



Effect of Crude Protein on Punganur Calves

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Effect of Concentrate Mixture Containing Varying Levels of Crude Protein on Growth Performance, Serum Biochemical Profile of Punganur Calves

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ABSTRACT

To arrive the optimum CP content of concentrate mixture for Punganur calves based on their growth performance, nutrient digestibility and serum biochemical profile, a study was conducted in a completely randomized design using fifteen growing Punganur calves of 3-4 months of age with average body weight of 29.72±2.96 kg which were fed on Super napier grass *ad libitum* supplemented with concentrate mixture containing 14 (T1), 16 (T2) and 18% (T3) CP at 1% of live weight. The experiment lasted for 90 days. The total weight gain (kg); 20.80, 20.76 and 21.17 and average daily gain (g) 233.71, 233.26 and 237.95 in T1, T2 and T3, respectively were comparable among different treatments. There was no significant difference in total DMI (g), DMI/kg gain, nutrient digestibility, serum biochemical constituents among the treatment groups. The results of the current study indicated that the concentrate mixture with 14% CP on Super Napier based diet was optimum for Punganur calves.

KEYWORDS: Growth performance, Nutrient digestibility, Punganur calves

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INTRODUCTION

Conserving indigenous cattle breeds requires a clear understanding of their nutrient requirements. Punganur, a dwarf dual-purpose breed native to Chittoor, Andhra Pradesh, is known for its drought resistance, heat tolerance, and ability to thrive on dry fodder. With an average adult weight of 240 kg (males) and 170 kg (females), its milk yield ranges from 200 to 1100 kg per lactation, averaging 550 kg over 153 ± 24 days (Ekambaram et al., 2014).

Indigenous breeds like Punganur are expected to have superior fibre utilization compared to crossbreeds, which can be assessed through digestion trials. Nutritional factors influence key metabolites (glucose, BUN, total protein), impacting growth and metabolism (Todini et al., 2007; Acuti et al., 2009). While dietary protein is essential for growth, excessive intake can lead to increased nitrogen excretion, posing environmental concerns (Klemesrud et al., 2000). However, data on optimal protein levels for Punganur calves remain limited. This study investigates the effects of varying crude protein levels in concentrate mixtures on their growth and nutrient utilization.

MATERIALS AND METHODS

The experimental protocols that were developed in this study were fully complied with the ethical principles of animal experimentation prepared by Institutional animal ethic committee (IAEC) with reference number 281/ go/ S/ 2000/ CPCSEA/ CVSc/ TPTY/ 012/ ANN/ 2020. At Livestock Research Station, Palamaner, Andhra Pradesh, a 90-day growth trial was conducted using 15 Punganur calves (3–4 months old, 29.72 ± 2.96 kg), randomly assigned to three treatment groups (n=5). Calves were housed in a well-ventilated, semi-open shed with individual feeding and watering facilities, ensuring proper hygiene. A seven-day adaptation period was provided before the trial to adjust to the diets. Feed ingredients *viz.*, Maize, Soybean meal and De-oiled rice bran (DORB) were procured from the local market in ground form and concentrate mixture was prepared at the feed mixing plant, Livestock Research Station (LRS), Palamaner. Concentrate mixture was prepared with different levels of crude protein (Table 1) and the calves were fed Super napier green grass *ad libitum* and concentrate mixture with 14% CP (T1), 16% CP (T2) and 18% CP (T3) at 1% of body weight.

Table 1. Chemical composition of concentrate mixture and Super Napier grass fed to Punganur Calves*

Nutrient	Concentrate mixture			Super Napier
	T1	T2	T3	
Dry matter	89.9	89.8	90.1	19.90±0.27
Organic matter	90.9	90.04	90.1	89.2
Crude protein	14.6	15.8	18.5	6.09
Crude fibre	9.0	10.4	10.3	33.5
Ether extract	2.29	1.98	1.39	2.05
Total ash	9.09	9.96	9.88	10.7
Acid insoluble ash	2.71	3.13	2.53	4.2
Neutral detergent fibre	36.02	35.98	35.19	69.65
Acid detergent fibre	12.66	13.39	12.25	40.22
Hemi cellulose	23.36	22.59	22.94	29.43
Cellulose	8.13	10.89	10.51	35.75
Acid detergent lignin	4.81	4.72	4.98	12.57
Gross energy(cal/gram)	4006	4003	3978	-

