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Improving udder health in Gir cows through post milking teat dipping

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Abstract
Mastitis is a most chronic inflammatory disease in cattle leading to huge economic losses to farmers. This disease which mostly occurs after milking when the holes of the teat remain open for certain period of time which results in increase susceptibility of mammary gland to microbial infections, physical injuries leading to mastitis. The present experiment was designed to see the effect of post milking teat dipping on udder health in Gir cow. Clinically healthy lactating Gir cows (n=17) were used for a period of 28 days. Inorganic iodine (0.71%) and organic lactic acid (3.5%) solutions were used as a disinfectant in T_1 (n=6) and T_2 (n=6) group, respectively and T_0 (n=5) group was kept as a control with general cleaning of udder and teat. The post milking teat dipping significantly ($p<0.05$) reduced the incidence of subclinical mastitis in T_1 (90.00%) and T2 (83.33%) groups compared to T_0 group in which increased (160.00%) in quarters. Milk Somatic Cell Counts decreased significantly ($p=0.002$) in T_1 (0.74×10^5/ml) and T_2 (0.77×10^5/ml) groups compared to T_0 (3.23×10^5/ml) group and milk pH reduced significantly ($p=0.013$) in T_1 (6.54) and T_2 (6.52) groups as compared to T_0 (6.63) group. Although post milking teat dipping did not affect the milk yield and composition but reduced the occurrence of subclinical mastitis in Gir cows.

Keywords: Teat dipping, subclinical mastitis, somatic cell counts, Gir cows

Introduction
Total milk production in India during 2018-2019 was 187.7 million tonnes (Anon., 2019) [1] and according to 20th livestock census, the population of cattle and buffalo in India is 192.49 and 109.85 millions, respectively.

Mastitis - An inflammation of the mammary gland or udder caused due to many reasons like physical injury, irritation by chemical and most commonly by infiltration of bacterial species and other microbes (fungi, mycoplasma, virus and algae species) (Jones and Bailey, 2009) [4]. The prevalence of mastitis ranges from 29.34% to 78.54% in cows (Sharma and Maiti, 2009) [14]. Mastitis is a major health concern as it affects the health of both, animals and consumers. There are no visible or gross changes (clots, color changes, consistency) found in milk of subclinical mastitis (SCM) like clinical mastitis.

Economic losses in India due to mastitis folded 115 times in last 5 decades. The losses due to mastitis were estimated to be ₹ 1390 per lactation, out of which around 49% was owing to loss of value from milk and 37% on account of veterinary expenses (Sinha *et al*., 2014) [18]. Management of mastitis covered by many events like rapid identification and treatment of mastitis, drying off the cows, culling of effected cows and pre and post milking teat dipping. Out of these, post milking teat dipping is very important and cost effective (Oliver *et al*., 1990) [11]. Most of intra-mammary infection spread from cow to cow via milking process. Teat skin and orifice are the main reservoir and pathway of mastitis pathogens (Neave *et al*., 1969) [10]. Mastitis causing organisms are generally present on the teat skin and teat orifice.

To detect the subclinical mastitis, SCC have been reported to be an index for udder health (Singh and Ludri, 2000) [15]. As compared to international standard, the quality of milk is very poor in India. Further the threshold value of milk SCC in healthy cows has been reported as ≤200,000 cells/ml and in mastitic cows condition as >200,000 cells/ml (NMC, 2001) [9]. The present study was conducted to investigate the effect of post milk teat dipping on the udder health by comparing the prevalence of sub clinical mastitis as well as changes in milk composition between post milk teat dipped animals with the non post milk teat dipped animals.

Material and Methods

Ethical approval

This experiment was approved by Institutional Animal Ethics Committee (IAEC) (Protocol no: JAU-JVC-IAEC-SA-49-19), College of Veterinary Science and Animal Husbandry, Junagadh.

