



EFFECT OF SHEANUT CAKE BASED COMPLETE DIET ON MINERAL BALANCE IN GRADED MURRAH BUFFALO CALVES

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ABSTRACT

Minerals have an important role to play in growth and productive performance of the animals. The present study aimed to analyze the effect of sheanut cake (SNC) and palm press fiber (PPF) inclusion at different levels in the complete diets of buffalo calves on maintaining mineral balance. The experiment was conducted on 18 graded Murrah buffalo calves in 2 x 2 x 2 Latin Square Design (LSD). Three experimental diets, D-I (conventional ration), D-II (complete diet with 18.5% SNC and 20% PPF) and D-III (complete diet with 28% SNC and 15% PPF) were fed to the three groups of animals. The experimental animals were subjected to fourteen days adaptation period followed by 7 days collection period with a switch over period of 21 days. The concentrations of nitrogen (N), calcium (Ca) and phosphorus (P) in dung and urine samples were analyzed. There were significant differences ($P < 0.01$) in the N, Ca and P balances in the buffalo calves fed with PPF-SNC based complete diet when compared to conventional diet fed animals. The nitrogen and calcium balances were significantly higher at 28% SNC & 15% PPF in the complete diet while the phosphorus balance was significantly higher at 18.5% SNC and 20% PPF. The results of the present study indicated that the SNC (unconventional feed resource) can be safely included in the buffalo calf ration without affecting the mineral balance in the body.

KEY WORDS: Sheanut cake, complete diet, Murrah buffalo calves, mineral balance.



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INTRODUCTION

Minerals are the inorganic elements required in small quantities and have an important role to play in essential physicochemical processes of life. They are present in all the body tissues and fluids and their requirement depends upon the physiological status of the animal¹. Growing animals require more quantities of minerals (micro and macro) to support the rapid growth of muscles and bones². The mineral composition is highly variable in various roughage sources and hence mineral mixture is supplemented in the ration³. The ever increasing buffalo population especially in rural India from 69.8 million in 1982-83 to 97.9 million in 2002-03 is emphasizing the need to depend on agricultural crop residues as potential feed ingredients⁴. The present study aimed to analyze the utility of sheanut cake based complete diet as buffalo ration based on its role in maintaining nitrogen, calcium and phosphorus balance in the body as these are the major minerals having diverse roles to play in growth and productive performance of the animals.

MATERIALS AND METHODS

EXPERIMENTAL DESIGN

The experiment was carried out on graded Murrah buffalo calves having similar age and body weights (Average body weights of 95.67 ± 18.65 kg for Diet I, 95.17 ± 15.11 for Diet II and 94.83 ± 18.01 for Diet III) for a period of 115 days. Eighteen buffalo calves were randomly distributed into three groups of three animals each in 2 x 2 x 2 Latin Square Design (LSD)⁵. All the buffalo calves were stall fed under hygienic conditions in well ventilated stall barn. Clean, fresh and wholesome water was made available to each animal in buckets thrice daily throughout the experimental period.

RATION FORMULATION & FEEDING

Three experimental diets (D-I, D-II & D-III) were formulated for the three groups of growing buffalo calves. The composition of the diets is given in Table 1.

Table 1
Ingredient composition (kg/100kg) of concentrate mixture and complete diets

Ingredients	Concentrate mixture (D-I)	Mash (D-II)	Mash (D-III)
Chopped Jowar straw (kutti)	-	20.00	25.00
Palm press fibre	-	20.00	15.00
Maize	30.00	10.00	10.00
Deoiled rice bran	17.00	10.50	4.00
Wheat bran	20.00	9.00	5.00
Ground nut cake	15.00	9.00	10.00
Cotton seed cake	15.00	-	-
Sheanut cake	-	18.50	28.00
Salt	1.00	1.00	1.00
Mineral mixture	2.00	2.00	2.00
Total	100.00	100.00	100.00
Nicomix (g/qt)		10.0(g)	10.0 (g)

The conventional diet (D-I) consisted of concentrate mixture and roughage of which roughage was offered separately. The animals were offered concentrate mixture twice daily at

8.00h and 16.00h *ad libitum* and roughage was offered in between twice daily *ad libitum*. Complete diets (D-II and D-III) were offered twice daily *ad libitums* at 8.00h and 16.00h.

