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Estimation of Milk Lactose and Somatic Cells for the Diagnosis of Sub-clinical Mastitis in Dairy Buffaloes

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ABSTRACT

The objective of the study was to estimate milk lactose and somatic cells in normal and sub-clinically affected dairy buffaloes under field conditions. Four hundred quarter samples from 100 healthy dairy buffaloes were subjected to Surf Field Mastitis Test (SFMT), direct microscopic somatic cell count (SCC) and milk lactose content analysis. Twenty quarters positive and negative samples for SFMT were subjected to microbiological examination. Mean milk SCC at SFMT score N (negative), T (traces), first degree positive (P1), second degree positive (P2) and third degree positive (P3) were 2.06×10^5, 3.73×10^5, 9.69×10^5, 31.97×10^5 and 121×10^5 mL^{-1} respectively. Mean milk lactose at SFMT score N, T, P1, P2 and P3 was 5.10, 4.81, 4.66, 3.92 was 2.66%, respectively. Out of twenty quarter samples with negative score of SFMT, 16 quarter samples showed no growth; whereas, gram negative cocco-bacilli were also isolated from two quarter sample and from two quarter samples mixed growth was observed. Out of twenty quarter samples with positive score of SFMT *Staphylococcus aureus* was isolated from 10 quarters samples, *Streptococcus agalactiae* from three quarters, mix growth of *S. aureus* and *S. agalactiae* from three quarter samples and from four quarter samples coagulsae negative staphylococci (CNS) were isolated.

Key Words: Sub-clinical mastits; Milk lactose; Somatic cell count; Surf field mastitis test; Buffaloes

INTRODUCTION

Mastitis is a serious disease in dairy animals causing great economic losses due to reduction in milk yield as well as lowering its nutritive value. Generally mastitis occurs in two forms i.e., clinical or overt and sub-clinical or hidden (Radostitis *et al.*, 2000). Sub-clinical mastitis is 15 - 40 times more prevalent than clinical mastitis and causes high economic losses in most dairy herds (Schultz *et al*., 1978).

One of the criteria used for determining whether milk is acceptable for processing or not (for human consumption) is the level of somatic cells and lactose contents under modern dairying. Somatic or body cells in milk are of two types, namely, sloughed epithelial cells from the udder cell population and leukocytes from the blood. The epithelial cells are present in the normal milk as result of normal breakdown and repair process, while leukocytes enter in milk from blood, being attracted by chemical substances released from injured mammary tissue. Most somatic cells are primary leukocytes, which include macrophages, lymphocytes and neutrophils. Studies identifying the cell types in milk have shown that epithelial cells range from 0 to 7% of somatic cell count (SCC) but main increase in total count occurs due to the influx of neutrophils into the milk (Miller & Paape, 1985). The level of somatic cell increases with the severity of mastitis. Lactose, the important disaccharide present in milk is formed by the mammary glands from glucose and galactose. The composition of diet or blood sugar level does not alter the lactose contents of milk. Lactose contents of milk decrease with the severity of mastitis as indicated by SCC, so an inverse relationship exists between severity of mastitis and lactose content of milk.

The detection of mastitis at an early sub-clinical phase can circumvent the therapeutic failure in mastitis. This paper describes the changes in somatic cell count and milk lactose content associated with sub-clinical mastitis. Development of a diagnostic tool based on these parameters may be helpful for early diagnosis of mastitis, which is a hallmark of a delayed therapeutic intervention.

MATERIALS AND METHODS

The study was carried out involving 400 hundred apparently mastitis free quarter milk samples from 100 healthy dairy buffaloes. Animals were selected randomly from rural, peri-urban and urban areas of Faisalabad. Quarter milk samples were subjected to Surf Field Mastitis Test (SFMT) as described by Muhammad *et al.* (1995), direct microscopic somatic cell count was carried out as described by Schalm *et al*. (1971) and milk lactose analysis was done following Lane and Eynon titration method as described by Egan *et al*. (1981). Twenty each positive and negative quarters for SFMT were subjected for microbiological examinations as described by (National Mastitis Council Inc., 1990). Procedures described by

(National Mastitis Council Inc., 1987) were followed for culturing the milk samples and for identification of mastitis pathogens.

