MATHEWS

Research Article

Mathews Journal of Veterinary Science

Prevalence of Bovine Clinical Mastitis and Associated Risk Factors in Dairy Farms in Debre Markos City, Northwest Ethiopia

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ABSTRACT

A cross-sectional study was conducted from February 2025 to August 2025 in dairy cows which were found in Debre Markos city to assess the prevalence of bovine clinical mastitis and associated risk factors and to correlate the frequency of bovine clinical mastitis with factors such as breed, age, parity, and lactation stage of cows. Sixteen dairy farms were selected by simple random sampling. All cows available in the selected farms were included until the required sample size was gained. Totally 384 cows were examined. Clinical examination, visual inspection, and palpation to detect possible abnormalities on the udder and milk were conducted for each cow. And, about 46/384 (12.0%) cows were positive for bovine clinical mastitis. The prevalence of bovine clinical mastitis detected from the study animals was significantly associated with breed, age, parity, and lactation stage (p-*value*<0.05). The prevalence of bovine clinical mastitis was found to be higher in the exotic cows (17.8%) than in cross breed cows (8%). However, it was not detected in local breed cows. Based on age category, 2.2% young cows and 21.0% adult cows were infected with bovine clinical mastitis. Similarly, based on parity, 2.2% cases in cows that give few birth and 21% cases in cows that give many birth were infected. Based on lactation, about 25.0%, 7.6%, and 2.5% of cows at early, mid, and late lactation stages were found with bovine clinical mastitis respectively. The result of this study showed that risk factors such as breed, age, parity, and lactation stage `of the cows were highly associated with occurrence of bovine clinical mastitis. Therefore, proper farm hygiene, clean balanced feed, and strong veterinarian supervision are vital to prevent and control bovine clinical mastitis.

Keywords: Bovine, Cow, Dairy, Mastitis, Milk, Prevalence.

INTRODUCTION

TThe livestock sector is increasingly organized in long market chains that employ at least 1.3 billion people globally and directly support the livelihoods of 600 million poor smallholder farmers in developing world. Keeping livestock is important risk reduction strategy for vulnerable

Vol No: 09, Issue: 07

Received Date: October 08, 2025

Published Date: November 07, 2025

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Citation: Shibabaw AY. (2025). Prevalence of Bovine Clinical Mastitis and Associated Risk Factors in Dairy Farms in Debre Markos City, Northwest Ethiopia. Mathews J Vet Sci. 9(7):89.

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communities. Globally livestock are important providers of nutrients and contribute 17% to kilo calorie consumption and 33% to protein consumption [1]. In Ethiopia, livestock represents a major national resource and form an integral part of the agricultural production system. The country has the largest livestock population in Africa with estimated 65 million heads of cattle and cows representing the largest proportion of indigenous cattle of the country [2].

It is important that livestock products and by-products in the form of meat, milk, honey, eggs, cheese, and butter supply provide mainly the needed animal protein that contributes to the improvement of the nutritional status of the people [3]. Dairy production is a biologically efficient system that converts feed and roughages to milk [4]. Milk is one of the most important foods of human beings. It is universally recognized as a complete diet due to its essential components [5]. It has also been concluded that in great parts of the developing world, including developing countries of Africa, milk products consist a very important energy source for many people, and can contribute to a substantial part of the total energy intake [6].

The production of meat and milk in the developing world has doubled in recent decades, as a result of increasing demands. This so-called "livestock revolution" provides; income, employment and high-quality nutrition, and the livestock are important to the food security of millions of people and the trend is expected to continue [7]. The Ministry of Agriculture and Rural Development has formulated a strategy to improve milk production through crossbreeding of the indigenous zebu with high-grade exotics (Holstein) [8]. And because of this, there is an increase in the percentage of improved breeds in dairy cattle population of Ethiopia which are known to be more susceptible to most diseases including mastitis than the indigenous stock. From the major diseases of crossbred cows in Addis Ababa milk shed, clinical mastitis was the second most frequent disease next to reproductive diseases [9].

