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EFFECT OF SEVERITY OF SUB-CLINICAL MASTITIS ON SOMATIC CELL COUNT AND LACTOSE CONTENTS OF BUFFALO MILK

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ABSTRACT

This study was conducted to determine the effect of severity of sub-clinical mastitis on somatic cell count (SCC) and lactose contents of milk in 100 apparently healthy dairy buffaloes. Surf Field Mastitis Test (SFMT) was used to determine the severity of sub-clinical mastitis which was graded as Negative (N), Traces (T), mild clumping (P1), moderate clumping (P2) and heavy clumping (P3). Mean milk SCC (x 10^5) at SFMT scores N, T, P1, P2 and P3 were 2.06 ± 1.09, 3.73 ± 0.96, 9.69 ± 4.05, 31.97 ± 10.26 and 121.01 ± 23.71 per ml, respectively. Using the same scoring, mean values of milk lactose were 5.10 ± 0.09, 4.81 ± 0.10, 4.66 ± 0.08, 3.92 ± 0.05 and 2.66 ± 0.37 percent, respectively. Percent increases of mean SCC in T, P1, P2 and P3 groups with respect to N (control) were 81.47, 370.51, 1451.71 and 5773.41, respectively. Percent decreases of mean lactose in T, P1, P2 and P3 groups with respect to N (control) were 5.54, 8.52, 22.98 and 47.81, respectively. Statistical analysis indicated non-significant difference of mean SCC in N and T groups, while there was highly significant ($P<0.01$) difference in mean SCC among P1, P2 and P3 groups and also with respect to N. Similarly, there was a significant ($P<0.05$) difference of mean lactose among T, P1, P2 and P3 groups and also with respect to control/ negative group.

Key words: Mastitis, somatic cell count, lactose content, buffalo, milk.

INTRODUCTION

Milk is an important diet of human beings. It contains a wide range of dietary components of vital importance like water, proteins, lactose, minerals and vitamins. The composition of milk varies with the species and breed of the animal, feeding regimes, stage of lactation, parity and udder health. Milk available to our masses is lower in food value due to high prevalence of mastitis in dairy animals (Allore, 1993).

Mastitis is a serious disease of dairy animals causing great economic losses due to reduction in milk yield, as well as lowering its nutritive value. Sub-clinical mastitis is 15 to 40 times more prevalent than clinical mastitis and causes high economic losses in most dairy herds (Schultz *et al*., 1978). In addition to causing colossal economic losses to farmers, the disease is important from consumers' and processors' point of view. The milk from an affected animal may harbor the organisms potentially pathogenic for humans (Barbano, 1989). Mastitis affects the milk quality in terms of decrease in milk protein, fat, sugar (lactose) contents and increase in somatic cell count. The processing of such milk results in substandard and sub-optimal output of finished fermented products like yogurt and cheese. The shelf life of processed milk is also reduced (Urech *et al*., 1999). The extent of various changes in composition depends on the inflammatory response (Kitchen, 1981).

Ullah *et al*. (2005) investigated the effect of severity of mastitis on protein and fat contents of buffalo milk. However, in Pakistan, limited work has been undertaken on the effect of sub-clinical mastitis on milk composition. The present study was, therefore, planned to see the changes in somatic cell count and milk lactose content with the severity of sub-clinical mastitis in buffaloes.

MATERIALS AND METHODS

Milk collection and examination

Milk samples from 100 apparently healthy dairy buffaloes having almost the same stage of lactation (second to third month post calving) and parity (third to fourth) were collected randomly from rural and urban areas around Faisalabad, Pakistan during the period from January to March, 2006. About 50 ml of milk from each quarter was collected in separate clean plastic bottles of 100 ml capacity for direct microscopic somatic cell count and estimation of milk lactose contents. Each bottle was labeled as Left Front (LF), Left Rear (LR), Right Front (RF) and Right Rear (RR). Quarter milk samples were immediately (within one hour after sampling) taken to the laboratory and subjected to Surf Field Mastitis Test (SFMT), as described by Muhammad *et al*. (1995). Based on the SFMT findings, the severity of sub-clinical mastitis was graded as Negative (N), Traces (T), Mild clumping (P1), Moderate clumping (P2) and heavy clumping (P3). Direct microscopic somatic cell count was carried out by the technique described by Schalm *et al*. (1971). Lactose in milk was estimated following Lane and Eynon method described by Egan *et al*. (1981).

Statistical analysis

The mean values (± SD) of milk SCC and lactose with respect to SFMT scores (Control, Traces, P1, P2 and P3) were subjected to analysis of variance using completely randomized design. Duncan's multiple range test was applied for multiple means comparisons, where necessary (Steel *et al*., 1996).

