Post Milking Teat Dip Effect on Somatic Cell Count, Milk Production and Composition in Cows and Buffaloes

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ABSTRACT : The effect of post milking teat dipping on somatic cell count (SCC) of milk was determined in 20 Crossbred cows and 20 Murrah buffaloes selected from institute's herd. The animals were divided into two groups of 10 each. Animals of Group I (control) were teat washed with water before the milking while Group II animals were applied teat dipping solution after the completion of milking. The cows were milked 3 times a day while buffaloes were milked twice a day. The milk samples were collected from control and treated animals on day 0, 5, 10, 15, respectively. The milk samples were analyzed for milk constituents like fat, protein, lactose, chloride, IgG, NEFA, pH and EC and total and differential somatic cell counts. The changes in milk composition and somatic cell counts were significantly different ($p<0.01$) between the animals and between the breeds. However SCC, chloride content ($p<0.05$) and epithelial cells ($p<0.01$) varied during different days of study. The alterations in SCC, epithelial cells, TLC, lymphocyte, neutrophil, IgG, and protein content were significantly different ($p<0.01$) between control and treated groups. The pH, EC, protein, SCC, epithelial cells, lymphocyte and neutrophil cells of milk declined significantly ($p<0.05$) after the application of teat dipping, the respective values were 6.5 vs 6.40, 2.28 vs 2.37 mhos, 3.33 vs 4.04%, 1.00 vs 0.87×10^5 cells/ml, 0.39 vs 0.34×10^5 cells/ml, 0.36 vs $0.31\times1,000$ cells/ml and 0.17 vs $0.14\times1,000$ cells/ml in cows. However in buffaloes, epithelial cells, lymphocytes, neutrophils, EC and SCC declined ($p<0.05$) after application of teat dipping, the values being 0.37 vs 0.29×10^5 cells/ml, 0.37 vs $0.25\times1,000$ cells/ml, 0.14 vs $0.11\times1,000$ cells/ml, 2.56 vs 2.37 mhos and 0.94 vs 0.73×10^5 cells/ml, respectively. The study indicated that post milking teat dipping could be used as an effective method for the lowering of SCC in milk of crossbred cows and buffaloes. ***(Asian-Aust. J. Anim. Sci. 2002. Vol 15, No. 10 : 1517-1522)***

Key Words : Somatic Cell Counts, Teat Dip, Milk Production and Composition, Cows and Buffaloes

INTRODUCTION

Somatic cell counts (SCC) have been reported to be an index of mammary health for detection of subclinical mastitis in cows and buffaloes (Dohoo and Meek, 1982; Singh and Ludri, Singh and Ludri, 2000a,b) and goats (Das and Singh, 1999). These cells are secreted during the normal course of lactation and influenced by a variety of factors like season (Allgower, 1990; Wilson et al., 1994; Lee et al., 1994), management (Bodoh et al., 1976; Mein et al., 1977; Moxley et al., 1978; Goodhope et al., 1980), stages of lactation (Cullen et al., 1967; Natzke et al., 1972; Reichmuth, 1975; Schultz, 1977; Eberhart et al., 1979), parity (Sheldrake et al., 1983; Singh and Ludri, 2000a), and vaccination (Scott et al., 1998; Hamann and Reichmuth, 1990). The values of SCC during lactation have been reported in the range of 0.50 to 3.0×10^5 cell/ml in cows and buffaloes. Various reports have indicated that hygienic condition play a very important role in lowering SCC in milk of which milking operations is very important (Mein et al., 1977; Moxley et al., 1978). Teat dipping before start of milking and after completion of milking lowers SCC of milk (Moxley et al., 1978; Neave et al., 1968). Such information on, in indigenous crossbred cows under tropical condition is not available. Further, to the knowledge of the authors, no study has been conducted on the effect of teat dipping on SCC counts of Murrah buffaloes. Therefore, present study was undertaken (a) to find out the effect of teat dipping on SCC of cows and buffaloes and (b) to determine the likely effects of teat dipping on milk composition and milk production and health of teats.

MATERIALS AND METHODS

Selection and management of animals

A total of 20 crossbred cows and 20 Murrah buffaloes were selected from institute's animal herd. All the cows and buffaloes were managed in a loose housing system during the experimental period of 15 days. The animals received a diet of concentrate mixture and green fodder. The green fodder was *ad lib* and consisted of maize (*Zea mays*) and berseem (*Trifolium alexandrium*) while concentrate mixture based on milk production was offered only at the time of milking. Free choice fresh tap water to all animals was available at all the time of the day. The cows were machine milked thrice a day at 6:00 am, 12:00 noon and 6:00 pm while buffaloes were hand milked twice a day at 6:00 am and 6:00 pm and milk yields was recorded.

