Effect of Body Condition Score at Parturition on Post-partum Productive and Reproductive Performance in Crossbred Dairy Cows

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Abstract
Twenty three HF crossbred cows with 260-270 days gestation were selected for the study. The animals were grouped based on their body condition score (BCS) in to three groups I, II and III with 2.5-2.99, 3.00-3.49 and 3.5 and above 3.5 respectively. The objective of the present study was to quantify the relationships between body condition score (BCS; scale 1 to 5), live weight (WT) changes, milk production and reproductive performance in crossbred dairy cows during 60 days of postpartum. The mean BCS at calving were 2.72±0.05, 3.20±0.03 and 3.74±0.011 for group I, II and III respectively. Statistical analysis reveals that significant associations were observed on productive performance but no significant association on reproductive performance. However, cows in group III with BCS > 3.5 at calving had the most favorable reproduction indicators when compared to group I and II. The cows having high BCS at calving had lost more condition and body weight, when compared to cows with low body condition and lesser body weights.

Key words: Body Condition Score, Live weight, Milk yield, Post-partum period, Postpartum estrus, Uterine involution

Introduction
Body condition score (BCS) is an easy, inexpensive but subjective method to evaluate the body tissue reserves of lactating cows, independent of frame size and body weight (BW). During the early lactation period, mobilization of body reserve for milk production induces a negative energy balance that has been reported to affect the reproductive performance of dairy cows (Beam et al., 1999). The impact of greater body condition loss on higher milk production is more consistent and high milk production associated with greater body condition loss in early lactation (Garnsworthy et al., 1987). However, the effects are inconsistent; for example, some researchers have reported that BCS had no effect on reproductive indices (Ruegg and Milton et al., 1995), whereas others have reported significant effects (Gillund et al., 2001; Buckley et al., 2003). Domecq et al. (1997) reported that greater BCS changes during the early lactation period were associated with a reduced probability of conception at 1st service in multiparous cows, but
not in primiparous cows. Thus, many factors, such as feeding system and level, system of milk production, the cow’s genetic background, and parity, might influence the reported results. The research reports on the effect of BCS on productive and reproductive performance currently available are predominantly on Friesian cows (Garnsworthy et al., 1987; Pedron et al., 1993). Therefore, the objective of present study was to establish the relationship between BCS at parturition on postpartum productive and reproductive performance in crossbred dairy cows.

Materials and Methods
The study was conducted at Dairy Farm, Department of Livestock Production and Management, Veterinary College Bangalore. Twenty three crossbred pregnant cows of 260-270 days gestation were selected for this experiment. All the experimental animals were housed and maintained as per the standard management practices. The body condition score (BCS) of all the cows were determined as per procedure of (Edmonson et al., 1989) by a team of 3 scorers and the average was taken in to consideration to group the animals in to BCS of 2.50-2.99, 3.00-3.49 and > 3.5 as group I, group II and group III, respectively. The body weight of all animal was recorded by using animal weighing balance. All cows were hand milked twice daily. The milk was analyzed for Fat and SNF according to AOAC 2000. The amount of milk produced by each cow was recorded. Postpartum per rectal examination of the genitalia organs was carried out once a week to assess the process of uterine involution. The estrus detection was monitored by the behavioral signs of estrus and checking the tail head and rump region of the cows for adherent vaginal discharge. The milk samples were collected once in a week up to 4 week of postpartum for estimation of progesterone by radio immune assay to monitor ovarian activity. The analysis of variance was employed to study the variation in body condition score and live weight, loss of live weight and change in weight among groups (Snedecor and cochron, 1967)

Results and Discussion
The frequency distribution of body condition score (BCS) at calving of 23 crossbred cows showed that 30.43, 34.78 and 34.78 per cent of cows were with BCS of 2.72±0.05 (group I), 3.20±0.03 (group II) and 3.74±0.11 (group III), respectively with overall frequency distribution of 3.18±0.09 at calving.

