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Effect of Restricted Suckling on Shortened Lactation Length and Performance of Sahiwal Cattle

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ABSTRACT

Background: Sahiwal cattle write is more prone to lactation failure and short lactation. The present study was conducted to study effects of restricted suckling on productive (with special reference to lactation length) and reproductive performance of Sahiwal cows, who had short lactation length.

Methods: A total of 24 multiparous Sahiwal cows of 2nd-4th parity were selected based on their previous history of short lactation length (70-190 days). Cows were randomly divided into 3 weaning groups *i.e.* zero day weaning group (G_1, n=8), restricted suckling up to 90 days (G_2, n=6) and restricted suckling up to 150 days (G_3, n=6). Recording of peak yield (PY), lactation milk yield (LMY) and lactation length (LL), udder morphometry, somatic cell count (SCC), milking behaviour and reproduction parameters was done. Blood plasma levels of prolactin (ng/ml), growth hormone (mg/ml) and cortisol (ng/ml), were also studied.

Result: Lactation MY (kg) was found highest in G_2 followed by G_3 and G_1. Lactation length was found significantly ($p \leq 0.05$) longer in group-3. Temperament scoring, days to first heat and service period of cows found significantly higher in RS groups. Overall improvement in lactation length was 38.27% in G2 and 37.28% in G3 as compared to their previous LL. So, the study indicated that the restricted suckling method seems to be more efficient compared to an immediate calf separation since this avoided the cow becoming dry prematurely, improved milk yield, lactation length and growth rate of calves.

Key words: Lactation length, Restricted suckling, Weaning, Zebu Cattle.

INTRODUCTION

Sahiwal is considered as best milch purpose breed or champion zebu breed of tropical and sub-tropical countries due to its adequate capacity of milk production, better hot climate adaptation and diseases resistance power. Under tropical conditions, an important feature of milk production is length of lactation period in zebu cattle as most of the cattle usually have shorter lactation length than standard 305 days (Rehman and Khan, 2011). Most of times, the lactation length is as short as 150 days (Mukasa- Mugerwa *et al*., 1989) in tropical cattle with about 500 litres lactation milk yield. 'Lactation failure' term is used when there is loss of milk production by the cow within 80 days of calving under normal milking conditions (Murugaiyah *et al*., 2001). As lactation length is one of the most important determinants of lactation yield but most of Sahiwal cows are not able to reach standard 10 months lactation length (Rehman *et al*., 2014) and show high proportions of short lactation length. The average lactation length of Sahiwal cattle was found to be 215.83±3.08 days on an organised herd (Narwaria *et al*., 2015) in India and 235±1.4 days in Pakistan (Rehman and Khan, 2012). There is large variation in lactation length of Sahiwal cattle ranging from 170.44 days to 349.77 (Parkash *et al*., 2005), which is showing large scope for improvement in this trait. Phenomenon of lactation failure had been observed in about 30% of total dairy herd which possibly causing loss of 60% potential of lactation in Sahiwal Friesian cattle (Murugaiyah *et al*., 2001). Shorter lactation length of indigenous cows is one of the important causes of lower milk production due to significant correlation between lactation length and milk yield (Syrstad, 1992).

Previous studies have reported that under temperate conditions, shorter lactation length (<305 days) occur only when there is any abnormal event occur like death, serious illness or injury but under tropical conditions, normal early drying up of cows and premature termination of lactation can occur. Various possible reasons of short lactation can be genetic basis, absence of calf stimulus or suckling, death of calves resulting in poor milk ejection reflex, poor milk let down, incomplete milk removal (Madalena 1988) or any type of discomfort, environmental stress and novel surroundings. In primiparous cows, this problem is more and about 10% of primiparous have problem of disturbed milk ejection and complete milk ejection or removal is necessary for optimum milk production performance of cows (Kraetzl *et al*., 2001). While analysis of lactation performance of tropical zebu

