Review On Bovine Mastitis And Its Economic Importance

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Abstract: Mastitis is a major disease problem, which appears to be worldwide in distribution and affects all species of animals. Mastitis is a disease having multiple etiologies including infectious and non-infectious agents. It is classified as sub clinical and clinical depending on the manifestation of clinical signs. The causation of mastitis involves a complex relationship of three factors: host, microbial agent and the environment. The sources of mastitis pathogens may be infected cows, cow's environment or natural environment. The pathogenesis of mastitis is well explained in terms of three stages: invasion, infection and inflammation. It is recorded as the most costly disease of dairy herd worldwide, which results in economic loss by increasing the cost of production and decreasing productivity. Several tests including screening and specific laboratory tests have been developed for detecting the presence of microorganisms in the mammary gland of lactating cows. Intra mammary antimicrobial therapy, parenteral antimicrobial therapy, supportive and dry cow therapy is the major options of treatment. There are different mastitis management techniques developed to reduce incidence of mastitis in dairy cattle. Eliminating existing infection, prevent new infection, and monitor udder health are the basic principles of mastitis control program. Loss of milk production, replacement of culled cows, extra labor, discarded milk from cows with treatment, and cost of control measures are the major economic losses to bovine mastitis. Mastitis has both economic and public health significance. Hence, coordinated action of all stakeholders is recommended.
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1. Introduction

Ethiopia has the largest cattle population in Africa estimated at 54 million (CSA, 2013). Cow represents the largest population of cattle production of the country (Almaw *et al*., 2008). However, the per capital consumption of milk is only 19 Kg per year due to low production level coupled with other factors (Redda, 2001). The country has large potential for dairy development due to its large cattle population and the favorable climate for improved high yielding animal breeds. Thus, the contributions of the dairy sector especially the smallholder system in Ethiopia to poverty alleviation and sustainable food production in the country is assumed considerable. However, among many factors the sector is constrained by mastitis, which incurs serious economic losses to the dairy industry (Getahun *et al*., 2008).

Mastitis is one of the most important diseases affecting dairy cows. It is a multi-factorial disease with worldwide distribution accounting for major economic losses in dairy cattle (Workineh *et al*., 2002). A number of previous reports from different parts of the country indicated that mastitis is a serious problem in the dairy industry of Ethiopia (Mungube, 2001; Lakew *et al*., 2009). But mastitis as a disease, especially the sub clinical form, has received little attention in Ethiopia; efforts have only been concentrated on the treatment of clinical cases (Girma, 2001; Mekibib *et al*., 2010). In some parts of Ethiopia, the disease is insufficiently investigated and information relating to its magnitude, distribution, risk factors is scant. Such information is important when designing appropriate strategies that would help to reduce its prevalence and effects (Biffa *et al*., 2005).

The impacts of mastitis can be categorized as economic loss and zoonotic potential. The economic loss may be caused by cost of early replacement of infected cows, reduction in quality and quantity of milk, cost of treatment and increased labor cost (Sorri *et al.,* 2011). Its zoonotic significance is due to the ability of bovine mastitis causing microorganisms to produce disease in humans and the risk of drug residues in milk (Smith, 2009).

To simplify understanding of mastitis complex, it is useful to consider that three major factors are involved in this disease: the causative agent, the cow and the environment, which can influence both the cow and the microorganisms (Schroeder, 2010). The diagnosis of mastitis depends largely up on the detection of clinical inspection, nature and appearance of milk secretion (Quinn *et al.,* 1994).

Physical examination of the udder and milk, California mastitis test and bacteriological diagnosis are some of the diagnostic methods for mastitis. The fundamental principle of mastitis control is carried out either by decreasing exposure of the teat ends to potential pathogens or else by increasing resistance of dairy cows to infection (Radostits *et al*., 2000). Therefore the objectives of this paper are: To provide general concepts about the etiology, epidemiology, pathogenesis, treatment and control of bovine mastitis and to review major economic impacts of bovine mastitis.

