



Effect of Body Condition Score during Transition Period on Early Lactation, Postpartum Interval to Estrus and Calf Birth Weight in Sahiwal Cows

Vikas Khune^{1*}, Sharad Mishra¹, M.K. Gendley², S.K. Chourasia¹ and Vandana Bhagat¹

¹Livestock Production Management Department, College of Veterinary Science and Animal Husbandry, Anjora, Durg (Chhattisgarh), INDIA

²Department of Animal Nutrition, College of Veterinary Science and Animal Husbandry, Anjora, Durg (Chhattisgarh), INDIA

*Corresponding author: V Khune; Email: doc_vik@rediffmail.com

Received: 17 February, 2016

Accepted: 04 March, 2016

ABSTRACT

A total of 26 purebred Sahiwal cows, 13 cows each from two farms i.e. the BMEF and CBF, Anjora, Durg, Chhattisgarh were studied during extended transition period (56 days prepartum to 84 days postpartum) to investigate variation in body condition score along with birth weight of calf, early lactational yield, postpartum interval to estrus (PPIE) and their interrelationships. In BMEF herd concentrate was not fed to the animals during prepartum stage. In BMEF, the mean BCS at periodical intervals was significantly less than that of CBF herd throughout the transition period. The postpartum mean unit loss in BCS of the cows of BMEF herd (0.54 ± 0.09) was significantly higher than that of CBF cows (0.52 ± 0.09). Significant differences were observed between overall pre- and post-partum means of BCS of each farm. Significantly higher early lactation yield was observed in the Sahiwal cows of CBF (667.23 ± 37.13 kg) than the cows of BMEF herd (476.92 ± 51.59 kg). The average PPIE was non-significantly shorter in CBF cows (228.69 ± 37.36 days) than those of the cows of BMEF herd (241.69 ± 43.51 days). The average birth weight of calf of CBF herd (22.38 ± 0.75 kg) was significantly higher than that of BMEF cows (19.58 ± 0.52 kg). Highly significant ($P < 0.01$) positive correlations were observed between the mean pre- and post-partum BCS with all periodical BCS at different intervals including mean pre- and post-partum BCS in both farms. Early lactation yield has shown negative and non significant correlation with 84 days postpartum BCS in both farms. PPIE was negatively correlated with BCS at 56 and 84 days postpartum in both the farms. PPIE had shown positive correlation with early lactation yield in BMEF ($r = 0.377$) and negative correlation in CBF herd ($r = -0.182$). It can be concluded that the energy status can be assessed by scoring of body condition periodically in transition Sahiwal cows which were indicative of their early lactation yield, interval to first detected heat and birth weight of calf.

Keywords: body condition score, transition period, calf birth weight, correlations, Sahiwal cow

Performance of fresh cows is important to the success of a dairy. The transition or peripartum period is critically important to health, production, and profitability of dairy cows. Although the transition period of 3 weeks pre-calving until 3 weeks post-calving is associated with a peak incidence of production diseases, the effects of these diseases on dairy cow health and productivity extend far into the following lactation. Thus this phase extends from start of dry period to peak yield in following lactation. The period is characterised by negative energy balance, fat mobilisation, and elevation of circulating non-esterified fatty acids and ketone bodies (Seifi, *et al.* 2007).

Good close-up and fresh cow nutritional programs, combined with excellent feeding management to achieve high levels of dry matter intake throughout the transition period, achieves 80 to 90 per cent of the potential of the first strategy and should always be the first area of focus for management (Overton, *et al.* 2003, 2004). The degree of changes in body reserves of a cow as assessed by periodical body condition score (BCS) during this period is an effective management tool. Most of the research pertaining to transition period is done in high yielding dairy cows. The data generated in high-yielding dairy cows on the effects of body reserves, milking, underfeeding,



endocrine regulation and nutrient partitioning could probably be used as a basis for the planning and discussion of applied as well as basic research directly related to tropical conditions (Chilliard, 1989). Sahiwal is one of the important milch Zebu breed. Therefore present investigation was undertaken to study the changes in early milk production and reproduction in relation to BCS in periparturient period so as to better understand the physiological mechanisms during this period in Sahiwal cows.