Experimental animals

Seventeen Gir cows divided into 3 groups; 5 in control (T_0) group, 6 in T_1 treatment group with inorganic (Iodine 0.71%) and 6 in T_2 treatment group with organic (Lactic acid 3.5%) based on their previous milk yield, body weight, parity and body condition score (BCS) at Cattle Breeding Farm, Junagadh Agriculture University, Junagadh, Gujrat and Department of Livestock Production Management, College of Veterinary Science and Animal Husbandry, Kamdhenu University, Junagadh, Gujarat. Experimental time was February to April (late winter-early summer) 2021. Experimental Gir cows were maintained under semi-loose housing system with both stone slab floor and iso-managerial conditions. Green fodder was offered to the animals throughout the experiment @ 10 kg/animal/day and dry fodder provided *ad-libidum*. There were two basis used to explain the relationship between post milking teat dipping and prevalence of SCM. First is California Mastitis Test **(**CMT) was performed quarter wise and then SCC of milk samples was estimated. To define SCM condition, ≥2 lakh/ml SCC (NMC, 2001) threshold value was used. Post milking teat dipping was carried out immediately after milking. All the parameters (except milk yield on daily basis) were screened quarterly for SCM. CMT of milk samples was done using CMT kit (DeLaval Private Limited), SCC by Lactoscan MCC Combo (Milkotronic Limited, Bulgaria), Milk pH using a single electrode digital pH meter (Atago Co. Limited, Malaysia) and milk composition using Lactoscan MCC Combo (Milkotronic Limited, Bulgaria).

Statistical analysis

Assessment of risk factors for SCM was carried out by using chi-square test and logistic regression using SPSS 16.0 (SPSS Inc., 2005, USA). The reduction in the number of SCM incidence case was calculated as [(% positive before teat dipping treatment − % positive after teat dipping treatment)/% positive before teat dipping treatment] (Munoz *et al.*, 2008)[8]. The data generated from the study was presented as mean ± standard error (S.E.).

Results and Discussion

Perusal of Table 1.1 revealed that there was significant (p<0.05) decrease in SCM cases in both (T1 and T2) the treatment groups compared to control group both in quarters as well as in animals. After completion of the experimental period the reduction of positive SCM cases in T1 and T2 groups were 90.90 and 83.33%, respectively. However, positive cases of SCM increased by 116.67% in control group of quarters. Findings of the present study for CMT cases are in agreement with Kamal and Bayoumi (2014) [5], Yasothai (2017) [20] and Singh *et al*. (2018) [17] who found significant (p<0.05) reduction in CMT cases in disinfectant treated group compared to control group. Kamal and Bayoumi (2014) [5] observed 80% reduction in CMT positive cases in post milking teat dipping group compared to control group (CMT positive case, 2 vs. 10). Yasothai (2017) [20] recorded less (0/25) cases in post milking teat dipping group as compared to control (11/25) group after 30th day. Singh *et al*. (2018) [17] observed significant reduction by 58.33% in post milking teat dip treatment group as compared to control group and CMT cases in post milking and control group were 24 and 10, respectively. Number of CMT cases was recorded less in both the post milking teat dipping treatment groups to control group may be due to decrease in the causative agents of mastitis at teats and udder region in iodine and lactic acid treated groups.

In animals, data indicates significant (p=0.002) reduction in the mean SCC values in T1 and T2 groups compared to T0 group after 28th day of experiment. Milk SCC decreased significantly (p=0.002) in T_1 (0.74×10^5/ml) and T_2 (0.77×10^5/ml) groups compared to T_0 (3.23×10^5/ml) group. In T2 group, there was significant (p=0.031) reduction of mean SCC value from 14th to 28th day of experiment in Gir cows.The present findings are in agreement with the reports furnished by Shailja and Singh (2002) [13], Kucevic *et al*. (2013) [6], Singh *et al*. (2019) [16] and Miseikiene *et al*. (2019) [7] who found significant (p<0.05) reduction in SCC values in post milking disinfectant group compared to control group. Shailja and Singh (2002) [13] recorded the mean SCC values in treatment and control groups as 87,000 and 100,000 cells/ml of milk, respectively. Kucevic *et al*. (2013) [6] recorded the milk SCC values in treatment and control group (133,000 and 257,000 cells/ml, respectively). There was increase in prevalence of SCM from 33.3% to 62.5% in control group while significant (p<0.05) reduction in SCM prevalence by 46.15% in post milking teat disinfection group (Singh *et al*., 2019) [16]. Miseikiene *et al*. (2019) [7] observed significantly (p<0.05) higher milk SCC (2.69 lakh/ml) in control group while lower (1.88 lakh/ml) SCC in post milking group in different farms. The organic and inorganic teat disinfectant used as post milking teat disinfectants may help to decrease the bacterial load in teats as well as in milker's hands leading to reduction in incidences of SCM and milk SCC.

