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Detection of bubaline mastitis using milk pH test

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Abstract

Udder health is the most crucial factor for dairy industry as healthy udder produce good quality milk with enhanced milk production. Mastitis is one of the costliest diseases affecting udder health leading to reduced milk yield and high treatment costs. Mastitis in buffaloes occurs due to various infections. Mastitic milk has high pH due to leakage of blood bicarbonate into milk following damage to mammary epithelium. Lactose is the main determinant for pH and is the most important osmotic component of milk. The current investigation was conducted to detect bubaline mastitis using milk pH technique. Forty five milk samples of buffaloes were collected from the university dairy farm. The results for pH was determined as low as 6.62 and as high as 7.18. The fluctuation in pH might be attributed to leakage of blood bicarbonate into milk following damage to mammary epithelium. 60% milk samples showed pH values within average range and considered negative for mastitis with mean of 6.62, while 40% milk samples were found with high pH values than average range. The mean pH value for subclinical mastitis is 6.85 and 7.16 for clinical mastitis. This proposed the presence of blood bicarbonate into milk as an indication of mastitis in buffaloes. This result concludes that milk pH can be effectively used to detect bubaline mastitis.

Keywords: Bubaline, udder, mastitis, pH

Introduction

Mastitis is the inflammation of parenchymal cells of mammary gland. Bubaline mastitis is less common as compared to cattle. Mastitis mainly occur in two forms: subclinical and clinical (Cantekin *et al.*, 2019) [4]. Several risk factors are associated with bubaline mastitis *viz.* farm and milk management, age, breed, season, parity number, lactation stage, hygiene, milking pattern and teat end morphology (Salvador *et al.*, 2012) [12].

Mastitis is caused by diverse pathogens including bacteria, fungi, virus and others (Dalanezi *et al.*, 2020) [6]. Among the microbes, *Coagulase-negative staphylococci*, *Staphylococcus aureus*, *Streptococcus sp.* and *Escherichia coli* are the most prevalent bacteria in bubaline mastitis (Amin *et al.*, 2023) [2].

Milk pH is an indirect screening test to detect subclinical mastitis in dairy buffaloes (Constable *et al.*, 2019) [5]. pH test measures pH of milk samples. Mastitis produces alkaline milk during late lactation and dry period which can be detected using this test (Lal *et al.* 2022) [11].

The calcium and phosphorus contents in dairy buffaloes are higher as compared to cows (Spanghero and Susmel, 1996) [14] and hence, the pH of normal buffalo milk is 6.81 (6.6-6.9) which is somewhat higher than normal cow milk *i.e.* 6.76 (Ahmad *et al.* 2008) [1]. This pH indicates slightly acidic nature of buffalo milk which is due to the presence of citrates, phosphates, proteins and carbon dioxide.

Milk pH can be measured by digital pH-meter (Khodke *et al.*, 2009) [10] as well as by impregnated pH-strips (Davis, 1999) [7].

Bilal *et al.* (2005) [3] used milk pH and specific gravity to assess the severity of mastitis on buffalo milk. Measurement of milk pH and specific gravity was done by using pH meter and lactometer. They recorded decrement in specific gravity and increment in milk pH as the severity of mastitis increased. In his study, 66.67% buffaloes were found positive for subclinical mastitis.

On the other hand, Kandeel *et al.* (2019) [9] reported that milk pH does not provide a clinically useful cow-side screening method for detecting mastitis, primarily because milk pH has a relatively wide range of values, even in uninfected quarters. However, the clinical utility of milk pH can be improved by combining pH test with other diagnostic test like CMT, Electrical Conductivity (EC), Total Somatic Cell Count (TSCC) to detect infected quarters.

So, keeping these facts in mind, the current study was conducted to detect bubaline mastitis using milk pH technique on dairy buffaloes.

Materials and Methods

Sample collection

A total of 45 fresh buffalo milk samples were collected from Instructional Dairy Farm at Nagla, Pantnagar. The samples were processed at the laboratory of Department of Veterinary Medicine for further investigation.

