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Bovine mastitis "Article Review"

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Abstract: Mastitis is the most complex and costly disease of dairy cows occurring throughout the world. It is a management related disease whose prevention and control depends among other factors on good management practices. Bovine mastitis can be caused by physical or chemical agents but the majority of cases are infectious and usually caused by bacteria. Financial loss involved as a result of permanent loss of production in individual cows, discarded milk following antibiotic therapy, early culling of cows, veterinary costs, drug costs, increased labor, death of per acute cases and replacement costs. In Ethiopia, the disease has been studied sufficiently, and information relating to its prevalence and risk factors are limited to some areas with a variable results. For this reason, more and exact knowledge from expanded epidemiological analysis of mastitis is needed for creating better control program. 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.
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1. Introduction

Ethiopia possesses the highest number of livestock in Africa with an estimated 53.99 million cattle, 25.5 million sheep and 24.06 million goats (CSA, 2013). However, the productivity of this livestock sector is lower than the potential level of the African production average. Traditional methods of animal husbandry render the output per unit of domestic breed of livestock to be too low (CSA, 2008). The major biological constraints contributing to low productivity include low genetic potential of the animals, poor nutrition and prevailing diseases. Among the prevalent diseases Foot and mouth Disease (FMD), Contagious Bovine Pleuropneumonia (CBPP), lumpy skin disease, trypanosomiasis, external parasites and tick borne diseases are main animal health problems in animal health context (Belay *et al.*, 2012).

Ethiopia has the largest cattle population of all African countries With 7.2 million dairy cows (CSA, 2017). Dairy cows are mainly kept in the Ethiopian highlands, which occupy the central part of the country, cover over 40% of the country (Fazzini et al., 2015).

Mastitis is one of the most important economically devastating diseases of dairy cattle particularly for the backyard farmers in developing world, with different levels of economic losses (Hogeveen et al., 2011). Mastitis is a complex and multi factorial disease the occurrence of which depends on variables related to the animal, environment and pathogen (Radostits *et al.,* 2007). Among the pathogens, bacterial agent are the most common one, the greatest share of which resides widely distributed in the environment of dairy cows, hence a common threat to the mammary gland (Bradley, 2002). Mastitis (Mast: breast, it is: inflammation) is characterized by inflammation of the mammary gland (udder) that causes physical and chemical changes in milk and leads to pathological condition of the glandular tissue, which may result due to microbial, thermal, chemical or physical causes (Fox, 2005). Although it may be caused by thermal or chemical or physical agents, the causes are almost entirely infectious and mostly bacterial. It is generally associated with poor hygienic and husbandry practices. The infection rate of mastitis in cows with pendulous udder is higher than those having non-pendulous udder (Hundera et al., 2005).

Mastitis can be classified as clinical or subclinical. Clinical cases of mastitis are characterized by the presence of one or more of symptoms such as abnormal milk, udder swelling and systemic signs including elevated temperature, lethargy and anorexia. Sub clinical mastitis are those in which no visible appearance of changes in the milk or udder, but milk production decreases, bacteria are present in the secretion and composition is altered. For every case of clinical mastitis there are 20-40 times as many cases of sub clinical mastitis (Eriskine, 2001).

Although the occurrence of mastitis in Ethiopia has been reported from different parts of the country (Sori *et al.,* 2005; Kifle and Tadelle, 2008, Almaw *et al.,* 2009), regular and systematic studies of the disease 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. Therefore, this review was undertaken to provide information on bovine mastitis.

2. Bovine Mastitis

2.1. Definition

Mastitis is defined as an inflammatory reaction of the mammary gland. It is induced when pathogenic microorganisms enter the udder through the teat canal, overcome the cow's defense mechanisms, begin to multiply in the udder, and produce toxins that are harmful to the mammary gland. Mammary tissue is then damaged, which causes increased vascular permeability. As a result of this, milk composition is altered: there is leakage of blood constituents, serum proteins, enzymes, and salts into the milk; decreased synthesis of caseins and lactose; and decreased fat quality. Mastitis is a multifactorial disease. As such, its incidence depends on exposure to pathogens, effectiveness of udder defence mechanisms, and presence of environmental risk factors, as well as interactions between these factors (Christel, 2009).

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2.2. Causes of Mastitis

Bovine mastitis is associated with many different infectious agents, commonly divided into those causing contagious mastitis, which are spread from infected quarters to other quarters and cows, those that are normal teat skin inhabitants and cause opportunistic mastitis, and those causing environmental mastitis, which are usually present in the cow's environment and reach the teat from that source (Radostits et al., 2006).