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cattle, lactations shorter than 100-150 days are considered as cases of abnormal or short lactation length, so excluded from the lactation length data (Madalena 1988). Even though the short lactation length problem has been identified since a very long time, no possible solution has been found till date. To increase the net returns from the dairy farming of Zebu cattle under tropical conditions, there is much scope to better exploit the lactation length through better management strategies. Lactation length is an important economic trait. The zero day weaning of calf or separation of calf from its dam just after birth is a common management practice in European dairy cattle. But the practice of rearing calf in an artificial way can create milk let down problems in zebu cattle and its crosses, which further give rise to short lactation problem due to high maternal instinct of zebu cattle. The milking of crossbred cows without the presence of calf at milking led to short lactation (about 34 days) problem in about 40% of cows (Alvarez *et al*., 1980). Previous studies have reported that calf suckling practice have positive effects on cow production performance, calf growth and weight gain under tropical conditions (Kanuya *et al*., 2006). Restricted calf-suckling results in increment in total milk yield due to complete removal of residual milk by calf suckling after milking (Mejia *et al*., 1998). To improve the productive performance via better exploitation of lactation length of indigenous Sahiwal cow, there is a need of better milking management strategy. Based on above intricacies, the present study was conducted to study the effects of restricted suckling on lactation performance of animals having short lactation length (<200 days).

MATERIALS AND METHODS

Animal's selection and experimental design

Location of study was Livestock Research Centre of ICAR-NDRI, Karnal under the project of ICAR-CIRC, Meerut from 2020-2022. A total of 24 multiparous Sahiwal cows with parity 2-4 were selected based on their previous lactation history for short lactation length (70-190 days). The selected cows were free from any type of reproductive disorder, udder infection/mastitis etc. These cows were randomly divided into three groups *i.e*. weaning group (G_1, n=8), restricted suckling up to 90 days (G_2, n=6) and restricted suckling up to 150 days (G_3, n=6). The average of two previous lactation length (days) of animals 133.75±12.69 days respectively in G_1, 164.17±13.42 days in G_2 and 168.50±18.57 days respectively in G_3. The milking of selected cows was done twice daily at 5.30 AM and 5.30 PM by hand milking method. In-group 1, calf weaning was done just after birth and they were provided colostrum/milk by pails/nipple bottle. In group-1, milking was done by hand milking along with concentrate feeding. In group 2 and group 3, prior to hand milking, calves were allowed to suckle for 30-60 seconds only for milk let down and calf remain tied in front of cows while milking for better maternal bonding of dam and neonate. In group-2 and group-3, restricted suckling was allowed for three months and five months respectively. After the completion of milking, the calves were allowed to suckle for 15-20 minutes for complete removal of residual milking in G_2 and G_3. The total contact time of calf and mother was about 10 minutes prior milking and 20 minutes post milking. Concentrate feeding was done in all three groups during milking. Estrus symptoms were recorded by visual observation in presence of teaser bull and estrus was also confirmed through per rectal examination by a trained person.

Recording of cow and calf performance

The milk yield was recorded at every milking and daily yield was calculated by taking average of morning and evening milk yield. The amount of milk suckled by calves due to restricted suckling was calculated every week for two days consequently by calculating the difference in body weight of calves before and after suckling. Total milk yield of each cow/day was determined by adding suckled quantity of milk by calf and daily milk yield received from hand milking at morning and evening (Alice *et at*., 2008). Recording of production parameters *viz*. average daily milk yield (kg/day), peak yield (kg), lactation milk yield (kg) and lactation length (days) during full lactation were done. The milking behaviour of cows including milking temperament (0-5) as described by Tulloh (1961), let-down time (sec), milking time (min), milk flow rate (kg/min) was observed by direct observation method during the milking time for first 60 days after calving at monthly interval. The milking behaviour parameters like milk let-down time (MLT), total milking time (TMT), average milk flow rate (kg/min) (MFR) were studied (Upadhyay *et al*., 2015). Reproductive parameters like days to first observed heat and days to successful conception were recorded.

Blood sampling and estimation of hormones

Blood samples (5 ml) were collected from jugular vein in vacationer (10 ml, coated with EDTA) at monthly interval starting from day zero to 150 days just after milking at monthly interval. The blood plasma was separated by centrifugation and stored at -20ºC for analysis of prolactin, cortisol and growth hormone. The estimation of hormone was done by bovine ELISA kits.

Udder scoring and biometry

In order to rule out the udder deformity, udder scoring (ICAR guidelines, 2018) was also done. The following udder related observations were recorded at monthly intervals up to three months, half an hour before milking. The shape of udder was also assessed and regular to pendulous udder shape was found in all the cows under study.

Statistical analysis

The statistical analysis was done using SPSS 21 version. The data were analysed by one way Analysis of variance.