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Experimental treatment

The cows and buffaloes were divided into two groups of 10 each. Group I served as a control and did not received the treatment, while Group II animals were applied teat dipping solution, Hygenius (Dipal, M /S. Alfa Laval Agri., 1 ml: 10 ml distilled water) after the completion of milking daily for a period of 15 days. The animals of the control group were given teat wash with water before the start of milking as per the practices followed in the farm.

Collection of milk samples and analysis

Milk samples were collected from control and treated animals on days of teat dipping (day 0) and thereafter on day 5, 10 and 15, respectively, of both breeds. To study milk somatic cell counts aliquots of milk samples from each animal was composited in proportion to their milk yield and were used for analysis of milk constituents. The udder was tested for mastitis using Modified California Mastitis Test (mCMT). In milk samples, fat was determined using fresh milk (10.75 ml) by Gerber's method (I.S.I., 1958) and protein by formaldehyde method (Singhal and Deshraj, 1989). Lactose was estimated by picric acid method (Perry and Doon, 1950). Chloride content of the milk was estimated by $AgNo_3$ method (I.S.I. 1981) and IgG by zinc sulfate turbidity test (McEwan et al., 1970). Non-esterified fatty acids (NEFA) were estimated by extraction method. (Chloroform: Heptane: Methanol 49:49:2) of Shipe et al. (1980). The pH of fresh milk was measured using Digital PH meter (Electronics Corporation of India Ltd.) and the electrical conductivity (EC) by digital meter (Century CC 601, Cell Constant).

Somatic cell count was measured microscopically by the method of Singh and Ludri (2000a). Differential cell counting was also carried out to determine the presence of different cell types like lymphocyte, neutrophils, basophils, eosinophils and monocytes (Jyotsana and Singh, 2001). 10 μl fresh milk was spread over a glass slide having a marked area of 10 mm×10 mm using a micropipette. The fine milk smear so prepared was dried in an oven at a temperature of 30-40°C. The slides were then dipped in xylene for 1 to 2 min. to remove the fat globules and dried subsequently. The slides were then stained using methylene blue dye (Methylene blue dye, 0.6 g; Ethyl alcohol 95%, 54 ml; Tetrachloroethane, 40 ml; Glacial acetic acid, 6 ml) for a period of 15 min, and were dried at room temperature. The excess of stain was removed from the smears with tap water and the slides were again dried at room temperature. The somatic cell counts were measured under microscope with a magnification of 15×40 in 50 fields and were multiplied by the microscopic factor to get the cells per ml of milk.

Statistical analysis

The statistical analysis of data of yield and composition of milk, EC (electrical conductivity), pH and the somatic cell count was done using 2-way ANOVA with interaction as described by Snedecor and Cochran (1980). Mean and standard error for all parameters were calculated. The averages were compared using Duncan's Multiple Range Test (DMRT) for significance difference. Correlation among the various parameters of milk composition, somatic cell counts and differential cell counts were also calculated to find out the effect of teat dipping.

RESULTS

The effect of teat dipping on various parameters in cows and buffaloes has been presented in Tables 1, 2 and 3, respectively. The mean pH values of milk declined ($p<0.01$) from 6.56 vs 6.40 and 6.50 vs 6.41 in control and teat dipped cows and buffaloes and varied ($p<0.01$) in different animals (Table 1). However there was no change in values of pH of milk between cows and buffaloes. EC of milk varied between breeds and also between groups ($p<0.01$). Because of change in pH value, EC also varied significantly ($p<0.01$) between the animals.

The values of immunoglobin level were different ($p<0.01$) between two groups of cows and buffaloes and breeds (Table 2). Chloride content (mg %) of milk were not affected by teat dipping and the values in cows and buffaloes were different ($p<0.01$), the values being 111.48 vs 89.18 mg % before start of teat dipping and 114.91 vs 83.82 mg % after the teat dipping. Fat content of milk was higher ($p<0.01$) in buffaloes in comparison to cows (7.91 vs 4.83%), however there was no effect of teat dipping on fat content of milk. The fat% also varied between the animals ($p<0.05$) during different days of study. Protein content varied ($p<0.01$) between animals, breeds and also before and after the teat dipping. Protein value increased from 3.33 to 4.04 and 4.96 to 5.05% in control and teat dipped cows and buffaloes, respectively. Because of significant changes in protein content, the interaction of group×breed was also significant ($p<0.01$). Milk NEFA concentration (mM/litre) varied between the animals and breed ($p<0.01$) but were not influenced by teat dipping. Lactose content of milk was not influenced by teat dipping and varied between animals and breeds.