MATERIALS AND METHODS

Animals, feeding and management

The study was conducted on 26 pure bred Sahiwal cows, 13 each from two different farms i.e. Bull Mother Experimental Farm (BMEF) and from Government Cattle Breeding Farm (CBF), Anjora, Durg. There were two different feeding regimens in these farms. In BMEF, cows were kept on greens, paddy straw and without concentrate feeding during prepartum stage and during postpartum stage greens and paddy straw along with concentrates @ 1 kg for maintenance and @ 0.5 kg/kg milk produced were fed to individual cow.

While in CBF herd, the cows were fed greens, paddy straw and concentrate (20% CP, 0.93% EE, 18% CF and 14% ash) @ 3.5 kg during prepartum, while during postpartum stage greens, paddy straw along with concentrates @ 4 kg for first 15 days and concentrates @ 1 kg for maintenance and @ 0.5 kg/kg milk produced for subsequent period.

Body condition score (BCS)

All these animals were studied during the periparturient period of 8 weeks (56 days) prior from expected date of calving to 12 weeks (84 days) onwards from the date of calving. The animals were examined to record Body condition score (BCS) at fortnightly intervals on days 56, 42, 28 and 14 before the expected calving, and on days 3, 14, 28, 42, 56, 70 and 84 after calving. A scoring system of 1 to 5 point scale with quarter point increment as suggested by Ferguson *et al.* (1994) and confirmed by Elanco (1996) was used to record BCS.

Other parameters

Daily milk production of each individual cow (*early lactation yield*) was recorded up to 100th day of lactation. Days at first estrus signs after calving (*post partum interval to estrus- PPIE*) of each individual cow were recorded. Birth weight of the newborn calf from each individual cow was recorded.

Classification of data

The experimental data of different parameters generated during the transition period of 8 weeks (-56 days) prepartum to 12 weeks (+84 days) postpartum were classified Farm wise i.e. BMEF and CBF.

Statistical analysis

To see the periodical variations of BCS during transition period, one way analysis of variance was applied as per the procedure of Snedecor and Cochran (1994) followed by Duncan's multiple range test. Similarly to see the difference of BCS between data of prepartum and postpartum period of same animal, paired t test was applied. To see the association between BCS with reproductive and production parameters correlation coefficient was calculated. Statistical analysis was performed using the SPSS 10.0 programme.

RESULTS AND DISCUSSION

Body condition score profile in both the farms

The fortnightly mean BCS of cows of both the farms are presented in table 1. At 56 days prepartum the cows of BMEF had the mean BCS of 3.52 ± 0.09 which is within the recommended range i.e. 3 to 3.50 (Aggarwal *et al.*, 2010). However, in the cows of CBF herd the BCS (3.88 ± 0.09) exceeded from the recommended range, which indicate that the cows of CBF herd were approaching obesity at this time. Throughout the experimental period, BCS of BMEF herd differed significantly ($P < 0.01$) from the BCS of CBF herd. There was little non significant drop in BCS from 56 days prepartum in the cows of BMEF herd. Whereas, in cows of CBF the BCS remained constant till 42 days of prepartum. At 28 days prepartum decline in BCS of the animals of BMEF and CBF herds were noticed.

Table 1: Mean and \pm SE Body Condition Score in Sahiwal cows of BMEF and CBF farms

Periods of observations (Days relative to calving)	Mean BCS of Sahiwal cows		Sign.
	BMEF Herd (13)	CBF Herd (13)	
-56	3.52 ^b \pm 0.09	3.88 ^a \pm 0.09	**
-42	3.48 ^b \pm 0.10	3.88 ^a \pm 0.10	**
-28	3.44 ^b \pm 0.09	3.85 ^a \pm 0.09	**
-14	3.35 ^b \pm 0.11	3.80 ^a \pm 0.09	**
At Calving	3.27 ^b \pm 0.12	3.81 ^a \pm 0.09	**
+14	3.02 ^b \pm 0.10	3.65 ^a \pm 0.07	**
+28	2.85 ^b \pm 0.09	3.52 ^a \pm 0.08	**
+42	2.73 ^b \pm 0.09	3.44 ^a \pm 0.08	**
+56	2.69 ^b \pm 0.08	3.38 ^a \pm 0.09	**
+70	2.67 ^b \pm 0.08	3.31 ^a \pm 0.09	**
+84	2.73 ^b \pm 0.07	3.29 ^a \pm 0.11	**
Mean	3.07 ^b \pm 0.04	3.62 ^a \pm 0.03	**

Means bearing different superscripts within a row differed significantly. *P< 0.05, **P<0.01

The mean BCS at calving of BMEF cows (3.27 \pm 0.12) was significantly (P<0.01) less than that of CBF cows (3.81 \pm 0.09). This difference could be attributed to higher BCS of CBF cows at calving, which were calved at a higher score than the score recommended by Aggarwal *et al.* (2010).