RESULTS AND DISCUSSION

Average milk SSC and mean lactose at various scores of SFMT score N was 2.06×10^5 mL^{-1}, which increased with the presence of mastitis based on SFMT score (Table I). Barbano (1999) reported concentrations of somatic cells in normal milk in cows are always less than 100,000 cells mL^{-1} from un-infected/un-inflamed mammary quarters. Hillerton (1999) also suggested an SCC of 100,000 cells mL^{-1} for a healthy quarter. Urech *et al.* (1999) stated that milk from healthy cow has a SCC between 50,000 and 200,000 and SCC values higher than 283,000 cells mL^{-1} indicate presence of mastitis (Reneau, 1986). Silva and Silva (1994) reported that in Sri Lanka total SCC in normal buffalo milk varied from 0.5×10^5 to 3.75×10^5 mL^{-1} of milk. Mean lactose found in SFMT score N was 5.10%, which decreased with the presence of mastitis based on SFMT score. Previous studies have reported decrease in lactose concentration in the milk of cows presenting high SCC (Auldist *et al*., 1995). Hirpurkar *et al*. (1987) found that lactose levels were reduced in milk samples positive for CMT. Berning and Shook (1992) also predicted mastitis using milk lactose. Hamann and Kromker (1997) indicated that lactose concentration of milk could be used as indicator of mastitis since it clearly decreases during mastitis. Rawdat and Omaima (2000) determined reduced lactose level in buffaloes suffering from sub-clinical mastitis. Hamann (2002) proposed that lactose was one of the most useful markers of mastitis and Pyorala (2003) proposed that lactose was one of the most promising parameters for monitoring sub-clinical mastitis.

Relationship of mean SCC and mean lactose was negative between mean SCC and lactose (Fig. 1). Reichmuth (1975) showed that as SCC exceeded 150,000 the concentration of lactose decreased. Lactose content from mastitic milk of buffaloes is significantly decreased in inverse proportion to the number of leukocytes (Qureshi & Ahmad, 1980). Miller *et al*. (1983) observed negative correlation between the percentage of lactose in milk and the severity of the disease. According to Harmon (1994), the mastitis or elevated SCC is associated with a decrease in lactose, because of reduced synthetic activity in the mammary tissue. Kukovics *et al.* (1996) found a negative correlation between SCC and lactose content. Hamann and Kromker (1997) indicted that lactose concentration of milk could be used as an indictor of mastitis. Schulz *et al*. (1998) noted decreasing concentration of lactose in cow milk resulting from increased permeability of tissues between milk duct of udder and blood. Klel *et al.* (1998) demonstrated that when SCC increases from 83,000 to 870,000 cells mL^{-1}, lactose concentration was reduced from 4.977 to 4.707%. Miller *et al*. (1983) showed that mastitis

Table I. Mean SCC ± SD ($\times 10^5$)/mL and mean lactose ± SD (%) of milk at various scores of SFMT

SFMT Score[a]	No. of quarters	Mean SCC ± SD[b]	Mean lactose ± SD[c]
N	249	2.06 ± 1.09	5.10 ± 0.09
T	31	3.73 ± 0.96	4.81 ± 0.10
P1	69	9.69 ± 4.05	4.66 ± 0.08
P2	38	31.97 ± 10.26	3.92 ± 0.25
P3	13	121.01 ± 23.71	2.66 ± 0.37

