

EFFECT OF CHALLENGE FEEDING ON PRODUCTION PERFORMANCE AND ECONOMIC IMPACT IN GIR COWS

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Received: 03.10.2022; Accepted: 04.05.2023

ABSTRACT

The present experiment was conducted to find out the effect of 'challenge feeding' on performance and economics of milk yield in Gir cows. The experiment was conducted during year 2018-19 at Cattle Breeding Farm, Junagadh Agricultural University, Junagadh, Gujarat. Sixteen advanced pregnant Gir cows were randomly divided into 2 groups having 8 animals in each group. The study was conducted for a period of 20 days pre-partum to 60 days postpartum (total 80 days). In the control group (T₁), cows were offered a ration as per ICAR feeding Standard (2013), both during pre-partum and postpartum periods. In the treatment group (T₂), cows were offered with a 100 g daily increase in concentrate during pre-partum and postpartum period over and above as per ICAR feeding Standard, 2013 (Maximum limit of total concentrate-10 kg). The study revealed that the mean body weight of Gir cows did not differ significantly between the two groups. During the pre-partum period, the mean DMI (kg) did not differ significantly between the two groups, whereas, during postpartum period, DMI was significantly ($P<0.05$) higher in T₂ group as compared to T₁ group. The mean BCS also did not differ significantly between T₂ and T₁ groups during pre-partum and postpartum period. The overall daily milk yield per animal was significantly ($P<0.05$) higher along with significant ($P<0.05$) increase in peak milk yield in T₂ group as compared to T₁ group. The T₂ group of cows generated an additional income of Rs. 30.70/cow/day and Rs. 9210/cow/year at market price of milk (Rs. 40/L). It was concluded that the practice of challenge feeding during early lactation in Gir cows improved production performance without affecting body condition score and was found to be economical.

Keywords: Challenge feeding, Economics, Gir, Milk yield

How to cite: Savaliya, B.D., Parikh, S.S., Gamit, P.M. and Sarma, M.P. (2023). Effect of challenge feeding on production performance and economic impact in Gir cows. *Haryana Vet.* 62(SI-2): 46-49.

The Gir cattle is one of the important indigenous dairy type breed of Saurashtra region of Gujarat. This breed is well known for its better heat tolerance capacity and resistant to various tropical diseases (Gajbhiye *et al.*, 2016; Patbandha *et al.*, 2020). With a population of 13,80,208 in the country, it contributes significantly to total milk production of the country. Owing to its unique traits, it is also used for grading up of various non-descript cows in India.

In developing countries, more than 70 % of the expenditure in dairy farming is contributed for the feeding of animals (Singh *et al.*, 2022). Challenge feeding is an accepted concentrate feeding system to increase milk production in dairy animals. In this system, concentrates are introduced to the animals in their last several weeks of pregnancy and initial phase of lactation. The amount is gradually increased as lactation progresses until no further response in milk yield. This system enables the animal to express their milk production as close to their genetic potential.

The period from two months (especially last 3 weeks) pre-calving to two months post calving which includes the transition period is the most stressful period in the annual cycle of dairy cow (Grummer, 1995). This period is very important for the animals to augment body reserves to

meet the demands of growing fetus and to avoid negative energy balance peripartum. Under feeding during this period could lead to low birth weight of calf. Thus, it is necessary that milch animals must be judiciously and adequately fed during this period to produce maximum milk production with minimum health problems and to increase the income of farmers. The theory behind challenge feeding is feeding a higher plane of nutrition to milch animals during last phase of dry period and in the early postpartum period (Dann *et al.*, 2006). Suboptimal transition from dry period to lactation can decrease total milk production, reproductive performance and the profit potential of dairy animals.

Considering the above points, the present experiment was planned with the aim of achieving better production performance in Gir cows through challenge feeding.

MATERIALS AND METHODS

The present experiment was conducted at Cattle Breeding Farm, Junagadh Agricultural University, Junagadh, Gujarat (India) during August- 2018 to January- 2019. Average rainfall of this region is 1200 mm. The temperature and relative humidity remained between 12.8 °C to 37.4 °C and 46 to 52%, respectively.

Selection of experimental animals and feeding schedule

Sixteen advanced pregnant Gir cows were selected

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20 days prior to their expected due date of calving and divided randomly into 2 groups (8 animals in each), control (T_1) and treatment (T_2), based on their parity, body weight and milk yield of previous lactation to maintain homogeneity among the experimental animals (Table 1). The present study was conducted for a period of 20 days pre-partum to 60 days postpartum (total 80 days).

Housing and management

All the experimental animals were maintained under uniform housing conditions. Each animal was allotted an individual pen with ample space, proper ventilation and drainage, soft bedding and watering facilities. The animals let loose for two hours in the morning for exercise.

