Correlations among the Number of Somatic Cells and Lactose Content in Bovine Milk

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Abstract
Bovine mastitis, defined as the inflammation of the mammary gland, is the most important diseases of the mammary gland in cows due to the considerable losses in milk production and the danger that milk from ill cows poses to public health. The number of somatic cells in milk is the most important indicator used for directly evaluating the condition of the mammary gland and the quality of the milk. The development of inflammatory disease in the mammary gland is indicated by somatic cell counts above 200 000 cells per millilitre. Differences in the composition of milk, such as its lactose content, are related to variations in the number of somatic cells. The present paper summarizes the current knowledge regarding the correlations between lactose content and milk somatic cell count, and the potential of this parameters as a biomarker for assessing udder health status in modern dairy cow health prevention programs.

Keywords: bovine, lactose, somatic cell count, subclinical mastitis.

1. Introduction

One of the most common bovine illnesses that harm the dairy sector the most is bovine subclinical mastitis, which has a high incidence worldwide.
In dairy cattle herds, the frequency of subclinical mastitis is influenced by the systems used for indoor versus outdoor housing, herd management, the quantity and variety of udder infections, and herd management practices [1].
However, germs like Staphylococcus aureus, Streptococcus agalactiae, and coliform bacteria like Escherichia coli are the most frequent causes of subclinical mastitis [2]. Bovine mastitis can be split into two main categories: clinical and subclinical, depending on how it manifests. The udder changes and milk that is clearly abnormal are symptoms of clinical mastitis.
Subclinical mastitis, in contrast to the clinical type, has no outward symptoms and can only be identified through a cow's individual somatic cell count or a microbiological culture examination. Milk output declines to vary degrees in both situations. Mastitis has a detrimental effect on milk quality, which has a negative impact on milk processing later [1,3,4].
Although somatic cells are not the sole or the most reliable indicator of udder inflammation, somatic cell count (SCC) in milk is strongly connected with udder diseases. Any udder issues manifest in a variety of udder function and structure changes, which also affect the content of the milk. Almost all milk constituents are altered in cows with mastitis.
As a result, information on milk composition, whether alone or in combination with other information, is frequently used to estimate the general health of animals, as well as to identify

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subclinical mastitis, improper feeding practices, and the causes of metabolic disorders, while also providing breeders with information on management and economic issues [5].

An increase in somatic cells has been seen to be connected with a decrease in milk lactose percentage due to alterations in the mammary gland homeostasis during mastitis infection. The quantity and variety of udder infections, as well as the herd management and housing systems, all affect the occurrence of subclinical mastitis in dairy cattle herds. According to [6], a rise in somatic cell count is connected with a drop in lactose (from 4.86% to 4.69%).

The main bovine milk solid is lactose, a disaccharide sugar comprised of molecules of glucose and galactose that account for about 40% of the total solids and 50% of the fat-free solids. The synthesis and concentration of lactose in milk are significantly influenced by udder health, the cow's energy balance, and metabolism [7].

The study's central idea is that the biomarker for subclinical mastitis may be lactose in milk from dairy cows.

2. Materials and methods

***Materials*:** cow milk, sterile containers, plates, Decon solution, Triton solution, staining solution, CMT reagent.

Methods: Identifying mastitis-affected cows

The AfiMilk application, the world's most cutting-edge dairy farm management software, was used to track the dynamic behaviour of cows. Every time the milk quantity and conductivity change, the software sends notifications based on the designed algorithm.

Collection of milk samples

Afimilk identified a herd of 60 dairy cows as having high electrical conductivity, and samples were taken from them in both the cold and warm seasons. The number of somatic cells present in each instance, and the physico-chemical characteristics considered in the analysis of the samples.

The first quick on-site analysis was performed by the veterinarian with the California Mastitis Test (CMT) and then the number of somatic cells was identified with the CombiScope analyser (Figure 1).

Evaluation of the total somatic cell count

The California mastitis test, which measures the somatic cell count in a milk sample, is the most popular screening test for mastitis diagnosis.

The samples are mixed with the CMT reagent, which causes somatic cells to be lysed and releases DNA that solidifies into a gel. assessment of the CMT test results is made based on the reaction's level of intensity [8].

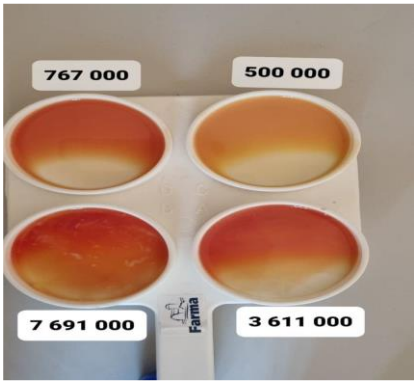

Figure 1. Milk samples identified with an increased number of somatic cells

Analysing the physico-chemical parameters of milk

The physico-chemical parameters (fat, dry matter, protein, lactose, and casein) and somatic cell count (SCC) were determined using the automated analyser FTIR CombiScope 600/300 (LactoScope FTIR 600/300 and SomaScope LFC 600/300). This method can reduce analysis time (200 milk samples per hour), costs, and reagent consumption [8].