*DM basis

The calves were fed weighed quantity of concentrate mixture at 9:00 AM daily and *ad libitum* Super Napier green grass twice daily at 10:30 AM and 3:30 PM. The leftover Super Napier grass, if any was recorded next day morning to calculate DMI. Experimental animals were weighed at weekly intervals before feeding and watering to know the effect of experimental diets on average daily gain (ADG) and feed efficiency. A digestion trial was conducted at the end of 90 days growth trial. During the 7-day collection period the daily feed intake, feed left over and faeces voided were recorded. Daily faeces voided of individual animals were collected for 24 h and pooled in air-tight polythene bag. An aliquot of faecal sample for dry matter estimation (1/50) and N estimation (1/500 preserved in 20 % H₂SO₄) was collected daily from individual animal. Dried samples of faeces and leftover grass were ground through a 2 mm sieve using a Wiley mill, labelled and were stored in air-tight polythene bags and used for subsequent analysis. The DM of fresh Super napier was estimated daily and the dried samples were preserved in airtight containers until analysis. About 15 ml of blood was collected at end of the experiment under aseptic conditions from jugular vein. The blood was transferred to clot activator tubes and kept in slant position for 30 minutes and samples were centrifuged at 3000rpm for 5 min. Serum was separated and collected in Eppendorf tubes and stored at -20°C for further analysis.

Dried samples of Super Napier grass, feed ingredients, concentrate feed, faeces and leftover feed were analysed for proximate principles (AOAC, 2005) and cell wall constituents (Van Soest et al., 1991). The serum biochemical constituents (glucose by Glucose oxidase/peroxidase method), Total protein by Biuret method, Albumin by Bromocresol green method, Triglycerides by glycerol phosphate oxidase/peroxidase method, Total cholesterol by cholesterol oxidase/peroxidase method and the activity of enzymes (AST and ALT) were estimated using A15 automated biochemical analyser using Biosystems A 15 analyser kits.

The data obtained were subjected to analysis using software (version 23.0; SPSS, 2015) by applying one-way analysis of variance through generalized linear model and the treatment means were ranked using Duncan's multiple range test with a significance at P<0.05 (Duncan, 1955).

RESULTS AND DISCUSSION

Growth performance

The total weight gain (kg) of Punganur calves during the 90-day growth trial was 20.80, 20.76 and 21.17 in T1, T2 and T3, and the corresponding average daily gain (g) of 233.71, 233.26 and 237.95 was comparable among treatments (Table 2). Similarly, no significant effect was observed in DMI (Table 3) among treatments. Though superior feed efficiency was observed in T2 group, but the

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values were statistically comparable. Previous studies, Sharma et al. (2020), Kumar et al. (2016) and Lohakare et al. (2006) also reported no significant difference in growth performance of calves fed the diet containing different levels of crude protein. In contrast to the present study, Brosh et al. (2000) have reported higher weight gain in male HF

calves fed high protein diet in comparison to feeding of medium or low protein diets. There was no significant difference in average faecal score and the values were 1.02, 1.02 and 1.04 in T1, T2 and T3 groups, respectively. This indicated that the different levels of crude protein did not show any effect on growth performance of Punganur calves.

Table 2. Effect of experimental diets on growth performance of Punganur calves

Parameter	T1	T2	T3
Average initial body weight (kg)	27.4±4.10	27.6±6.71	28.3±2.76
Average final body weight (kg)	48.2±4.34	48.4±7.71	49.4±2.65
Average total gain (kg)	20.8±1.43	20.7±2.61	21.1±1.14
Average daily gain (g)	233.71±16.10	233.26±29.34	237.95±12.85
FCR(g DMI / g gain)	4.36±0.75	4.09±1.03	4.35±0.58
Faecal score (1-4)	1.02±0.01	1.02±0.02	1.04±0.02

Table 3. Effect of experimental diets on DMI of Punganur calves

Treatment	DMI from Super Napier(g)	DMI from Concentrate mixture(g)	Total DMI (g)	DMI (% Body weight)	CP (%DM)	TDN (%DM)
T1	591.93±153	323.16±47	915.09±196	2.76±0.26	9.26	61.76
T2	534.43±206	336.19±73	860.76±272	2.47±0.32	10.20	64.74
T3	613.03±155	335.04±312	944.92±186	2.79±0.47	10.87	62.82

Nutrient digestibility

The data revealed non-significant effect ($P>0.05$) on digestibility of nutrients with diet containing varying levels of crude protein (Table 4). Similar to

our study, several authors reported that dietary crude protein levels did not alter the digestibility of nutrients (Senger et al., 1985; Mehra et al., 2001; Chantriatikul et al., 2009; Tatsapong et al., 2010 and Andersen et al., 1994).