Feeding and milking management

Digestible crude protein (DCP) and total digestible nutrient (TDN) requirements were calculated according to the body weight and milk production as per ICAR feeding standard (2013). Adjustment in nutritional allowances were made keeping in view of body weight and milk production every fortnight. Animals in treatment group were provided a graded increase in concentrate ration daily 100 g both during the pre-partum and post-partum phase (maximum limit-10 kg). Experimental animals were offered individually with seasonal green fodder (maize) soilage @10 kg/cow/day. Dry fodder (mature pasture grass hay) was offered ad lib to all the animals. Daily concentrate allowance consisted of ISI grade-I cattle feed (dan), cotton seed cake and ground maize. They were mixed and divided into two equal portions and offered to the animals morning and evening. All the animals were provided 30 g of mineral mixture daily.

The animals were milked twice a day by hand milking method allowing the calf to suckle the dam. Milk samples were collected at weekly interval from each cow for milk composition analysis. There was daily recording of feed offered and leftover collected individually for each animal to calculate DM intake. Body weight of all the animals recorded on start of experiment (day 0) and weekly interval thereafter.

Body condition score

Body condition score (BCS) was done by using a five point scale body condition scoring method from 1 (thin) to 5 (fatty) at increment of 0.25 (Ferguson *et al.*, 1994). The animals were scored on the first day of induction to the experiment and then at weekly interval.

Statistical analysis

Data obtained from the experiment were analyzed as per Snedecor and Cochran (1994) by using the t-test. The difference was considered statistically significant if the p-value was < 0.05.

Table 1. Feeding schedule of experimental animals

Particulars	Control group (T_1)	Treatment group (T_2)
Pre-partum period		
20 days before calving	Dry fodder - <i>ad lib</i> . Seasonal green-10 kg Concentrate - As per ICAR feeding standard (2013)	Dry fodder - <i>ad lib</i> . Seasonal green -10 kg Concentrate - As per ICAR feeding standard (2013)+ increasing 100 g per day
Postpartum period		
Calving to 60 days postpartum	Dry fodder- <i>ad lib</i> . Seasonal green-10 kg Concentrate-As per ICAR feeding standard (2013)	Dry fodder - <i>ad lib</i> . Seasonal green-10 kg Concentrate - As per ICAR feeding standard (2013) + increasing 100 g per day (Maximum limit of total concentrate-10 kg)

Table 2. Effect of challenge feeding on dry matter intake (DMI) in Gir cows.

Parameters	Control (T_1)	Treatment (T_2)	P value
Pre-partum			
Body weight (kg)	443.46±06.65	431.64±05.49	0.24
Total DM intake (kg)	9.20±0.40	9.47±0.30	0.324
DM intake/100 kg BW	2.09±0.11	2.21±0.08	0.46
DM intake g/kg BW ^{0.75}	95.80±4.84	100.34±3.61	0.49
Body condition score	3.39±0.05	3.47±0.07	0.37
Postpartum			
Body weight (kg)	397.50 ^a ±02.18	407.22 ^b ±02.76	0.01
Total DM intake (kg)	10.75 ^a ±0.11	12.95 ^b ±0.056	0.0018
DM intake/100 kg BW	2.73 ^a ±0.04	3.20 ^b ±0.12	0.002
DM intake g/kg BW ^{0.75}	121.63 ^a ±1.65	146.36 ^b ±5.56	0.002
Body condition score	3.41±0.04	3.50±0.02	0.053

*Means with different superscript in a row differ significantly (P<0.05)

Table 3. Effect of challenge feeding on production performance of Gir cows

Parameters	Control (T_1)	Treatment (T_2)	P value
Postpartum			
Milk yield (kg/day)	6.43 ^a ±0.16	8.52 ^b ±0.42	0.0003
Peak yield (kg/day)	8.54 ^a ±0.40	11.66 ^b ±0.58	0.0005
Days to attain peak yield (d)	29.00±0.87	36.25±4.72	0.10
Milk fat (%)	3.98±0.07	4.06±0.09	0.65
Milk SNF (%)	8.66±0.11	8.97±0.10	0.052
Milk lactose (%)	4.48±0.08	4.63±0.13	0.33
Milk protein (%)	3.16±0.04	3.17±0.05	0.83
Milk total ash (%)	0.78±0.01	0.75±0.01	0.02
Milk total solids (%)	11.72±0.20	13.04±0.25	0.33

*Means with different superscript in a row differ significantly (P<0.05)

RESULTS AND DISCUSSION

DM intake

The mean DMI during pre-partum period was 9.20±0.40 and 9.47±0.30 kg/cow/day in T_1 and T_2 groups,

respectively (Table 2). The results showed that the overall total DM intake (kg/day), DM intake/100 kg body weight and metabolic body weight during pre-partum period had no significant difference between two groups. These results are in agreement with earlier researchers (Panigrahi *et al.*, 2005; Bindal, 2012) who did not find any significant effect of pre-partum supplementation of extra amount of concentrate on crossbred cows. The mean DM intake in Gir cows during postpartum period was 10.75 ± 0.11 and 12.95 ± 0.05 kg/cow/day in T₁ and T₂ groups, respectively (Table 2). The results revealed that the mean daily dry matter intake of T₂ group was significantly ($P < 0.05$) higher than T₁ group during the postpartum period.