Body condition score and body weight
The mean BCS of group at the time of calving were recorded as 2.72±0.05, 3.20±0.03 and 3.74±0.011, however the mean BCS at the end of 8 weeks of postpartum were found as 2.29±0.5, 2.68±0.03 and 3.12±0.08 respectively for group I, II and III. The total loss of 0.43, 0.52 and 0.62 points of BCS was recorded for group I, II and III respectively, at the end of 8 week of postpartum. (Table 1)
The mean body weights recorded at the time of calving were 366.00±5.92, 390.87±4.88, and 451.37±7.31 kg and the mean body weight at the end of 8 weeks of postpartum were 336±5.96, 357.87±5.01 and 412.12±7.38 kg for group I, II and III respectively. The total loss of 29.42±0.86, 33.50±0.59 and 38.75±0.77 kg live body weight was noticed at the end of 8 weeks of postpartum for group I, II and III respectively. (Table 1).

Table 1 - Relationship between BCS, body weight change and milk production during postpartum period of 60 days. (Mean ±SEM)

<table>
<thead>
<tr>
<th>BCS</th>
<th>Group I</th>
<th>Group II</th>
<th>Group III</th>
</tr>
</thead>
<tbody>
<tr>
<td>Body condition loss</td>
<td>0.43b</td>
<td>0.52c</td>
<td>0.62d</td>
</tr>
<tr>
<td>Body weight loss (kg)</td>
<td>29.42±0.86ab</td>
<td>33.50±0.59c</td>
<td>38.75±0.77d</td>
</tr>
<tr>
<td>Milk production (kg/day)</td>
<td>9.1±0.513a</td>
<td>10.83±1.36b</td>
<td>13.29±0.42c</td>
</tr>
</tbody>
</table>

Note: mean bearing any one common superscript in row differ significantly (P<0.05)

The cows having high BCS (fatter cows) at calving lost significantly more body condition and body weight than other two groups of cows. The findings of the present study are in agreement with the findings of Edmomson et al. (1989) :Pedron et al (1993). The findings support the hypothesis that the level of body fat at calving has a negative feedback effect on feed intake, so cows that calved in higher condition score could not increase feed intake sufficiently to meet energy requirements for milk production until they had lost a certain amount of body fat.

Live body weight change and milk yield.

Per day 9.1±0.513, 10.83±1.36, 13.29±0.42 kg of milk was produced by cows from group I, II and III respectively. In the present study the group I cows yield 9.1±0.513 (kg/day) with loss of 0.43 points BCS and 29.42±0.86 kg body weight and group II cows' yield 10.83±1.36 (kg/day) with loss of 0.52 points BCS and 33.50±0.59 kg body weight. Similarly, group III cows yield 13.29±0.42 (kg/day) with loss of 0.62 points BCS and 38.75±0.77 kg body weight.

The positive effect of BCS at calving on overall milk production was found to be non-significant Garnsworthy et al (1987), it failed to identify any significant effect of BCS at calving on milk production. However there was significant increase in milk production with higher BCS at calving Treacher et al (1986). The quality of the diet post-calving may impact the association between BCS at calving and milk production, since on energy dense diets, the greater intake of cows in low BCS at calving may be sufficient to meet energy requirements Holter et al (1990), Pedron et al (1993). In contrast, thin cows fed with low-energy diets may not be able to ingest sufficient quantities of energy and as a consequence, milk production, as well as other bodily functions, may suffer.

Similarly, cows that lost more live body weight during 60 days of postpartum period, on an average produced more milk. The findings of the present study are in agreement with Treacher, et al. (1986),
Holter et al. (1990). Cows produced 25 kg more milk in 60 days from calving lost 38.75±0.77 kg body weight during the period than the cows that lost 29.42±0.86 kg.

