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Effect of varying levels of dietary degradable protein on blood biochemical parameters in crossbred calves

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Abstract
A feeding trial of 120 days was conducted in female crossbred calves to study the effect of different levels of dietary degradable protein on blood biochemical parameters. Eighteen weaned crossbred calves of six to nine months of age were selected from ULF & FRDS, Mannuthy and randomly allotted to three dietary treatments (CP 20%, TDN 70%) varying in degradable protein levels: Control- 65%; T_1 -55%; T_2-45%, respectively of total CP. The experimental calves were fed as per ICAR standards (ICAR, 2013). The blood biochemical parameters like, Hb, RBC, WBC, PLT, HCT, Lymphocytes, Monocytes, MPV, creatinine, serum calcium, phosphorus, zinc, copper, magnesium were analysed at the end of feeding trial. The observed values were similar between the treatments groups for all blood parameters and within the normal range opined for species. Therefore, it was concluded that feeding of concentrate mixtures (20% CP and 70% TDN) containing rumen degradable protein from 45-65% as percent of total CP had no adverse effects on blood biochemical parameters and health of crossbred calves.

Keywords: Rumen degradable protein, haematology, serum minerals, health

Introduction
Ensuring optimum nourishment of crossbred dairy calves is essential for achieving high growth rate of dairy calves. In calves, dietary crude protein is essential for growth and is divided into degradable protein and undegradable protein. The degradable protein is utilised by rumen microbes for synthesising microbial protein available for host animals for absorption in the small intestine.

In the feeding of novel feed formulations for cattle, it is critical to examine the blood parameters after feeding to assess the health status (Arewad *et al*., 2011) [3]. But the studies on the effect of varying dietary levels of degradable protein on health status of growing calves were limited. Hence the current research project was envisaged to study the effect of varying levels of dietary degradable protein on blood biochemical parameters in cross bred dairy calves.

Materials and methods
This study was conducted at the University Livestock Farm and Fodder Research and Development Scheme, College of Veterinary and Animal Sciences, Mannuthy, Kerala, India.

Experimental animals
Eighteen crossbred female calves aged six to nine months were randomly allotted into three groups of six animals each. Calves were weaned and housed individually in a well-ventilated, clean, and dry shed with feeding and watering facilities. Before beginning the feeding study, all of the calves were dewormed. All the experimental calves were kept under the same management conditions throughout 120 days of experimental period.

Experimental feed
The experimental calves were fed with diets (CP 20%, TDN 70%) containing varying levels of degradable protein *viz*., Control: 65%, T_1: 55%, and T_2:45% as percent of CP respectively. The experimental animals were fed according to the feeding standard (ICAR, 2013) and kept on their respective diet for 120 days.

Blood biochemical parameters
Blood samples were collected from the experimental calves at the end of the feeding trial from

jugular vein to estimate, haemoglobin, red blood cells (RBC), white blood cells (WBC), platelets (PLT), haematocrit (HCT), Lymphocytes, Monocytes, mean platelet volume (MPV) and serum creatinine. Serum calcium and phosphorus (AOAC, 2016) [2] were assessed using standard kits in separated serum by using Semi Automated Biochemical Analyser. Serum zinc, copper and magnesium were analysed by atomic absorption spectrophotometry. The data obtained on various blood biochemical parameters were analysed statistically using statistical package SPSS 24.) As per Snedecor and Cochran (1994) [15].

Results and Discussion

The haematological and serum biochemical parameters of the experimental calves such as haemoglobin, RBC, WBC, PLT, HCT, Lymphocytes, Monocytes, MPV and creatinine, serum calcium, phosphorus, zinc, copper, magnesium (estimated towards the end of the experiment) are listed in Table 1 and 2.

Haematological profile

The varying levels of dietary degradable protein had no effect on the haematological parameters like haemoglobin, RBC, WBC, PLT, HCT, Lymphocytes, Monocytes, MPV and were within the normal range. Similarly, Liker et al. (2005) [10] also observed no considerable difference in RBC, WBC, HCT, PLT count in beef cattle by providing rumen protected methionine. Also Movaliya et al. (2013) [14] identified no statistically significant ($p>0.05$) difference between the control (T_1), cotton seed cake diet (T_2), and bypass methionine-lysine supplementation (T_3) groups for WBC, RBC, PLT, PCV, and haemoglobin levels in Jaffarabadi heifers. Kumari et al. (2017) [9] found that haemoglobin concentration was higher in Murrah buffalo heifers fed with protected protein as compared to control though it was not significant whereas other haematological parameters like RBC, WBC did not showed any difference among the groups. Maty (2021) [11] observed no major variation in HGB, PLT, HCT but observed improvement in WBC, RBC values in calves when they were fed with diet rich in rumen protected methionine and lysine.