2. Literature Review

2.1. Definition

Mastitis is inflammation of the parenchyma of the mammary gland regardless of the cause. Mastitis is therefore characterized by a range of physical and chemical changes in the milk and pathological changes in the glandular tissue primarily result from invasion of pathogenic microorganisms through the teat canal. Characterization of mastitis depend on identification of the causative agent whether it be infectious or physical (Radostits *et al*., 2007).

Mastitis is one of the most complex diseases of dairy cows that generally involve the interplay between management practice and infectious agents, having different causes, degree of intensity and variation in duration and residual effect (Harmon, 1994).

2.2. Etiology

The causes of mastitis may be either- infectious or non- infectious agents. The infectious agents include: bacteria, fungi, yeasts and viruses. The non-infectious causes are injury, bruising, or rough milking (Tyler and Ensminger, 2006).

A total of about 140 microbial species, sub species and serovars have been isolated from the bovine mammary gland through microbiological techniques. These can be grouped in to four (Radostits *et al*., 2007).

2.2.1. Contagious mastitis pathogens

Contagious bacteria are those that spread from infected quarter to other quarters or from infected cow to healthy cow through fomites. These bacteria have poor survival in the environment when not associated with the skin or in the gland. There are many contagious mastitis pathogens. The most common are *Staphylococcus aureus* and *Streptococcus agalactia*. *Mycoplasma bovis* is less common cause of contagious mastitis (Radostitis *et al*., 2007).

2.2.2. Environmental mastitis pathogens

Environmental bacteria are those commonly present in the cows environment. Such bacteria include *Streptococcus species* (*Streptococcus uberis*, *Streptococcus dysagalactia*), and environmental coliforms like *Eschercia coli*, *Klebsiella* species, *Enterobacter* species (Quinn *et al*., 2002). The majority of infections caused by environmental pathogens are clinical and of short duration (Harmon, 1994).

2.2.3. Teat skin opportunistic pathogens

These bacteria are normally resides on teat skin and have the ability to create intra mammary infection via ascending infection through the streak canal during milking. Such bacteria include coagulase negative staphylococcus species such as *Staphylococcus hyicus*, *Staphylococus chromogens*, *Staphylococcus xylosus* and *Staphylococcus sciuri*, which can found free in the environment (Radostits *et al*., 1994; Quinn *et al*., 2002).

2.2.4. Miscellaneous causes or uncommon pathogens

These groups of pathogens less commonly cause Mastitis. They include: *Nocardia* species, *Pasteurella* species, *Mycobacterium* bovis, *Bacillus cerus*, *Pseudomonas* species, *Clostridial* species, *Citrobacter* species, Fungi and Yeasts (Radostits *et al*., 2007).

2.3. Epidemiology

Mastitis is a complex disease problem. It is a classical example of the interaction of microorganisms, host factors and the environment as risk factors (Radostits *et al*., 2007).

2.3.1. Risk factors

The ability of the microorganism to colonize and eventually infect a host depends on its characteristics, including expression of several virulence factors and antimicrobial resistance (Contreras and Rodriguez, 2011).

Host factors include age, anatomy of the udder, intra mammary defense mechanism and peri parturition disease (Radostits *et al*., 2000).

The stage of lactation and parity of the cow influence the rate of infection. The rate of new infection is highest during two weeks following drying off and two weeks prior to calving (Radostits *et al*., 2007).

The cows' environment influences the number and types of bacteria they are exposed to and their ability to resist those organisms. The design of housing system, hygiene of the bedding, size of milking cowherd, milking practice and the climate interact to influence the degree of exposure of a cow to Mastitis pathogens (Radostits *et al.,* 2007).

2.3.2. Source of infection and transmission

The contagious pathogens, *Staphylococcus aureus* and *Streptococcus agalactia* reside mainly in the udder of infected cows and those bacteria are spread by contaminated milking equipment, human hands or any other material that act as carrier (Radostits *et al.,* 2007). Environmental mastitis pathogens - present in the housing and bedding - can transfer during milking or between milking, when the cow is loafing, eating or lying down. Transmission with in herds is thought to be strictly contagious due to insufficient hygiene in the milking parlor allowing multiple animals to come in to contact with equipment, hands or towels that are contaminated by milk from an infected cow. Fly and other insects may also spread the infection from one place to the other (Zadoks *et al.,* 2001). *Staphylococcus aureus* and *Staphylococcus epidermidis* species can be transmitted from people to cows with subsequent cow-to-cow transmission (Zadoks *et al*., 2011).

