RESEARCH ARTICLE

Effect of Different Feeding Regimes on Feed Intake, Body Weight and Body Condition Score of Crossbred Cows

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Abstract

This study was conducted from 45 d prepartum to 300 d post-partum on 18 crossbred cows, distributed into three treatment groups comprising six animals in each group. Animals of the T_1 (Farmers' feeding) group were maintained as per the feeding regime, followed by small and marginal farmers. Animals of T_2 (Modified feeding) group were fed with scientific interventions using resources available with farmers. Animals of the T_3 (Farm feeding) group were fed as per feeding followed at Livestock Research Station. Average DMI both on kg/animal/d and kg/100 kg b.wt. was significantly ($p < 0.05$) higher in T_2 (12.45 ± 0.28 and 2.74 ± 0.06) and T_3 (12.62 ± 0.22 and 2.81 ± 0.06) as compared to T_1 (9.71 ± 0.20 and 2.24 ± 0.05, respectively) group. Similarly, average DCPI (g/animal/d) was significantly ($p < 0.05$) higher in T_2 (801.87 ± 22.30) and T_3 (839.53 ± 16.63) when compared with T_1 (543.83 ± 14.83) group. Average DCPI (g/100 kg b.wt.) was 128.49 ± 4.51, 177.40 ± 5.00, and 187.84 ± 4.51 in T_1, T_2, and T_3 groups, respectively, which differed significantly ($p < 0.05$) among each other. Average TDNI both on kg/animal/d and kg/100 kg b.wt. was significantly ($p < 0.05$) higher in T_2 (7.13 ± 0.16 and 1.57 ± 0.04) and T_3 (7.30 ± 0.13 and 1.63 ± 0.04) as compared to T_1 (4.82 ± 0.10 and 1.11 ± 0.03, respectively) group. Irrespective of periods, the overall body weight (kg) of crossbred cows were significantly ($p < 0.05$) higher in the T_2 (459.32 ± 5.69) and T_3 (458.55 ± 5.72) as compared to the T_1 (444.58 ± 6.41) group of animals. The average body condition score was maximum in T_3 (3.29 ± 0.02) followed by T_2 (3.07 ± 0.03) and T_1 (2.89 ± 0.03) groups, which differed significantly ($p < 0.05$). It may be concluded from the present study that the feeding regime significantly influenced feed intake, body weight, and body condition score of crossbred cows.

Keyword: BCS, Body weight, Crossbred cows, Feed intake, Feeding regimes.

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Introduction

In developing countries like India, 70% of expenditure in dairy farming is on the feeding of animals (Singh *et al.,* 2003). Most of the poor and illiterate farmers are not aware of the benefits of quality feeding, though feeding standards have been devised for crossbred cattle in the Indian subcontinent (Ranjhan, 1998), leading to underfeeding of animals in field conditions (Khan *et al.,* 2004). The success of livestock farming greatly depends on the continuous supply of good quality balanced feed (Suharyono *et al.,* 2018). Green roughage feeding to livestock is restricted to certain parts of India. Animals are maintained on straw-based rations, and on such rations, often they suffer from malnutrition (Kumar *et al.,* 1980). These straws' voluntary feed intake and nutrient digestibility are low due to high lignification (Gupta, 1991). Maintaining livestock on grazing without access to mineral and vitamin supplementation is common in most parts of India (Garg *et al.,* 2004).

