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Effect of pre-partum management on udder and teat development, temperament score, milking traits, milk yield and composition in primiparous Nili-Ravi buffaloes

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ABSTRACT

To investigate the effect of pre-partum heifer management on udder and teat development, temperament score, milking traits, milk yield and composition, 12 primiparous Nili-Ravi buffaloes from ICAR-CIRB, Nabha Buffalo Farm were enrolled. All experimental heifers were uniformly divided into 2 groups (6 in each group) based on their duration of pregnancy, dam's milk yield and body weight. The udders of first group heifers were neither massaged nor they were taken into milking parlour and were considered as control (T_0). The udders of other group were massaged for 5–10 min at alternate days since 30 days pre-partum and were considered as treatment (T_1) group. The udder/teat biometry, temperament score, milking traits and milk composition of experimental buffaloes were recorded. The T_1 group heifers had significantly higher absolute change in udder length, width and depth than control. Though the level of change in teat diameter was significant, it was much more prominent in fore-teats than rear. The massaged group become docile earlier than non-massaged. The milk let-down time was quicker in treatment group than control. The test day milk yield was comparatively higher but the difference was not significant. The milk composition did not vary significantly between T_1 and control. It can be concluded that in primiparous Nili-Ravi buffaloes, udder/teat massaging and pre-partum exposure into milking parlour not only helped to develop udder/teat capacity but also reduced fear during milking operations resulting into quick milk let-down/milk flow-rate and favoured management during early lactation.

Keywords: Milk production, Milking traits, Nili-Ravi buffaloes, Prepartum management, Temperament score, Udder massage, Udder traits

Parity is one of the most important factors of milk production in dairy buffaloes. Milk production of primiparous buffaloes used to be very low and the production increases gradually up-to fourth lactation and then, again decreases slowly (Ahmad and Shafiq 2002). Thus, first lactation yield plays an important role in lifetime production of dairy buffaloes. Improper development of body including udder, small size teats unsuitable for milkman to hold for milking, inexperience of milking operations in the milking parlour, nervousness of animals etc. are the different factors responsible for milk production in primiparous buffaloes. Moreover, buffalo cows have a small udder cistern and almost 95% of the milk is stored in the alveolar compartment (Thomas *et al*. 2003). As a result, pre-milking stimulation has extreme importance for optimal milk ejection response in buffaloes (Abdel-Raouf *et al.* 2011). The stimulation for milk let-down in buffaloes requires more time compared to cows (Svennersten-Sjaunja 2000). Earlier reports envisaged that pre-partum udder massaging increased milk production in the first lactation through reducing fear of first calving crossbred cows (Das 2004), developing udder size and improving udder function (Bogatyreva *et al*. 1983, Kitaev 1991 and Das 2001), enhanced milk fat content (Zhuzha *et al*. 1987) and protein content (Mikhailyuk *et al*. 1981, Yarovaya 1981). Introduction of pregnant heifers into the milk parlour regularly was found to be beneficial for crossbred primiparous dairy cows to accustom with the milking environment (Das 2001). Roy and Nagpaul (1985) and Burrow (1997) correlated temperament score with milk flow rate and milk yield. In buffaloes, the reference in this aspect is very limited. Therefore, the study was undertaken to find out the effect of pre-partum heifer management on udder and teat development, temperament score, milking traits, milk yield and milk composition in primiparous Nili-Ravi buffaloes.

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MATERIALS AND METHODS

Study Location and climatic condition: The present study was conducted at the Central Institute for Research on Buffaloes, Regional Station-Bir Dosanjh, Nabha, Patiala, Punjab, India during 2013. The average annual rainfall is around 700 mm. The ambient temperature reaches 1°C in winter and 45°C in summer.

