

Review Article

Determinants of Bovine Mastitis and Impact of the disease in Ethiopia

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Abstract

Mastitis is a common disease of dairy animals. The source of mastitis infection may be regarded as contagious or environmental. A wide range of pathogens including bacteria, viruses, fungi, and the toxins of these pathogens can cause the disease. Mastitis is generally associated with poor hygienic and husbandry practices. The primary reservoir of infection is the mammary gland. The infectious agent enters through the milk canal, interacts with the mammary tissue/cells and multiplies. Most contagious mastitis causing pathogens are spread during milking. Most other species are opportunistic invaders from the cow's environment.

Keywords: Determinants; Impact; Mammary gland; Mastitis; Pathogens

1. INTRODUCTION

1.1. Background

Mastitis is a common disease of dairy animals. It is an inflammation of the ‘mastos’, the Greek word for mammary gland that causes the pathological condition of the glandular tissue and leads to physical and chemical changes in the milk. A wide range of pathogens including bacteria, viruses, fungi, and the toxins of these pathogens can cause the disease. The mammary tissue reacts to these all and becomes inflamed. Mastitis is generally associated with poor hygienic and husbandry practices. The frequency of contagious pathogens among mastitis cases is greater. The infectious agent enters through the milk canal, interacts with the mammary tissue/cells and multiplies (Kinfe, 2017).

1.2. Objective

General Objective

- ❖ To review the determinants of bovine mastitis and the impact of mastitis in Ethiopia.

Specific Objectives

- ❖ To review the determinants of bovine mastitis
- ❖ To review the impact of bovine mastitis in Ethiopia

2. SOURCES OF INFECTION

Mastitis is a multi-etiological disease. The source of mastitis infection may be regarded as contagious or environmental. Contagious pathogens except some that invade the cow's udder after bacteremia are spread during milking. Most other species are opportunistic invaders from the cow's environment. The primary reservoir of infection is the mammary gland; transmission occurs at milking. Environmental pathogens are commonly known to cause clinical mastitis in most dairy herds. The bedding used for housing cattle is the primary source of environmental pathogens in addition to other contaminated fomites as well as skin and teat lesions and vector parasites (Erskine, 2020).

3. RISK FACTORS

Mastitis is a complex disease and the difference in its prevalence and distribution might be due to differences in the breeds of cattle reared, lactation stage, parity, age of the animal, the geographical locations, weather conditions, the management system of the farm and previous episodes.

3.1. Host factor

For contagious pathogens, adult lactating cattle are most at risk for infection, either while lactating or during the dry period. Stage of lactation is one of the intrinsic factors that determine the level of infection. Particularly, the early stage of lactation is more prone to mastitis occurrence than the remaining stage of lactation (Rahmeto *et al.*, 2016). Age of cow is also a factor that is associated with the case of mastitis where commonly aged cows are more liable to mastitis than others (Mahantesh and Basappa, 2014). Parity has a direct relationship with mastitis occurrence. The presence of mastitis increases with increasing parity number. The likelihood of mastitis is higher in multiparous cows having more calvings compared with primiparous cows. This might partly be associated with the

position of the udder in older cows that let exposure of the teat and udder to injury and pathogens easily so that make it to be the most susceptible one to mammary infections (Rahmeto *et al.*, 2016). Breed of a cow is also another factor that determines presence or absence as well as the level of mastitis. Mostly high producing cows are more exposed to mastitis than low-level milk producers (Zygmunt *et al.*, 2015).

3.2. Environment factor

The primary source of environmental mastitis pathogens is the cows' environment. The bedding materials used for housing cattle may contaminate fomites, skin, and teat lesions and could be a potential source of mastitis-causing pathogens. It appeared that the floor was a potential source for mastitis organisms, particularly for the environmental pathogens, to enter the udder through the teat orifice (Rahmeto *et al.*, 2016). Bedding and bedding management contribute to udder health and milk microbial quality. A clean, dry adequately bedded stall maintains cow cleanliness, inhibits microbial growth, and their transfer to a teat.

3.3. Agent Factor

Mastitis is a complex disease with multi-etiology. A wide range of pathogens including bacteria, viruses, fungi, and the toxins of these agents can cause the disease. Most of the agents that cause mastitis are opportunistic environmental pathogens that are more favored during a poor hygienic condition in the cow's environment as well as related to the milkier. Others are contagious pathogens that are systemic and may finally get access to the udder and localize themselves there and cause infection. Mastitis is caused by a wide spectrum of pathogenic agents that penetrate the teat canal and multiply in the udder cistern (Erika and Rosa, 2012). The inflammation severity depends on the causative agent. The etiology of mastitis is in a continuous changing spree, with the evidence of new microbial species being incriminated (Shaheen *et al.*, 2016).