Mastitis is a disease of many mammalian species. At least, 137 infectious causes of bovine mastitis are known to date and in large animals the commonest pathogens are staphylococcus aureus, streptococcus agalactiae, other streptococcus species and Coliform as reported by (Bitew et al., 2010). Staphylococcus sp. is the main aetiological agents of clinical and subclinical mastitis in cows while, S. aureus and Escherichia coli are most commonly isolated pathogen from the clinical mastitis, coagulase negative Staphylococci (CNS) are the most frequently isolated pathogens from the subclinical cows mastitis (Islam et al., 2011).

Major bacteria's cause: Cow-associated bacteria such as Staph. aureus and Strep. Agalactiae and the main environmental bacteria such as Strep. uberis, Strep. Dysgalactiae and coliforms are the Major bacteria (pathogens) capable of causing clinical mastitis, udder tissue damage, and long term or chronic subclinical infections (LI, 2001). The most important major pathogens involved in bovine mastitis worldwide are Staphylococcus aureus, Streptococcus uberis, Streptococcus dysgalactiae, Streptococcus agalactiae, Escherichia coli and Klebsiella spp. (Idriss et al., 2013).

Minor bacteria's cause: The Minor bacteria's cause less udder damage but cause slight to moderate increases in SCC. usually remain subclinical (LI, 2001). Some organisms, particularly non-hemolytic coagulase negative Staphylococci (CNS) and Corynebacterium bovis are almost ubiquitous inhabitants of the bovine mammary gland and are regarded as part of the normal flora (Gizat, 2004). Minor bacteria can be contagious, especially C. bovis but can be readily controlled by effective post-milking teat sanitation. There is growing evidence that subclinical infections by either CNS or C. bovis may put the udder more at risk of developing an infection by major bacteria (LI, 2001).

2.3. Diagnosis of mastitis

Clinical examination of Mastitis: examined for visible abnormalities, symmetry, size, consistency, presence of lesions and/or ticks. Clinical Mastitis can recognized by some pathology in udder, which is manifested by sign 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 change in milk color, presence of flakes and clots (Ismael, 2018).

California mastitis test (CMT): The early detection of disease is very important because in early stages it is amenable to treatment. Physical examination of udder helps in detecting cases where changes have occurred. The California mastitis test is most commonly used and has proved to be very efficient, After mixing milk and the reagent the result is read as traces, 1, 2, 3, and negative depending up on the gel formation in the milk sample (ICAR, 2011).

White side test: the principle of this test is based on the increased number of leukocyte in mastitic milk. Milk sample are placed on a clean dry glass slide and add a drop of 4% sodium hydroxide and mix with a glass rod. If the milk is from animal having Mastitis, it becomes thickened and flakes appear. While the negative milk sample remain the same (Chauhan and Agarwal, 2008).

Bacteriological examination: The first 3 to 4 streams of milk were discarded as it may complicate the diagnosis. After collection, the sample is subject to bacterial culture and isolation within 7 to 10 days. Aseptic procedures for collecting quarter milk samples were followed. The time chosen for milk sample collection was before milking. Udders and especially teats were cleaned by antiseptic's and water and dried before sample collection. Each positive CMT milk sample was collected separately to avoid confusion and cross contamination and was subject to laboratory for routine bacteriological investigation and cultured onto 10% sheep blood agar and MacConkey agar plates (Iqbal et al., 2004).

The suspected colonies could be identified morphologically, microscopically, biochemically and culture with fine bacterial growth were considered as positive and those with no visible growth taken as negative (Quinn et al., 2002).

For the primary isolation and identification of Mastitis causing microorganisms, colony size, shape, color, pigmentation, hemolytic characteristic, gram's reaction, oxidase, O-F tests can be performed. colonies then sub cultured to different media, such as Mannitol salt agar, MacConkey agar (Oxiod, Hampshire, England), Edward's medium (Oxiod Hampshire, England), Eosin methylene blue medium (EMB) (Oxiod, Hampshire, England) to get a pure culture and the secondary biochemical tests such as, coagulase test, urease test, IMVIC tests, sugar tests are important for bacterial species identification (Ismael, 2018).

2.4. Control of mastitis

Mastitis Control Program includes, Use proper milking management methods, Proper installation, function, and maintenance of milking equipment, Dry cow management, Appropriate therapy of mastitis during lactation, Culling chronically infected cows, Maintenance of an appropriate environment, Good record keeping, Monitoring udder health status, Periodic review of the udder health management program and Setting goals for udder health status (Radostits *et al*., 2006).