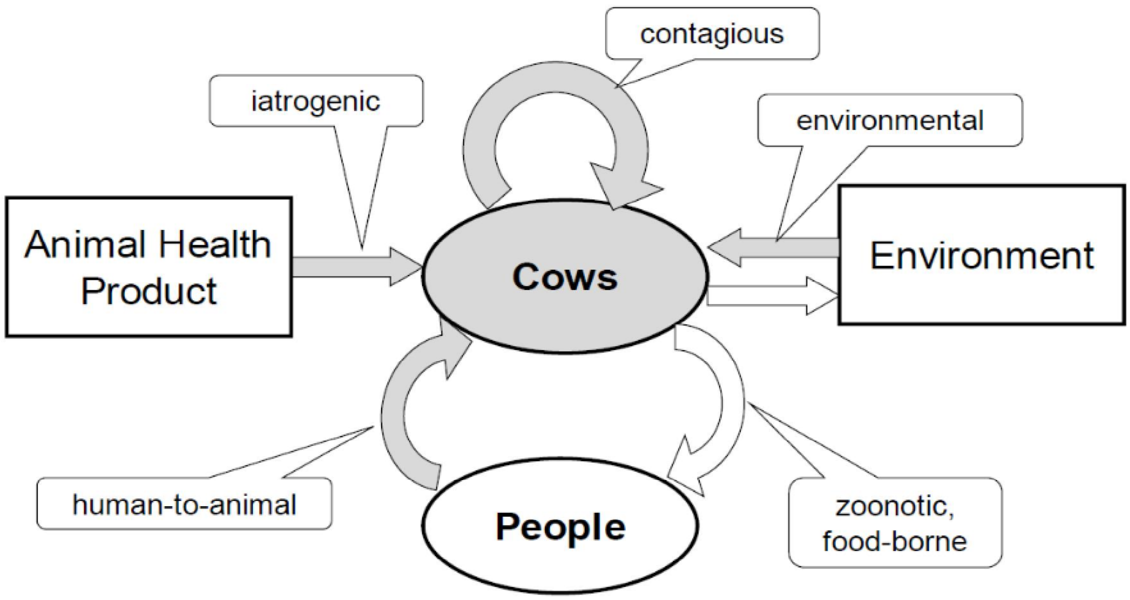

Figure 1. Possible sources and transmission routes for mastitis pathogens (Zadoks, 2014).

2.3.3. Mastitis in Ethiopia

The prevalence of clinical and sub clinical mastitis in Ethiopia range from 1.2 to 21.5% and 19 to 46.6%, respectively (Lemma *et al* 2001; Workineh *et al* 2002; Kerro and Tarekegn 2003).

Table 1: Prevalence studies of bovine mastitis in different parts of Ethiopia

Place	Clinical mastitis	Sub-clinical mastitis	Reference
In selected areas of southern Ethiopia	37.0%	62.9%	Kerro and Tarekegn, 2003
Bahir Dar	3.9%	44.6%	Gizat *et al*., 2004
Sebeta	16.11%	36.67%	Hunderra *et al*., 2005
North Gondar	3.95%	26.36%	Nibret, 2007
Eastern part of Amhara region	9%	42.1%	Girum, 2009
Bahir dar and its environs	3.0 %	25.2%	Bitew *et al*., 2010
Holleta Agricultural Research Center	7.8%	73.3%	Duguma *et al*., 2014

Usually Ethiopian farmers especially smallholders are not well informed about the invisible loss from sub clinical mastitis since dairying is mostly a sideline business among these farmers (Fufa *et al*., 2013). However, as shown in the above table, a number of epidemiological studies carried out in Ethiopia showed that mastitis is a serious problem.