Experimental design and animals: Nili-Ravi buffalo heifers (12) of late pregnancy were selected from the Buffalo Farm, CIRB-Bir Dosanjh, Nabha. Heifers were uniformly

divided into 2 groups (6 in each group) based upon their duration of pregnancy, dams' milk yield, body weight etc. The udder of first group buffaloes was neither massaged nor taken into milking parlour and was considered as control (T_0). The udder of second group buffaloes was massaged at alternate day since 30 days pre-partum taking them into the milking parlour and was considered as treatment (T_1) group.

Management of animals: All experimental buffaloes were managed under loose housing and group management system. A conventional tail-to-tail house containing concrete roof shed was used for massaging and milking of buffaloes. As a routine practice of the farm, during summer, all experimental buffaloes were allowed to the wallowing tank for 10–15 min twice daily, i.e. around 7.00 AM and 2.30 PM. Before calving, concentrate and chopped green fodders were offered to the animals in groups. After calving, the total amount of required concentrate ration was divided into 2 equal parts and was distributed among lactating buffaloes twice, i.e. in the morning and evening before milking as per standard practice of the farm. The green fodder was chopped and total required amount was supplied to the buffaloes twice daily, i.e. around 10 AM and 3 PM in groups. *Ad lib.* drinking water was available for 24 h.

Massaging of animals: To massage udder/teats of treatment group, heifers were taken into milking parlour around 10 AM and fastened properly. One male stock person of farm worked as massager. He washed his hands properly before massage and started udder massaging with both his hands. Massage started from its (udder) base, progressed towards and ended at teats of udder following the direction of hairs. The duration of massage was 5–10 min/day/session.

Parameters recorded: Udder length (UL), udder width (UW), udder depth (UD), teat lengths (TL), teat diameters (TD) and teat distances of control and treatment group were recorded fortnightly from one month pre-partum until calving. Before taking measurements, all animals were taken into a levelled ground and they were tied. Measuring tape (cloth), measuring rod, scale and Vernier Callipers were used to take various measurements. Temperament score during massage at every week upto calving (in massaged animals) was recorded. Temperament score during milking was also noted twice in a week upto 60 days of lactation. The scoring during massaging as well as milking was recorded by the experienced observer following the procedure of Das and Das (2004). Considering the hardness of teats in buffaloes, calves of respective buffaloes were allowed to suckle their mother during hand milking for let-down of milk. Milking traits were recorded twice in a week and from that, average milk flow-rate was calculated (Das and Das 2004). The total milk yield during first 60 days of lactation was recorded. Milk fat%, SNF%, lactose% and protein % were analysed at every week for both groups with automatic milk analyser-Master Classic LM2 pH®.

Statistical analysis: The data generated from the experiment were used to find out absolute change and per cent change in the measurements of udder length, width, depth, teat length, diameter and distance between teats in control and treatment group. Statistical analysis (Independent sample T-test) was done to know the significant differences of udder/teat development, temperament score, milking traits, test day (60 days) milk yield and composition between 2 groups using SPSS (2001).

RESULTS AND DISCUSSION

The average increase of UL and UW in massaged and non-massaged animals was 14.2 cm vs. 14.0 cm and 9.5 cm vs. 9.5 cm, respectively (Table 1). The absolute change of average UD was also comparatively higher in T_1 (8.33 cm) than T_0 (3.67 cm). The absolute changes of udder traits differed significantly (varied from $P<0.02$ to $P<0.0001$) between two groups. The average per cent change of UL, UW and UD in massaged group varied from 36.80 to 105.83% and in non-massaged group from 23.35 to 45.96%. The differences were statistically significant (varied from $P<0.039$ to $P<0.013$). The present result also showed that pre-partum massaging definitely helped in developing udder dimension in primiparous buffaloes. Das (2001) studied the significant ($P<0.01$) increase of udder traits in massaged group crossbred primiparous cows than non-massaged. Earlier researchers envisaged that pre-partum udder massaging was not only effective in helping heifers to adopt to noise and action of machine milking (Kitaev 1991) but it had also favourable effect on udder development (Kotendzhi 1976, Kostenko 1980, Yarovaya 1981, Bogatyreva *et al.* 1983, Valitskii 1990 and Kitaev 1991).