2.5. Economic loss

Economic losses due to mastitis are recognized worldwide as a major problem on dairy farms. Financial loss involved as a result of permanent loss of production in individual cows, discarded milk following antibiotic therapy, early culling of cows, veterinary costs, drug costs, increased labor, death of per acute cases and replacement costs (Sisay *et al.*, 2012).

In Ethiopia, the aggregate annual economic losses from animal diseases through direct mortality and reduced productive and reproductive performance were estimated at US$ 150 million (Belay et al., 2012). Economic losses from clinical and subclinical mastitis in Addis Ababa milk shed were reported to be approximately 270 Ethiopian birr (ETB) per lactation (Sisay *et al*., 2012).

The economic loss from mastitis in the urban and peri urban areas of Addis Ababa includes on milk production losses, treatment costs, withdrawal and culling losses as parameters for calculating losses. This loss was found to be 210.8 birr per cow per lactation. Losses due to culling, milk loss, treatment, and withdrawal contributed 49%, 38.4%, 9.3% and 3.3% to the total mastitis losses, respectively. Milk production losses contributed 38.4% of the total losses, sub clinical mastitis contributing 94% and clinical mastitis 6% of the milk losses. Sub clinical mastitis contributed 36.1% of the total losses, which is primarily due to, reduced milk production (Gizat, 2004).

In Debre Zeit dairy herds, the overall financial loss for each cow per lactation was 984.64 Eth Birr (US$78.65) and losses in large farms (1,882.40 Eth Birr or US$150.35) were over 3.5 times the loss in small-size farms. These figures possibly underestimate the potential benefits of mastitis control program as they do not include other direct and indirect costs (Tesfaye et al., 2010).

2.6. Risk factors influencing prevalence of mastitis

There are a number of factors that influence the occurrence of mastitis and fewer studies that have investigated cow-level factors associated with the development of Clinical mastitis was carried out. The risk of developing Clinical mastitis is greatest in early lactation and increases with parity and level of milk production (Berry and Meaney, 2005). They have also reported that the risk of a cow developing in the subsequent month of lactation is also a function of number of cases of Clinical mastitis in the previous lactation, number of clinical cases in the previous months of the current lactation, and the occurrence of Clinical mastitis in the current month. The risk of contracting Clinical mastitis was 4.8 times greater if the animal experienced Clinical mastitis in the previous stage of lactation. Clinical mastitis occurred in 38% of cows that experienced Clinical mastitis in the previous lactation, as opposed to 23% of those that had not (Berry and Meaney,2005). The prevalence of infected quarters increases with age, peaking at 7 years (Radostits et al., 2006). It may also be a result of a greater cellular response to infection or of a greater amount of permanent udder damage after infection in older cows. Older cows, especially after four lactations were submitted to more lactation, increasing the risk for mastitis and udder tissue damage (Christa, 2008).

Most new infections occur during the early part of the dry period and in the first 2 months of lactation, especially with the environmental pathogens (Radostits et al., 2006). The first month of lactation is the most sensitive period for risk of mastitis in the cow, even in well managed herds. On the other hand, the SCC of cows late in lactation is higher than the average throughout lactation, but this is due to an increased prevalence of sub-clinical infections late in lactation and a reduced milk flow production (Christa, 2008).

Predisposing factors such as poor management and hygiene, teat injuries and faulty milking machines are known to hasten the entry of infectious agents and the course of the disease (Islam et al., 2010, Islam et al., 2011). Where predisposing factors are present the organisms are able to pass along the teat canal and enter udder the set up infection. These factors may be age (the older the animal the greater the likelihood of the infection), stage of lactation (more likely at the beginning of and the end of lactation), milk yield (high yielder), hereditary factors, trauma, hygiene and unknown factors (ICAR, 2011).

2.7. Bovine mastitis in Ethiopia

Different studies conducted in different parts of Ethiopia showed variable prevalence of mastitis depending on the type of farm and managements systems. Biffa et al. (2005) conducted a study on mastitis of 974 lactating dairy cows in Southern Ethiopia as, 34.9% (340) had mastitis; 11.9% (116) clinical, and 23.0% (224) subclinical mastitis respectively. Mastitis prevalence in dairy farms of Holeta town, Central Ethiopia at cow level was 71.0% (76/107), out of which 22.4% (24/107) and 48.6% (52/107) were clinical and subclinical, respectively. The study in Holeta also revealed that quarter level prevalence of mastitis as 44.9% (192/428); from this the clinical form was 10.0% (43/428) and the subclinical was 34.8% (149/428) (Mekibib et al., 2010).