2.4. Pathogenesis

Infection of the mammary gland almost always occur via the teat canal and on first impression the development of inflammation after infection seems a natural sequence. It occurs in three stages: invasion, infection and inflammation. Invasion is the stage at which the organism passes from the exterior of the teat to the milk inside the teat canal. Normally, the teat canal is tightly closed by sphincter muscles, preventing the entry of pathogens. It is lined with keratin, a waxy material derived from stratified squamous epithelium that obstructs the migration of bacteria and contains antimicrobial agents, such as long-chain fatty acids, that assist in combating the infection. However, the efficiency of keratin is restricted. Fluid accumulates within the mammary gland as parturition approaches, resulting in increased intra mammary pressure and mammary gland vulnerability caused by the dilation of the teat canal and leakage of mammary secretions. Additionally, during milking, the keratin is flushed out and there is distention of the teat canal. The sphincter requires about two hours for returning to the contracted position. After invasion, a bacterial population may be established in the teat canal and a serious of multiplication and extensions in to mammary tissue may cause inflammation (Radostits *et al*., 2007).

The bacteria penetrate the streak canal to establish in the udder, and the bacteria produce toxin to secretory tissues and when extensive damage to the blood-milk barrier has occurred, blood might be detected in the milk. This leads to visible changes on the udder, such as enhanced external swelling and reddening of the gland. Changes also occur in the milk, including increased conductivity, increased pH, raised water content and the presence of visible clots and flakes. This marks the initial stage of clinical symptoms, and the most severe infections might ultimately result in the death of the animal or otherwise cause reduction of potential milk production (Singh, 2006).

2.5. Forms of mastitis

2.5.1. Clinical mastitis

Clinical Mastitis is characterized by grossly abnormal milk and evidence of mammary gland inflammation to systemic signs. It is further classified according to the severity of inflammatory response as per acute, acute, sub-acute and chronic. Per acute mastitis is characterized by gross inflammation, reduction in milk yield and changes in milk composition, Systemic signs like fever, depression, shivering and loss of appetite and loss of weight. Acute mastitis is similar to per acute mastitis, but with lesser systemic signs like fever and mild depression. Sub acute mastitis is a type of mastitis in which the mammary gland inflammation signs are minimal and no visible systemic signs. Chronic mastitis is an inflammatory process that exists for months and it may continue from lactation to lactation. It exists as subclinical but may exhibit periodical flare-ups sub acute or acute form, which last for a short period of time (Radostits *et al*., 2007).

2.5.2. Sub-clinical mastitis

In sub-clinical mastitis, there is neither visible signs of the udder inflammation nor gross abnormalities of milk. It is detected by routine tests such as CMT, SCC, and routine culture. SCM causes the greatest financial loss to dairy farmers through lowered milk production. In addition, infected cows can be a source of infection to other animals in the herd. For every clinical case of mastitis, there will be 15 to 40 sub clinical cases (Schroeder, 2010).

2.6. Diagnosis

An effective control of bovine mastitis requires identification of prevalent problem in the herd. Methods most commonly employed for diagnosis of mastitis are screening tests and bacteriological examination of milk. Besides these, physical examination is also employed for the diagnosis of clinical mastitis (Radostits *et al*., 1994, Radostits *et al*., 2007).

2.6.1. Physical examination

This involves close clinical examination of the mammary gland for any signs of inflammation, the milk for its color, viscosity and the cow for any signs of systemic disturbance. This can be done through visual examination of the milk and mammary gland and or palpation of the mammary gland (Radostits, 2001).

2.6.2. California mastitis test

The California Mastitis Test (CMT, also known as the California Milk Test) is a simple indicator of the Somatic Cell Count (SCC) of milk. It works by using a reagent, which disrupts the cell membrane of somatic cells present in the milk sample; the DNA in those cells to reacting with the test reagent. It is a simple but very useful technique for detecting subclinical mastitis on-farm, providing an immediate result and can be used by any member of farm staff. A four-well plastic paddle is used, one well being used for each quarter of the cow to be tested. The foremilk is discarded, and then a little milk drawn into each well. An equal volume of test reagent is added and then the sample is gently agitated (Azmi *et al*., 2008).