METABOLIC STUDIES

The experimental animals were subjected to fourteen days adaptation period followed by 7 days collection period with a switch over period of 21 days. The trial was conducted for 63 (21 x 3) days. Urine bags were harnessed two days before the metabolic trial in each period for acclimatization by animals. Urine voided by each animal in 24 hours was collected into bottles containing toluene as preservative. Total urine voided by each animal in 24h was recorded. For urinary nitrogen estimation, total urine voided daily by individual animal was mixed thoroughly and 1/100th part of it was pipetted out in duplicate into Kjeldahl flasks containing 30ml of concentrated sulphuric acid. The aliquots thus pooled into the flasks for 7 days were maintained separately for each animal. Aliquots of urine samples were taken into silica crucible every day for each animal, for assessing calcium and phosphorus balance.

The total quantity of dung voided during 24h was weighed, mixed thoroughly and placed in a wide mouthed stoppered bottle before shifting to the laboratory for analysis. For the determination of nitrogen, 1/1000th part

of total faeces voided in 24h was weighed and mixed with sufficient quantity of sulphuric acid and preserved in previously weighed and labeled air tight screw capped sample bottles.

The nitrogen, calcium and phosphorus concentrations of dung and urine samples were analyzed by the methods of Varley (1976)⁷.

RESULTS

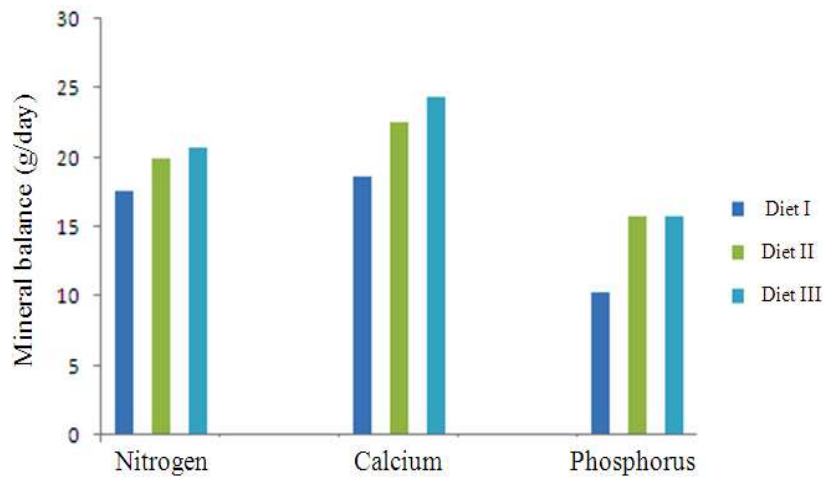
The N, Ca and P balances were positive in all the treatment groups but significantly ($P < 0.01$) higher with complete diets (D-II and D-III) when compared to the conventional diet (D-I) (Table 2) (Graph-I). The inclusion of SNC at 18.5% and PPF at 20% in the complete diet (D-II) had significantly elevated total intake and excretion (urine and faeces) of nitrogen and phosphorus. Total calcium intake and excretion (urine and faeces) were higher at 28% SNC and 15% PPF inclusion in the complete diet (D-III). Irrespective of the intake and excretion, nitrogen and calcium balances were the highest in D-III and phosphorus balance was the highest in D-II.