Prevalence of bovine mastitis in and around Wolaita Sodo, Southern Ethiopia. From the total of 349 lactating cows examined, 103 (29.5%) were positive for mastitis. Of these, 9 (2.6%) and 94 (26.9%) were found to be positive for clinical mastitis and subclinical mastitis, respectively (Mulugeta and Wassie, 2013). According to Zeryehun et al. (2013), a total of 499 cross-bred cows from 38 dairy farms were examined for mastitis detection and out of which 373 (74.7%) cows were found to be affected with clinical and sub clinical mastitis based on the clinical diagnosis and CMT. Out of the 1898 quarter examined 98 (19.6%) quarters which belongs to 73 (14.6%) animals were found to be blind teat. Up on screening of the functional teats (1898) by CMT, a quarter of 909 (42.7%) found to be affected by sub clinical mastitis in small holder dairy farms in and around Addis Ababa, Ethiopia. This great variation could result from differences in environment and management Gizat (2004).

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References

1. Almaw, G., Molla, W. and Melaku, A. (2009): Prevalence of bovine subclinical mastitis in Gondar town and surrounding areas, Ethiopia. Livestock Res. Rural Devt. (7): 21.
2. Belay, D., Kechero, Y. and Janssens, P.J. (2012): Survey of Major Diseases Affecting Dairy Cattle in Jimma Town, Oromia, Ethiopia *Global Veterinaria.* 8 (1): 62-66.
3. Berry, D.P. And Meaney, W.J. (2005): Cow factors affecting the risk of Clinical mastitis *Irish J. Agri. and Food Res.* 44: 147-156.
4. Biffa, D., Debela, E., and Beyene, F., (2005): Prevalence and Risk Factors of Mastitis in Lactating Dairy Cows in Southern Ethiopia. *Intern. J. Appl. Res. Vet. Med.* 3(3):189-192.
5. Bitew, M., Tafere, A., and Tolosa, T. (2010): Study on Bovine Mastitis in Dairy Farms of Bahir Dar and its Environs. *J. Anim. Vet. Adv*. 9(23):2912-2917.
6. Bradley, A. J. (2002): Bovine Mastitis: an Evolving disease. Vet. J., 163: 1-13.
7. Chauhan, R.S, Agarwal, D.K. (2008): Text book of Veterinary Clinical & Laboratory Diagnosis, 2nd edn. Japeebrothers India. 162-64.
8. Christa, (2008): The effect of *coryne bacterium cutis* lysate to control somatic cell counts in dairy cows, Dissertation submitted in accordance with the requirements for the degree Magister Scientiae Agriculturae to the Department of Animal, Wildlife and Grassland Sciences Faculty of Natural and Agricultural Sciences University of the Free State, Bloemfontein. Pp 25-26.
9. Christel, N. (2009): Economic Impact of Mastitis in Dairy Cows. *Faculty of Veterinary Medicine and*

Animal Science Department of Animal Breeding and Genetics Uppsala Doctoral Thesis.

