REASERCH ARTICLE

Influence of Different Protein Level Feeding on Physiological Response and Biochemical Indices in Crossbred Calves

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Abstract

This study was conducted on 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 physiological responses of calves like rectal temperature (°F), respiration rate (no./min) and pulse rate (no./min) were recorded at weekly intervals at 07:30 am and 02:30 pm. The blood samples from individual calves were collected on 0, 42 and 84 days for hematology, serum biochemical parameters and hormone concentration. Feeding of calf starter with different level of crude protein and source has a non-significant influence on physiological responses like rectal temperature, respiration and pulse rate, hematological parameters like white blood cells, red blood cells, hemoglobin, pack cell volume, serum parameters like total protein, albumin, glucose, alkaline phosphatase, cholesterol, aspartate aminotransferase, alanine aminotransferase, triiodothyronine, thyroxine and cortisol level of crossbred calves. In conclusion, the feeding of calf starter with different sources and levels of protein non-significantly influenced physiological responses, blood parameters, and the hormonal level of crossbred calves.

Keyword: Blood parameters, Calf starter, Crossbred calves, Hormone level, Physiological responses, Protein level.

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Introduction

Lack of proper feeding, management and care of calf during early age leads to poor growth and reduced lifetime milk production. As milk feeding accounts for 40% of total rearing costs from birth to weaning(Boulton *et al.*, 2017), intensive dairy calves are separated from the cow immediately or shortly after the parturition and fed limited quantities of milk until weaning. Before weaning, growth in young calves mainly occurs in the skeleton and muscle systems. Tissue growth is largely a function of protein deposition in bone and muscle, with corresponding mineralization of the protein matrix in bone (Drackley, 2008). Calf starter is a feed mixture containing high-quality feed ingredients for supplying energy and protein to the calf. The calves fed with starters containing 22% CP were more efficient than those fed 18% CP (Drackley *et al.*, 2002). Feeding calf starters with varying crude proteins has a variable effect on physiological response (Beiranvand *et al.,* 2016; Daneshvar *et al.,* 2017), hematology and serum chemistry (Daneshvar*et al.,* 2017; Sharma *et al.,* 2020). Thus, to evaluate the effect of protein levels in concentrate mixture on physiological response, blood serum metabolites, and hormone levels of crossbred calves, this experiment was planned with two levels of protein and two sources of concentrate.

Materials and Methods

Ethical Approval: The use of calves and protocol was approved by Institutional Animal Ethics Committee-IAEC vide No. 321/LRS/2020.

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This experiment was of 84 days and conducted at Livestock Research Station (LRS), College of Veterinary Science & Animal Husbandry, Anand Agricultural University, Anand, Gujarat. The experiment season was 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. Eighteen newborn crossbred calves (Holstein Friesian 75%

× Kankrej25%) of either sex were randomly and sequentially assorted into three groups based on body weight, viz. T_1 (Commercial concentrate: 18% CP), T_2 (Commercial concentrate: 25% CP) and T_3 (Farm made concentrate: 25% CP). The birth weight of calves was 32.27 ± 1.96, 32.452 ± 1.32 and 32.26 ± 1.98 kg in T1, T2 and T3, respectively. The calves were housed in the well-ventilated pakkashed with an individual feeding facility. The feeding schedule of concentrate to calves is as per Table 1.

First, colostrum was fed immediately after birth and then in equal half at the morning and evening for three days @ 4 litres a day. The concentrate and dry roughage was offered at 9:00 hours morning in a plastic bowl, starting with 100g/ day and ensuring *ad libitum* intake. 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). The calves were dewormed on 15th, 30th and 60th day of the experiment with a broad spectrum dewormer.

The physiological responses of calves like rectal temperature (°F), respiration rate (no./min) and pulse rate (no./min) were recorded at the weekly interval at 07:30 am and 02:30 pm. The pulse rate of calves was measured with stethoscope by semiotic technique in a standing position. The respiration rate was measured by counting of right flank movements of calves from a distance without disturbing the animals. The rectal temperature was measured with a clinical digital thermometer inserted in the rectum touching mucosal membrane.

The blood samples from individual calves were collected at 0, 42 and 84 days aseptically from the jugular vein in a vacuttee (EDTA and clot activator). The hematological parameters were estimated from whole blood by using an automated blood cell counter (Mindray – BC -2800 VET). The serum biochemical parameters were analysed using Coral kits in MINDRAY BS-120 chemistry analyzer. Triiodothyronine, thyroxine and cortisol concentrations were estimated by standard Radioimmune-Assay (RIA) technique using standard diagnostic kit.