Somatic cell count (SCC) of milk were significantly different ($p<0.01$) among the animals, between breeds, between control and treated groups and interaction of breeds and groups (Table 1, Figure 1). SCC values were higher in cows (1.00 vs 0.94×10^5 cells/ml) in comparison to buffaloes (0.87 vs 0.73×10^5 cells/ml) in control and treated group.

Table 1. Average values (±SE) of pH, electrical conductivity, somatic cell counts and differential counts in control and treated animals

	Control					Treated				
Breeds	0	5	10	15	Overall mean	0	5	10	15	Overall mean
					pH					
Cows	6.59	6.58	6.59	6.47	6.56^a±0.03	6.41	6.40	6.40	6.40	6.40^b±0.02
Buffaloes	6.51	6.51	6.50	6.49	6.50±0.02	6.42	6.41	6.41	6.42	6.41±0.02
					EC (mhos)					
Cows	2.29	2.28	2.28	2.28	2.28±0.02	2.37	2.36	2.58	2.37	2.37±0.02
Buffaloes	2.56	2.56	2.57	2.57	2.56±0.03	2.38	2.36	2.36	2.37	2.37±0.02
					SCC ($\times 10^5$cells/ml)					
Cows	0.99	0.98	0.98	1.03	1.00^a±0.02	1.00	0.85	0.83	0.81	0.87^b±0.02
Buffaloes	0.91	0.93	0.94	0.98	0.94^a±0.02	0.84	0.73	0.71	0.67	0.73^b±0.02
					Epithelial cell ($\times 10^5$cells/ml)					
Cows	0.40	0.37	0.38	0.40	0.39^a±0.01	0.42	0.33	0.32	0.29	0.34^b±0.01
Buffaloes	0.36	0.37	0.39	0.40	0.37^a±0.01	0.35	0.28	0.27	0.25	0.29^b±0.01
					TLC ($\times 10^5$cells/ml)					
Cows	0.59	0.60	0.59	0.63	0.60±0.01	0.55	0.52	0.50	0.51	0.52±0.01
Buffaloes	0.54	0.55	0.55	0.58	0.56±0.01	0.48	0.43	0.43	0.40	0.44±0.01
					Lymphocyte (×1,000)					
Cows	0.35	0.36	0.35	0.38	0.36^a±0.01	0.34	0.31	0.30	0.31	0.31^b±0.00
Buffaloes	0.35	0.38	0.36	0.37	0.37^a±0.01	0.29	0.25	0.23	0.24	0.25^b±0.01
					Neutrophil (×1,000)					
Cows	0.15	0.17	0.17	0.16	0.17^a±0.00	0.16	0.14	0.12	0.13	0.14^b±0.00
Buffaloes	0.14	0.14	0.13	0.15	0.14^a±0.00	0.14	0.10	0.11	0.10	0.11^b±0.00
					Monocyte (×1,000)					
Cows	0.06	0.05	0.05	0.06	0.06±0.00	0.04	0.04	0.06	0.05	0.05±0.00
Buffaloes	0.03	0.02	0.03	0.03	0.03±0.00	0.03	0.05	0.05	0.05	0.04±0.00

Values with different superscripts in a row differ ($p<0.05$).
SCC: Somatic cell counts.
TLC: Total leucocyte counts.

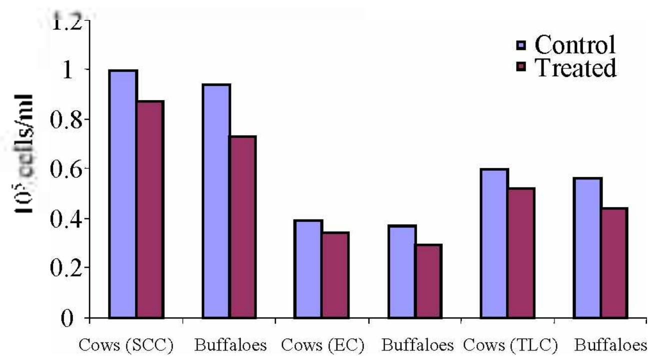

Figure 1. Effect of post-milking teat dipping on SCC, Epithelial cell and TLC in cows and buffaloes.