Milk composition
The mean milk fat percent of the present experimental cows in group I, II and III were depicted in Table 2. The fortnightly difference in mean fat percent of milk during the postpartum period did not differ significantly in all groups. However the mean fat percent among three groups differ significantly (P<0.05) when tested at different periods. (Table 2)

Table 2 - Relationship between BCS, Fat% and SNF % during postpartum period in crossbred dairy cows (Mean ±SEM)

<table>
<thead>
<tr>
<th>BCS</th>
<th>15th day</th>
<th>30th day</th>
<th>45th day</th>
<th>60th day</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.72±0.05</td>
<td>3.15±0.34a</td>
<td>3.05±0.27a</td>
<td>3.02±0.28a</td>
<td>3.01±0.31a</td>
</tr>
<tr>
<td>3.20±0.03</td>
<td>3.96±0.42b</td>
<td>34.21±0.42b</td>
<td>3.95±0.32b</td>
<td>3.73±0.31b</td>
</tr>
<tr>
<td>3.74±0.11</td>
<td>4.08±0.41c</td>
<td>4.21±0.42c</td>
<td>4.51±0.44c</td>
<td>4.36±0.38c</td>
</tr>
</tbody>
</table>

The milk produced by fatter cows contains higher fat concentration and these results collaborate with findings of Garnsworthy et al. (1987), Roche et al. (2007a). This is attributable to the greater predisposition of fatter cows to lose condition in early lactation which may be used for milk fat synthesis.

The higher concentration of short-chain fatty acids and a lower concentration of long-chain fatty acids were found in the milk of cows calving at a lower BCS.

The mean milk SNF percent of the present experimental cows in group I, II and III were depicted in Table 2. The fortnightly difference in mean SNF per cent of milk during the postpartum period did not differ significantly in all groups. However the mean SNF percent of group I, II, III on comparison did not differ significantly (P>0.05) between the groups. (Table 2)

The results obtained in the present study are in agreement with the findings of Edmonson et al. (1989), Roche et al. (2007a) who had reported the non-significant effect of BCS at calving on the milk SNF.
BCS on Reproduction

The experimental cows were subjected to per rectal examination to check the uterine involution between 14 to 28 days of postpartum and it was confirmed that early uterine involution could result in early resumption of ovarian cyclicity (Nakao et al., 1997). Slow or delayed uterine involution of the reproductive tract was associated with inefficient reproduction (Morrow, 1969). The slow involution of uterus was associated with a delay in onset of normal ovarian activity (Foote and Reik, 1999). The process of uterine involution appears to be largely independent of ovarian activity (Menge et al., 1962).

In the present the complete involution of uterus was reported as 23.57±0.48, 23.87±1.04 and 21.62±0.90 days in cows of group I (BCS 2.72±0.05), group (BCS of 3.20±0.03), and group III (BCS 3.74±0.11) respectively. The difference between the days of complete involution of uterus in all groups is found to be non-significant (Table 1). It was concluded from present study that cows of all the experimental groups had BCS above 2.5 points at the time of calving, which is considered as normal and satisfactory BCS in dairy animal production systems for a well-managed dairy herd (Edmonson et al., 1989). The days required for complete involution of uterus reported by Rasbech, (1950); Morrow, (1969), Fonseca et al.,(1983), Compco et al., (1987), Bekana et al., (1996), Kassa and Teggene, (1998), Casida and Wisnicky, (1950) were found to be within the range of 18 to 25 which are agreement with the findings of present study. However, the reported values of 47 days in HF cows (Buch et al., 1955), 41 days in dairy cows (Higaki et al., 1959), 33 days in Hariana cows Subramanian (1961), 40 to 50 days reported by Gier and Marion (1968); 42 to 50 days reported by Roberts, (1971) were significantly more than the present values observed. Therefore, it was concluded that the increased number of days taken for complete uterine involution in the earlier reports of different authors may be due to various factors such as parity, degree of exotic inheritance, status of uterine microflora, season of calving and difference in criteria adapted to evaluate the process. (Peter et al., 1987).