The infection level is measured by a CMT reactive agent on a scale of zero to three (zero= negative or trace; one= weak positive; two= positive reaction; three= strong positive). In a negative sample (score of zero), the mixture of milk and reagent remains liquid and produces no precipitate. As the score increases the degree of precipitation increases, and when the CMT score reaches three, a distinct gel with central peak is formed. The advantage of the CMT over individual cow cell count results is that it assesses the level of infection of individual quarters rather than providing an overall udder result (Babaei *et al*., 2007). Production losses from CMT score three values may be 25-50% (Tariku *et al*., 2011).

2.6.3. Bacteriological diagnosis

Colonial Characteristics: *Staphylococcus aureus* is round, shine, golden yellow colony surrounded by a zone of double- haemolysis on blood agar and change from pink to yellow (phenol red) on mannitol salt agar (Quinn *et al*., 1994). Pathogenic strain of *Streptococcus* has thick capsules and produce mucoid colonies. *Klebsiella*, *Enterobacter* and some strain of *E.coli* have very mucoid colony. *Coryn bacterium* is a lipophylic bacterium, which produces small, white, non-haemolytic colonies in a wall of plate inoculated with bovine milk sample (Quinn *et al*., 2002).

Biochemical tests: *Staphylococci* are spherical gram-positive bacteria that divided in several planets to form irregular cluster (Hirsh and Zee, 1999). They are facultative anaerobic, catalase positive, oxidative and non-motile (Quinn *et al*., 1994). Most *Streptococci* are facultative anaerobic, catalase-nagative, non-spore forming and non-motile (Gyles *et al*., 2004). They are fastidious bacteria and require addition of blood or serum to culture media (Quinn *et al*., 2002). Member of *corynbacterium* are short, club-shaped, and gram-positive rods (Gyles *et al*., 2004). Most of them are catalase-positive, oxidase-negative, non-spore forming, non-motile and facultative anaerobic (Quinn *et al*., 2002).

2.6.4. PH test

The rise in milk pH, due to mastitis, is detected using bromothymol blue. It is user friendly, cost effective and rapid. It is not as sensitive as other tests. The pH of milk, normally around 6.6, can increase to 6.8 or 6.9 in mastitic cows (Sharma *et al*., 2010).

2.6.5. Strip cup test

The second most frequently used test is the strip test, which involves stripping the first few streams of milk onto a strip plate or onto the floor in milking parlors. Mastitic milk will show discoloration, clots, or other abnormalities. Milk should never be stripped directly into the hands, nor should it be stripped onto the floor of a stanchion barn where the cows lie at the same place they are milked, as this procedure will aid in the spread of mastitis organisms to other cows or the other quarters (Thirapatsakun, 1999).

2.7. Public health significance

Besides mastitis render milk unsuitable for human consumption, it provides a mechanism for the spread of many diseases to humans (Radostitis *et al*., 1994).

Table 2: Important human disease causing organisms that can found in milk

No.	Pathogenic micro organisms	Their effect and disease condition in humans
1	*Mycobacterium bovis* and tuberculosis	Tuberculosis
2	*Brucella* species	Undulant or Malta or Mediterranean fever
3	*Salmonella* species	Salmonellosis
4	*E. coli*	Toxigenic micro organisms
5	*Staphylococcus aureus*	Intoxication
6	*Streptococcus pyogens*	Otitis media, septicemia
7	*Corynbacterium haemolyticum*	Pharyngitis, cervical adenitis

Source: (Singh and Sing, 1994).

Milk and milk products have, therefore, pose a risk to consumers if it is contaminated by any pathogens and subjected to temperature abuse, where these organisms can multiply to high counts and may produce toxins (Singh and Sing, 1994). *Streptococcus agalactia* is the leading cause of human neonatal sepsis, pneumonia and meningitis and is a major cause of bovine mastitis (schukken *et al*., 2004).

Another public health concern regarding mastitis is antibiotic residues in milk. Residues in food can initiate severe reactions in people allergic to antibiotics and at low levels, can cause sensitization of normal individuals and development of antibiotic resistant strains of bacteria. Compliance with the recommended withholding time helps minimize the risk of antibiotic residues in milk and meat, which is the producers' responsibility (Smith, 2009).