Data presented in Table 1.2 revealed slight reduction in average milk pH in T1 and T2 group significantly (p=0.013) than T0 group (6.63 vs. 6.54 and 6.52). The present finding is in accordance with the results given by Shailja and Singh (2002) [13], Waghmare *et al*. (2013) [19] and Patil *et al*. (2014) [12], who found significant reduction in milk pH in post milking teat dip group as compared to control group. Shailja and Singh (2002) [13] observed significantly lower milk mean pH in treatment group than control group (6.56 vs. 6.40, p<0.05). Waghmare *et al*. (2013) [19] observed significant (p<0.05) reduction in milk pH in post milking treatment group (from 6.76 to 6.54) compared to control group (from 6.56 to 6.56). According to Patil *et al*. (2014) [12], the milk pH values declined significantly after treating in treatment group (from 7.32 to 6.69, P<0.05) but remained similar (from 6.69 to 6.62, p>0.05). The rise of milk pH in control group may be due to utilization of the milk lactose by microorganisms to produce lactic acid and its less availability in milk. Further, there is increase in concentration of alkaline blood constituents owing to increase in permeability of the blood capillaries during inflammation of the mammary gland.

Table 1.1: Prevalence of SCM in Gir cows

Parameter	Group	Quarter				Animal			
		T	0th day	14th day	28th day	T	0th day	14th day	28th day
CMT	T0 (Control)	20	5 (25.00%)	8 (40.00%)	13 (65.00%)	5	3 (60.00%)	2 (40.00%)	5 (100.00%)
	T1 (Inorganic)	24	10 (41.67%)	12 (50.00%)	1 (4.17%)	6	4 (66.67%)	4 (66.67%)	1 (16.67%)
	T2 (Organic)	24	12 (50.00%)	15 (62.50%)	2 (8.33%)	6	6 (100.00%)	5 (83.33%)	2 (33.33%)
p-value			0.234	0.326	0.0001		0.232	0.321	0.016
SCC	T0 (Control)	20	6 (30.00%)	8 (40.00%)	13 (65.00%)	5	3 (60.00%)	2 (40.00%)	5 (100.00%)
	T1 (Inorganic)	24	11 (45.83%)	12 (50.00%)	1 (4.17%)	6	4 (66.67%)	4 (66.67%)	1 (16.67%)
	T2 (Organic)	24	12 (50.00%)	13 (54.17%)	2 (8.33%)	6	6 (100.00%)	5 (83.33%)	3 (50.00%)
p-value			0.379	0.635	0.0001		0.232	0.321	0.022

