Effect of Level of Concentrate Supplement on Blood Biochemical Changes and Testosterone Level in Crossbred (*Bos indicus*×*Bos taurus*) Calves

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ABSTRACT : A growth study was conducted for 238 days in twenty crossbred cattle calves to observe the effect of dietary concentrate supplement on blood biochemical changes and serum testosterone levels. The calves were divided into four groups (A, B, C and D) of five animals each. Calves of groups A and B were fed 60% and 30% concentrate, respectively, supplying equal amount of protein along with wheat straw. The calves in group C received 30% concentrate in their diet for 1 to 119 days of experiment and 60% concentrate during 120~238 days of experiment and vice versa in group D. Mean DM and TDN intake were significantly higher in group A than group B, C or D, resulted in higher daily growth rate in the former group. Blood glucose level was significantly higher in group A where as blood urea, hemoglobin, total protein, albumin and globulin levels remained unchanged among the groups. Serum testosterone level increased with the increasing age of the animals but the level remained same in the animals of group A, B, C and D. A 30% concentrate diet does not have any severe adverse effect on the performance of crossbred cattle. (*Asian-Aus. J. Anim. Sci. 1999. Vol. 12, No. 6 : 881-885*)

Key Words : Calves, Concentrate Level, Blood Testosterone, Blood Biochemical

INTRODUCTION

Livestock in India has a very important role in the agricultural sector and consequently in its rural economy. Due to continuously increasing demand of cereal grains for human consumption and extensive export of oil cakes to the foreign countries, it may be difficult to maintain even the present quantity and quality of concentrate in the diet of farm animals in the near future. Thus straws, other fibrous crop residues and grain milling byproducts will form the main components of bovine diets. But impact of such type of diets on nutrient intake and its relationship with growth rate and onset of puberty in crossbred cattle are not well understood. A number of researchers have reported that limited nutrient intake and therefore growth rate, delays onset of puberty in bulls (Pruitt and Corah, 1986; Nolan et al., 1990 and Brown, 1994). Limited nutrient or energy intake by pubertal bulls decreased serum testosterone level (Pruitt and Corah, 1986 and Chase et al., 1993). Keeping in view the above facts, the present experiment was conducted to study the effect of low levels of concentrate feeding along with wheat straw on blood biochemical changes and serum testosterone concentration in crossbred calves.

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MATERIALS AND METHODS

Experimental animals

Twenty growing male crossbred (*Bos indicus*×*Bos taurus*) calves of nine months of age and 166±3.74 kg mean body weight were taken from the Dairy Farm of Indian Veterinary Research Institute for experimental studies. *Bos indicus* is a Indian Jebu cattle and *Bos taurus* is a European humpless cattle. The crossbred calves used in this study were obtained from a herd in which *inter sey* breeding policy using crossbred of Haryana breed of *Bos indicus* were crossed with Holstein Friesian, Brownsuis and Jersey breeds of *Bos taurus*. Thus the animals belong to the three breed crosses. The animals were properly dewormed and vaccinated against prevailing diseases.

Experimental design and feeding schedule

The calves were divided in to four groups (A, B, C and D) of five calves each as per randomised block design so that mean body weight of calves in each group was almost same. The calves were fed as per NRC (1989) for 500 g daily body weight gain for 238 days. Wheat straw was used as the basal roughage. Four concentrate mixtures (table 1) were prepared which contained different levels of CP but same level of TDN. Concentrate mixture C1 was offered to group A and D whereas concentrate mixture C2 was offered to group B and C up to 119 days of experiments. After that, calves had more than 200 kg body weight and they required less amount of protein and more energy for their growth. So the concentrate

mixtures C3 and C4 were offered to the calves of groups A and C and groups B and D respectively after 119 days experiment. Feeding schedule of experimental calves are given in table 2. All the calves were fed individually at 9.00 hrs and weight of feed offered and refused were recorded daily. Fortnightly body weight changes of experimental calves were recorded. Blood samples were collected from all calves at 0, 60, 119, 179 and 238 days of experimental feeding.

Table 1. Physical composition of concentrate mixtures

Ingredients (%)	Concentrate mixtures			
	C1	C2	C3	C4
Crushed maize	39	26	46	37
Wheat bran	40	7	37	7
Deoiled groundnut cake	18	64	14	53
Mineral mixture[a]	2	2	2	2
Salt	1	1	1	1
Vitamin supplement[b]				

[a] Mineral mixture contained calcium 28.0%, phosphorous 6.2%, salt 35.8%, iron 0.4%, iodine 250 ppm, manganese 740 ppm, copper 280 ppm and sulphur 0.15%.