2.8. Treatment

All clinical mastitis episodes accompanied by an abnormal gland or systemic signs of illness should be treated with antimicrobial agents given by intra mammary infusion and or parenterally. The degree of response to treatment depends on the type of causative agents, the speed with which the treatment is commenced, proper antimicrobial selection and decision to react a particular cause systematically by a parentral injection or locally by intra mammary infusion or both (Singh, 2006).

2.8.1. Intra mammary antimicrobial therapy

For reasons of convenience and efficiency, antimicrobial udder infections are in common use for the treatment of mastitis in lactating cows and dry cow therapy. Disposable tubes containing suitable antimicrobials in a water-soluble ointment base are ideal for dispensing and for the treatment of individual cows. Strict hygiene is necessary to avoid the introduction of bacteria, yeasts and fungi in to the treated quarters. The use of short canula that just penetrates the external sphincter is preferred as it is less likely to introduce bacteria (Radostits *et al*., 2007).

2.8.2. Parenteral antimicrobial therapy

This should be considered in all cases of mastitis in which there is an abnormal cow (fever, decreased appetite or in appetence). The recommended doses per Kg body weight are 16,500 units of penicillin (Singh, 2006).

2.8.3. Supportive therapy

Supportive treatment including the intra venous administration of large quantities of isotonic crystalloid fluids is indicated in cattle with severe systemic illness (Radostits *et al*., 2007).

2.8.4. Dry cow therapy

Dry cow therapy is the use of intra mammary anti microbial therapy immediately after the last milking of lactation and is an important component of effective mastitis control program. Intra mammary infections at drying off decrease the number of existing infections and prevent new infections during the early weeks of dry period (Radostits *et al*., 2007).

2.9. Control and prevention

Control of mastitis requires understanding of its causes and of management techniques, which limit the spread of infection. Mastitis control program must be designed towards correcting mastitis problem associated with three epidemiological factors; the host, agent and environment (Radostits *et al*., 2007). The specific components of a mastitis control program must be devised to fulfill the three basic principles, which are to eliminate existing infections, prevent new infections and monitor udder health. Anti microbial therapy during dry period is the best method to eliminate existing infection. Better feeding strategies, bedding and housing management, good nutritional management, keep milking order and udder hygiene, proper milking methods, proper installation, function and maintenance of milking equipments, dry cow management and therapy, appropriate therapy of mastitis during lactation, culling of chronically infected cows, good record keeping and periodic review of the udder are the main strategies to control mastitis. A good milking routine is vital for prevention. This usually consists of applying a pre-milking teat dip or spray, such as an iodine spray, and wiping teats dry prior to milking. The milking machine is then applied. After milking, the teats can be cleaned again to remove any growth medium for bacteria. A post-milking product such as iodine-propylene glycol dip is used as a disinfectant and a barrier between the open teat and the bacteria in the air. Mastitis can occur after milking because the teat holes close after 15 minutes if the animal sits in a dirty place with dung and urine (Tyler and Ensminger, 2006; Flavey and Chantalkhana, 1999).

Table 3: Comprehensive mastitis control

Management task	Specific actions
Milking hygiene	Milk teats that are both clean and dry
Milking machines	Stable milking vacuum, no slipping or squawking of liners shutting off vacuum before removing
Post-milking teat dipping	Immediately after removing cups full teat immersion not spraying
Drying off	All quarters of all cows after last milking
Treatment of clinical cases	Early detection and treatment and maintain records
Culling	Cull chronic cases
Environment	Clean, dry, un crowded and well ventilated
Herd replacements	Test new animals before adding to herd and check new animals regularly

Source: (Thirapasakum, 1999).

