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Influence of different protein level feeding on growth performance and body measurements in preweaned crossbred calves

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Abstract
Experiment was conducted to determine the effect of different levels of protein in the diet on growth performance and body measurements of crossbred calves. For this trail eighteen newborn crossbred calves (Holstein Friesian 75% × Kankrej 25%) of either sex randomly and sequentially grouped into three groups. viz. T_1 (Commercial concentrate: 18% CP), T_2 (Commercial concentrate: 25% CP) and T_3 (Farm made concentrate: 25% CP) for period of 84 days (twelve weeks). The body weight and body measurements of calves was recorded at birth, then on weekly interval body weight was taken in the morning before feeding and watering and body measurements like heart girth, body length and height at withers of calves was recorded at biweekly interval till 84 days of age. In conclusion it was found that calves fed with commercial concentrate (T_2) were significantly ($p<0.05$) influenced positively than T_1 and T_3 in terms of mean body weight (kg), mean average daily gain (g) and total weight gain (kg/week). Similarly, body length (cm) was significantly ($p<0.05$) influenced by treatment and observed significantly ($p<0.05$) higher in animals of T_2 group as compared to T_1 and T_3 groups. However, mean biweekly gain in height at withers and body length was not influenced by treatment.

Keywords: Crossbred calves, dietary protein, growth performance, body measurements

Introduction
Lack of proper feeding, management and care of calf during early age leads to poor growth and delayed age of puberty and age at first calving. Milk is most expensive and most essential feed for calf which costs around 40% of the rearing costs of calves from birth to weaning (Boulton *et al.*, 2017) [3]. Calves raised on a high level of nutrition reaches calving age earlier and produced more milk in the first lactation (Bar-Peled *et al.*, 1997) [2]. Studies suggest early weaned calves had a higher feed consumption over the conventional weaning and encourage the rumen development (Khan *et al.* 2007; Kehoe *et al.*, 2007) [10, 9]. Thus, calf starter feeding is an important tool to promote early rumen development. Therefore, milk can be diverted for human consumption. Tissue growth is largely a function of protein deposition in bone and muscle, with corresponding mineralization of the protein matrix in bone (Drackley, 2008) [8]. Thus, this experiment was planned to determine the effect of feeding high protein concentrate at an early age with restricted amount of milk feeding on growth performance of crossbred calves.

Materials and Methods
This experiment was conducted at Livestock Research Station (LRS), Collage of Veterinary Science & Animal Husbandry, Anand Agricultural University, Anand, Gujarat. This experiment was conducted in August to December, 2020 during which maximum and minimum temperature was 28.6-35.0 and 14.6-26.1 °C and relative morning and evening humidity recorded was 79-93 and 37-80%, respectively. The calves were cared and managed as per directives of IAEC. In this experiment, for the duration of 84 days, eighteen newborn crossbred (Holstein Friesian 75% × Kankrej 25%) calves of either sex were divided into three groups randomly and sequentially on the birth weight basis with the average±SE, 32.27±1.96, 32.452±1.32 and 32.26±1.98 kg in T_1 (Commercial concentrate: 18% CP), T_2 (Commercial concentrate: 25% CP) and T_3 (Farm made concentrate: 25% CP),

respectively. The calves were housed in the well-ventilated barn with an individual feeding facility built in a north-south orientation. The feeding schedule of concentrate to calves is as per Table 1.

Colostrum was fed immediately after birth and then in equals half at the morning and evening for three days continuously @ 4 litres a day. The concentrate and dry roughage was offered at 9:00 hour's morning in a plastic bowl, starting with 100g/day and ensuring *ad libitum* intake from the 8th day onwards. The calves were offered *ad libitum* water daily at 10:00 and 15:00 h. The proximate analysis of all concentrates, dry and green fodders was done as per AOAC (2005) [1]. The calves were dewormed on 15th, 30th and 60th day of the experiment with a broad spectrum dewormer.

The body weight of calves was recorded at birth, then every week on the electrical weighing balance in the morning at 06:00 am before feeding and watering. The difference between the present body weight and body weight taken the previous week had been considered as the total weight gain during that week and subsequently, daily weight gain was calculated.

The body measurements were recorded at birth and after that biweekly interval till 84th day of age by placing the animal squarely on all four feet with the head in an upright position with a standard measuring tape The heart girth measurements were taken by placing the tape round the animal at the point of smallest circumference just behind the forelegs passing through the position of withers. The body length of the animal was measured from the point of shoulder to the pin bone and the height at withers was determined by placing a ruler on the point of withers and measuring the perpendicular distance from the ground to the ruler.

Statistical Analysis

The data generated during the experiment were analyzed following completely randomized design (CRD) as per statistical method described by Snedecor and Cochran (1994) [15].

Results and Discussion

Composition of Feeds and Fodders

The chemical composition of feeds and fodders is given in Table 2. The crude protein content of concentrate mixture was 17.62, 24.18 and 24.60 in T_1, T_2 and T_3, respectively. It also indicated that crude protein and ether extract level in T_1 commercial concentrate was lower than T_2 commercial concentrate and T_3 farm formulated concentrate but was higher in total ash. A comparison of high protein concentrates (T_2 and T_3) revealed higher ether extract and calcium in T_2 compared to T_3. The level of calcium and phosphorus were sufficient to meet the requirement of growing crossbred calves.

Growth performance

Results of growth performance showed that overall body weight, weight gain and average daily gain were significantly ($p<0.05$) higher in the group T_2 fed with commercial high protein concentrate compared to the groups T_1 and T_3, commercial low protein concentrate and farm made high protein concentrate, respectively.