3.4. Management

The presence of mastitis was significantly influenced by herd size (Tesfaheywet and Gerema, 2017). There is a high chance of occurrence of mastitis in herds under intensive management. In intensively managed large herds, the higher chance of mastitis occurrence might be associated with increased exposure of the cows for mastitis pathogens in their environment due to high stocking density, dirty ground, poor ventilation, and high humidity (FAO, 2014). Cows with poor body condition, leaking milk, or previous udder infections had a significantly higher risk of clinical mastitis (Mungube *et.al.*, 2004). Milking a cow infected with mastitis and/or an infected teat, at last, is the best technical management to reduce the risk of transmission of the disease from infected one to the others.

4. EPIDEMIOLOGY

Mastitis is a worldwide problem affecting mainly lactating animals but during their dry periods as well. It affects a wide range of hosts; different breeds, age, parity, lactation stage, and milk yield categories (Rebeka *et. al.*, 2019). Even if the degree varies, mastitis exists under different environmental conditions and poor management systems (Klaas and Zadoks, 2017). The prevalence of mastitis varies spatially and temporally and also from a test instrument used to another.

Table 1: Epidemiology of Bovine Mastitis in Ethiopia in Time and Space

Prevalence (%)	Year	Area	Author
64.3	2016	Eastern Harrarghe Zone	Tesfaheywet & Gerema
62.6	2016	Hawassa, Arsi-Nagele, Wendo Genet	Rahmeto <i>et. al.</i>
35.8	2015	Shashemene	Tilahun <i>et.al.</i>
39.9	2015	Kofale	Tilahun <i>et.al.</i>
53.2	2015	Dire Dawa	Biniam <i>et.al.</i>
74.3	2013	Addis Ababa	Zeryehun <i>et.al.</i>
29.5	2013	Wolaita Sodo	Mulugeta & Wassie
37.1	2012	Shashemene	Mesele <i>et al.</i>
62.9	2012	Central High land	Mekonnen <i>et al.</i>
59.1	2012	Borena	Bedane <i>et.al.</i>
56.5	2011	Batu	Bedacha and Mengistu
75.2	2011	Jimma	Sori <i>et.al.</i>
60.9/32.6	2011	Gonder	Nibret <i>et al.</i>
71.1	2010	Holeta	Mekibib <i>et.al.</i>
44.1	2010	Holeta	Girma
28.2	2010	Bahir Dar	Bitew <i>et al.</i>
46.7	2010	Adama	Abera <i>et.al.</i>
64.6	2009	Asella	Lakew <i>et al.</i>
52.8	2005	Sebeta	Sori <i>et. al.</i>
34.9	2005	Southern Ethiopia	Biffa <i>et al.</i>
46.6	2004	Central highlands	Mungube <i>et. al.</i>
38.2	2002	Adami Tulu	Workineh <i>et. al.</i>

Table 2: Mastitis Distribution in different Countries in Africa.

Country	Ethiopia	Tanzania	Egypt	Sudan	Zimbabwe	Rwanda	Uganda	Nigeria
Prevalence (%)	52.15*	51.6	42.9	9.8	21.1	51.8	87.9	85.3
Reference	Different	Mdegela	Elbably & Asmaa	Madut	Simbarashe	Iraguha	Abrahmsén	Shittu
	<i>et. al.</i>	<i>et. al.</i>	<i>et. al.</i>	<i>et. al.</i>	<i>et. al.</i>	<i>et. al.</i>	<i>et. al.</i>	<i>et. al.</i>

* average for the range 23.2% to 81.1%

5. IMPACT OF MASTITIS

Mastitis is a serious problem that reduces milk production, affects the quality of milk, and leads to public health hazards, results in the death of animals and consequently leads to economic losses (FAO, 2014). Costs due to mastitis include reduced milk production, condemnation of milk due to abnormal color, odor and test and due to antibiotic residues after treatment, reduced quality of milk in terms of some desired contents of milk responsible in determining quantity and quality of milk by-products, veterinary costs, culling of chronically infected cows and occasional deaths (Rahmeto *et. al.*, 2016). Moreover, mastitis has a serious zoonotic potential associated with shedding of pathogens and their toxins in the milk.

6. CONCLUSIONS

The determinants of mastitis can be grouped as host factors (the breeds of cattle reared, lactation stage, parity, age of the animal), the environmental factors (geographical locations, weather conditions), the agent factor, the management system of the farm and previous episodes. Mastitis causes death of animals, reduced milk production, affects the quality of milk, and leads to public health hazards and/or condemnation of milk, and consequently leads to economic losses to veterinary costs, culling of chronically infected cows and occasional deaths.

7. Conflict of Interests

The author declare that there is no conflict of interest regarding the publication of this paper.

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