Table 2
Mineral balance (g/day) of sheanut cake based complete diets in buffalo calves

Treatment group	Total mineral intake	Outgo		Total mineral outgo	Balance
		Faeces	Urine		
Nitrogen (N)					
Diet I	56.10 ± 1.81	20.51 ± 0.94	18.04 ± 1.03	38.55 ± 1.97	17.55 ^a ± 0.29
Diet II	61.11 ± 1.68	22.22 ± 0.80	18.98 ± 0.54	41.20 ± 1.32	19.92 ^b ± 0.43
Diet III	57.51 ± 1.59	19.35 ± 0.80	17.41 ± 0.83	36.76 ± 1.62	20.75 ^b ± 0.44
Calcium (Ca)					
Diet I	30.37 ± 1.00	10.48 ± 0.22	1.29 ± 0.05	11.77 ± 0.27	18.60 ^a ± 0.75
Diet II	36.23 ± 1.00	11.81 ± 0.15	1.90 ± 0.06	13.72 ± 0.20	22.52 ^b ± 0.81
Diet III	39.02 ± 1.05	12.21 ± 0.19	2.35 ± 0.13	14.57 ± 0.31	24.45 ^b ± 0.79
Phosphorus (P)					
Diet I	18.57 ± 0.59	7.09 ± 0.21	1.25 ± 0.03	8.33 ± 0.22	10.24 ^a ± 0.38
Diet II	25.67 ± 0.71	8.40 ± 0.23	1.44 ± 0.08	9.83 ± 0.29	15.83 ^b ± 0.50
Diet III	25.24 ± 0.59	8.20 ± 0.27	1.26 ± 0.05	9.46 ± 0.29	15.78 ^b ± 0.31

Mean with different superscripts in a column differ significantly ($P < 0.01$)

Graph 1
Mineral balance (g/day) of sheanut cake based complete diets in buffalo calves



DISCUSSION

The nitrogen utilization was the best at 28% SNC and 15% PPF (D-III) which was evident as the highest positive nitrogen balance. It reflected better digestibility of crude protein (CP) in diet III when compared to diet I and diet II. Significantly ($P < 0.01$) higher N balance in diet II and diet III than in diet I in the present study might be due to higher concentrate to roughage ratio (60:40) in complete diets (D-II and D-III) when compared to conventional diet (D-I) which was forage based ration and concentrate was offered to meet the balance CP requirement. The complete feeds have been reported to improve nitrogen balance in crossbred calves and steers^{8, 9, 10}.

The progressive increase in the average nitrogen balance from diet I to diet III was in accordance with the N content of experimental rations in buffalo calves. Similar results were reported by George et al. (2005) in crossbred bulls fed on four levels of voluntary dry matter intake with a diet consisting of concentrate mixture and wheat straw (1:1 ratio)¹¹. In the present study, positive nitrogen balance was recorded in all the treatment groups with significantly higher N balance in complete diet fed animals indicating that all the three experimental diets met the N requirements of

buffalo calves. This was due to adequate supply and optimum utilization of dietary nitrogen by microbes¹².

The progressive increase in calcium balance from diet I to diet III and comparatively higher calcium balance in complete diets (D-II and D-III) when compared to conventional diet (D-I) can be attributed to higher feed intake and proportionately lower calcium excretion in animals on complete diets than those on conventional diet. Positive calcium balance had been reported in steers, Deccani rams, sheep and goats fed on complete diets^{10, 13-15}. The results of the present study indicated that higher calcium balance which is particularly advantageous in growing calves was achieved with PPF-SNC based complete diets over conventional diet.

The higher phosphorus (P) balance in PPF-SNC based complete diets when compared to conventional diet reflected higher P intake and better utilization. Higher phosphorus retention had been reported due to higher intakes of P in the complete diets^{10, 12}. Positive phosphorus balance was recorded on wheat straw based complete diets in buffaloes¹⁶ and on urea and molasses based diets in goats¹⁷. Higher phosphorus balance was observed on calves fed 40% sugar cane bagasse and 20% palm press fibre (PPF) based diets^{18, 19}.

CONCLUSION

There was significant difference in the N, Ca and P balances between conventional and complete diets. Among the complete diets, N and Ca were at higher positive balance at 28%

SNC and 15% PPF (D-III) while P was at higher positive balance at 18.5% SNC and 20% PPF. Positive mineral balance in all the three diets reflected availability of respective minerals for growth and production.

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