The number of days taken to exhibit the first estrous symptom in group I cows with mean BCS of 2.72±0.05 was 26.74±0.52 days, in group II cows with mean BCS of 3.20±0.03 was 27.25±1.06 days where as group III cows with mean BCS of 3.74±0.11 had taken 25.87±0.29 days to exhibit the estrous symptom after calving. In the present study the difference in exhibiting the postpartum estrous symptom between the group I, II and III was not statistically significant (Table 1).

The interval between calving to initiation of first estrus among the present three groups of cows did not differ significantly, because the cows of all the three groups had BCS more than 2.5 at calving. The present observation is in agreement with the earlier reports of Yadav et al., (1976) in crossbred cows and
Ruegg et al., (1992) in HF cows and also with the Wettemann (1994) who had reported that cows with BCS of 2.5 or more at calving had shorter postpartum intervals for first estrous than those of cows scoring the BCS of 1.5 -2.0. However some of the earlier reports confirmed that the time taken for initiation of first estrous was more than 37 days after calving where BCS was less than 2.5 (Staple et al., 1990). Therefore it was confirmed from the present study and also based on earlier reports that the BCS of dairy cows at the time of calving has got dominant role to play on the postpartum initiation of estrous. If the BCS is more than 2.5 at the time of calving the interval from calving to initiation of first estrous will be comparatively shorter because desirable range was 2.56 to 4.37 for a well-managed dairy herd where the overall performance of cows were good, nevertheless if the BCS at calving is less than 2.5 it will prolong the interval between calving to initiation first estrous.

**BCS at calving and ovarian activity as measured by milk progesterone profiles.**

Milk progesterone assays has been widely applied in assessment of the reproductive status of cows (Heap et al., 1973; Hoffman et al., 1976). Milk progesterone concentrations are correlated with those in peripheral blood progesterone concentration (Hoffman et al., 1976).

In the present study, the milk progesterone concentrations were 0.40, 0.42, and 0.38 ng/ml in cows with BCS of 2.72±0.05, 3.20±0.03 and 3.74±0.11 at 7th day of post-partum. The low progesterone concentration observed between parturition to first ovulation recorded in the present study is in accordance with the earlier report by Echternkamp and Hansel (1973). However in the suckled cows, a rise in serum progesterone was observed prior to the first observed estrus (Donaldson et al., 1970).

The resumption of cyclicity in postpartum cows is characterized by the absence of estrus activity preceding first ovulation (Murphy et al., 1990). However the serum progesterone concentration could be used to select the interval between calving and the start of luteal activity (Darwash et al., 1997).

In the present study, by the milk progesterone assay 3 cows, 2 cows and 2 cows from group I,II, and III, respectively were confirmed as ovulated before 14 days of postpartum. The present findings are in close conformity with reported values of Menge et al., (1962). Further, 2 cows, 3 and 4 cows from group I,II, and III, respectively were confirmed as ovulated before 14-21 days of postpartum. The present findings are in close agreement with values reported by Rajamahendran and Taylor, (1988). In dairy cows, 47 percent resumed cyclic ovarian activity within 20 days of calving (Marion and Gier, 1968). Finally the remaining 2 cows, 3 cows and 2 cows from group I, II, and III, respectively were confirmed as ovulated between 21-31 days of postpartum. These values are in close agreement with the value reported by Carruthers and Hafs, 1980). The present observations confirmed that postpartum uterine health and
energy deficiency may modify the ovarian activity in early postpartum period. The delay in the initiation of normal postpartum reproductive cyclicity is influenced by body weight and BCS during postpartum period in dairy cows (Butler et al., 1981)

**Conclusion**

The results of the present study showed a significant and positive association between BCS at calving and milk production. The body condition score of cows (>2.5) at calving significantly did not affect the period to exhibit postpartum estrus and complete uterine involution. The cows with BCS more than 3.5 at calving did not affect the reproductive performance even though greater loss in body condition and body weight and had the most favorable reproductive indicators than cows with low BCS.

**References**