RESULTS AND DISCUSSION

Effects on cow's performance

There was no any significant difference found for milk peak yield (kg) among three groups (Table 1). Overall lactation milk yield was found to be highest in group-2 followed by group-3 and group-1. Due to early drying up of cows in group-1, the lactation length was significantly affected and did not reach to standard 305 days. Overall lactation length was found to be less than even 150 days in group-1 and it reaches to at least 227 and 231 days in group-2 and group-3 respectively. The significant difference in lactation length between weaning and restricted suckling groups indicated the influence of calf and maternal instinct on short lactation susceptible zebu cows. Our study findings were found in agreement with previous studies like Little *et al*. (1991) and Sanh *et al*. (1997). The milk let down by calf stimulates better psychological signal for release of oxytocin and effective milk ejection reflex (Tancin *et al*., 2001). The suckling of calf provides longer teat stimulation and removes all the residual milk with their deep sucking action (Mejia *et al*., 1998) which can be the reason of higher milk yield and longer lactation length. Due to early weaning in zebu cows, amount of residual milk in udder will be more leading to slow release of milk secretion rate between milking times and returning of milk from cistern compartment to alveolar portion (Caja *et al*., 2004), this ultimately results into decrease in milk yield and early drying up of cows. Another study in Sahiwal-Friesian cows also reported the progressive increase in amount of residual milk stasis in udder after normal milking causing autocrine inhibitory feedback, disturbed milk ejection reflex and premature udder involution in short lactation susceptible cows (Murugaiyah *et al*., 2001).

The milking behaviour and temperament scoring of lactating cows were studied for first two months post calving and have been given in Table 2 and 3. Milk let down time (sec) was significantly ($p \leq 0.05$) higher in weaning group. Milking time (min) was not significantly different among the three groups. Milk flow rate (kg/min) was significantly lower in weaning group. Table 4 showed that the overall

Table 1: Effect of weaning and restricted suckling (LS means± S.E.) on production of cows.

Parameter		Group-1	Group-2	Group-3
Daily milk yield (kg)	0-30 days	5.18±0.28	5.52±0.44	5.23±0.31
	31-60 days	4.50^{b}±0.19	5.50^{a}±0.34	5.83^{a}±0.31
	61-90 days	2.8^{b}±0.29	4.77^{a}±0.34	4.62^{a}±0.32
	91-120 days	1.71^{c}±0.32	4.75^{a}±0.27	4.35^{ab}±0.32
	121-150 days	0.85^{b}±0.23	4.45^{a}±0.33	4.01^{a}±0.92
Peak yield (kg)		5.53±0.26	6.00 ±0.28	6.25±0.42
Lactation my (kg)		953.13^{b} ±66.23	1434.66^{a}±167.80	1354^{a}±80.98
Lactation length (days)		149.25^{b}±11.12	227.01^{a}±11.57	231.33^{a}±13.15

[a, b]Means with different superscripts differ significantly in a row (p value≤0.05).

Table 2: Effect of weaning and restricted suckling (LS Mean± SE.) on milking behaviour of cows.

Parameter		Group-1	Group-2	Group-3
0 -30 day	Milk let down (Sec)	118.75^{a}±4.6	95.33^{b}±4.98	97.67^{b}±3.56
	Milking time (Min)	8.75±0.79	8.23±0.55	7.50±0.64
	Milk flow rate (kg/min)	0.59^{a}±0.02	0.67^{b}±0.02	0.69^{b}±0.03
	Temperament scoring	2.38^{a}±0.18	1.18^{b}±0.12	1.50^{b}±0.22
31-60 day	Milk let down (sec)	117.50^{a}±3.61	82.83^{b}±3.89	87.67^{b}±6.45
	Milking time (Min)	7.23±1.78	9.81±0.72	9.47±0.23
	Milk flow rate (kg/min)	0.54^{a}±0.02	0.56^{ab}±0.02	0.61^{b}±0.27
	Temperament scoring	2.25^{a}±0.25	1.67^{ab}±0.21	1.33^{b}±0.33

[a, b]Means with different superscripts differ significantly in a row (p value≤0.05).

Table 3: Effect of weaning and restricted suckling (LS Mean± SE.) on milking temperament of cows.