The absolute change of average left fore teat length (LFTL) and right fore teat length (RFTL) in massaged group heifers was increased by 1.43 cm and 1.70 cm, respectively (Table 1). In non-massaged heifers, the respective increases were recorded to be only 0.43 cm and 0.32 cm. In massaged group, similar increase was found in left rear teat length (LRTL; 1.40 cm) and right rear teat length (RRTL; 1.60 cm). The absolute increase in non-massaged group varied from 0.40 cm to 0.55 cm. In massaged heifers, per cent change of teat length ranged from 29 to 38% and in control group, it was found to be only 8 to 13%. All teat lengths increased significantly ($P<0.01$) between two groups. In massaged animals, such increase of teat length particularly in fore teats might facilitate milkers for full hand milking resulting into more milk production from first calving buffaloes. Similar increased teat length due to prepartum massaging was reported by Das (2001) in crossbred heifers. He suggested that udder massaging at least 30 days pre-partum was beneficial for developing udder and teats, for increasing mammary gland and for easing of milking process.

In massage group heifers, the absolute changes of average left fore teat diameter (LFTD), right fore teat diameter (RFTD), left rear teat diameter (LRTD) and right rear teat diameter (RRTD) were recorded as 0.92, 0.95, 0.73 and 0.88 cm, respectively (Table 2). The respective values were 0.32, 0.40, 0.38 and 0.43 cm in non-massaged heifer group. The differences were also statistically significant

Table 1. Mean±SE of udder traits and teat length of Nili-Ravi pregnant heifers in different groups

Parameter	Group	Initial measurement (cm)	Final measurement (cm)	Change in measurement (cm)	P value	Per cent change in measurement (Mean)
Udder length (UL)	Non-massaged	41.83±1.87	51.33±1.28	9.5±0.92	0.020	23.35
	Massaged	39.17±2.18	53.33±2.38	14.2±1.4		36.80
Udder width (UW)	Non-massaged	34.5±0.56	44.0±0.77	9.5±1.87	0.004	27.64
	Massaged	35.33±1.15	49.33±1.33	14.0±2.37		39.95
Udder depth (UD)	Non-massaged	8.33±0.67	12.00±0.73	3.67±1.03	0.0001	45.96
	Massaged	9.17±1.20	17.50±1.12	8.33±0.52		105.83
Left fore teat length (LFTL)	Non-massaged	4.12±0.24	4.55±0.27	0.43±0.20	0.0001	10.89
	Massaged	5.03±0.32	6.47±0.33	1.43±0.38		29.10
Right fore teat length (RFTL)	Non-massaged	4.27±0.28	4.58±0.25	0.32±0.03	0.0001	7.81
	Massaged	4.50±0.18	6.20±0.30	1.70±0.19		37.77
Left rear teat length (LRTL)	Non-massaged	4.53±0.37	5.08±0.38	0.55±0.09	0.001	12.57
	Massaged	4.60±0.23	6.00±0.31	1.40±0.13		30.44
Right rear teat length (RRTL)	Non-massaged	4.72±0.35	5.12±0.34	0.40±0.09	0.0001	8.81
	Massaged	4.50±0.22	6.10±0.29	1.60±0.14		35.83

(P<0.01) between groups. The result showed that not only the level of change in teat diameter was significant but also it was much more prominent in fore teats (P<0.0001) as compared to rear teats (P<0.01). The increased teat diameter due to massage could help milkers in holding teats properly during milking particularly in first calvers where the teat diameter used to be very small. The findings of Das (2001) supported the present results.