Mastitis means inflammation of the udder and is a common disease among dairy cows worldwide. Mastitis can be classified, according to its etiology, into environmental and contagious or, according to symptoms, into clinical and subclinical [10]. Major contagious mastitis pathogens include *Staphylococcus aureus, Streptococcus agalactiae, and Mycoplasma bovis*. Environmental mastitis pathogens include a wide range of organisms, such as coliforms (*Escherichia coli, Klebsiella, Enterobacter and Citrobacter), environmental streptococci (Streptococcus uberis and Streptococcus dysgalactiae),* Trueperella pyogenes, non-aureus staphylococci (NAS), and others such as *Pseudomonas, Proteus, Serratia, Aerococcus, Listeria, yeast, and Prototheca* [11]. It is often associated with bacterial intramammary infections (IMI) and is subdivided into clinical mastitis (inflammation with visual signs of inflammation in the udder or milk; CM) and subclinical mastitis (inflammation without visual signs; SCM). Both CM and SCM influence milk quality and yield negatively, and mastitis is therefore of major economic concern for the farmer. Clinical mastitis is also of potential concern from an animal welfare perspective [12].

Clinical mastitis is easily identified by visible abnormalities such as blood-stained milk, a red and swollen udder, and fever in the cow [13]. On the other hand, subclinical mastitis does not cause any obvious changes to the udder or milk, thus making it difficult to be recognized by farmers [14]. Cows diagnosed with clinical mastitis have shown longer intervals between calving and first AI, greater pregnancy losses, more days open, decreased milk production, and decreased milk fat percentage compared with healthy cows [15]. Mastitis is an important factor that limits dairy production due to its heavy financial losses involved and the existence of latent infections characteristics [16].

Milk from a cow infected with mastitis poses health concerns for consumers [17]. In addition, the use of antibiotics to treat mastitis can contribute to antibiotic resistance and antibiotic residue, which pose a public health risk [18], considering that approximately 62% of isolated mastitis-causing agents are resistant to at least one antimicrobial agent, and that some of them are zoonotic agents [19].

It has been demonstrated that animal characteristics like breed, age, parity, lactation stage, and milk output of a cow are related to the prevalence of mastitis [20]. This study was conducted to estimate the prevalence of clinical mastitis in dairy cow and to identify risk factors in dairy farms found in Debre Markos city.

MATERIALS AND METHODS

Study design and Study area

A cross-sectional study was conducted from February 2025 to August 2025 in dairy cows which are found in Debre

Markos city to assess the prevalence of bovine clinical mastitis and associated risk factors. Debre Markos is found in Amhara Regional State, North West Ethiopia. It is located in the North West of Addis Ababa on the way to Gondar road at an elevation of 2400 meters. The area is geographically located at latitude 10°19'N and longitude 37°43'E.

Study animals

The study was conducted on cows from sixteen dairy farms in Debre Markos city. There is semi-intensive farming system in the area. Manual method of milking was practiced and most of the farm owners didn't do any hygienic preparations. During the study, the cows were categorized into exotic, cross, and local breeds. Exotic cows are cattle breed that were not native to the study area. Cross breed cows were the offspring of exotic and local breeds. Local cows were breeds of cattle that originate and adapted to environment and climate of study area. Local cows are indigenous animals. The study animals were classified as young (3–6 years) and adult (>6 years) based on their dentation. Based on their parity, cows giving 1-3 birth were classi-fied as few and cows giving >3 birth were classi¬fied as many. Based on stage of lactation cows were categorized as at early stage (1-3 months), mid stage (3-6 months, and late stage (> 6 months).

Sampling technique and sample size determination

Farms were selected by simple random sampling. Then each cow in selected farms was examined until the required sample size was gained. The required sample size was determined based on the procedure and formula described by [21]; using 50% expected prevalence of clinical mastitis in cow in the area, 5% desired absolute precision, and at 95% confidence level, and calculated as follows;

$$n = (1.96)^2 P_{exp} * (1-P_{exp})/d^2$$

(Where, n = required sample size, P_{exp} = Expected prevalence of clinical mastitis were 50%, d = Desired absolute precision (0.05)). Using this formula 384 cows were sampled.