The overall mean of DMI per 100 kg BW in T₁ and T₂ groups were 2.73 ± 0.04 and 3.20 ± 0.12 kg during the postpartum period, respectively, which was significantly higher in T₂ as compared to T₁ group (Table 2). Similarly, DM intake/kg BW^{0.75} was also significantly higher in T₂ as compared to T₁ group during the postpartum period. This might be due to increase concentrate level in challenge feeding. The present results are in agreement with Bindal (2012) and Kamboj *et al.* (2016) who found increased DM intake during postpartum phase in crossbred cows by supplementation of concentrate in increasing levels.

Body condition score (BCS)

The weekly body condition score of both control and treatment groups did not differ significantly during the pre- and postpartum period though the mean pre- and postpartum BCS of T₂ was marginally higher and showing an rising trend (Table 2). During the postpartum period, the allowance of concentrate mixture in T₂ group was enhanced increasingly but the significantly higher milk yield in T₂ group leading to higher body tissue loss may have nullified the effect of challenge feeding on their BCS. The result obtained in the present study is in agreement with the previous studies carried out by Khan *et al.* (2004), Samanc *et al.* (2010) and Mithuna *et al.* (2015).

Production performance

The mean daily milk yield of cows in T₂ group was significantly ($P < 0.05$) higher than T₁ group (Table 3). The milk yield was also increased significantly ($P < 0.05$) in all the weeks. Cows fed with challenge diet in this study might be the reason for positive energy balance in pre-partum as well as in postpartum period as compared with control (T₁) group of cows and this might be resulted in their significantly higher average daily milk yield. The positive effect on milk yield was due to challenge feeding as reported by Singh *et al.* (2003), Khan *et al.* (2004), Das *et al.* (2007) and Gillah *et al.* (2014).

Table 4. Economics of challenge feeding in Gir cows

Parameters	Control (T ₁)	Treatment (T ₂)	Difference
Milk yield (kg/day)	6.43	8.52	2.09
Milk yield/cow/day (L)	6.24	8.27	2.03
Milk sold @ Rs.40/L	249.60	330.80	81.2
Concentrate consumed (kg/cow)	4.64	7.23	2.59
Cost of concentrate consumed/cow @ Rs.19.5/kg	90.48	140.98	50.50
Total income/cow/day (Rs.)	159.12	189.82	30.70
Increase in net profit/cow/day (Rs.)	-	30.70	-
Increase in net profit/cow/year (Rs.)	-	9210	-

Milk composition parameters like fat, SNF, lactose, protein, total solids and ash were found similar in both the groups (Table 3). Das *et al.* (2007) also observed the similar results. Contrary to the present study, Singh *et al.* (2003) reported that animals kept on higher feeding levels had better milk fat content than animals kept on lower feeding level.

Peak yield

There was significantly ($P < 0.05$) increased peak milk yield in T₂ group (11.66 ± 0.58 kg/day) as compared to T₁ group (8.54 ± 0.40 kg/day). The higher plane of nutrition during pre-partum and postpartum phase of the experimental periods may have provided the necessary impetus to the animals of T₂ group. These findings are in agreement with Singh *et al.* (2003). Contrary to the above, Das *et al.* (2007) reported non-significant response to peak yield in spite of higher plane of nutrition.

Economics

The total milk yield obtained per cow per day of T₁ and T₂ groups during first 60 days of lactation was 6.24 and 8.27 L, respectively (Table 4). Since, milk was sold on the basis of fat percent and selling price was taken into account as Rs. 40/litre, amount received from sale of milk was Rs. 249.60 and Rs. 330.80 in T₁ and T₂ groups, respectively. Total concentrate mixture consumed during postpartum period was 4.64 and 7.23 kg/cow/day in T₁ and T₂ groups, respectively. The cost of concentrate (@ Rs.19.50/kg) per/cow/day was Rs. 90.48 and Rs. 140.98 in T₁ and T₂ groups, respectively. Increase in net profit was Rs. 30.70/cow/day in T₂ group as compared to T₁ group. Considering 300 days of lactation, the farmer got additional economic benefit of Rs. 9210 per cow/year.

CONCLUSION

It was concluded that the practice of challenge feeding during early lactation in Gir cows improved production performance without affecting body condition score and was also economically beneficial.

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