Body condition scoring (BCS) is a subjective method of assessing the amount of metabolizable energy stored in fat and muscle (body reserves) on a live animal (Edmonson *et al.,* 1989). It provides a better understanding of the biological relationship between body fat, milk production, and reproduction that helps in adopting the optimum managemental practices to derive maximum production and maintain better health status (Patel *et al.,* 2018). BCS may be used as a valuable management tool for high-yielding dairy herds since significant mobilization of reserves takes place to sustain production in early lactation. It is desirable to have

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cows in a BCS of 3.5 (5-point scale) at calving (Ferguson and Otto, 1989). A significant correlation of BCS at calving and 1 to 2 months post-partum with milk production, uterine involution, and reproductive performance has been reported (Lopez *et al.,* 2004). Cows with low BCS at 65 d post-partum are more likely to be anovulatory (Santos *et al.,* 2008), which can compromise pregnancy success at first post-partum insemination. Fattier animals (>4.5 BCS) at calving are likely to develop ketosis in early lactation. Excessive condition/weight loss after calving has an adverse effect on the reproduction and health of dairy animals (Gadariya *et al.*, 2004). Comprehensive reports on feed intake, body weight, and BCS interrelationship of crossbred cattle kept by small and marginal farmers in India are not available. Therefore, this experiment was planned to study how the plane of nutrition offered by farmers during pre-partum and during the lactation period affects feed intake, body weight, and BCS of crossbred dairy cows.

Materials and Methods

The experiment was conducted at Livestock Research Station (LRS), College of Veterinary Science and Animal Husbandry, Anand Agricultural University, Anand, Gujarat, India on 18 dry pregnant HF x Kankrej (50:50) crossbred cows. Dry advanced pregnant animals were randomly selected on the basis of first lactation milk (300 d) yield, parity, and body weight (kg) (Table 1). The experiment was conducted from 45 d before calving (advance pregnancy) to 300 d post-partum. Animals were distributed into three treatment groups (T_1, T_2, and T_3) comprising of 6 animals each. Animals of T_1 (Farmer's feeding) group were maintained as per the feeding regime, followed by small and marginal farmers. Here the animals were fed with paddy straw *ad libitum* and green hybrid napier @10 kg/animal/d devoid of mineral mixture The concentrate feed was also not given during pre-partum period but was fed @ 50% of milk production during the lactation period. Animals of T_2 (Modified feeding) group were fed with scientific interventions using resources available with farmers. Animals were provided with pigeon pea and paddy straw (50:50 ratio) *ad libitum*, green hybrid napier @ 10 kg/animal/d, with mineral mixture @ 30 g/animal/d and concentrate feed was given @ 1 kg/animal/d during pre-partum and @ 50% of milk production during the lactation period. Animals of T_3 (Farm feeding) group were fed as per feeding followed at LRS. Here the animals were fed Jowar hay *ad libitum* with green hybrid napier @ 10 kg/animal/d and mineral mixture @50 g/animal/d. Concentrate feed was given for steaming up in the pre-partum period, starting from 500 g/animal/d in the first week of the experiment and increasing by 500 g every week, reaching 3.5-4.0 kg/animal/d till parturition. During the lactation period, concentrate feed was given @ 40 % of milk production plus 1 kg maintenance/animal/d. Representative samples of concentrate mixture (Amul dan), Jowar hay, hybrid Napier, paddy straw, and legume straw were collected during the experiment and were analyzed for proximate principles as per AOAC (2000).

Daily intake of concentrate, green and dry fodder was recorded for individual animals. Animals were tied individually with neck chains to prevent the eating of each other's feed and fodders. Dry fodders were provided to animals in small quantities at one time to prevent spoilage by spilling. The body weight of each experimental animal was measured fortnightly at 8.00 a.m. before offering drinking water by an electronic weighing platform throughout the experiment. BCS of all the experimental animals was estimated on a 5-point scale with an increment of 0.25 at fortnightly interval by a panel of three scientists before providing green fodder in the morning hours as described by Edmonson *et al*. (1989).

Observations of various parameters recorded during the experimental period were statistically analyzed by Completely Randomized Design (Factorial) and one-way ANOVA using SAS software 9.3 version and SPSS software 20.00 version, respectively.