Clinical examination

The udder was examined through visual inspection and palpation to detect possible abnormalities like swelling or decrease in size, pain, swelling of su¬pra mammary lymph nodes, disproportional symmetry of teats, and blindness. Likewise, the milk was examined for discoloration and the presence of clots, flakes, blood, and watery secretions to detect bovine clinical mastitis. Clinically positive animals for mastitis were treated with antimicrobials.

Data analysis

The data collected were recorded on formats prepared for this purpose and raw data were entered into a Microsoft Excel spreadsheet. The prepared data was analyzed using Statistical Package for Social Science (SPSS 2007 version 20) software. The potential risk factors considered in the study were breed, age, parity and lactating stage. P-value < 0.05 was considered statistically significant.

RESULTS

From 384 cows examined, 46 (12%) were found with bovine clinical mastitis. Out of these cows sampled for the study 168 cows were exotic, 200 were cross and 16 were local in breed. From these breeds the case is found in 30 exotics and 16 crossbred cows. No one local breed cow was found infected by bovine clinical mastitis. Based on their age, 184 cows were young (3-6 years) and 200 cows were adult (>6 years). From these cows 4 young cows and 42 adult cows were infected by bovine clinical mastitis. Based on the parity 190 cows were giving few birth (1-3) and 194 were giving many birth (>3). From these cows 4 and 42 cows were found with bovine clinical mastitis respectively. Based on lactation stage 120,184, and 80 cows were at early (1-3 month), mid (3-6 month) and late (>6 month) lactation stage respectively. From those cows examined 30, 14, and 2 cows at early, mid and late lactation stage were infected by bovine clinical mastitis respectively. The prevalence of bovine clinical mastitis with different risk factors is shown in tables below.

Table 1. Prevalence of bovine clinical mastitis with breed

Factor	Category	Number of cows examined	Number of positive cows	Prevalence (%)
Breed	Exotic	168	30	17.8
	Cross	200	16	8.0
	Local	16	0	0.0
Total		384	46	12.0

Note: Exotic cows- cattle breed that were not native to the study area, cross breed cows- the offspring of exotic and local breeds, and local cows- breeds of cattle that are indigenous animals that originate and adapted to the environment.

Table 2. Prevalence of bovine clinical mastitis with age

Factor	Category	Number of cows examined	Number of positive cows	Prevalence (%)
Age	Young	184	4	2.2
	Adult	200	42	21.0
Total		384	46	12.0

Table 3. Prevalence of bovine clinical mastitis with parity

Factor	Category	Number of cows examined	Number of positive cows	Prevalence (%)
	Few	190	4	2.2
	Many	194	42	21.0
Total		384	46	12.0

Table 4. Prevalence of bovine clinical mastitis with lactation stage

Factor	Category	Number of cows examined	Number of positive cows	Prevalence (%)
L.stage	Early	120	30	25.0
	Mid	184	14	7.6
	Late	120	2	2.5
Total		384	46	12.0

Different risk factors considered in this study were breed, age, parity and lactation stage. All risk factors considered were statistically significant with *p-value*<0.05.

Table 5. Association of bovine clinical mastitis prevalence and breed

Factor	Category	Number of cows examined	Number of positive cows (%)	p-value
Breed	Exotic	168	30(17.8)	0.01
	Cross	200	16(8.0)	
	Local	16	0	
Total		384	46(12.0)	

Table 6. Association of bovine clinical mastitis prevalence and age

Factor	Category	Number of cows examined	Number of positive cows (%)	p-value
Age	Young	184	4(2.2)	
	Adult	200	42(21.0)	0.00
Total		384	46(12.0)	

Table 7. Association of bovine clinical mastitis prevalence and parity

Factor	Category	Number of cows examined	Number of positive cows (%)	p-value
Parity	Few	190	4(2.2)	
	Many	194	42(21.0)	0.00
Total		384	46(12.0)	

Table 8. Association of bovine clinical mastitis prevalence and lactation stage

Factor	Category	Number of cows examined	Number of positive cows (%)	p-value
Lac. stage	Early	120	30(25.0)	
	Mid	184	14(7.6)	0.00
	Late	80	2(2.5)	
Total		384	46(12.0)	

DISCUSSION

Bovine clinical mastitis results in greater economic loss due to loss of milk production, veterinary service cost, medication cost and culling especially when it occurs in early lactation. Mastitis is a complex disease involving interactions of several factors and its prevalence is expected to vary from place to place and from time to time.