3. Economic Importance

Since mastitis occurs in all species of animals, it assumes major economic importance in dairy cattle and may be one of the most costly diseases in dairy herds. Mastitis results in economic loss for producers by increasing the cost of production and by decreasing productivity. The premature culling of potentially profitable cows because of chronic mastitis is also a significant loss. The components on economic loss can be divided into; loss of milk production, discarded milk from cows with clinical mastitis and treated cows, replacement of culled cows, extra labor required for treatment and monitoring, veterinary service for treatment and control and cost of control measures (Radostits *et al.,* 2000). Economic loss to mastitis in the United States is estimated to be approximately $ 185/cow annually. If we assume the same milk price and their value is multiplied by a total number of milking cows (9.5 million head), the annual cost of mastitis is about $ 1.8 billion. The average production loss per lactation for one infected quarter is about 1,600 pounds (Schroeder, 2010). The economic loss from mastitis in the urban and peri urban area of Addis Ababa are USD 58 and 78.65 per cow per lactation respectively (Mungube *et al*., 2005 and Tesfaye *et al*., 2010).

Losses due to mastitis are commonly divided into those associated with sub-clinical and clinical mastitis and their effects are reflected on milk production, composition and quality. The magnitude of these changes in individual cows varies with severity and duration of infection and the causative microorganism that cause mastitis (Radostits *et al*., 2000).

3.1. Effects on milk production

Most estimates have shown a 30% reduction in productivity per affected quarter and a 15% reduction per cow per lactation. Making the disease one of the most costly and serious problems affecting the dairy industry worldwide (Sori *et al*., 2005). In individual cows, the loss of production associated with *Streptococcus agalactia* mastitis is about 25% during the infected lactation and in affected herds, the loss may be the order of 10-15% of the potential production. About 75% of the economic loss from sub- clinical mastitis is attributable to loss of milk production (Radostits *et al*., 2007). Mungube (2001) estimated the economic losses from mastitis in the peri-urban areas of Addis Ababa; losses due to mastitis (milk production loss, treatment cost, withdrawal losses and culling losses) were estimated to 210.8 ETB/cow/lactation from which milk production loss contributed to 38.4%.

3.2. Effects on milk composition

The lactose and fat contents in milk are decreased with an increase in SCC because of a reduced ability of mammary gland to produce these components. Although there may be little changes in the total protein content because of sub-clinical mastitis, there are marked and significant changes in the type of protein present. The major milk protein is casein, which has high nutritional quality and is very important in cheese manufacturing but casein content of milk with a high SCC is reduced (Schroeder, 2010).

Sodium and chloride increase in high SCC milk due to increase passage of these minerals from blood in to milk. Potassium normally the predominant minerals in milk, decline due to its passage out of milk to lymph between damaged secretory cells. Calcium level in the milk that is associated with casein is reduced. Other important compositional changes include increase in enzymes originating from damaged mammary tissue. Many of these enzymes have negative impact on milk quality; for example, an increase in enzyme lipase can raise the content of free fatty acids which intern produces off-flavor in the milk (Schroeder, 2010).

3.3. Effects on milk quality

Good quality milk production is one of the main objectives in dairy farming because milk of good quality is desirable to the processors and acceptable by the consumer. Mastitis not only reduces dairy producer profits but also results in important and costly losses to processors due to poor quality milk (Thirapasakum, 1999).

3.4. Discarded milk

Economic damage due to discarded milk is comparable with that from decreased milk production. However, there is one difference: the discarded milk is actually produced by the cows, which means that feeding costs for that amount of milk have to be taken into account in the calculations. The economic damage of 100 kg of discarded milk is therefore larger than for 100 kg of decreased production (Halassa *et al*., 2007).

Conclusion And Recommondations

Mastitis is the most important factor that contributes for reduced milk production and increased losses in dairy farm in different expenses, which will be in charged for treatment cost, labor, veterinary and other costs that could affect the profitability of the dairy farm business and has public health importance. The economy of the country would also be affected just by interference of the flow rate of export product for the country itself. So it is recognized as one of the costliest diseases that happen worldwide.

Based up on the above conclusion, the following recommendations are forwarded.

- ❖ Hygiene of the house should be kept well.
- ❖ Regular screening for early detection and treatment and follow up of chronic cases should be practiced.
- ❖ If it is possible, the treatment should be based on isolation of causative agent and antimicrobial sensitivity test.
- ❖ Culling of chronically infected cows should be practiced.

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