The differential counts indicated that epithelial cells, total leucocyte counts (TLC), lymphocytes and neutrophils varied significantly ($p<0.01$) in different animals during different days of study in both the breeds. The overall average values of epithelial cells declined significantly ($p<0.01$) in cows and buffaloes. Teat dipping had significant ($p<0.01$) effect on TLC, lymphocytes and neutrophils, however monocyte counts were found only in few samples and were not influenced by teat dipping. The monocyte cells of cows and buffaloes were significantly different ($p<0.01$).

The changes in milk yield between animal and breeds were significant ($p<0.01$). Teat dipping also affected milk yield ($p<0.01$) in control and treated animals, the respective values being 19.36 vs 21.08 kg, 6.16 vs 6.67 kg in cows and buffaloes. The correlation analysis (Table 3) indicated positive correlation of pH with SCC, TLC and differential leucocyte counts. Electrical conductivity of milk was negatively correlated to milk yield and chloride. Further, SCC was positively correlated ($p<0.01$) with epithelial cell, TLC, milk yield, chloride content of milk. Protein content of milk was negatively correlated ($p<0.01$) with the SCC, TLC and differential cell counts, milk yield and chloride contents.

DISCUSSION

In the present study teat dipping effectively reduced somatic cell counts of milk in cows and buffaloes. The change in values of composition of milk, pH and EC further

Table 2. Average values (±SE) of milk yield and composition in control and treated animals

Breeds	Control Days 0	5	10	15	Overall mean	Treated Days 0	5	10	15	Overall mean
					Milk yield (kg)					
Cows	20.25	19.40	19.40	18.40	19.36±0.59	22.50	21.00	20.75	20.10	21.08±0.88
Buffaloes	6.60	6.25	6.00	5.80	6.16±0.33	6.85	6.75	6.70	6.70	6.67±0.15
					Fat (%)					
Cows	4.79	4.90	4.87	4.77	4.83±0.07	4.83	4.96	5.01	5.00	4.95±0.08
Buffaloes	7.94	7.89	7.88	7.93	7.91±0.09	8.02	8.08	8.05	8.07	8.05±0.10
					Protein (%)					
Cows	3.36	3.32	3.31	3.34	3.33^{a}±0.06	4.07	3.99	4.05	4.06	4.04^{b}±0.06
Buffaloes	4.99	4.90	4.92	5.03	4.96±0.07	5.05	4.96	5.09	5.11	5.05±0.04
					Lactose (%)					
Cows	3.76	3.83	3.63	3.63	3.71±0.10	4.25	6.10	4.31	4.25	4.70±0.50
Buffaloes	4.22	3.87	3.72	3.86	3.92±0.17	3.89	3.92	4.02	3.91	3.93±0.13
					Chloride (mg%)					
Cows	112.62	109.20	112.43	116.67	111.48±1.85	115.06	115.11	116.30	113.16	114.91±1.52
Buffaloes	83.34	85.98	93.08	94.31	89.18±2.57	80.13	87.05	81.37	86.71	83.82±2.81
					NEFA (m M/l)					
Cows	0.15	0.14	0.18	0.17	0.165±0.01	0.13	0.15	0.13	0.15	0.14±0.00
Buffaloes	0.12	0.12	0.12	0.12	0.125±0.00	0.14	0.14	0.14	0.14	0.14±0.00
					IgG (mg/ml)					
Cows	2.38	2.23	2.23	2.48	2.33±0.11	2.26	2.27	2.75	2.91	2.54±0.10
Buffaloes	1.59	1.75	1.80	1.75	1.72±0.11	2.12	2.31	2.12	1.96	2.12±0.11

IgG: Immunoglobulins, NEFA: Non-esterified fatty acids.
Values with different superscripts in a row differ ($p<0.05$).

indicated that teat dipping has a beneficial effect on the quality of milk and also determines the quantity of milk in dairy animals. The counts of SCC were higher in cows as compared to buffaloes, indicates that crossbred cows are more prone to infection as compared to buffaloes (Singh and Ludri, 2001b). The decrease in SCC was attributed to decline in total leucocyte counts including lymphocytes and neutrophils, but such comparative studies in buffaloes are lacking. The earlier studies in cows indicate that teat dipping effectively reduce intramammary infections by the bacteria transmitted to the teat end during milking than bacteria exposed to teat end primarily during the intermilking period (Pankey et al., 1984). Further, for mastitis control programme, teat dipping in combination with dry cow therapy was more effective (Neave et al., 1966; Wesen and Schultz, 1970). Dodd et al. (1969) found, antibiotic therapy of dry cows a practical and effective complement to teat dipping.