The data generated during the experiment was analyzed following a completely randomized design (CRD) as per the statistical method described by Snedecor and Cochran (1994). Significance was tested at 5% level by calculating the critical difference for comparison of means.

Results and Discussion

Composition of Feeds and Fodders

The chemical composition of feeds and fodders is given in Table 2. The crude protein of concentrate mixture T1, T2 and T3 were 0.38, 0.82 and 0.40% lower than the calculated value. It also indicated that crude protein and ether extract level in T1 commercial concentrate was lower than T2 commercial concentrate and T3 farm formulated concentrate but was higher in total ash. A comparison of high protein concentrate (T2 and T3) revealed higher ether extract and calcium in T2 compared to T3. The level of calcium and phosphorus were sufficient to meet the requirement of growing crossbred calves.

Table 1: Feeding schedule of crossbred calves

Particulars	*T1*	*T2*	*T3*	*Remarks*
No. of animals	06	06	06	-
Milk	4.0 Lit/ day with two frequencies (As per farm practices)			Method to milk offering: Bucket with nipple
Concentrate	Control - 18 %, CP	25 %, CP	25 %, CP (Formulated)	From 7th day and onward
Dry Fodder	*Ad lib.* (Chaffed Sorghum/Jowar hay)			From 15th day and onward
Cereal Green Fodder	200 g/d (From 42 to 63 days of age) 300 g/d (From 64 to 84 days of age)			From 42nd day and onward

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%)*
T1	89.00	17.62	4.24	11.97	51.34	14.83	3.20	1.56	0.70
T2	89.10	24.18	6.60	9.90	50.74	8.58	2.64	1.66	0.78
T3	88.30	24.60	5.32	11.60	47.33	11.15	3.26	1.49	0.72
Sorghum 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

Physiological Responses

The effect of feeding of calf starter with varying protein levels (%) and source on rectal temperature, respiration rate and heart rate are presented in Table 3. The treatment did not influence the rectal temperature, respiratory rate, and pulse rate significantly. The rectal temperature, respiratory rate and pulse rate were numerically higher at 02:30 pm than 07:30 am because of the higher environmental temperature at 02:30 pm.

Rectal temperature of Holstein calf (38.85 vs. 38.94^{0}C) was not influenced by feeding 18 and 22% protein calf starter concentrate (Niroumand *et al*., 2020). Beiranvand *et al.,* (2016) and Daneshvar *et al*.,(2017) reported that any parameter on the physiological response of calf was not influenced significantly on feeding calf starter with varying level of crude protein, which supported the present findings. The physiological responses recorded in the present experiment were within normal range (Kubkomawa *et al*.,2015; Aiello *et al*., 2016). Change during a different measurement time would be owing to body mechanisms adjustment to changes in the external environmental (Jat, 2020).

Hematological Parameters

Mean hematological parameters (Table 4) like white blood cells-WBCs, red blood cells-RBCs, haemoglobin-Hb and pack cell volume-PCV were not influenced significantly by different treatments. The hematological parameters like WBCs, RBCs, Hb and PCV values were within normal physiological range (Aiello et *al*., 2016), indicating no adverse effect on feeding high protein mixture (T2 and T3). Lohakare *et al.* (2006) reported a non-significant effect on Hb and PCV for diet containing 25.33, 16.60 and 20.5% CP. Daneshvar

Table 3: Physiological response of crossbred calves fed different calf starter

Parameters		*T_1 (18% CP)*	*T_2 (25% CP)*	*T_3 (25% CP)*
Rectal temperature **(F)**	7:30 am	101.62 ± 0.05	101.53 ± 0.05	101.51 ± 0.05
	2:30 pm	102.26 ± 0.04	102.24 ± 0.04	102.26 ± 0.05
Respiration rate (no./min)	7:30 am	36.86 ± 0.76	36.32 ± 0.69	35.86 ± 0.70
	2:30 pm	41.07 ± 0.75	41.65 ± 0.89	40.32 ± 0.80
Pulse rate (no./min)	7:30 am	86.47 ± 1.06	86.26 ± 1.11	86.28 ± 1.09
	2:30 pm	88.96 ± 1.05	88.26 ± 1.03	89.19 ± 1.06

Means without superscript in a row differ non-significantly (P > 0.05)

Table 4: Haematology, serum biochemical parameters and hormone of crossbred calves fed different calf starter