Table 4. Effect of experimental diets on nutrient digestibility (%) in Punganur calves

Parameter	T1	T2	T3
Dry matter	64.4±0.78	67.1±0.60	65.4±2.32
Organic matter	65.9±0.60	68.5±0.58	66.8±2.31
Crude protein	57.07±2.44	62.7±2.05	62.3±2.27
Ether extract	63.3±2.53	66.2±1.38	64.9±1.63
Crude fibre	57.4±2.80	61.1±0.97	60.3±3.24
Nitrogen free extract	71.7±0.51	73.5±1.09	71.6±2.13
Neutral detergent fibre	54.1±2.37	54.6±1.21	55.1±2.87
Acid detergent fibre	43.1±2.19	46.9±2.32	45.2±2.13
Hemicellulose	69.6±1.37	69.8±1.22	70.9±2.26

Serum biochemical profile

There was no significant difference in serum biochemical profile except for BUN (Table 5). The results agreed with the those of Kumar et al. (2013) and Lohakare et al. (2006) who reported a non-significant difference in serum biochemical profile in calves fed ration containing different levels of crude protein.

In the present study, concentration of BUN was significantly ($P < 0.05$) lower in T1 than in T2 and T3 which might be due to higher crude protein content of diets T2 and T3 than T1. This agrees with Dong

et al. (1997) and Luo et al. (2000) who reported that the BUN level increased with the level of dietary crude protein. Concentration of total protein and albumin reflect the availability of protein and their concentration that decline in the face of protein deficiency (Lohakare et al., 2006). The concentration of protein and albumin after three months of feeding experimental diets was comparable which is suggestive of adequacy of the protein even on the low protein diet. However, all the values were reported to be within normal physiological range (Kaneko et al., 2008).

Table 5. Biochemical profile of Punganur calves at the end of growth trial

Parameter	T1	T2	T3
Glucose (mg/dL)	88.8±7.93	96.9±7.58	92.5±3.48
Total protein (g/dL)	6.46±0.24	6.72±0.18	6.92±0.17
Albumin (g/dL)	3.73±0.18	3.93±0.10	3.98±0.06
Globulin (g/dL)	2.74±0.22	2.79±0.11	2.94±0.16
ALT (IU/L)	36.5±6.93	32.12±5.69	33.3±6.49
AST (IU/L)	72.2±6.16	64.8±5.36	67.2±1.84
AST: ALT	2.09±0.21	1.85±0.26	2.44±0.58
BUN (mg/dL)*	7.52±1.09 ^a	9.58±1.08 ^{ab}	10.5±0.45 ^b
Cholesterol (mg/dL)	141.75±25.47	161.10±37.28	187.10±18.05
Triglycerides (mg/dL)	51.63±6.38	50.30±7.39	58.00±4.41
Cholesterol HDL (mg/dL)	120.46±18.80	124.00±20.51	137.87±8.73
Cholesterol LDL (mg/dL)	15.17±4.72	34.76±14.27	37.63±10.62
VLDL	10.33±1.28	10.06±1.48	11.60±0.88
Ca (mg/dL)	10.65±0.40	10.38±0.34	11.11±0.43
P (mg/dL)	10.14±0.55	8.98±0.53	9.65±0.33
Mg (mg/dL)	2.44±0.20	2.39±0.16	2.28±0.12

CONCLUSION

The present study indicated that, the performance of growing Punganur calves was comparable on low (14% CP), medium (16% CP) and high (18% CP) Protein concentrate mixture supplementation (@1% of body weight) on Super Napier green fodder-based diet. Thus, the concentrate mixture containing 14% CP supplemented at 1% of body weight along with *ad libitum* Super Napier grass is concluded as optimum for rearing Punganur calves from 3-6 months of age to exhibit its maximum growth potential.

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