In massaged group, all the distances between teats increased from 2.45 to 6.13 cm (Table 2). In non-massaged, it varied from 1.51 to 3.36 cm. The change of teat distances between F-F, RF-RR and RF-LR differed significantly (ranged from P<0.05 to P<0.01) between two massage group animals. Except LF-RR, the values were statistically significant. The present findings showed that capacity and volume of udder/teats might be increased significantly in treatment group buffaloes due to the effect of pre-partum massaging. Das (2001) reported significant (P<0.01) increase of teat distances in massaged group heifers than control.

Table 2. Mean±SE of teat diameter and teat distance of Nili-Ravi pregnant heifers in different groups

Parameter	Group	Initial measurement (cm)	Final measurement (cm)	Change in measurement (cm)	P value	Per cent change in measurement (Mean)
Left fore teat diameter (LFTD)	Non-massaged	2.20±0.09	2.52±0.12	0.32±0.04	0.0001	14.36
	Massaged	2.48±0.10	3.40±0.08	0.92±0.09		37.93
Right fore teat diameter (RFTD)	Non-massaged	2.38±0.19	2.78±0.18	0.40±0.07	0.0001	17.90
	Massaged	2.45±0.08	3.40±0.14	0.95±0.09		38.89
Left rear teat diameter (LRTD)	Non-massaged	2.38±0.14	2.77±0.15	0.38±0.07	0.013	16.45
	Massaged	2.60±0.08	3.33±0.13	0.73±0.08		28.25
Right rear teat diameter (RRTD)	Non-massaged	2.48±0.14	2.92±0.14	0.43±0.05	0.010	17.94
	Massaged	2.52±0.23	3.40±0.17	0.88±0.13		37.46
Fore to fore teat distance (F-F)	Non-massaged	11.62±0.99	14.80±0.92	3.18±0.22	0.001	28.86
	Massaged	9.53±0.75	15.67±0.33	6.13±0.54		68.26
Rear to rear teat distance (R-R)	Non-massaged	4.87±0.27	7.92±0.34	3.05±0.46	0.071	65.61
	Massaged	4.77±0.50	9.18±0.92	4.41±0.48		94.74
Left fore to left rear teat distance (LF-LR)	Non-massaged	4.85±0.63	6.78±0.57	1.93±0.14	0.084	45.11
	Massaged	3.62±0.30	6.07±0.30	2.45±0.22		71.33
Right fore to right rear teat distance (RF-RR)	Non-massaged	4.90±0.56	6.42±0.54	1.51±0.23	0.002	34.78
	Massaged	4.38±0.60	7.23±0.51	2.85±0.21		71.30
Left fore to right rear teat distance (LF-RR)	Non-massaged	10.13±0.81	13.40±0.59	3.26±0.48	0.705	35.02
	Massaged	8.11±0.58	11.58±0.66	3.46±0.50		43.75
Right fore to left rear teat distance (RF-LR)	Non-massaged	10.38±0.71	13.75±0.60	3.36±0.35	0.020	33.78
	Massaged	6.87±0.63	11.28±0.56	4.41±0.14		68.42

The present investigation envisaged (Fig. 1) that massaged animals showed very good temperament, i.e. more docile since calving than non-massaged animals who had similar temperament after sixth week of lactation. It indicated that udder/teat massaging and pre-partum exposure of animals into milking byre in former animals caused early customization with the post calving situations which did not happen in latter group. Pre-partum management helped primiparous buffaloes in reducing fear from milking operations. Thus, more milk was harvested from massaged buffaloes and that too, very comfortably. Similar observation was put forth by Das and Das (2004) in crossbred primiparous dairy cows. In earlier studies, Ronda and Gutierrez (1991) and Burrow (1997) pointed out that temperament score of cows influenced milk flow-rate.