Parameter	Group-1	Group-2	Group-3
0 -30 day	2.38^{ab}±0.25	1.53^{bc}±0.21	1.67^{bc}±0.33
31-60 day	2.25^{a}±0.18	1.18^{b}±0.12	1.50^{b}±0.22
61-90 day	1.88^{a}±0.13	1.17^{b}±0.15	1.00^{b}±0.01
90 day	1.63^{a}±0.18	1.17^{b}±0.01	1.00^{b}±0.01
120 day	1.50±0.19	1.00±0.17	1.02±.01
150 day	1.83±0.19	1.53±0.16	1.50±0.23

[a,b,c] Means with different superscripts differ significantly in a row (p value≤0.05)

improvement in lactation length was 38.27% in group-2 and 37.28% in group-3 as compared to their previous lactation lengths given in Table 5 when the weaning on zero day was practiced. Temperament scoring of cows found significantly higher *i.e*. restless category in weaned group and docile category in suckling group. Poor temperament scoring in weaned group might be other important reason for short lactation which results in inhibition or poor release of oxytocin. Upadhya *et al*. (2015) and Kumar *et al*. (2017) also reported similar findings. We reported higher interval to first estrus and service period in RS groups in comparison to weaning group (Table 5). Sanh *et al*. (1997) did not report significant effects of restricted suckling on reproductive performance of cows. Studies have indicated that restricted suckling had a non-significant effect on first heat interval after calving, so it will not probably affect the calving interval because after weaning the cows had showed relatively higher fertility (Krohn, 2001).

Effects on udder health and scoring

We did udder evaluation and measurement for first two months to see effect of udder morphometry on lactation yield and length. Udder shape was found regular to pendulous and teat end shape varied from pointed to flat (Dahiya, 2006). All udder measurement traits were found to be in normal range (Table 6) of biometry for Sahiwal cattle (Khan and Khan, 2015). During first month, udder traits like rear udder width and teat length were found statistically different in three groups, which may be due to individual animal difference. During second month, only teat length showed significant difference and during third month, only rear udder width found significantly different.

Table 4: Effect of restricted suckling (LS Mean± SE) on lactation length of cows.

Animal. no.	Group -2 (RS up to 3 months)			Group -3 (RS up to 5 months)		
	Previous LL	LL after study	% Change	Previous LL	LL after study	% Change
1	165	190	15.15	175	250	42.85
2	158	198	25.31	185	254	37.29
3	149	240	61.07	138	210	52.17
4	175	256	46.28	152	175	13.14
5	151	223	47.68	169	245	44.97
6	187	255	36.36	192	254	32.29
Overall	164.16	227	38.27	168.50	231.33	37.28

Table 5: Effect of Weaning and Restricted suckling (LS Mean± SE) on reproductive parameters of cows.

Parameter	Group-1	Group-2	Group-3
Days to first observed heat (days)	44.50^{a}±2.63	56.17^{b}±5.30	62.0^{b}±2.30
Service period (days)	123.50^{a}±5.49	147.83^{b}±7.11	174.33^{c}±8.89

^{a,b,c} Means with different superscripts differ significantly in a row (p value<0.05).

Table 6: Effect of weaning and restricted suckling (LS Mean± SE.) on udder measurement of cows.

Parameter	Udder trait	Group-1	Group-2	Group-3
0 -30 day	Udder depth (cm)	8.5±0.50	7.25±0.63	7.49±0.77
	Rear udder height (cm)	13.81±0.67	13.91±1.56	14.43±1.64
	Rear udder width (cm)	6.22^{b}±0.39	7.31^{ab}±0.56	8.03^{a}±0.65
	Teat length (cm)	7.18^{b}±0.21	8.67^{a}±0.53	8.01^{ab}±0.52
	Teat thickness (cm)	4.56±0.28	4.33±0.31	4.68±0.32
31-60 day	Udder depth (cm)	7.56±0.50	6.83±0.61	7.12±0.72
	Rear udder height (cm)	13.01±0.59	13.39±1.41	14.41±1.56
	Rear udder width (cm)	6.20±0.38	7.31±0.32	8.03±0.51
	Teat length (cm)	7.17^{b}±0.22	7.25^{b}±0.53	8.67^{a}±0.51
	Teat thickness (cm)	4.2±0.23	4.33±0.31	4.68±0.32
61-90 day	Udder depth (cm)	7.03±0.48	7.16±0.61	7.48±0.76
	Rear udder height (cm)	11.25±0.49	12.41±1.58	13.13±1.64
	Rear udder width (cm)	6.20^{b}±0.49	7.29^{ab}±0.57	8.03^{a}±0.65
	Teat length (cm)	7.07±0.23	7.08±0.58	7.83±0.44
	Teat thickness (cm)	4.43±0.28	4.25±0.31	4.68±0.32

Means with different superscripts differ significantly in a row (p≤0.05).

This might be due to lactation stages related changes in udder biometry.