The level of significance within average BCS at periodic intervals is presented in table 2. Significant (P<0.05) drop in mean BCS had occurred at the time of calving in the cows of BMEF. In BMEF this significant declining trend was continued till 42 days after calving indicating low energy intake. However, in the cows of CBF the changes between 14 days prepartum to calving were nadir. In CBF the significant decline in mean BCS started from the time of calving till 28 days after calving. Subsequently in both the herds there was non significant decline in BCS. This drop in BCS is usually associated with negative energy balance which normally occurs after parturition (Bauman and Currie, 1980).

The unit change in BCS during prepartum period (-56 to calving) of BMEF herd was 0.25 \pm 0.08 and for CBF herd was 0.08 \pm 0.06 (Table 3).

Table 2: Pre and Post partum change in mean BCS in Sahiwal cows of BMEF and CBF

Sl. No.	Pre and Post partum intervals	Level of significance in mean BCS of Sahiwal cows	
		BMEF herd (n=13)	CBF herd (n=13)
1	-56 & -42 days	NS	NS
2	-42 & -28 days	NS	NS
3	-28 & -14 days	NS	NS
4	-14 & calving days	*	NS
5	calving & 14 days	**	**
6	14 & 28 days	*	**
7	28 & 42 days	*	NS
8	42 & 56 days	NS	NS
9	56 & 70 days	NS	*
10	70 & 84 days	NS	NS
11	-56 & 84 days	**	**
12	-56 & calving days	**	NS
13	calving day & 84 days	**	**
14	-56 & 56 days	**	*

* P< 0.05, ** P<0.01, NS = non significant.

The significant (P<0.05) difference in prepartum unit change (in days before calving and at calving) of BCS could be attributed to fall in BCS in prepartum phase of the cows of BMEF herd indicating the negative energy balance situation, whereas the unit change during same period was meager in CBF herd.

Table 3: Mean BCS at Pre and Post partum period and unit change in BCS in Sahiwal cows of BMEF and CBF

Sl. No.	Particulars	Mean BCS and unit change of Sahiwal cows (BMEF) (n=13)	Mean BCS and unit change of Sahiwal cows (CBF) (n=13)	Level of significance
1	Overall unit change in BCS	0.79 ^a \pm 0.10	0.59 ^b \pm 0.09	**
2	Overall mean BCS at prepartum	3.41 ^b \pm 0.05	3.85 ^a \pm 0.04	**
3	Overall unit change in BCS (prepartum)	0.25 ^a \pm 0.08	0.08 ^b \pm 0.06	**



	Overall			
4	mean BCS at postpartum	2.85 ^b ±0.04	3.49 ^a ±0.04	**
	Overall			
5	unit change in BCS (postpartum)	0.54 ^a ±0.09	0.52 ^b ±0.09	*

Means bearing different superscripts within a row differed significantly. * P< 0.05, ** P<0.01

The unit changes in BCS during postpartum period were significantly (P<0.01) higher in the cows of BMEF (0.54±0.09) than those of CBF herd (0.52±0.09). The unit change in BCS was higher in magnitude till 42 days post calving in the cows of BMEF herd, whereas, it was lower in the cows of CBF. After 42 days post calving reverse trend was noticed and the magnitude of unit change in BCS of CBF herd was higher than that of BMEF. Thus, the overall unit change in BCS in postpartum phase was at par in showing significant difference between them.

Early lactation yield, Post partum interval to estrus (PPIE) and Calf weight of both the farms

In present investigation the Sahiwal cows of BMEF herd had given significantly lesser amount of milk (476.92±51.59 kg) than those of CBF herd i.e. 667.23±37.13 kg in first 100 days of lactation (Table 4). The trend in weekly average early milk production showed substantial reduction in peak yield of the cows of BMEF herd compared to that of CBF cows, although the days to reach peak is same i.e. 6 weeks in both herds. The persistency was better in CBF cows than BMEF cows.