Results and Discussion

Feed and Nutrient Intake

Average fortnightly DMI both on kg/animal/d and kg/100 kg b.wt. was significantly ($p < 0.05$) higher in T_2 and T_3 compared to T_1 group (Table 2). DMI (kg/animal/d) was 28.22 and 29.97 % higher in T_2 and T_3 compared to T_1 group, respectively, whereas on kg/100 kg b.wt. it was 22.32 and 25.45% higher in T_2 and T_3 compared to the T_1 group. Significantly ($p < 0.05$) low DMI in the T_1 group as compared to T_2 and T_3 in the present study might be due to sudden change in feeds of experimental farm animals. During the pre-partum period, animals of the T_1 group were completely devoid of concentrate feed and mineral mixture, which decreased DMI. Apart from concentrate feed and mineral mixture, dry fodder supplied to this group was the paddy straw which might have decreased the palatability of animals and ultimately lead to decreased DMI. DMI was also found to

Table 1: Grouping of experimental animals

Treatments	*Parameters*		
	First lactation milk yield (kg)	*Parity*	*Body weight (kg)*
T_1	3008.00 ± 356.94	3.00 ± 0.55	515.00 ± 39.99
T_2	3072.80 ± 321.63	3.00 ± 0.89	513.33 ± 30.67
T_3	3048.00 ± 229.59	3.00 ± 0.94	500.00 ± 39.41

be non-significantly less in T_2 compared to T_3 group as the animals of T_2 group received a fixed amount of concentrate feed (1 kg/animal/d) during the pre-partum period, instead of steaming up in T_3 group. Dry fodder provided to animals of the T_2 group was pigeon pea straw which proved to be better than paddy straw as the DMI did not decrease when compared with T_1 group. Ryan *et al.* (2003) concluded that the proportion of concentrate in pre-partum diet had no effect on voluntary DMI post-partum, which supports the present findings. Agenas *et al.* (2003) also did not observe a significant difference in post-partum DMI of cows fed low, medium, high TMR providing 71, 106, and 177 MJ/d for the last two months of gestation. Panigrahi *et al.* (2005) reported a similar non-significant effect of pre-partum feeding treatments on total dry matter intake of crossbred cows.

The average fortnightly DCPI (g/animal/d) was significantly ($p < 0.05$) higher in T_2 and T_3 (by 47.45 and 54.37 %) groups as compared to the T_1 group (Table 2). Average DCPI (g/100kg b.wt.) was 128.49 ± 4.51, 177.40 ± 5.00, and 187.84 ± 4.51 in T_1, T_2, and T_3 groups, respectively, which also differed significantly ($p < 0.05$) among each other. It was 46.19 and 5.89 % higher in T_3 compared to T_1 and T_2 groups, respectively. Significantly ($p < 0.05$) low DCPI in the T_1 group as compared to T_2, and T_3 observed in the present study might be due to a change in feeding regime. Since during the pre-partum period, animals of the T_1 group were provided only paddy straw and were completely devoid of concentrate feed. In T_2 group also less DCPI was there as compared to T_3. The reason for this is that pigeon pea straw as a source of dry fodder, and a fixed amount of concentrate feed was offered during pre-partum period in T_2. These finding were supported by Garg *et al.* (2016), who observed a significant ($p < 0.01$) effect of ration balancing on CP intake (g/d), which was more after ration balancing (1513 ± 50.61 g) compared to before ration balancing (1442 ± 47.57 g). Suharyono *et al.* (2018), also observed significantly ($p < 0.05$) higher CP (kg/d) intake in the group fed usual feed + 500 g multi-nutrient feed supplement (1.22 kg) as compared to the group fed usual feed (0.99 kg), and the group fed usual feed + 500 g urea molasses multi-nutrient block (0.93 kg).