10. CSA (2008): Central statistics for livestock population in Ethiopia. Addis Abeba, Ethiopia.
11. CSA (2013): Central statistics for livestock population in Ethiopia. Addis Abeba, Ethiopia.
12. CSA (2017): Federal democratic republic of Ethiopia. Central statistical agency. Agricultural sample survey, 2016/17, Volume II: Report on livestock and livestock characteristics. Statistical Bulletin 585, Addis Ababa, Ethiopia.
13. Eriskine, R. J. (2001): Intramuscular administration of ceftiofursodiu versus intrammamary infusion of penicillin/novobiocin for treatment of *Streptococcus agalactiae* mastitis in dairy cows. *J. Am. Vet. Med. Assoc*. 208:258-260.
14. Fazzini, M., Bisci, C. and Billi, P. (2015): The climate of Ethiopia. In: Landscapes and land forms of Ethiopia, World geomorphological landscapes. P. Billi ed. Springer Science. Business Media Dordrecht. P: 65-87.
15. Fox, L.K. (2009): Prevalence, incidence and risk factors of heifer mastitis. Vet. Micro.134: 82- 88.
16. Gizat, A. (2004): A Cross-sectional Study of Bovine Mastitis in and Around Bahir Dar and Antibiotic Resistance Patterns of Major Pathogens, A thesis submitted to the Faculty of Veterinary Medicine, Addis Ababa University in the partial fulfillment for the requirements for the Degree of Master of Science in Tropical Veterinary Medicine, Debrezeit, Ethiopia.
17. Hogeveen, H., Pyorala, S., Waller, K.P., Hogan, J.S., Lam, T.J.G.M., Oliver, S.P., Schukken, Y.H., Herman, W. and Hillerton, J.E. (2011): Current status and future challenges in mastitis research. NMC. Annual Meeting Proceedings. P: 36-40.
18. Hunderra, S., Ademe, Z. and Sintayehu, A. (2005): Dairy cattle mastitis in and around Sebeta, Ethiopia. Int. J. Appl. Re.s Vet. Med. 3 (4):34-37.
19. Idriss, S, H. E., Foltys, V., Tančin, V., kirchnerová, K. and Zaujec, K., (2013): mastitis pathogens in milk of dairy cows in Slovakia. *Slovak J. Anim. Sci.* 46(3): 115-119.
20. Indian council of agricultural research (ICAR) (2011): handbook of animal husbandry. 3rd edition, new Delhi P: 520-522.
21. Iqbal, M., Khan, M.A., Daraz, B. and Siddique, U. (2004): Bacteriology of mastitic milk and *in vitro* antibiogram of the isolates. Pak Vet J. 24: 161-64.
22. Islam, M. A., Islam, M. Z., Islam, M. A., Rahman, M. S. and Islam, M. S. (2011): prevalence of subclinical mastitis in dairy cows in selected areas of Bangladesh. *Bangl. J. Vet. Med.* 9 (1): 73–78.
23. Islam, M. A., Rahman, A.K.M., Rony, S. A. and Islam, M. S. (2010): prevalence and risk factors of mastitis in lactating dairy cows at baghabari milk shed area of sirajganj. *Bangl. J. Vet. Med.* 8(2): 157-162.
24. Ismael, A. (2018): Epidemiology of Bovine Mastitis in Ethiopia. J Vet Med Health. 2: 104.
25. Kifle, A. and Tadele, T. (2008): Prevalence of sub clinical mastitis in small holder dairy farms in Selale, North Shewa Zone, Central Ethiopia. Internet J. Vet. Med. 5(1): 1-4.
26. Livestock improvement (LI) (2001): managing mastitis. 3RD ED, A practical guide for New Zealand dairy farmers, New Zealand P: 9-10.
27. Mekibib, B., Furgasa, M., Abunna, F., Megersa, B. and Regassa, A. (2010): Bovine Mastitis: Prevalence, Risk Factors and Major Pathogens in Dairy Farms of Holeta Town, Central Ethiopia. *Vet. World.* 3(9):397-403.
28. Mulugeta, Y. and Wassie, M. (2013): Prevalence, risk factors and major bacterial causes of bovine mastitis in and around Wolaita Sodo, Southern Ethiopia. African journal of microbiology research. 7(48): 5400-5405.
29. Quinn, P.J., Carter, M.E, Markey, BK, Carter, G.R. (2002): Clinical Veterinary microbiology. Harcourt publishers Virginia. P: 331-44.
30. Radostits, O. M., Gay, C. C. Hinchcliff, K. W. and Constable, P. D. (2007): Mastits In: Veterinary Medicine. A Text book of disease of cattle, sheep, pigs, goats, and horses 10th edition, Ballier, Tindall, London. 674-762.
31. Radostits, O. M., Gay, C.C., Hinchcliff, K. W., and Constable, P. D. (2006): Veterinary medicine. 10TH ED, A textbook of the diseases of cattle, horses, sheep, pigs and goats, London, Pp: 674-676.
32. Sisay, G., Mammo, A., Bogele, K., Sori, T., Tadesse, F., and Jibat, T. (2012): Study on prevalence of bovine mastitis and its major causative agents in West Harerghe zone, Doba district, Ethiopia. *J. Vet. Med. and Ani. Heath*. 4(8):116-123.
33. Sori, T., Zerihun, A. and Abdicho, S. (2005): Dairy Cattle Mastitis in and around Sebeta, Ethiopia. Int. J. Appl. Res. Vet. Med. 3(4): 332-338.
34. Tesfaye, F.Y., Regassa, F.G. and Kelay, B. (2010): Milk yield and associated economic losses in quarters with subclinical mastitis due to Staphylococcus aureus in Ethiopian crossbred dairy cows, *Trop Anim Health Prop.* 45(5): 925-931.
35. Zeryehun, T. Aya, T. and Bayecha, R. (2013): Study on Prevalence, Bacterial Pathogens and Associated Risk Factors of Bovine Mastitis In Small Holder Dairy Farms In and Around Addis Ababa, Ethiopia. *J. Anim. Plant Sci*. 23(1): 50-55.

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