These differences can be attributed to comparatively lower energy intake, significantly lower periodical body condition scores (Table 1) in Sahiwal cows of BMEF as compared to that of CBF cows and significantly (P<0.01) higher overall average unit loss in BCS during prepartum stage (Table 3) of nearly one increment (0.25±0.08). This indicated that one increment loss in BCS during gestation could reduce about 190.31kg of milk in subsequent early lactation period in Sahiwal cows which they calve at a mean BCS of 3.27.

The low energy status in Sahiwal cows of BMEF herd had also affected the period required for resumption of ovarian cyclicity with comparatively higher PPIE (241.69±43.51 days) than the cows of CBF herd (228.69±37.36 days). The lower energy intake with one increment unit loss of BCS during prepartum had also affected the average calf weight at birth in BMEF herd (19.58±0.52 kg) than that of CBF (22.38±0.75 kg).

Correlation coefficients between BCS at periodical intervals, productive and reproductive parameters in Sahiwal cows of the BMEF herd

Highly significant (P<0.01) positive correlation were observed between the mean prepartum BCS and mean postpartum BCS with all periodical BCS at different prepartum and postpartum intervals including mean pre- and post-partum BCS in BMEF herd (Table 5). This shows the significant and long term positive relationship between prepartum body reserves during transition period in Sahiwal cows. Obviously the BCS at calving was significantly and positively correlated with periodical

Table 4: Mean and ±SE of early lactation yield, Post partum interval to estrus (PPIE), Birth weight of calf and BCS profile in Sahiwal cows of BMEF and CBF herds

Farms (n)	Mean Early Lactation yield (kg)	Mean PPIE (days)	Mean calf birth weight (kg)	Mean BCS on 56 days prepart.	Mean BCS at calving	Mean BCS on 84 days postpart.	Overall unit change in BCS (pre-part.)	Overall unit change in BCS (post-part.)
BMEF	476.92 ^b	241.69	19.58 ^b	3.52 ^b	3.27 ^b	2.73 ^b	0.25 ^a	0.54 ^a
(13)	±51.59	±43.51	±0.52	±0.09	±0.12	±0.07	±0.08	±0.09
CBF	667.23 ^a	228.69	22.38 ^a	3.88 ^a	3.81 ^a	3.07 ^b	0.08 ^b	0.52 ^b
(13)	±37.13	±37.36	±0.75	±0.09	±0.09	±0.04	±0.06	±0.09
Sign.	**	NS	**	**	**	**	**	**

Means bearing different superscripts within a column differed significantly. *P< 0.05, **P<0.01

Table 5: Correlation coefficients (r)# between BCS at different periodical intervals and productive as well as reproductive parameters in BMEF herd

Parameters	BCS at 56 days prepart	BCS at calving	BCS at 56 days postpart.	BCS at 84 days postpart	Mean BCS at prepart	Mean BCS at postpart	Early lact. yield	PPIE	Birth wt. of calf
BCS at 56 days prepart.	1.000								
BCS at calving	0.754**	1.000							
BCS at 56 days postpart.	0.500	0.619*	1.000						
BCS at 84 days postpart.	0.516	0.736**	0.792**	1.000					
Mean BCS at prepart	0.928**	0.930**	0.575**	0.635*	1.000				
Mean BCS at postpart	0.653*	0.836**	0.940**	0.862*	0.774**	1.000			
Early lactation yield	0.393	0.305	0.047	-0.053	0.355	0.103	1.000		
PPIE	0.127	0.005	-0.445	-0.251	0.065	-0.338	0.377	1.000	
Birth wt. of calf	0.471	0.111	0.130	0.067	0.301	0.189	-0.061	-0.398	1.000

Each value is based on 13 observations. *P<0.05, P<0.01

postpartum BCS including mean pre- and post-partum BCS.

Early lactation yield has shown positive and non significant correlation with 56 days prepartum and BCS at calving and mean prepartum BCS indicating that higher and better BCS is beneficial for milk production. The correlations between early lactation yield and BCS at 56th and 84th days postpartum were 0.047 and -0.053, respectively (Table 5), which were very low and non-significant. The low correlation might be due to low magnitude of unit change in BCS after calving which has been noticed in each groups of this experiment. However, the negative correlations between early lactation yield and BCS at 84th day postpartum suggested that the postpartum reduction in BCS is associated with improvement of early lactation yield. In this experiment, mobilization of body fat during postpartum period was meager hence no specific association between BCS at postpartum and early lactation yield was noticed.