The body weight and body weight gain were not influenced by feeding calf starter containing CP from 18 to 25% (Ozkaya and Toker, 2012; Stamey *et al.*, 2012; Zothanpuii *et al.*, 2015; Casper *et al.*, 2017; Mehrdad *et al.*, 2018; Sharma *et al.*, 2020) [12, 16, 17, 5, 11, 13], which contraindicated the present findings. Whereas the body weight and body weight gain of calves were significantly influenced by CP% in calf starter (18-25%), which supported the present findings (Drackley, 2002; Brown *et al.*, 2005; Rincker *et al.*, 2011) [7, 4, 14].

Body Measurements

Mean height at wither and mean heart girth were not significantly influenced by treatments. However, in animals of T_2 group, body length (cm) was significantly ($p<0.05$) 2.03 and 3.16% higher than animals of T_1 and T_3 groups, respectively. This indicated good quality of calf starter was required for skeletal development.

The difference in body measurement *viz.* height at wither and heart girth were not influenced by protein% of calf starter (Drackley, 2002; Stamey *et al.*, 2012; Casper *et al.*, 2017; Daneshvar *et al.*, 2017) [7, 16, 5, 6], which supported the present finding except body length. However, different scientists (Brown *et al.*, 2005; Rincker *et al.*, 2011; Ozkaya and Toker, 2012; Zothanpuii *et al.*, 2015) [4, 14, 12, 17] reported significant effect of protein% (18-25) of calf starter on body measurements (WH, HG, and BL) which contraindicated present finding except body length.

Table 1: Feeding Schedule of crossbred calves

Particulars	T_1	T_2	T_3	Remrks
No. of animals	06	06	06	-
Milk	4.0 lit/day with two frequencies (As per farm practices			Method of offereing: Bucket with nipple
Concentrate	Control-18% CP	25% CP	25% CP (Formulated)	From 7th day onwards
Dry Fodder	Ad lib. (Chaffed Sorghum/Juwar Hay			From 15th day onwards
Cereal	200 g/day (From 42 to 63 days of age)			From 42nd day onwards
Green Fodder	300 g/day (From 64 to 84 days of age)			

Table 2: Chemical composition of feeds and fodder fed to crossbred calves (Dry matter basis)

Feed		DM (%)	CP (%)	EE (%)	CF (%)	NFE (%)	Total ash (%)	AIA (%)	Ca (g%)	P (g%)
Conce--ntrate	T_1	89.00	17.62	4.24	11.97	51.34	14.83	3.20	1.56	0.70
	T_2	89.10	24.18	6.60	9.90	50.74	8.58	2.64	1.66	0.78
	T_3	88.30	24.60	5.32	11.60	47.33	11.15	3.26	1.49	0.72
Jowar hay		90.00	5.51	2.57	32.50	49.22	10.20	2.19	0.36	0.22
NB-21		22.00	7.44	2.45	31.62	49.37	9.12	1.98	0.33	0.19
Milk		13.53	22.84	27.34	0.00	44.64	5.18	-	-	-

DM = Dry Matter, CP = Crude Protein, EE = Ether Extract, NFE = Nitrogen Free Extract, AIA = Acid Insoluble Ash, Ca = Calcium, P = Phosphorus, NB-21 = Hybrid Napier variety

Table 3: Growth performance of crossbred calves

Parameters	Treatments			SEm*
	T_1	T_2	T_3	
Initial BW (kg)	32.72±1.96	32.42±1.32	32.26±1.98	-
Final BW (kg)	54.14^{x}±1.86	56.44^{y}±2.04	54.30^{x}±1.94	0.62
Mean weight Gain (kg/week)	4.06^{x}±0.22	4.57^{y}±0.24	4.10^{x}±0.19	0.13
ADG (g)	580.36^{x}±31.02	653.37^{y}±34.45	586.19^{x}±27.62	18.48

BW = Body Weight, SEm = Standard Error of Mean

Mean with different superscripts (x and y) in row differ significantly (p<0.05) showing treatment effect

Table 4: Body measurements of crossbred calves

Parameters	Treatments			SEm*
	T_1	T_2	T_3	
Initial HW (cm)	73.00±1.19	73.00±1.58	74.42±1.22	-
Final HW (cm)	84.72±1.11	85.35±1.16	84.90±1.08	0.51
Initial HG (cm)	73.58±1.2	72.67±1.23	73.33±1.12	-
Final HG (cm)	87.90±1.22	88.92±1.50	87.61±1.32	0.45
Initial BL (cm)	69.42±1.92	68.50±1.48	67.75±1.82	-
Final BL (cm)	83.13^{x}±1.31	84.82^{y}±1.40	82.22^{x}±1.39	0.52

HW = Height at withers, HG = Heart girth, BL = Body length, SEm = Standard error of mean

Mean with different superscripts (x and y) in row differ significantly (p<0.05) showing treatment effect

Conclusion

Feeding of calf starter with different sources and level of crude protein has significant (p<0.05) effect on mean body weight (kg), mean average daily gain (g/d) and total weight gain (kg) when calves are fed with commercial concentrate: 25% CP (T_2) compared to calves fed with commercial concentrate: 18% CP (T_1) and farm made concentrate: 25% (T_3). The height at wither and heart girth were not significantly influenced by treatment and interaction of treatment and period. The body length of animals of T_2 group was significantly (p<0.05) higher by 2.03 and 3.16% than animals of T_1 and T_3 groups, respectively.

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