



## **Review on bovine mastitis and assessments of its associated risk factors in lactating dairy cows**

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### **Abstract**

Bovine mastitis, which causes inflammation of the mammary gland parenchyma as a result of pathogen infection, injury, allergy, and tumor, is regarded as the most expensive disease affecting dairy animals globally. Given that the host, pathogens, and environment interact to produce the disease, it is referred to as having multiple etiologies. Physical, chemical, and bacterial abnormalities in the milk as well as pathological alterations in the glandular tissue of the udder are symptoms of the condition. The most significant etiologic agents of mastitis are considered to be infectious agents, in particular the numerous types of bacteria. A huge number of potential encounters between dairy animals, which are particularly facilitated by milkers' hands and milking equipment, make disease transmission throughout the herd probable. Due to the subclinical character of the breast infection, the diagnosis of mastitis is frequently challenging. Mastitis is the most economically significant disease of cattle in the worldwide dairy sector. Milk and other dairy outputs are scarce in developed countries, including Ethiopia. Mastitis is a disease warranting serious attention for its control and preventions as it is the most economically overwhelming disease, causing reduction in milk production & milk quality, veterinary expenses and/ or treatment costs with antibiotic withdrawal period besides to the possibility of transmission of zoonotic disease and antibiotics residue secreted by milk. The essential aspects to be advised in the management and prevention of mastitis include good husbandry practices and sanitation, post-milking teat dipping, mastitis treatment during the non-lactating time of the dairy cow, and culling of chronically infected cows are the key elements to be recommended in the control and prevention of mastitis.

**Keywords:** Mastitis, Subclinical, Clinical, Cow, Milk, Pathogen

### **1. Introduction**

Mastitis, which often manifests as udder infection in dairy animals, is of great concern as it affects public health and results in heavy economic losses to the dairy industry (Awandkar et al., 2021). Mastitis is a disease of major economic importance in dairy industry worldwide, It is of

particular concern in developing countries like Ethiopia, where milk and milk products are scarce (Abebe et al., 2016) and it is the common and costly disease-causing loss in milk yield, treatment cost, milk discarded, and reduction in quality and quantity of milk produced by a cow (Abera, 2020). Raw cow milk has potentially transmission zoonotic diseases include

brucellosis, leptospirosis, listeriosis, Q-Fever, Staphylococcal food poisoning and tuberculosis (Tesfanesh Fentahun Demissie<sup>1</sup>, 2018).

Mastitis, a complex disease of multifactorial aetiology, is one of the most costly diseases in the dairy industry worldwide. It can be categorized as clinical and subclinical type relying on the clinical sign (Tezera and Aman Ali, 2021). Clinical mastitis is characterized mainly by appearances of changes in the milk such as flakes and clots and presence of signs of inflammation on the mammary glands such as swelling, heat, pain, and edema. Subclinical mastitis refers to inflammation of the mammary gland in the absence of visible gross lesion in the udder or its secretion with the presence of pathogenic microorganisms and usually high number of somatic cells in the milk, milk production decreases, bacteria are present in the secretion, and composition is altered (Lidet et al., 2013).

Majority of microorganisms that are responsible for mastitis and spoilage of milk are bacterial origin and include *Staphylococcus aureus*, *Streptococcus agalactiae*, *Corynebacterium bovis*, *Mycoplasma* species, *Escherichia coli* and *Streptococcus uberis* as dominant and pathogenic (Worku, 2009). Streptococci are one among the major mastitis pathogens which have a considerable impact on cow health, milk quality and productivity (Almaw and Melaku, 2020). Transmission occurs mainly at milking time through contaminated milking machines, clothes and hands of milkers or machine operators. Clinical mastitis can be detected easily by the farmer, but subclinical mastitis can only be detected by the measurement of inflammatory components and pathogens in the milk due to absence of any visible indications (Almaw and Melaku, 2020).

Mastitis has been known to cause a great deal of loss or reduction of productivity, to influence the quality and quantity of milk yield, and to cause culling of animals at an unacceptable age. The occurrence of mastitis in dairy cows can affect household food security and reduce the income in general. Regular and systematic studies of

Mastitis should be carried out in order to make information on the prevalence of the disease available and put forward an appropriate disease control strategies for this economically important disease. The occurrence of mastitis in dairy cows can affect household food security and reduce the income in general. Therefore the general Objective is to review on bovine mastitis and assessments of its associated risk factors in lactating dairy cows

## **2. Literature Review**

### **2.1. Types of Mastitis**

Depending on the etiological pathogens, mastitis in cows is divided into three main types: infectious mastitis, environmental mastitis and summer mastitis