PPIE has shown lower 'r' values (-0.338) during prepartum stage and indicated non significant relationship of this trait with prepartum BCS. However, during early lactation this trait was negatively (non-significant) correlated with periodical BCS at 56 (-0.445) and up to 84 days (-0.251) postpartum (Table 5). This indicates that lower the BCS more will be the PPIE. This finding was in accordance with the findings of Reugg and Milton (1995).

Calf birth weight is positively, however non-significantly correlated with BCS at 56 days prepartum (r=0.471) showing the effect of body reserves of cow on calf birth weight. The correlations between birth weight of calf and mean BCS at calving, 56th and 84th days postpartum were very low and non-significant. However, later on this 'r' values get lesser. The negative correlation of this trait with early lactation yield might be due to lower energy intake or loss in BCS units during last gestation stage causing preferential partitioning of nutrients towards fetus development affecting early lactation milk yield. Thus causing no lesser effect on calf weight at birth, however significantly reducing milk yield. Similar to this hypothesis the PPIE has shown negative correlation with calf weight at birth in BMEF herd. Perhaps this is more pronounced in the group where the animals had lost BCS during postpartum period. This shows the differential trend in correlations among herds, feeding regimens causing changes in BCS during transition period.

Correlation coefficients between BCS at periodical intervals, productive and reproductive parameters in Sahiwal cows of the CBF herd

Similar to the correlation studies of BMEF herd, the mean BCS at prepartum and postpartum periods is highly correlated with periodical BCS observations during transition period in Sahiwal cows of CBF herd (table 6).



Table 6: Correlation coefficients (r)# between BCS at different periodical intervals and productive and reproductive parameters in CBF herd

Parameters	BCS at 56 days prepart.	BCS at calving	BCS at 56 days postpart.	BCS at 84 days postpart.	Mean BCS at prepart.	Mean BCS at postpart.	Early lact. yield	PPIE	Birth wt. of calf
BCS at 56 days prepart.	1.000								
BCS at calving	0.646*	1.000							
BCS at 56 days postpart.	0.688**	0.839**	1.000						
BCS at 84 days postpart.	0.647*	0.625*	0.820*	1.000					
Mean BCS at prepart.	0.866**	0.910**	0.834**	0.745**	1.000				
Mean BCS at postpart.	0.716**	0.917**	0.959**	0.805**	0.903**	1.000			
Early lactation yield	0.198	0.106	0.139	-0.145	0.096	0.124	1.000		
PPIE	-0.069	0.101	-0.233	-0.296	-0.047	-0.114	-0.182	1.000	
Birth wt. of calf	-0.053	-0.320	-0.334	-0.523	-0.222	-0.338	0.608*	-0.371	1.000

Each value is based on 13 observations. *P<0.05, **P<0.01

The mean BCS at calving in Sahiwal cows of CBF herd has also showed significant positive correlation with periodical pre- and post-partum BCS which is in accordance to that observed in BMEF herd. The correlation between BCS at 56 days prepartum with BCS during postpartum period (56 and 84 day) in Sahiwal cows of CBF herd were better than that observed in BMEF herd (Table 5). This result indicated that the prepartum BCS will be significantly and highly correlated with postpartum BCS (56 and 84 days) only if the energy part of the ration during prepartum stage is optimum causing controlled change in BCS units during last 56 days of gestation. The negative correlations found between postpartum BCS and PPIE in CBF herd were similar to those observed in BMEF. The birth weight of calf in CBF herd is positively and significantly (P<0.05) correlated with early lactation yield which differs from those observed in BMEF herd indicating that higher energy intake during gestation and less loss of prepartum BCS lead to higher birth weight and higher lactational yield in Sahiwal cattle.

It can be concluded from present study that energy status can be easily assessed by scoring body condition periodically in transition Sahiwal cows which has significant effect on their early lactation yield, interval to first detected heat and birth weight of calf.

ACKNOWLEDGEMENTS

The authors thank the Dean, College of Veterinary Science and A.H., Anjora, Durg for providing all the necessary facilities during experiment and the Director, Veterinary Services, Livestock Development Department, Government of Chhattisgarh (India) for providing permission to use the herd of Cattle Breeding Farm, Anjora, Durg for the study.

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