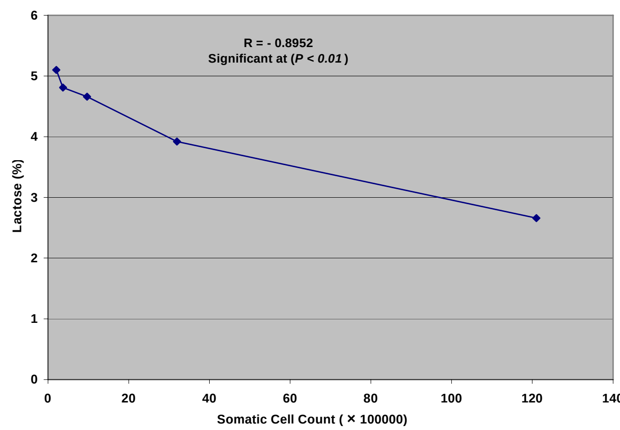
SD = Standard Deviation

Significance (*P <0.01*) between a & b and a & c

Fig. 1. Relationship between Somatic Cell Count and Lactose

Negative correlation (R = - 0.8952)

Significance (*P < 0.01*) between SCC and Lactose



determines a continuous reduction in lactose concentration in milk with SCC above 100,000 cells mL^{-1}. Munoz *et al.* (2002) concluded that regression coefficient of transformed SCC on percent lactose was negative. Fernandes *et al.* (2004) reported a negative relationship between somatic cell counts (SCC) and lactose content.

Frequency distribution of pathogens isolated from SFMT negative and positive quarters is given in Table II. Frequency distribution for quarter samples having no growth was 80% and the values for Gram-negative cocco-bacilli and mixed growth were 10% for both. Frequency distribution of *Staphylococcus aureus*, *Streptococcus agalactiae*, *Staphylococcus aureus* plus *Streptococcus agalactiae* and coagulase negative staphylococci was found in 50, 15, 15 and 20% of the quarters, respectively. Karimuribo *et al*. (2005) found *Staphylococcus aureus* (35.3%), other staphylococci (20.8%), coliforms (27.7%), micrococci (5.8%) and streptococci (9.8%) as major isolates of sub-clinical mastitis based on CMT.

Mean SCC, Mean Log_{10} Somatic Cell Count (LSCC) and mean lactose of quarters infected with minor and major pathogens is described in Table III. Mean SCC was more increased in quarters infected with major pathogens than quarter infected with minor pathogens. Mean milk lactose was more decreased in quarter samples infected with major pathogens than quarter infected with minor pathogens. Previous studies have also shown that major pathogens were

Table II. Frequency distribution of pathogens isolated from SFMT negative and positive quarters

SFMT Score	Class and species	No. of quarters	Frequency (%)
	No growth	16	80
Negative	Gram-negative cocco-bacilli	2	10
	Mixed growth	2	10
	Staphylococcus aureus	10	50
	Streptococcus agalactiae	3	15
Positive	*S. aureus* + *S. agalactiae*	3	15
	Coagulase negative staphylococci	4	20

Table III. Mean SCC ($\times 10^5$)/mL, Mean Log_{10} Somatic Cell Counts (LSCC) and Mean Lactose contents (%) of quarters infected with minor and major pathogens

Microbial status	No. of quarters	Mean SCC ($\times 10^5$)	LSCC	Mean Lactose
No infection	16	1.87	5.27	5.04
Infected quarters	24	30.94	6.49	4.24
Minor pathogens	6	7.72	5.88	4.82
Major pathogens	18	36.68	6.58	4.05

accompanied by higher SCC and lower lactose concentration (Coulon *et al*., 2002). Eberhart *et al*. (1979) also found that for no infections, minor pathogens and major pathogens the somatic cell count was 1.53×10^5, 2.78×10^5 and 8.52×10^5 cells mL^{-1}, respectively in cattle. Djabri *et al*. (2002) stated minor pathogens cause less elevation in the SCC. Silva and Silva (1994) reported that in Sri Lanka total somatic cell count in normal buffalo milk varied from 0.5×10^5 to 3.75×10^5 mL^{-1} of milk. Hillerton (1999) pointed out an SCC of 100,000 cells mL^{-1} for a healthy quarter. Kromker *et al*. (2001) stated that SCC in healthy quarter with no bacterial growth is less than 100,000 cells mL^{-1}.

CONCLUSION

Data showed that SCC and lactose were negatively correlated and measuring lactose can reveal a change in SCC of buffalo milk in comparison with normal. The change in lactose and SCC was remarked observed even when pathogens of different kinds were present.

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