The effects of udder massaging on milk let-down time (MLDT) and milk flow-rate (MFR) in primiparous buffaloes has been shown in Fig. 2 and 3, respectively. During first week of lactation, the average milk let-down time in non-massaged group buffaloes was 129.5±3.6 sec. In massaged group, it was only 85.0±2.9 sec. In both groups, let-down time decreased gradually with the advancement of lactation (Fig. 2). The MLDT was significantly ($P<0.01$) lower in treatment group than control from 1st to 9th week of lactation signifying that milkers spent less time for starting of milking. The result also depicted that at first week of lactation, the average MFR was recorded as 9.8±0.8 g/sec and 7.84±0.3 g/sec in massaged and non-massaged group buffaloes, respectively. The flow-rate in both the groups increased gradually towards 9th week of lactation (Fig. 3) and the values differed significantly (varied from $P<0.05$ to $P<0.01$) between two groups. It showed that MFR was comparatively higher in T_1 and T_0 group, i.e. more milk could be obtained from animals in lesser time. Gorewit and Gassman (1985), Valitskii (1990), Kitaev (1991), Das and Das (2004) and Tancin *et al.* (2007) also put forth similar observations.

The result depicted that the test day (60 days) average milk yield of T_1 (543.00±35.87kg) group was comparatively higher than control (531.00±17.61 kg). However, the values

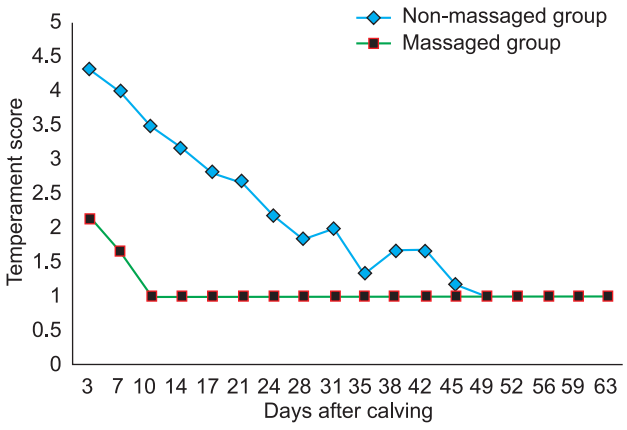

Fig. 1. Post-partum temperament score of Nili-Ravi primiparous buffaloes in different groups.

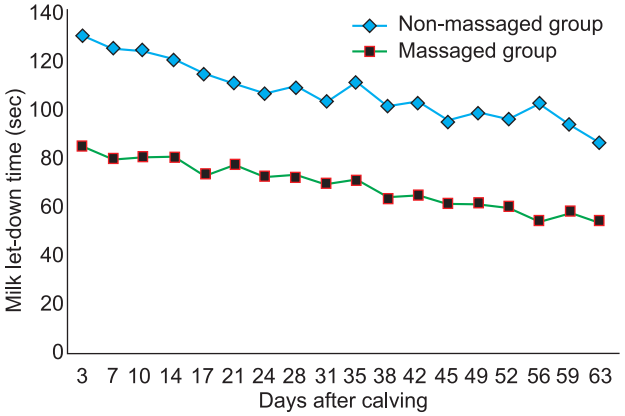

Fig. 2. Milk let-down time (sec) of Nili-Ravi primiparous buffaloes in different groups.

did not differ significantly between two groups. Abdel-Raouf *et al.* (2011) compared the effect of pre-partum udder massaging in primiparous and multiparous buffaloes on milk yield and composition. They pointed out that pre-partum udder massaging resulted higher milk yield in primiparous than multiparous buffaloes. The report of Valitskii (1990) and Kitaev (1991) also supported the present findings.

During first 60 days of lactation, the average milk fat % in T_1 animals were slightly lower than T_0 animals (Table 3) which might be due to comparatively higher milk production in T_1 group. The average milk SNF % in two groups showed almost similar results. Throughout the study period, average milk lactose % and milk protein % (Table 4) had slightly higher values in T_1 animals than T_0. However, in no case, the values were significantly differed between two groups. Earlier, Gorewit and Gassman (1985) observed that the milk composition was not affected by udder stimulation. In contrast, high fat content (Zhuzha *et al*. 1987) and high protein content (Mikhailyuk *et al*. 1981 and Yarovaya 1981) in milk due to pre-partum udder massaging were reported by few earlier researchers.