#### **2.1.1. Contagious Mastitis**

It is caused by bacteria that live in the skin of the breast and decay. Infectious mastitis can be passed from one cow to another during lactation and can further be classified as;

Clinical mastitis: It is characterised with the aid of using the presence of gross irritation symptoms and symptoms (swelling, heat, redness, pain). That is with the aid of using visible clots or discolorations of the milk, regularly in mixture with gentle and swollen udder, from time to time in mixture with fever, lack of urge for food etc. Clinical mastitis can once more be divided into Per-acute mastitis that is characterised with the aid of using gross irritation, discount in milk yield and adjustments in milk composition, Systemic symptoms and symptoms like fever, melancholy, shivering and lack of urge for food and lack of weight; Acute mastitis this is much like per-acute mastitis however with lesser systemic symptoms and symptoms like fever and moderate melancholy and Sub-acute mastitis, the mammary gland irritation symptoms and symptoms are minimum and no seen systemic symptoms and symptoms (Fesseha et al., 2021).

Subclinical mastitis: It is characterised through alternate in milk composition (SCC, leukocytes & epithelial cells, modifications in milk pH and ion concentration) with out a medical symptoms and symptoms of gross infection or milk abnormalities. In healthful lactating mammary gland, the milk SCC is regularly a million cells/ml of milk throughout subclinical mastitis. The most important issue affecting the SCC on the herd and character degree is the presence of intra mammary infections (IMM) (Guidry, 2007).

Chronic mastitis: It is an inflammatory process that exists for months, and may continue from lactation of one to the other lactation. It exists as subclinical but may exhibit periodical flare-ups sub-acute or acute form that last for a short period of time (Sisay Girma<sup>1\*</sup>, 2012).

### **2.1.2. Environmental Mastitis**

It is caused by organisms such as *Escherichia coli*, which do not normally live in the skin or in pus, but enter the teat canal when the cow comes into contact with a contaminated environment. Microorganisms are usually found in feces, bedding, and food (Heeschen, 2012).

### **2.1.3. Summer Mastitis**

The udder is severely and painfully damaged by a third type of mastitis, known as summer mastitis, which affects dry cows and heifers. Because the affected quarter is irreversibly destroyed, the cow must be killed sooner rather than later. When cows are in an environment where their teats can easily be damaged and where there are a lot of flies, infection is more likely to occur. The clinical symptoms of summer mastitis include a hot, hard, and swollen quarter along with a viscous discharge that has an unpleasant odor (<http://www.Towe.Org.uk>) (Quinn et al., 2002).

## **2.2. Mastitis Causing Major Pathogen**

Although mastitis may have a traumatic or toxic etiology, the International Dairy Federation (IDF) (1987) states that it is typically caused by a microbiological infection. Moreover, the pathogenic bacteria that cause mastitis in dairy cows are more than 150 different species strong. There may be a role for bacteria, fungi, and yeasts, although bacteria are by far the most important of these (Quinn et al., 2002). Although between 20 and 35 percent of clinical mastitis cases have an unidentified etiology (Wellenberg et al., 2002), it is generally agreed that bacteria are the primary cause of bovine mastitis. It may fall under the environmental or infectious categories. In the first instance, bacteria like *S. aureus* and strep are to blame. *agalactiae*, *Strep. dysgalactiae*, and other bacteria that have evolved to live in the udder cause subclinical infections. Environmental pathogens, such as *Strep. uberis* or *Enterobacteriaceae*, such as *E. coli*, are not well adapted to thrive inside the udder and, instead, grow quickly after invasion, elicit a quick immune response, and are removed (Bramley, 2002). Depending on the origin of the organisms involved, the main etiological agents for mastitis infections in dairy cows can be categorized into various types of organisms. They include infectious pathogens, environmental microbes, opportunistic microbes, and/or other less common mastitis-causing organisms (Philpot and Nickerson, 1999).

## **2.2. Epidemiology**

### **2.2.1. Global Epidemiology of Mastitis**

In the global dairy industry, mastitis is the main economic significant disease of cattle. Milk and other dairy outputs are scarce in developed countries, including Ethiopia (Fesseha et al.,

2021). Bovine mastitis is caused mainly by certain *Staphylococcus* and *Streptococcus* species (Forsman et al., 1997). The etiological agents include a variety of gram-positive and gram-negative bacteria, and can be either contagious (e.g., *Staphylococcus aureus*, *Streptococcus agalactiae*, *Mycoplasma* spp.) or environmental (e.g., *Escherichia coli*, *Enterococcus* spp., coagulase-negative *Staphylococcus*, *Streptococcus uberis*) (Cheng and Han, 2020).