RESULTS

The range and mean milk SCC as affected by severity of sub-clinical mastitis are given in Table 1. Maximum SCC was found in P3 grade mastitic quarters, while minimum in negative quarters (P<0.01). Further analysis indicated non-significant difference of mean SCC in N and T groups, while there was highly significant (P<0.01) difference in mean SCC among P1, P2 and P3 groups and also with respect to N. The maximum percent increase in mean SCC with respect to N (control) was recorded in P3, while the minimum was in group T (Table 1).

The range and mean values of lactose as affected by severity of sub-clinical mastitis are given in Table 2. Maximum lactose was found in negative control quarters and minimum in P3 grade mastitic quarters (P<0.01). Further analysis indicated significant (P<0.01) difference in mean lactose among T, P1, P2 and P3 groups and also with respect to control/negative groups. Percent decreases in mean lactose in T, P1, P2 and P3 groups with respect to negative (control) were 5.54, 8.52, 22.98 and 47.81, respectively (Table 2). The maximum decrease in milk lactose was observed in P3, while the minimum was in T group.

DISCUSSION

Previous studies have reported an increase in somatic cell counts in the milk due to mammary gland infection (Schalm *et al*., 1971; Eberhart *et al*., 1979). Total SCC in normal (non-infected) buffalo milk varied from 0.5×10^5 to 3.75×10^5/ml (Silva and Silva, 1994). Dhakal (2006) reported that mean SCC of California Mastitis Test negative and positive samples were 104×10^3 and 1572×10^3/ml of milk, respectively. An increase in SCC of inflamed mammary gland (mastitis) occurs in response to invasive agents (pathogens). Neutrophils are the predominant cells found in the mammary tissue and mammary secretions during early stage of mastitis and constitutes >90% of the total leukocytes (Sordillo *et al*., 1987).

In the present study, SCC increased and lactose contents decreased with the severity of sub-clinical mastitis. Increase in SCC may be due to increased number of leukocytes in milk. An increase in SCC also damages the secretory cells (Selsted *et al.*, 1993). According to Harmon (1994), the mastitis severity or

Table1: Range and mean values (± SD) of milk somatic cell count of normal and mastitic quarters in buffaloes

SFMT groups	Range ($\times 10^5$/ml) (Min – Max)	Mean ($\times 10^5$/ml)	Increase with respect to control (%)	Increase between groups (%)
Negative	1.75 – 2.15	2.06 ± 1.09^a	--	--
Traces	2.96 – 4.21	3.73 ± 0.96^a	81.47	81.47
P1	7.54 – 11.39	9.69 ± 4.05^b	370.51	159.26
P2	25.63 – 39.96	31.97 ± 10.26^c	1451.71	229.79
P3	98.09 – 138.43	121.01 ± 23.71^d	5773.41	278.61

Mean values with different superscripts in a column differ significantly (P<0.01).

Table 2: Range and mean values (± SD) of milk lactose of normal and mastitic quarters in buffaloes

SFMT groups	Range (%/ml) (Min – Max)	Mean (%/ml)	Decrease with respect to control (%)	Decrease between groups (%)
Negative	5.03 – 5.17	5.10 ± 0.09^a	--	--
Traces	4.76 – 4.88	4.81 ± 0.10^b	5.54	5.54
P1	4.61 – 4.73	4.66 ± 0.08^c	8.52	3.15
P2	3.76 – 4.14	3.92 ± 0.25^d	22.98	15.8
P3	2.50 – 2.83	2.66 ± 0.37^e	47.81	32.24

Mean values with different superscripts in a column differ significantly (P<0.01).

elevated SCC is associated with a decrease in lactose, because of reduced lactose synthetic activity in the mammary tissue.

In this study, reduction in lactose contents occurred with the severity of sub-clinical mastitis that may be due to the passage of lactose from milk into blood and increased permeability of tissues between milk duct of udder and the blood which leads to increased leakage of blood components into the udder and changes the milk composition. This view is also supported by Shuster *et al*. (1991) and Schallibaum (2001). Secondly, mastitis results in tissue damage and decreases synthetic ability of the enzyme system of the secretory cells and biosynthesis of lactose decreases in the mammary tissue (Kitchen, 1981; Harmon, 1994). The reduced lactose concentration is an important factor for impaired acidification properties of milk with mastitis because the mastitic milk is easily affected by proteolytic enzyones.

Conclusions

Based on the findings of the present study, it can be concluded that severity of sub-clinical mastitis has clear effect on the composition of milk in terms of decreased lactose and an increased SCC, deteriorating its wholesomeness. Somatic cell count/lactose contents in milk may be used as indicators of sub-clinical mastitis.

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