A number of routine hygienic practices at milking including washing of udder with disinfectant, use of separate towel for washing, rinsing milking machine, teat cups disinfectant and teat dipping effectively reduces udder infection and mastitis (Philpot, 1975; Hogan and Smith, 1987; Erskine and Eberhardt, 1990) however, when teat dipping was discontinued the incidence of bacterial infection increases (Harmon and Langlois, 1986). In cows teat dipping after milking reduces SCC and had no adverse reaction or teat irritation (Mcbridge, 1994; Winter, 1999; Kalit and Havranek, 1999) as also observed in this study. The lowest cell counts have been reported in herds which adopts a full control programme of teat dipping, dry cow therapy and annual milking machine maintenance. Dry cow therapy when used in conjunction with teat dipping proved more effective (Brander et al., 1975).The regular use of teat dips lowers somatic cell counts in milk of lactating cows. The highest SCC was also reported in farms which did not use teat dip (Bodoh et al., 1976; Mein et al., 1977; Schultz, 1977).

In the present study there was no effect of dipping on teat, the injury to teat, irritation of teat or redness over teats in both cows and buffaloes. The decrease in SCC with increase in fat, protein and lactose % was also reported earlier in cows (Schukken et al., 1992). High SCC milk has lower fat, SNF and lactose levels (Everson, 1980; King, 1978). The positive correlation of SCC with pH of milk and negative correlation with lactose indicated that pH or lactose of milk could be used as indicator of udder health.

CONCLUSION

The study indicated that somatic cell counts can effectively be reduced by application of teat dip solution

Table 3. Details of overall correlation analysis of various parameters

Variables	Level of significance	Variables	Level of significance
pH vs protein	-0.2528**	Lactose vs milk yield	0.1538*
pH vs NEFA	-0.1854**	SCC vs epithelial cell	0.9079**
pH vs SCC	0.2154**	SCC vs TLC	0.9259**
pH vs TLC	0.2547**	SCC vs lymphocytes	0.8807**
pH vs lymphocytes	0.2181**	SCC vs neutrophil	0.7460**
pH vs neutrophil	0.1727*	SCC vs milk yield	0.2521**
Ec vs fat	0.3292**	SCC vschloride	0.2143**
Ec vs protein	0.2928**	Epithelial cell vs TLC	0.6979**
Ec vs lymphocyte	0.1942**	Epithelial cell vs lymphocytes	0.6684**
Ec vs monocyte	-0.1575*	Epithelial cell vs neutrophil	0.6282**
Ec vs milk yield	-0.3587**	Epithelial cell vs milk yield	0.1987**
Ec vs chloride	-0.3763**	Epithelial cell vschloride	0.1931**
IgG vs fat	-0.3683**	TLC vs lymphocytes	0.9233**
IgG vs protein	-0.2232**	TLC vs neutrophil	0.7290**
IgG vs monocyte	0.2202**	TLC vs milk yield	0.2394**
IgG vs milk yield	0.2926**	TLC vs chloride	0.1878**
IgG vs chloride	0.2065**	Lymphocyte vs neutrophil	0.6059**
Fat vs protein	0.7186**	Neutrophil vs monocyte	-0.2025**
Fat vs NEFA	-0.1780*	Neutrophil vs milk yield	0.2675**
Fat vs SCC	-0.2378**	Monocyte vs milk yield	0.2597**
Fat vs TLC	-0.2774**	Monocyte vs chloride	0.2886**
Fat vs lymphocyte	-0.1788*	Milk yield vs chloride	0.6538**
Fat vs neutrophil	-0.2675**		
Fat vs monocyte	-0.2519**		
Fat vs milk yield	-0.8521**		
Fat vs chloride	-0.6439**		
Protein vs SCC	-0.3718**		
Protein vs epithelial cell	-0.2761**		
Protein vs TLC	-0.3837**		
Protein vs lymphocyte	-0.2834**		
Protein vs neutrophil	-0.3558**		
Protein vs monocyte	-0.2555**		
Protein vs milk yield	-0.6829**		
Protein vschloride	-0.6147**		

* $p<0.05$; ** $p<0.01$.

after completion of milking. Further, due to decrease in SCC, milk production and composition also alters. However, such changes can be maintained in long term application of teat dipping.

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