreeds have higher prevalence of clinical mastitis (75.6%) than local breeds (24.4%).

Table 1. The prevalence of bovine clinical mastitis on the basis of breed

Breed	Studied cows	Mastitis positive	Prevalence (%)	χ^2	P-value
Local	202	10	24.4		
Cross	182	31	75.6	13.81	0.000

3.2.2. Lactation stage

The stage of lactation was the risk factor for bovine mastitis. The lactation stage was found to play a vital role in the prevalence of bovine clinical mastitis in the study area. The difference in the presence of bovine mastitis in the study population according to the category set was statistically significant indicating that those cows at the end stage of lactation were affected the most.

Table 2. The prevalence of bovine clinical mastitis based on stage of lactation

Lactation stage	Sampled cows	Mastitis positive	Prevalence (%)	χ^2	P-value
Early	105	18	43.9%		
Mid	171	4	9.8%	54.93	0.001
Late	108	19	46.3%		

3.2.3. Parity

The prevalence measure on the basis of parity in this study was statistically significant at ($P < 0.05$). A higher prevalence (46.3%) was recorded in cows that gave birth to five calves and a lower prevalence (4.9%) was recorded in cows that gave birth to one calf.

Table 3. The prevalence of bovine clinical mastitis on the basis of parity

Parity	Recorded cows	Mastitis positive	Prevalence %	χ^2	P- value
Parity 1	62	2	4.9	26.03	0.000
Parity 2	84	3	7.3		
Parity 3	73	7	17.1		
Parity 4	76	10	24.4		
Parity 5	89	19	46.3		

3.2.4. Age group

There was a significant difference in the prevalence of bovine mastitis between animals of different age categories ($P<0.05$). Higher prevalence (65.9%) was found in adult lactating cows (ages greater than six years) compared to young lactating cows (ages less or equal to six years) (34.1%).

Table 4. The prevalence of bovine clinical mastitis on the basis of age

Age	Sampled cows	Mastitis positive	Prevalence %	χ^2	p- value
Young	218	14	34.1	7.42	0.006
Adult	166	27	65.9		

Young= cows less or equal to six years, Adult = cows greater than six year

4. Discussion

This study focused on the prevalence and risk factors of clinical bovine mastitis only. The study revealed that 10.7% of the cows were positive for clinical mastitis which agrees with a study by Zeryehun and Abera (2017) who reported 10.7% prevalence of clinical mastitis in selected districts of Eastern Hararghe Zone. It is also congruent with of the findings of Tollosa et al. (2009) who reported 9.5% prevalence of bovine clinical mastitis at Wolayta Sodo town of South central Ethiopia. This in turn agrees with the study of Alemu et al. (2013) who reported

9.7% prevalence of bovine clinical mastitis in and around Gondar town. Similarly, Mitiku et al. (2017) reported 9.31% clinical prevalence at Sebeta. The finding of this study is nearly similar with the reports of Mekbib et al. (2010), Sarba and Tola (2017), Lakew et al. (2009), Girma et al. (2010) and Bitew et al. (2010) who reported 10.0%, 9.9%, 10.3%, 10.3%, and 11.9% clinical prevalence of bovine mastitis at Holeta Town, Ambo District, Asella, around Holeta Town and around Bahir Dar and its surroundings, respectively. On the other hand, the study showed differences in prevalence of mastitis with studies in other areas, which could be attributed to the variation in management, environmental hygiene and difference in the handling of lactating cows.

This study on the prevalence of bovine mastitis revealed a higher prevalence in cross-breed cows (75.6%) than in local breeds (24.4%). This agrees with the report of Alemu et al. (2013) who described a higher prevalence of mastitis (60.2%) in cross-breed cows than in local breeds (23.1%) in dairy farms in and around Gondar town, which might be due to differences in the anatomical structure of the teats and difference in genetic resistance to disease (Radostits et al., 2007). In addition, high-yielding cows are more susceptible to mastitis than low-yielding ones. This may be due to the ease with which injuries are sustained in large udders, so the foci for the entrance of pathogens are created, and stress associated with a high milk yield may upset the defense system of the animal (Radostits et al., 2000). This is consistent with the report of Sarba and Tola (2017) who described a higher prevalence of mastitis (47.2%) in cross-breed cows than in local breeds (15.4%) in Ambo district.

The relationship between the prevalence of bovine mastitis at different lactation stages was studied; and the result showed significantly higher infection ($P < 0.05$) in cow with late (46.3%) and early (43.9%) lactation than in cows with mid-lactation stage (9.8%). This finding closely agrees with the finding by Gebremichael et al. (2013) who reported the higher prevalence of bovine mastitis (51.2%) in the late stage of lactation, 37.5% in the early stage of lactation and 10.1% in the mid stage of lactation in and around Areka town. This in turn came to agreement with 48.4%, 47.4% and 45.1% prevalence of bovine mastitis at late, early and mid-stage of lactation in and around Gondar Town as reported by Alemu et al. (2013).

This study showed statistically significant association ($P < 0.05$) between parity and prevalence of bovine mastitis and observed a higher prevalence of bovine clinical mastitis in cows having greater than parity of four. This is in agreement with Moges et al. (2012) who reported cows with many calves (4-7 calves) had higher clinical prevalence (58.5%) than those

of cows having (1-3) calves (22.5%) in lactating dairy cows in Hawassa. This is also consistent with the work of Kerro and Tareke (2003), Mungube et al. (2004), Biffa et al. (2005), Getahun et al. (2008) and Lakew et al. (2009). Quinn et al. (1994) have also stated that older cows, especially after four lactations are more susceptible to mastitis.

This study also showed a significant relationship ($P < 0.05$) between the age and prevalence of bovine clinical mastitis in the study area. Similarly, studies reported by Sarba and Tola (2017) showed a significantly higher prevalence of mastitis (72%) in older cows than in young cows (28.0%) in Ambo district. The study also agreed with Zenebe et al. (2014) who reported cows with having 4-7 calves (69.8%) were at greater risk than cows having 1-3 calves. Also, similar findings were stated by Moges et al. (2011) who reported a higher prevalence in old cows than young ones. The highest prevalence in older cows is because of their largest teats and more relaxed sphincter muscles, which increase the accessibility of infectious agents in the cows' udder (Radostits et al., 2007)

5. Conclusion

In conclusion, bovine clinical mastitis in the study area was more prevalent in crossbreeds than in local breeds. It was also higher in late lactation stages than early and mid-lactation, in cows with more than three parities, and in adult cows than young cows. Breed, lactation stage, parity, and age are relevant factors in the epidemiology of bovine clinical mastitis. This study attests that bovine clinical mastitis plays a role in milk yield loss which in turn leads to financial loss at a household level. Hence further comprehensive epidemiological and microbiological study of clinical and sub clinical mastitis involving different potential risk factors, economic impact and ways to improve milk production should be conducted in the study area.

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Conflict of Interest

There was no conflict of interest, according to the author

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