Average fortnightly TDNI both on kg/animal/d and kg/100 kg b.wt. was significantly ($p < 0.05$) more in T_2 and T_3 compared to T_1 group (Table 2). TDI (kg/animal/d) was higher by 47.93 and 51.45 % in T_2 and T_3 compared to T_1 group, whereas on kg/100 kg b.wt. it was 41.44 and 46.85 % higher in T_2 and T_3 compared to the T_1 group, respectively. Significantly ($p < 0.05$) low TDNI in the T_1 group as compared to T_2 and T_3 noticed might be due to less DMI of poor quality feeds and fodder lacking TDN fed during the pre-partum period in T_1 group. Higher TDNI in T_2 and T_3 compared to the T_1 group concurred with Garg *et al.* (2016) who observed a significant ($p < 0.01$) effect of ration balancing on TDN intake. In another study (Lawrence *et al.*, 2015) also, the TDNI in cows fed 7.0 kg DM/d was 2.9 kg higher ($p<0.001$) than cows fed 4.0 kg DM/d. However, Suharyono *et al.* (2018) observed TDN (kg/d) intake statistically at par among the groups fed usual feed, usual feed + 500 g multi-nutrient feed supplement, and usual feed + 500 g urea molasses multi-nutrient block.

Body Weight of Cows

The average body weight of pregnant cows at the beginning of the experiment was 514.16 ± 40.61, 513.33 ± 30.67, and 500.83 ± 39.18 kg in T_1, T_2, and T_3 groups, respectively. Irrespective of periods, overall body weight at the end of the experiment (300 d post-partum) was significantly ($p < 0.05$) higher in T_2 (459.32 ± 5.69) and T_3 (458.55 ± 5.72) as compared to T_1 (444.58 ± 6.41) group (Table 3). The Body weight of cows decreased faster ($p < 0.05$) in T_1 compared to T_2 from the beginning of the experiment to the day of parturition, while in the case of T_3, body weight increased every fortnightly till parturition. In the present study, before the experiment, all experimental animals were maintained under the same farm feeding condition. During the pre-partum period, rapid or slow fall in body weight of the animals in T_1 and T_2 groups might be due to sudden change in their feeding schedule, which was, of course, better in T_2 than T_1. However, in T_3, the animals were maintained as per the farm feeding schedule. Body weight loss from the beginning of the experiment to the day of parturition (after the expulsion of placenta) was maximum in T_1 (79.33 kg, 15.43%), followed by T_2 (64.00 kg, 12.47%) and T_3 (43.50 kg, 8.68%). Further, the Body weight loss during the first eight weeks of lactation was maximum in T_3 (26.83 kg, 5.87%) followed by T_2 (21.00 kg, 4.67%) and T_1 (13.50 kg, 3.10 %). Overall average body weight, irrespective

Table 2: Feed and nutrient intake of crossbred cows during the experiment

	Treatments		
Parameters	T_1	T_2	T_3
DMI (kg/animal/d)	$9.71^a \pm 0.20$	$12.45^b \pm 0.28$	$12.62^b \pm 0.22$
DMI (kg/100kg b.wt.)	$2.24^a \pm 0.05$	$2.74^b \pm 0.06$	$2.81^b \pm 0.06$
DCPI (g/animal/d)	$543.83^a \pm 14.83$	$801.87^b \pm 22.30$	$839.53^b \pm 16.63$
DCPI (g/100kg b.wt.)	$128.49^a \pm 4.51$	$177.40^b \pm 5.00$	$187.84^c \pm 4.51$
TDNI (kg/animal/d)	$4.82^a \pm 0.10$	$7.13^b \pm 0.16$	$7.30^b \pm 0.13$
TDNI (kg/100 kg b.wt.)	$1.11^a \pm 0.03$	$1.57^b \pm 0.04$	$1.63^b \pm 0.04$

Means with dissimilar superscripts in a row differ significantly ($p < 0.05$).

