

# DETECTION OF MASTITIS LEVEL IN THE CATTLE: A REVIEW

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**Abstract**—Mastitis is found to be the most common disease in the cattle's in last few decades. It usually happens due to the infections in the udder by the pathogens that produces disease in the udder. Pathogen invades the mammary glands usually caused by bacterial infection of udder tissues. It causes significant harm to the cattleman thereby decreasing the milk production and its quality, which is usually determined by the measurement of somatic cell counts per million of milk. Milk itself is a complete food; it contains all the essential nutrition's for the humans. If the cow has mastitis in one or more udders, its milk cannot be drunk. In India, milking is one of most adopted method of earning for the illiterate and many of them are not aware about the disease that is a threat. In this paper an exhaustive literature survey has been done for study of methods which are used for determination of mastitis level by the dairy owners. Three different regions of punjab namely Bathlana, Mansa, Badmajra were selected for determination of mastitis. It was observed that cows yields more milk than buffaloes. Herd condition is determined on the scale of best, average, bad for three different regions as Bathlana (27%, 18%, 18%), Mansa (46%, 15%, 8%), and Badmajra(25%, 13%, 12%) respectively [1]. Hence there is a scope of developing a device which can be used for determination of mastitis by small scale dairy owners.

**Keywords**—Mastitis, Contagious Mastitis, Electrical Conductivity, Subclinical Mastitis, Clinical Mastitis.

## I. INTRODUCTION

Mastitis is of great concern from last few decades, as it is one of the costliest diseases found in the dairy cattle [1]. It leads to the inflammation of intra mammary glands and udder tissues that results in the loss of milk production and increase production cost [2,17]. If the cow has mastitis in one or more udders, its milk cannot be drunk. As the udder of the cattle are infected the milk produced from these cattle will not be consumed by the humans because that is not safe for human consumption. This should be detected at early stage, to protect the cattle from the disease, as it has a declining impact on the cattle health as well as on the milk quality. The testing methods for mastitis are Somatic Cell Count (SCC), California Mastitis Test (CMT), and Electrical Conductivity (EC) which are not in the range of the small scale dairy owners. Mastitis is a complex disease, increases veterinary expenses as the health of the cattle is infected, and it does not have any simple solution for its control.

## II. LITERATURE REVIEW

The researchers have studied and developed many concepts and techniques for detection of mastitis, these are illustrated as below:

Mandheer Kaur (2016) Focussed on the variations in the sub-clinical and clinical mastitis in cows and buffaloes. Presented the results of various tests performed on number of cattle of Bathlana, Mansa, Badmajra[1].

Francisco J. Ferrero (2000) Focussed on current methodologies for identification of mastitis pathogens and for detection of inflammation. These detection systems are required as in case of sub-clinical mastitis because the symptoms are not visible, most methods are based on the somatic cell count (SCC) and California mastitis test (CMT) [2].

Chen Ming-Chih (2014) Developed the design of information system for detecting mastitis level in dairy cattle and managing their milk processes. The system protects the humans from consuming the contaminated milk as it prevents from milking infected cows (mastitis suffered cows). The proposed system can easily search out the infected cows at early stage and with the help of the database the data can be stored and managed. Hence the farmer will be aware about the health status of cattle. This improves the efficiency of milk production [3].

Galfi.A (2015) Proposed that electrical conductivity of the milk is used for checking the mastitis level in the cows from last four decades. The intra-mammary infections in the milk changes its composition and increase its electrical conductivity. Cows with mastitis may not always have increased electrical conductivity (EC) of milk from infected quarters. This method tells us the information about the health of the udder [4].

Romero.G (2014) Aimed at checking and comparing the detectability of the goat mastitis using different algorithms to improve the potential of the goat. The test was conducted with all the animals with intramammary glands. The algorithms were based on the basis of the individual conductivity level on the daily basis [5].

Pamela L. Ruegg (2002) Proposed different testing methods for milk quality, that should be done with proper guidance about different methodologies. Bulk milk bacterial counts, bulk tank somatic cell count tests were conducted on bulk samples of milk and cattle. For Sub-clinical mastitis detection CMT is the most accurate method [6].

Shoof International PYT LTD presented a shoof fact sheet that has different testers for mastitis. The sheet includes CMT, pH papers test, SCC and found that CMT is the best test for mastitis detection [7].

Samson Terefe (2018) Presented that considerable amounts of bacterias results in contamination of mammary glands. It was found that the cows with advanced age groups are highly prone to infection, and the prevalence rate of sub-clinical mastitis was higher than the clinical mastitis [8].