The overall prevalence of bovine clinical mastitis in the present study was 12.0%, which was comparable with previous finding by [22] who reported 11.9% clinical mastitis prevalence in southern Ethiopia and [23] who reported 12.1% clinical mastitis prevalence in Oromia reginal state, South Eastern Ethiopia. The present finding was lower than the reports of [24] revealed 25.1% prevalence in Addis Ababa. The result of the present study was higher than the finding by [25] who reported 9.5% clinical mastitis prevalence in Modjo town, central Ethiopia. These prevalence varia¬tions may be due to differences in blood level of study animals, farm management and agro-climatic variation.

In the present study the prevalence of bovine clinical mastitis in exotic, cross and local breed cows was 17.8%, 8.0% and 0.0% respectively. The breed of cows was significantly associated with occurrence of bovine clinical mastitis (p-value=0.001). Breed difference play a vital role in the prevalence of different diseases. In this study, the prevalence of mastitis in exotic and cross breed cows was statistically higher than that of local cows. This finding is comparable with report of [26] in and around Sebeta, Ethiopia and [27] at Sokoto metropolis. These variations of clinical mastitis prevalence in breed level could be that the disease is associated with the lactating cow's milk yield that recently stated high yielding cows are more susceptible to mastitis than low-yielding ones [28].

The prevalence of bovine clinical mastitis associated with age groups of lactating cows in the present study area was 2.2% in young (3-6 years) and 21.0% in adult cows (>6 years). This finding was in agreement with the finding of [22] revealed that 11.7% prevalence in older cows and 3.1% prevalence in younger cows in Southern Ethiopia.

This finding was in contrary to the study of [29] reported 47.73% in young and 38.46% in adult cows in Sidama Zone SNNPRS, Ethiopia. In the present study the age of cows was significantly associated with occurrence of bovine clinical mastitis (*p-value*=0.00).

In the present study the prevalence of bovine clinical mastitis with parity, from cows that had few parity (1-3 birth) 2.2% cows was found with the case and from cows that had many parity (>3) 21.0% cows were infected. This finding was in agreement with the finding of [22] revealed that in cows with many calves 9.2% and in those with fewer calves 2.6%. In this study the parity of cows was significantly associated with occurrence of clinical mastitis (*p-value*=0.00). This finding was in contrast to finding of [30] in and around Areka, Southern Ethiopia based on parity group mastitis prevalence that was statistically insignificant. In the current study the prevalence of bovine clinical mastitis in cows that were in early lactation stage was 25.0%, in mid lactation stage was 9.6% and in late lactation stage was 2.5%. This finding was in agreement with the report of [22] which stated that early stage and the period of involution of the mammary glands were the most susceptible stage. Stage of lactation was found to affect bovine clinical mastitis prevalence significantly (*p-value*= 0.00).

CONCLUSION AND RECOMMENDATIONS

The result of the present study showed that there was 12.0% overall prevalence of bovine clinical mastitis in the Debre Markos city. This leads to high economic loss due to loss of milk production and cost of treatment. Mastitis case might be associated with poor hygienic farm management practices. So keep the hygiene of farms, protect the udder from trauma, proper washing of udder before milking, keep the milkers' hand clean before starting milking and after milking each cow, and provide clean and balanced feed for dairy cows are recommended to prevent mastitis. Use antibiotic dry cow therapy is another crucial way to prevent mastitis. If the case occurs, present the case to veterinarian early to prevent the spread of the disease in the farm.

ACKNOWLEDGMENT

First of all, thanks God for his gracious and merciful helping to do this research. Then I would like to thank to all farm owners who allowed me to conduct this research on their dairy cows.

COMPETING INTERESTS

The author declares that he has no competing interests.

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