Table 3: Body weight and BCS of crossbred cows during the experiment

Parameters	*Treatments* T_1	T_2	T_3
Initial body weight (kg)	514.16 ± 40.61	513.33 ± 30.67	500.83 ± 39.18
Final body weight (kg)	$444.58^a \pm 6.41$	$459.32^b \pm 5.69$	$458.55^b \pm 5.72$
Initial BCS	3.19 ± 0.15	3.49 ± 0.17	3.40 ± 0.12
Final BCS	$2.89^a \pm 0.03$	$3.07^b \pm 0.03$	$3.29^c \pm 0.02$

Means with dissimilar superscripts in a row differ significantly ($p < 0.05$).

of treatments and periods, was 453.97 ± 3.45 kg during the experiment. Findings of the present study were similar with the results of Singh et al. (2003), who observed significantly higher ($p < 0.05$) than average body weights before calving in experimental animals fed 20% above NRC during 60 day pre-partum and as per NRC post-partum (517.67 kg) and the group fed 20% above NRC during both 60 d pre-partum to 120 day post-partum (510.67 kg) than those in control group fed as per NRC (486.33 kg). In the present study, higher body weight during the pre-calving period in T_2 and T_3 groups might be due to improved nutritional status of animals as compared to T_1 group. Body weight loss during the pre-partum period and minor body weight change from calving to 16 weeks of lactation in the poorly fed group seen in the present study, corroborated with the observations of Khan *et al*. (2004). Results of the present study were also in the line of Banuvalli *et al*. (2014), who observed significantly ($p < 0.05$) more Body weight loss at the end of 8 weeks of lactation in cows having high body weight at calving than other two groups of cows having low body weight at calving.

Body Condition Score

At the beginning of the experiment, the average BCS of cows was 3.19 ± 0.15, 3.49 ± 0.17, and 3.40 ± 0.12 in T_1, T_2, and T_3 groups, respectively (Table 3). BCS of cows decreased at a faster rate in T_1 as compared to T_2 till the day of parturition, while in the case of the T_3 group, BCS increased every fortnightly till parturition. BCS loss from the beginning of experiment to the day of parturition (after expulsion of placenta) was maximum in T_1 (0.42, 13.16 %) followed by T_2 (0.21, 6.01%) and T_3 (0.01, 0.29%). Further, BCS loss during the first two months of lactation (after reaching peak yield) was 0.41 (12.5%) in T_2 and 0.22 (6.49%) in T_3, while in the case of T_1 BCS was maintained without any further decrease. Regardless of periods, overall mean BCS was maximum in T_3 (3.29 ± 0.02) followed by T_2 (3.07 ± 0.03) and T_1 (2.89 ± 0.03) cows. Mean BCS differed significantly ($p < 0.05$) among treatment groups due to the feeding effect. Results of the present study were in accordance with the study of Banuvalli *et al.* (2014), where total BCS loss at the end of 8 weeks post-partum was 0.43, 0.52, and 0.62 points (on a 5-point scale) for low (2.72 ± 0.05), medium (3.20 ± 0.03) and high (3.74 ± 0.011) BCS group at calving, respectively. However, the BCS loss was lower in the present study, although the pattern was the same. Sahoo *et al*. (2016) found improvement in feed intake of groups supplemented with area-specific mineral mixture resulting in increased general health, glossy skin and improved BCS. In the present study also, the overall BCS was significantly ($p < 0.05$) higher in T_3 followed by T_2 and T_1 groups supplemented with 50, 30, and 0 g/d mineral mixture, respectively. Prasad and Tomer (1996) found that BCS of cows on a high level of pre-calving energy (120% of NRC) was more just before calving than the cows that were on a low energy diet (80% of NRC). Contrary to this, Bindal (2012) noted that there was no significant effect of challenge feeding on BCS of animals over control (3.45 ± 0.02 vs 3.38 ± 0.02).

Conclusion

The present study concluded that the feeding regime significantly influenced feed intake, body weight, and BCS of crossbred cows. Dairy farmers should feed a combination of pigeon pea and paddy straw in a 50:50 ratio and mineral mixture @ 30 g/head/day during the peripartum period for better feed intake, body weight, and BCS of crossbred cows.

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