Joseph and Ally (2011) [6] also stated that haemoglobin values were unaltered in dairy cows when they were provided with two varying levels of UDP (28 and 40% respectively of CP as RUP, respectively, on DM basis). Akhtar et al. (2017) [1] reported that values of haemoglobin were unaltered between the groups in crossbred dairy heifers when they were provided with diets varying in RUP (25, 35, 45, and 55% of total CP respectively). In contrast Mishra et al. (2018) [12] reported that haemoglobin values in lactating buffaloes were significantly ($p<0.05$) higher in formaldehyde treated mustard oilseed cake (FT-MOC) group than in untreated group.

Liker et al. (2005) [10] noticed that in beef cattle there was no significant ($p>0.05$) variation in serum creatinine levels in control and methionine supplemented groups. Joseph and Ally (2011) [6] also stated that creatinine values were unaltered in dairy cows when they were provided with two varying levels of undegradable protein (UDP) (28 and 40% respectively of CP as RUP, respectively, on DM basis). In contrast to the findings of the present study, Akhtar et al. (2017) [1] reported creatinine levels were reduced significantly ($p<0.05$) in crossbred dairy heifers when they were provided with diets varying in RUP (25, 35, 45, and 55% of total CP respectively) levels.

Serum mineral profile

In the present study serum minerals like calcium, phosphorus, copper, zinc, magnesium were unaffected by different levels of degradable protein in diets and all the values were within the normal range reported for the species.

Similar to the findings of the present study, Joseph and Ally (2011) [6] also observed that calcium, phosphorus, values were unaltered in dairy cows when they were provided with two varying levels of UDP (28 and 40% respectively of CP as RUP, respectively, on DM basis). Calcium and phosphorus levels in Mehsana buffalo calves remained stable in both the cotton seed cake-supplemented group and the control group (Barman et al., 2019) [4]. Mondal and Chopra (2008) [13] observed no difference in blood copper concentrations in crossbred cows fed varying levels of rumen degradable and undegradable protein. Kumari et al. (2021) [8] found that feeding different sources of rumen bypass proteins (soya bypass protein, fish meal) had no effect on serum copper, zinc levels in Murrah buffalo heifers and values were within the normal range.

In contrast, Mishra et al. (2018) [12] reported that in lactating buffaloes, Ca, P values were significantly ($p<0.01$) higher in formaldehyde treated mustard oilseed cake (FT-MOC) group than in untreated group.

Table 1: Haematological parameters[1] of experimental crossbred calves

Parameters	Control	T_1	T_2	p value
Haemoglobin (g/dL)	10.77±0.30	11.62±0.94	10.53±0.47	0.46[ns]
RBC (10^6/μl)	9.59±0.26	10.11±0.44	9.30±0.26	0.248[ns]
WBC (10^3/μl)	10.87±0.79	10.37±0.23	9.62±0.79	0.42[ns]
PLT (10^3/μl)	236.5±15.83	241±28.07	230.83±41.42	0.972[ns]
HCT (%)	28.62±0.79	30.48±2.14	27.77±1.18	0.436[ns]
Lymphocytes (%)	53.93±1.80	58.68±1.13	59.45±3.55	0.242[ns]
Monocytes (%)	7.08±0.37	6.05±0.74	7.37±0.80	0.361[ns]
MPV (fl)	7.07±0.22	7.25±0.18	6.95±0.09	0.482[ns]

[1]Mean average was based on six replicates with SE
NS-Non significant ($p>0.05$)

Table 2: Serum biochemical parameters[1] of experimental female crossbred calves

Parameters	Control	T_1	T_2	p value
Calcium (mg/dL)	9.72±0.36	10.02±0.38	10.25±0.13	0.557[ns]
Phosphorus (mg/dL)	5.72±0.17	5.82±0.07	5.94±0.09	0.480[ns]
Zinc (mg/L)	1.01 ± 0.10	1.00 ± 0.10	1.02 ± 0.02	0.986[ns]
Copper (mg/L)	0.85±0.06	0.84±0.06	0.83±0.09	0.990[ns]

Magnesium (mg/dL)	2.27 ± 0.12	2.29 ± 0.10	2.34 ± 0.12	0.911 [ns]
Creatinine (mg/dL)	0.71 ± 0.02	0.73 ± 0.03	0.70 ± 0.05	0.840 [ns]

[1]Mean average was based on six replicates with SE
NS-Non significant ($p > 0.05$)

Conclusion

In the present study, all the blood biochemical parameters studied were within normal range across the treatment groups. Hence, it was concluded that feeding of concentrate mixtures (20% CP and 70% TDN) containing rumen degradable protein from 45-65% as percent of total CP had no adverse effects on blood biochemical parameters and health of crossbred calves.

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