It can be concluded that in primiparous Nili-Ravi buffaloes, udder/teat massaging and pre-partum exposure into milking parlour not only helped to develop udder/teat

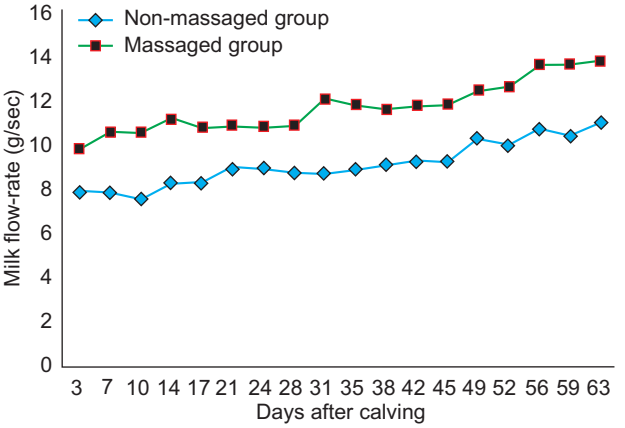

Fig. 3. Milk flow-rate (g/sec) of Nili-Ravi primiparous buffaloes in different groups.

Table 3. Milk composition of primiparous Nili-Ravi buffaloes in different groups

Week after calving	Fat (%)				P value	SNF (%)				P value
	Non-massaged		Massaged			Non-massaged		Massaged		
	Mean	SE	Mean	SE		Mean	SE	Mean	SE	
1	7.63	0.20	7.06	0.41	0.243	10.70	0.20	10.77	0.29	0.846
2	7.43	0.30	7.02	0.19	0.264	10.69	0.16	10.66	0.28	0.940
3	7.56	0.67	7.75	0.33	0.702	10.31	0.10	10.60	0.19	0.209
4	7.02	0.34	7.17	0.34	0.775	10.29	0.21	10.22	0.17	0.778
5	7.26	0.44	7.30	0.26	0.944	9.87	0.25	10.19	0.21	0.353
6	7.35	0.16	7.45	0.39	0.818	9.87	0.10	9.92	0.19	0.794
7	7.35	0.15	7.09	0.15	0.248	10.00	0.17	10.04	0.26	0.902
8	7.74	0.31	7.85	0.20	0.760	9.79	0.07	9.96	0.14	0.312
9	7.89	0.26	7.32	0.31	0.192	9.87	0.15	9.93	0.18	0.802

Table 4. Milk composition of primiparous Nili-Ravi buffaloes in different groups

Week after calving	Protein (%)				P value	Lactose (%)				P value
	Non-massaged		Massaged			Non-massaged		Massaged		
	Mean	SE	Mean	SE		Mean	SE	Mean	SE	
1	3.92	0.07	3.95	0.10	0.848	4.92	0.15	5.16	0.17	0.308
2	3.92	0.06	3.91	0.10	0.957	4.98	0.14	5.10	0.21	0.638
3	3.78	0.04	3.88	0.07	0.215	4.67	0.12	4.81	0.12	0.442
4	3.78	0.08	3.75	0.06	0.767	4.85	0.18	4.74	0.10	0.595
5	3.62	0.09	3.74	0.08	0.347	4.46	0.16	4.67	0.13	0.323
6	3.60	0.04	3.64	0.07	0.601	4.41	0.07	4.44	0.20	0.896
7	3.67	0.06	3.68	0.10	0.890	4.52	0.11	4.64	0.18	0.600
8	3.55	0.06	3.65	0.05	0.210	4.25	0.13	4.33	0.11	0.650
9	3.62	0.05	3.64	0.06	0.832	4.25	0.07	4.48	0.14	0.162

capacity but also reduced fear during milking operations resulted into quick milk let-down/milk flow-rate and favoured management during early lactation.

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