Table 1.2: Mean milk parameters with standard errors in experimental Gir cows

Parameter	Experimental period								
	0th day			14th day			28th day		
	T0	T1	T2	T0	T1	T2	T0	T1	T2
SCC (×10^5/ml)	1.74±0.39	2.94±1.14	2.46^{ab}±0.52	3.01±1.35	2.62±0.92	2.99^{b}±0.76	3.23^{X}±0.76	0.74^{Y}±0.21	0.77^{aY}±0.26
pH	6.55±0.04	6.61±0.05	6.58±0.02	6.65±0.05	6.60±0.02	6.58±0.02	6.63^{X}±0.03	6.54^{Y}±0.02	6.52^{Y}±0.02
Yield (kg)	6.62±1.18	5.88±0.80	5.53±1.17	6.88±0.73	6.50±0.91	6.80±1.55	6.24±0.75	7.68±1.14	7.55±1.33
Fat (%)	4.25±0.22	3.92±0.17	4.10±0.26	3.93±0.20	3.96±0.16	4.46±0.18	4.15±0.38	4.17±0.11	4.64±0.18
SNF (%)	8.87±0.11	9.03±0.17	9.04±0.08	9.07±0.25	9.15±0.14	8.76±0.08	9.00±0.06	9.20±0.11	8.96±0.07
Protein (%)	3.24±0.05	3.37±0.05	3.27±0.05	3.35±0.10	3.37±0.05	3.25±0.08	3.28±0.04	3.35±0.04	3.31±0.03
Lactose (%)	4.77±0.07	4.97±0.14	4.99±0.04	4.97±0.15	5.03±0.07	4.83±0.09	4.95±0.03	5.09±0.07	4.86±0.08
Salt (%)	0.71±0.008	0.73±0.011	0.73±0.004	0.72±0.020	0.72±0.010	0.72±0.002	0.73±0.006	0.72±0.003	0.72±0.004
Total solids (%)	13.00±0.30	13.03±0.26	13.14±0.23	13.00±0.28	13.14±0.30	13.21±0.20	13.19±0.33	13.35±0.18	13.61±0.19

Values with different letter superscript in a row differ significantly (p<0.05)

Although there was slight improvement in milk yield and milk fat% in both the treatment groups compared to control group but non significantly. Finding of present study is in concurred with the results of Shailja and Singh (2002) [13], Waghmare *et al*. (2013) [19], Patil *et al*. (2014) [12] and Singh *et al*. (2018) [17], who also found significant (p<0.05) increase in the milk yield of post milking teat dip group compared to control group. According to Shailja and Singh (2002) [13], milk yield of control and treatment groups were 19.36 and 21.08 kg, respectively. Waghmare *et al*. (2013) [19] recorded increment in milk yield in post milking teat dip group by 19.25% compared to control group. Patil *et al*. (2014) [12] concluded that milk yield increased (17.3%) after 60th day of experiment in post milking teat dipping group. Singh *et al*. (2018) [17] observed that milk yield significantly increased in Povidone Iodine (T1) group from 17.3 to 19.3 kg and in filmadine (T2) group from 16.2 to 18.2 kg while no increment was observed in control group. In mastitic cow, milk yield decreases may be due to physical damage to epithelial cells of mammary gland and leads to decrease in secretary capacity.

There were no significant changes found in between control and treatment groups for milk SNF%, protein%, lactose%, salts% and total solids% in Gir cows The present finding is in agreement with Singh *et al*. (2018) [17], who found non-significant increment in SNF% of milk in treatment groups (from 8.5 to 8.6%) compared to control group (from 8.4 to 8.3%). There was no effect of post milking teat dipping on SNF% in milk.

The present finding is in conflicting with the results by Shailja and Singh (2002) [13], who found significant (p<0.01) increment in protein% of milk in treatment groups compared to control group and milk protein in control and treatment groups were 3.33 and 4.04%, respectively. The present findings are in agreement with the results of Shailja and Singh (2002) [13], who observed a slight increment of milk lactose% in treatment group (3.71%) compared to control group (4.70%) but the difference was not significant. The results obtained in the present study regarding salts% of milk is in normal range of milk salts (0.71-0.73%) and no change was observed due to post milking teat dipping (Bade *et al*., 2008) [2]. The results obtained in Gir cows in the present study regarding total solids% of milk is in normal range (8.85%) of healthy Gir cow and it was affected by post milking teat dipping (Gajbhiye *et al*., 2019) [3].

Conclusion

Mastitis is a recurrent inflammatory disease of mammary glands in cattle causing great economic losses in dairy industry. The main precursor for this disease is infection to teat canal through the teat hole post milking. Therefore the present study revealed that post milking teat dipping reduces the prevalence of SCM, milk SCC and milk pH in Gir cows and post milking teat dipping can be useful to prevent SCM in field level. However, post milking teat dipping does not affect the milk yield and composition in early lactating Gir cows.

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