Effects of weaning and restricted suckling on hormonal profile

In this study, three hormones *i.e*. prolactin, growth hormone and cortisol were studied from first day of calving to 150th day of calving (Fig 1-3 respectively). These hormones are important for lactogenesis and galactopoiesis in cattle. On day 0 and 30, prolactin (ng/ml) and G.H (ng/ml) did not differ significantly but on day 60, there was significant difference observed. Cortisol (ng/ml) was significantly higher in weaning group on day zero that indicates stress of calf separation in cows. In ruminants, prolactin and GH have been found important lactogenic hormones for lactogenesis and galactopoiesis (Flint and Knight, 1997). Prolactin and growth hormone started to decrease in weaning group 60 days onwards. Similar findings have been reported by Pandey *et al*. (2019) and Mishra *et al*. (2020). Hand milking and calf suckling have been found more potent stimulus and resulted in more release of prolactin (Hernandez *et al*., 2002) and more milk yield (Bar-Peled *et al*., 1995). Suckling stimulus caused not only effective teat stimulation and more release of prolactin and GH in crossbred cows but also short-term elevated GH levels after suckling/milking (Negrao and Marnet, 2002) followed by increased milk production. The cortisol hormone was found higher in weaned group and it is proven fact that ACTH acts as stimulator of cortisol cause suppression of milk secretion (Almeida *et al*., 1994). Jindal and Ludri (1990) reported that the GH value decreases as the lactation is advanced from first to sixth fortnight and the decrease in milk yield was positively correlated with GH levels in crossbred cows. Involution of udder is affected by endocrine factors and studies have indicated the influence of prolactin and GH on decrease in secretary epithelial cells through apoptosis. Therefore, declining prolactin levels has proposed to be as important primary signal for udder involution in dairy cows.

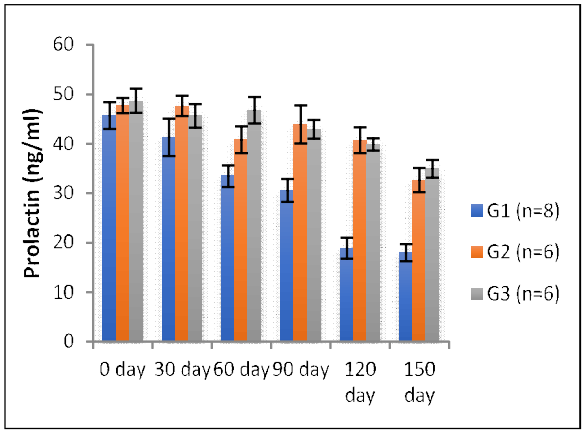

Fig 1: Number of days post calving (Prolactin ng/ml).

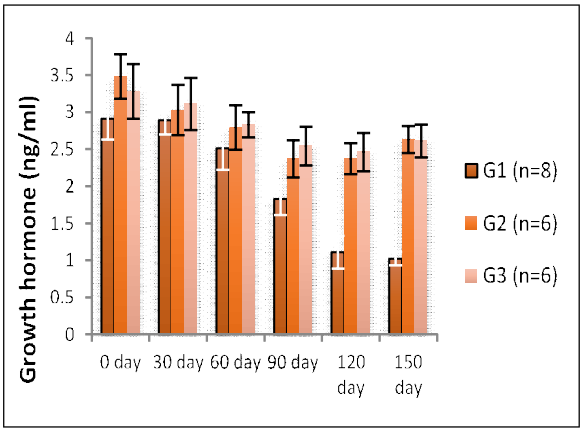

Fig 2: Number of days post calving (Growth hormone (ng/ml).

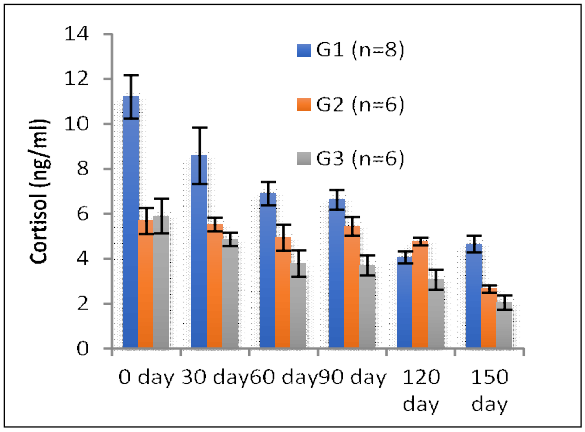

Fig 3: Number of days post calving (Cortisol (ng/ml).

CONCLUSION

The restricted calf suckling avoided the cow becoming dry prematurely, resulted in improved milk yield and lactation length. Short-term suckling has more advantages than disadvantages on production, health and behaviour of cows as compared to an immediate calf separation after birth.

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