Daniella Flauia Vilas Boas (2017) Focussed on the quality of the milk by the different mastitis test on the basis of electrical conductivity and somatic cell count. Provides a correlation between EC (Electrical Conductivity) and SCS (somatic cell score), and concluded that electrical conductivity is a simple, rapid and inexpensive method for measurement of mastitis [9].

Carla M. Duarte (2015) Focussed on current methodologies for identification of mastitis pathogens and for detection of inflammation, as well as the advantages and disadvantages of different methods. Emerging technologies, such as transcriptome and proteome analyses and nano-and micro-fabrication of portable devices, offer promising, sensitive methods for advanced detection of mastitis pathogens and biomarkers of inflammation [10].

Francesca Gabriele (2014) Focussed on the risk factors that are caused by mastitis. It was estimated that cows are prone to the disease than buffaloes in small scale dairy production systems [11].

Stephen P. Oliver (2012) Focusses on the poor quality of the milk that results in declining the milk production. The main cause of declining production rate was mastitis, as the cattle with mastitis, has increased number of somatic cell counts (SCC) above threshold range which is not suitable [12].

Jurjen Draaiyer (2009) Provides information on simple and cost-effective sampling, testing in developing countries. The main objective was to increase income from milk producers and small –scale entrepreneurs [13].

Caria Maria (2016) Presented electrical conductivity of the milk for the sub clinical mastitis. The milk is tested by the means of the probe that are integrated in the milk. In this approach not only mastitis is detected but there is a deep knowledge about the electrical conductivity and the milk of the sarda sheep. It measures the somatic cell count (SCC) of sarda sheep milk, as in milking process SCC is a pure indication about the purity of the milk. The quality of the milk is dependent on the number of SCC [14].

### III. TYPES OF MASTITIS

#### Contagious Mastitis

In contagious mastitis the bacteria causing this mastitis is present on the udder of the cow. The main bacteria for causing contagious mastitis is streptococcus agalactiae, mycoplasma. It is also called as cow-to cow mastitis, as the infection can be caused from one cow to another by using the same sponge that has been used to clean the teats of different cows.

#### Clinical Mastitis (CM)

The cow as well as the milk of the cow show visible signs like the cow will suffer pain in the udder as the udder may get swelled and even the color of the milk may change, the milk will have clots, color changes, and fibrin in it. It varies from 1-10% in cattle which is less comparatively to the other type of mastitis as it has visible signs it can be detected at early stage and the health of the cow will not be affected more [1,17]. While on the other hand we have sub-clinical mastitis that does not have the visible signs and therefore it is a major concern for the dairy owners. The milk composition is changed by these udder infections and this increases the conductivity of the milk. Clinical mastitis shows the presence of pathogenic bacteria in the milk composition ordinarily.

#### Subclinical Mastitis (SCM)

Subclinical mastitis is the form of mastitis in which the udder and the milk of the cow both appears normal, neither the cattle nor the milk of the cattle shows the visible signs that is why sub-clinical mastitis is a major concern from last decades [1]. The health of the milk can be detected by the SCC (Somatic Cell Count) in milk, as it is an indicator for udder health problems. A healthy cow should have <200.00 somatic cell counts (SCC), and samples having (SCC) >200.00 are infected with mastitis. As it does not have visible signs and therefore it is of major concern for the dairy owners because the udder of the cattle looks normal and the milk also looks normal [10,17]. In this mastitis can be detected by SCC (Somatic Cell Count) and CMT (California Mastitis Test) which is not in the range of small dairy holders. It varies from 10% - 50% in cows and 5% -20% in buffaloes in India [1]. The dairy holders without knowing the health conditions of their cattle continues the milking process because there is no visible sign, this may even cause the loss of the cattle if it is not detected.

#### Environmental Mastitis (EM)

In this mastitis the intra-mammary infections are mainly present in the environment in which the cow lives. In this disease is caused if the habitat of the cattle is not clean, the cattle do not have proper bedding these problems leads to mastitis. In this case the bacteria is present in the environment of cow. The main bacterias responsible for this kind of mastitis are Streptococci, S.agalactiae, and E.coli. It comes from the bedding, soil, manure, wet clothes, and uncleanliness. It can be controlled by proper cleanliness of cows and their surroundings [11,17]. The cows get infected when same cloth is used for cleaning the teats of different cows, and even if they are not cleaned with a dry cloth. If the teat of the cow is injured then the udder is more prone to the infections, as it leads the pathogens to directly enter the udder through the injured teat. Moisture and mud is the major component for environmental mastitis.