[b] Vitamin supplement (Rovimix) was added 20 g per 100 kg of concentrate mixture. Rovimix contained 40,000 IU vitamin A, 20 mg vitamin B_2 and 5000 IU D_3 per g.

Chemical analyses

The samples of feeds were analysed for proximate principle (AOAC, 1980), acid detergent fibre (ADF), neutral detergent fibre (Van Soest et al., 1991) and gross energy by ballistic bomb calorimeter (Gallen Kamp). Blood samples were analysed for estimation of urea (Rahmatullah and Boyde 1980), glucose (Folin and Wu, 1920), haemoglobin (Wong, 1928), total protein, albumin and globulins (Hiller and Van Slyke 1927). Serum testosterone level was estimated by using radio tracer technique (Hall and Sufi, 1981).

Statistical analyses

All statistical analyses were done as per principles described by Steel and Torrie (1980). The difference between the treatments mean was tested applying Duncan's (1955) multiple range test.

Table 3. Chemical composition (% DM) of concentrate mixture and wheat straw

Items	Concentrate Mixtures				Wheat straw
	C1	C2	C3	C4	
Organic matter	89.88	90.22	90.40	91.10	92.24
Crude protein	16.10	31.85	15.17	28.13	3.02
Ether extract	3.20	4.13	2.98	3.77	1.20
Total carbohydrate	70.58	54.24	72.95	59.20	88.02
Neutral detergent fibre	37.43	37.92	37.48	38.01	79.93
Acid detergent fibre	10.40	11.70	10.13	11.92	49.96
Hemicellulose	27.03	26.22	27.35	26.09	29.97
Gross energy (kcal/g)	4.34	4.28	4.41	4.38	4.13

RESULTS

Nutrient intake and body weight change

Calves of group A consumed higher ($p<0.01$) amount of dry matter and TDN per day than the calves of other groups (table 4). Total Body weight gain in calves of group A was highest ($p<0.01$) followed by calves of group C, D and B.

Blood biochemical changes

The concentrations of haemoglobin, glucose, urea, total protein, albumin and globulin in blood of experimental calves are presented in table 5. Plasma glucose level was higher ($p<0.05$) in group A than group B animals. Other blood metabolites (haemoglobin, urea, protein, albumin and globulin) remained unchanged in all the groups.

Serum testosterone level

Mean serum testosterone level in the calves of all groups during total experimental period was the same (table 6). Serum testosterone concentration in all calves increased with increasing age of the calves.

Table 2. Feeding schedule of experimental calves

Feeding treatment	Feeding schedule
A	60% Concentrate (C1) ± 40% Wheat straw for 1 to 119 days of experiment
	60% Concentrate (C3) ± 40% Wheat straw for 120 to 238 days of experiment
B	30% Concentrate (C2) ± 70% Wheat straw for 1 to 119 days of experiment
	30% Concentrate (C4) ± 70% Wheat straw for 120 to 238 days of experiment
C	30% Concentrate (C2) ± 70% Wheat straw for 1 to 119 days of experiment
	60% Concentrate (C3) ± 40% Wheat straw for 120 to 238 days of experiment
D	60% Concentrate (C1) ± 40% Wheat straw for 1 to 119 days of experiment
	30% Concentrate (C4) ± 70% Wheat straw for 120 to 238 days of experiment

Table 4. Nutrients intake and body weight changes of experimental calves

Items	Feeding treatments				±SEM	Significance
	A	B	C	D		
Dry matter intake (kg)/calf/d						
Concentrate	3.40^{a}	1.43^{c}	2.50^{b}	2.33^{b}	±0.06	p<0.05
Wheat straw	2.20^{c}	3.27^{a}	2.70^{b}	2.81^{b}	±0.21	p<0.05
Total	5.60^{a}	4.70^{b}	5.20^{ab}	5.14^{ab}	±0.18	p<0.05
DCP intake (kg/d)	0.41	0.36	0.39	0.38	±0.02	NS
TDN intake (kg/d)	3.13^{A}	2.49^{C}	2.84^{B}	2.78^{B}	±0.13	p<0.01
Initial body weight (kg)	166.20	165.80	166.02	166.21	±5.38	NS
Final body weight (kg)	300.60^{A}	260.13^{B}	287.80^{A}	282.81^{AB}	±9.31	p<0.01
Body weight gain (kg)	134.40^{A}	94.33^{C}	121.78^{AB}	116.60^{B}	±5.17	p<0.01