Parameters	*T_1 (18% CP)*	*T_2 (25% CP)*	*T_3 (25% CP)*
Haematological Parameters			
WBCs ($10^{3/}$µL)	9.26 ± 0.51	9.27 ± 0.39	10.19 ± 0.46
RBCs ($10^{6/}$µL)	10.09 ± 0.26	10.17 ± 0.23	10.29 ± 0.30
Hb (g/dL)	9.38 ± 0.16	9.58 ± 0.15	9.80 ± 0.22
PCV (%)	35.61 ± 0.82	36.61 ± 0.66	37.38 ± 0.85
Serum Biochemical Parameters			
Total protein (g/dL)	6.55 ± 0.19	6.63 ± 0.14	6.81 ± 0.15
Albumin (g/dL)	2.66 ± 0.06	2.74 ± 0.05	2.76 ± 0.03
Glucose (mg/dL)	80.28 ± 2.61	82.09 ± 2.50	83.36 ± 2.63
Alkaline phosphates (U/L)	213.17 ± 11.59	233.06 ± 10.99	225.84 ± 9.28
Cholesterol (mg/dL)	131.86 ± 10.07	120.95 ± 9.19	122.52 ± 10.08
SGOT-AST (U/L)	54.11 ± 3.51	60.13 ± 4.53	55.17 ± 4.44
SGPT-ALT (U/L)	13.40 ± 0.83	14.89 ± 1.16	14.58 ± 1.19
Hormone Profile			
T_3 (ng/mL)	2.77 ± 0.32	3.24 ± 0.30	3.24 ± 0.27
T_4 (ng/mL)	35.93 ± 2.43	40.88 ± 3.73	38.09 ± 2.86
cortisol (ng/mL)	68.78 ± 10.07	69.72 ± 9.13	71.56 ± 10.8

Means without superscript in a row differ non-significantly (P > 0.05)
WBCs=White Blood cells, RBCs=Red Blood Cells, Hb=Haemoglobin, PCV=Pack Cell Volume, SGOT-AST=Serum Aspartate Aminotransferase, SGPT-ALT= Serum Alanine Aminotransferase, T_3=Triiodothyronine, T_4= Thyroxine

et al. (2017) reported that Hb, PCV, RBC and WBC did not differ significantly by different levels of milk feeding and CP concentration in calf starter. In contrast to the present findings, Sharma *et al.* (2020) stated that total leucocyte count decreased significantly as the protein level increased in calf starters.

Biochemical Parameters

The serum biochemical parameters (Table 4) such as total protein, albumin, serum glucose, alkaline phosphatase, cholesterol, SGOT-Serum Aspartate Aminotransferase and SGPT-Serum Alanine Aminotransferase were not influenced significantly after treatment.

The total protein, albumin and glucose were not influenced significantly by different levels of protein (18-25% CP) in calf starter (Lohakare *et al.,* 2006; Zothanpuii *et al.,* 2015; Daneshvar *et al.,* 2017). Lohakare *et al.* (2006) reported that alkaline phosphatase was not influenced significantly by level of protein in calf starter, which supported the present finding. Makizadeh *et al.*(2020) also indicated a non-significant effect on serum glucose, total protein, albumin, SGOT and SGPT on feeding 18 and 21% protein-containing calf starter in Holstein dairy calves. However, Sharma *et al.* (2020) reported that total protein, glucose increased significantly as the level of protein increased in calf starter. Park (1985) reported that cholesterol concentration was significantly influenced by levels of protein (12 and 25%) in the diet of Holstein calves, which contraindicated the present finding.

Hormone Profile

The blood hormones like triiodothyronine (T_3), thyroxine (T_4) and cortisol level were non-significantly influenced after treatment. The thyroid hormone was highest at the time of birth and then declined as age increased, whereas the concentration of cortisol increased as age increased.

Guindon *et al.* (2015) reported that cortisol concentration was non-significantly higher on high plane of nutrition (28% CP milk replacer), which supported the present finding. While, Lohakare *et al.* (2006) indicated lower ($p > 0.05$)T3 and T4 concentrations in blood of crossbred calf-fed low protein diet compared to high protein diet. Non-significant level of cortisol indicated that feeding of high protein concentrate (T2 and T3) had no stressful effect on crossbred calf. Hammon *et al*. (2002) reported a decrease in cortisol concentration as age increased, which contraindicated the present finding. Hammon *et al.* (2002) and Lohakare *et al.* (2006) reported that T_3 and T_4 hormones decreased as age increased, supporting the present finding.

Conclusion

Feeding of calf starter with different sources and level of crude protein has non-significant influence on physiological response like rectal temperature, respiration and pulse rate, hematological parameters like white blood cells, red blood cells, hemoglobin, pack cell volume, and serum parameters like total protein, albumin, glucose, alkaline phosphatase, cholesterol, aspartate aminotransferase, alanine aminotransferase, triiodothyronine, thyroxine, and cortisol level of crossbred calves.

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ANNOUNCEMENT: SVSBT-NS-2022

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