Figure 3. Automated analyser - FTIR CombiScope

3. Results and discussion

Numerous cellular and structural systems in the mammary gland aid in preventing the invasion and colonization of the gland by pathogens [9]. Prior to, during, and following periods of lactation, pathogens typically enter the quarter through the teat canal. A keratin plug made of the stratified squamous epithelial lining of the duct seals the teat canal during dry periods and in between

milkings. Invading germs are effectively blocked by this physical and microbicidal barrier.
However, injury to the plug may either temporarily or permanently increase the teat canal's susceptibility to penetration, raising the risk of mammary infections. Once there is a bacterial illness milk leukocytes in rapidly increases [10]. For dairy farmers, lactose and somatic cell scores are economically valuable. The energy output from cows is significantly influenced by milk lactose %, and somatic cell score serves as both a mastitis predictor and a gauge of infection response. These parameters can be changed through genetic or dietary selection, which could increase breeding effectiveness.
Lactose in milk from healthy cows is around 4.8 %, and lactose in mastitic milk is between 1% and 4.5%. Lactose content and somatic cell count in cow's milk samples were evaluated the of relationship between the two parameters were established (Figure 4). Lactose may be a possible cow health indicator. According to Costa and collaborators' effectuated research [11-16], cows with a lactose level of 4.553% experienced a higher rate of health impairment than cows with a lactose content of 5.045% [1].
The researchers also discovered that subclinical mastitis and milk lactose have a genetic correlation and that more productive cows had a higher genetic susceptibility to mastitis than less productive cows. The presence of agents causing bovine subclinical mastitis was directly correlated with increases in somatic cell count and decreases in lactose content.
These results imply that changes in lactose content may be monitored as a diagnostic technique in the management of subclinical mastitis in cows.

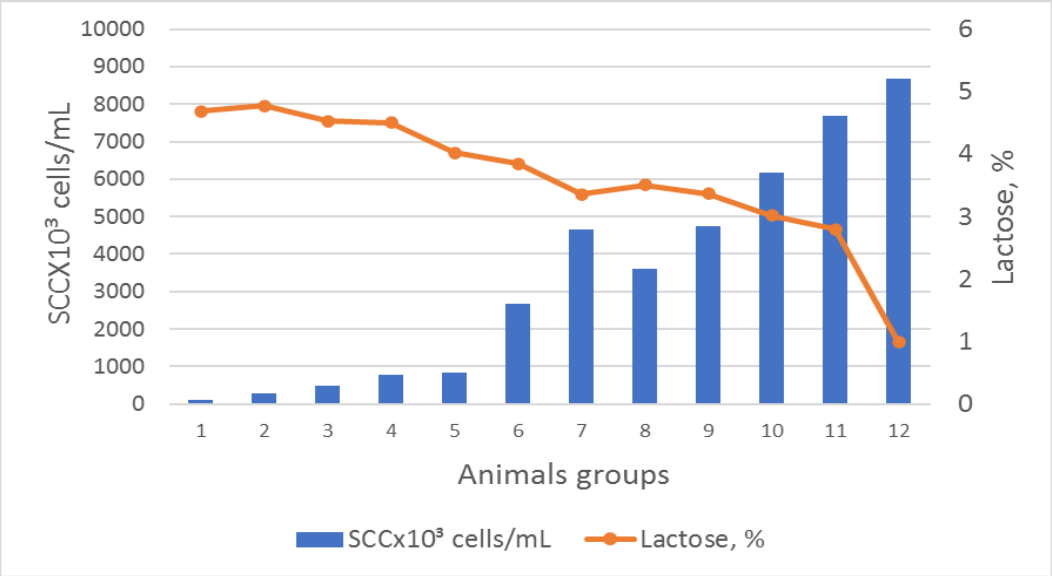

Figure 4. Relationship between Milk Lactose and Somatic Cell Count in Cow's Milk

4. Conclusions

Results highlight the significance of lactose as a possible biomarker for mastitis in cattle. This indicator may be used in controlled herds to support efforts to avoid subclinical mastitis by providing additional data on cows with possible udder inflammation.
Registered lower levels of milk lactose can be used for early identification of metabolic disorders.
This indication could support data on suspected udder inflammation in cows in contemporary subclinical mastitis prevention programs in managed herds.

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