Table 5. Blood biochemical changes in calves

Items	Feedings treatments				±SEM	Significance
	A	B	C	D		
Blood haemoglobin (g/dl)	11.84	10.96	11.48	11.04	±0.61	NS
Plasma glucose (mg/dl)	74.30^{a}	66.99^{b}	70.79^{ab}	70.71^{ab}	±2.01	p<0.01
Plasma urea (mg/dl)	21.21	22.13	20.97	21.56	±0.59	NS
Serum protein (g/dl)	6.96	6.89	6.92	6.93	±0.25	NS
Serum albumin (g/dl)	3.73	3.67	3.63	6.69	±0.18	NS
Serum globulin (g/dl)	3.23	3.22	3.29	3.24	±0.15	NS

Table 6. Serum testosterone level (ng/ml) in calves

Days of trial	Age of animal (days)	Feeding treatments				±SEM	Significance
		A	B	C	D		
00	270	1.96	1.94	2.01	1.98	±0.12	NS
60	330	2.98	2.65	2.59	2.95	±0.27	NS
119	389	4.01	3.80	3.82	3.97	±0.14	NS
179	449	4.11	4.02	4.08	3.96	±0.19	NS
238	508	4.14	4.10	4.12	4.08	±0.16	NS
Overall Mean		3.44	3.30	3.32	3.39	±0.17	NS

DISCUSSION

Mean dry matter and TDN intake in high concentrate fed group was higher than the other groups as also reported in other workers (Matthes, 1991; Falchowsky and Schneider, 1992; Johnson and Comb, 1992). This difference in nutrients intake was reflected in higher gain in body weight in the former group. A positive relationship between live weight gain and feed intake which increased with the increase in dietary concentrate intake in ruminant animals has also been reported by many workers (Mallikarjunappa et al., 1983; Nachtomi et al., 1991; Cherkashachenko and Adil'bekov, 1993).

Blood haemoglobin level was not affected by dietary concentrate level. The haemoglobin concentration in the blood of experimental calves was similar to that reported by Sahoo (1994). Glucose concentration in blood of calves, fed low fibre diet was higher than the calves fed on diet containing high concentrate percentage which may be due to change in the rumen fermentation pattern resulting in greater amount of propionate production which along with increased flow of starch to the intestine might have given rise to higher blood glucose level than the feeding of high roughage diets (Evans et al., 1975; Dhiman et al., 1991). Blood urea level normally increases with the increasing consumption of protein or non protein nitrogen (Huber et al., 1976). The experimental diets in all the treatments of the present experiment were isonitrogenous. So there was no significant difference in plasma urea concentration as also observed by Dhiman et al., (1991). Serum total protein, albumin and globulin concentrations were also not affected due to isonitrogenous diet. In isonitrogenous diets, low energy diet had no effect on total protein and protein fractions of blood in crossbred heifers (Lebengarts, 1986).

Testosterone concentration increased as the age of the calves increased with the progress of experiment. Same type of trend of serum testosterone concentration with minor variation has been reported by Hemida (1985) for Egyptian buffalo, Sharma et al. (1989) for Murrah buffalo, Chantra Pratap and Thiber (1979) for Swamp buffalo, Cox et al. (1981) for Holstein, Lustra et al. (1989) for crossbreds and Champawat et al. (1994) for Surti, Jersey and Holstein Calves. Due to continuous supply of high concentrate diet the calves in group A reached earlier pubertal stage as evident from serum testosterone level. Dietary energy level influences onset of puberty directly at the testicular level (Nolan et al., 1990). In the present experiment low concentrate feeding in comparison with high concentrate had no effect on serum testosterone level. That means medium shortage of energy has no effect on onset of puberty and serum testosterone level.

CONCLUSION

On the basis of above results it may be concluded that 30% dietary concentrate along with wheat straw does not have any severe adverse effect on the performance of growing crossbred calves. Moreover shifting from high concentrate diet to low concentrate diet may not be as advantageous as the shifting of animals from low concentrate diet to high concentrate diet.

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