### 2.2.2. Predisposing Risk Factors

#### 2.2.2.1. Environmental Factor:

Environmental conditions that can increase exposure include: overcrowding; poor ventilation; inadequate manure removal from the back of stalls, feeding areas and exercise lots; poorly maintained (hollowed out) free stalls; access to farm ponds or muddy exercise lots; dirty maternity stalls or calving areas; and general lack of farm cleanliness and sanitation. (Kurjogi and Kaliwal, 2011)

#### 2.1.2.2. Pathogen Factors:

Factors that mediate adhesion of bacteria to host cells; those that produce tissue damage; and those that protect the bacteria against the host's immune system and antibiotics (Sisay Girma<sup>1\*</sup>, 2012).

### 2.3. Diagnosis Method

It is essential to diagnose mastitis at the initial stage of infection to initiate the treatment as early as possible before the bacteria are anchored in the mammary gland (Zeryehun and Abera, 2017).

#### 2.3.1. California Mastitis Test (CMT)

Performed at milking time, gives instant results and is economical. It will be carried out as screening test for sub-clinical mastitis and for selection of samples for culture. A squirt of milk,

about 2 ml from each quarter will be placed in each of four shallow cups in the CMT paddle. An equal amount of commercial reagent will be added to each cup. A gentle circular motion will be applied to the mixtures, in horizontal plane for 5s. The reaction will be interpreted based on the thickness of the gel formed by CMT reagent and milk mixture, and the test result will be scored as negative (0), trace (T), +1 (weak positive), +2 (distinctive positive) and +3 (strong positive) according to (Zeryehun and Abera, 2017).

### 2.4. Treatment of Mastitis

In Pathogens (*Streptococcus agalactiae*, *Streptococcus dysgalactiae*, coagulase-negative staphylococci) that are generally noninvasive and are not believed to cause abscess formation in the parenchyma. So that intra-mammary administration of antimicrobial drug is enough (Birhanu Abera, 2013). In pathogens consisting of deep tissue of the mammary gland. For this systemic administration with intra-mammary infusion of antimicrobial is indicated for pathogens such as *Staphylococcus aureus* or *Streptococcus uberis* that are invasive or create abscesses. So that Cefquinome, a fourth-generation cephalosporin which has good tissue distribution and low MIC for gram negative bacteria was determined to be beneficial in reducing deleterious clinical outcomes of experimentally induced *Escherichia coli* mastitis. (Lidet et al., 2013).

### 2.5. Prevention and Control

Control of environmental mastitis can be achieved by reducing the number of bacteria to which treatise posed, increasing immune resistance of the cow, pre milk in great dipping with a germicidal. Proper ventilation and good sanitation at the farm building is necessary to decrease the exposure of pathogens to the mammary (Mengistu, 2017).

### 3. Conclusion and Recommendations

Depending upon the Etiological Agents  
Depending on the causative agent, mastitis in cow can be categorized into three main types: Contagious, Environmental and Summer Mastitis. Mastitis in dairy cows is a serious problem as it is an economically devastating disease causing immense economic losses in the dairy industry and is the worldwide costliest production disease in dairy herds. Subclinical mastitis is the most serious type as the infected animal shows no obvious symptoms and secretes apparently normal milk for a long time, during which causative organisms spread infection in herd, so it is an important feature of the epidemiology of mastitis. Mastitis has been known to cause a great deal of loss or reduction of productivity, to influence the quality and quantity of milk yield, and to cause culling of animals at an unacceptable age.. The occurrence of mastitis in dairy cows can affect household food security and reduce the income in general. Regular and systematic studies of Mastitis should be carried out in order to make information on the prevalence of the disease available and put forward an appropriate disease control strategies for this economically important disease. Intra-mammary administration of antimicrobial drug is enough Control of environmental mastitis can be achieved by reducing the number of bacteria to which treatise posed, increasing immune resistance of the cow, pre milk in great dipping with a germicidal. Proper ventilation and good sanitation at the farm building is necessary to decrease the exposure of pathogens to the mammary

Based on this, the following points are recommended

- Dairy producers must have to be willing to change old habits or ineffective/incorrect practices that may be causing or permitting new intramammary infections (IMIs) to occur.
- Milker's should be trained on proper hygienic milking methods,

- Regular investigation of mastitis especially sub clinical form should be practiced
- Mastitis treatments should be preceded with identification of the causative agent and susceptibility test profile of pathogens and
- Culling of old aged and repeatedly infected cows should be done on regular planned basis.
- Management, housing and environmental sanitation should be improved

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