### IV. OCCURANCE OF MASTITIS

There are different ways by which mastitis can occur, it may depend on different seasons, in India cattle are more prone to mastitis in the monsoon season as compared to summer and winters. As the occurrence is due to the pathogens and these

pathogens depends on the specific value of temperature and humidity which multiplies the bacteria's in large numbers with in their specific range. It is estimated that during summers with the rise in temperature, the stress level in the animals increases and results in the reduction in their immune system [11].

Milking methods is also responsible for udder infection if milking is not done with proper method. The different methods of milking cows are stripping, knuckling, full hand method, and machine milking, if these methods are not properly performed they can harm the cattle, as they cause infections that lead to mastitis. The mechanical method of milking with vacuum pressures has a great impact in sub-clinical mastitis. Fast milking method or such faulty methods lead to the infections [11].

## V. TESTING FOR MASTITIS

As mastitis has become the most dangerous disease from last few decades, because of its declining rate in profitability, milking, many different methods are considered for testing the disease at an early stage to prevent from great losses in the future. The methods for testing are based on the milk samples of the cattle. These methods are:-

### Electrical conductivity (EC)

Electrical conductivity of milk is a parameter usually used for identifying early sub-clinical mastitis and clinical mastitis in dairy cattle [5]. Measurement of electrical conductivity is a useful tool for monitoring somatic cell counts individually. EC is used to detect health status and detection of infected intramammary glands [14].



Figure: 1 The prototype of the portable device for measuring conductivity in milk.

### Somatic Cell Count (SCC)

It is basically counting the cell counts of the somatic cells present usually in the milk. It is an indicator for checking the quality of the milk. White blood cells (WBC) (leukocytes) contain the majority of the somatic cells [17]. The cow with mastitis will have an increased number of SCC [14], this

increased number of somatic cells is due to the pathogenic bacteria like staphylococcus aureus [17].

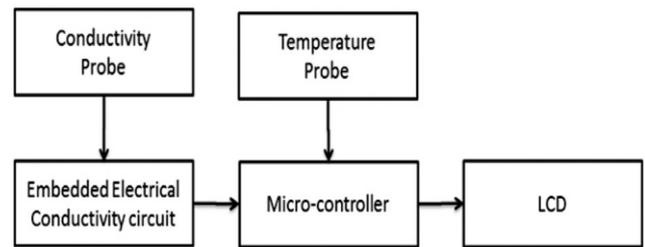


Figure: 2 Block diagram for estimating the SCC in milk.

### CMT (California Mastitis Test)

CMT is also referred as RMT (Rapid Mastitis Test) as it is simple and quick test for indicating the somatic cell counts in the milk from milk samples reliably. For the test four-well plastic peddle is used one for each quarter, in which each peddle contains a mixture of milk and CMT reagent. DNA is released from the cells and merges to form a stringy, gel mass. As the number of cells increase in the milk, the amount of gel formed increases. [7].

### PH Test (pH)

pH test papers were used as mastitis detection over many years. It is quick and reliable mastitis detection test, as it is user friendly and cost effective method. It was no longer in use because it comes in a re-sealable pack of 25 papers and while testing if the drop of infected milk drops at the ph paper it will change the color of paper and it will be destroyed [7].



Figure: 3 Mastitis test Papers

## VI. RISK FACTORS

There are many factors that can risk the life of cattle such as their environment, food, body immunity, age, bedding etc, [11].

- Mastitis is more prevalent in cows than buffaloes.
- Pendulous quarters of cows appear to be more prone to mammary infections.
- Long teats increase the risk of accidents.

## VII. CONCLUSION

Mastitis is the major primeval disease of the dairy cattle and it leads to inflammation of the mammary gland and udder tissue. In mastitis as the udder of the cattle are affected, symptoms of infected udder are swelling, heat, redness, hardness, or pain (pain is also the case of severe mastitis i.e clinical mastitis). The milk quality, its production, and farm economics are affected negatively by mastitis. Three different regions of punjab (Bathlana, Mansa, Badmajra) studied the current status of mastitis on the basis of the techniques used to determine the mastitis in the cattle [1]. From literature review it is observed that there are number of techniques for measurement of mastitis level measurement available for milk industries, as well as big dairy farms, so there is a need of developing a low cost device that detects mastitis level for small-scale dairy farms.

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