The pH value measures true milk acidity. The pH value is reduced by the development of acidity. The milk pH becomes alkaline if the animal is suffering from mastitis. In the present study, the milk pH was determined immediately using pHep® Pocket –sized pH Meter from Hanna® instruments.

Procedure

For determination of milk pH, the pH meter was calibrated at pH 7 with buffer before taking the pH of milk samples. The protective cap of the instrument was removed. The meter was turned “ON” sliding the switch on top. It was immersed into the milk upto the maximum immersion level. It was stirred gently and the reading was allowed to stabilize. After use, the electrodes were rinsed with water to minimize contamination. The electrode was stored in protective cap with a few drops of storage solution.



Fig 1 & 2: Milk samples showing milk pH with digital pH meter

Results and Discussion

The results for the analyzed 45 raw milk samples of lactating buffaloes were shown in Table 1 with ranges of milk pH values. According to these results, the milk samples were classified as healthy, subclinical mastitic and clinical mastitic milk. On the basis of analyzed results, 60% milk samples (30 in number) had pH values less than 6.75 and considered as

healthy whereas, 40% milk samples (15 in number) had pH values greater than 6.75 and considered as mastitic. The minimum value of pH for healthy milk was 6.62 and maximum value was 6.79 with mean value of 6.68. The mastitic milk had minimum pH value of 6.85 and maximum of 7.18.

Table 1: Milk pH Values (range) for Healthy, Subclinical, and Clinical Mastitis

No. of Samples	Percentage of Samples	pH	Milk Status
30	60	6.39-7.08	Healthy
11	22	6.37-7.10	Subclinical Mastitis
4	8	6.41-7.20	Clinical Mastitis

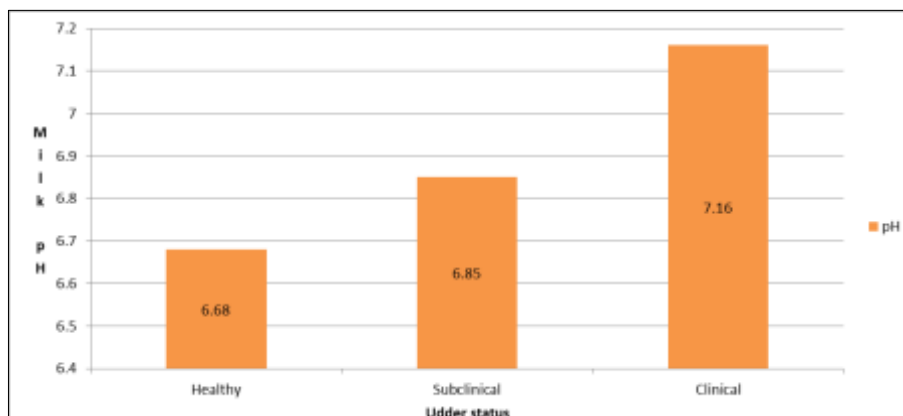


Fig 1: Comparison between mean pH values of Milk Samples

The standard range for pH of normal buffalo milk is between 6.39-7.08 and that of subclinical and clinical mastitis milk is 6.37-7.10 and 6.41-7.20 respectively, as suggested by Dhakal

and Nagahata (2018) [8]. The mean value of milk was 6.68 ±0.05 in apparently healthy buffaloes whereas, mean value of milk pH was 7.53±0.04 in sub-clinically mastitis buffaloes as

recorded by Singh *et al.* (2022) ^[13]. Rise in milk pH due to mastitis is attributed to the leakage of bicarbonate into the blood during udder damage (Subedi and Dhakal, 2002) ^[15].

Conclusion

In conclusion, measurement of milk pH can be used to detect mastitis in buffaloes at an early stage under the field conditions. The analyzed results clearly discriminated the healthy, subclinical and clinical mastitic milk status. The pH value for healthy, subclinical and clinical mastitic milk was 6.68, 6.85 and 7.18 respectively. The effectiveness of milk pH test can be increased by combining it with other tests like CMT, EC and TSCC.

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