A COMPARATIVE STUDY ON NUTRIENT UTILIZATION IN MURRAH BUFFALO BULLS FED CONVENTIONAL AND CROP RESIDUE BASED COMPLETE RATIONS

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ABSTRACT

An experiment was conducted to study the effect of feeding complete rations on nutrient utilization compared to conventional system of feeding in Murrah buffalo bulls. Four adult Murrah buffalo bulls (5 years; 350±9.36 kg BW) divided into four groups in a 4x4 Latin square switch over design were offered isonitrogenous complete rations comprising of locally available crop residues viz. maize stover (T_1) , red gram straw (T_2) and black gram straw (T₂) and concentrate mixture in 60:40 ratio, respectively and a conventional ration (C) for a period of 28 days. The DM intake (kg/d) was similar in all the experimental rations. The digestibility (%) of CP, EE, CF, NDF, ADF, hemicelluloses and cellulose were higher (P<0.01) in buffalo bulls fed complete rations than those fed conventional ration. However, the digestibility (%) of DM (P<0.01) and OM (P<0.05) were higher in T₁ and NEF (P<0.05) was higher in T₂ when compared to other experimental rations.

The Nitrogen retention (g/d) was higher (P<0.01) in the animals fed complete rations than those fed conventional ration and the differences for calcium and phosphorus balance (g/d) were not significant among the different experimental rations. The DM and TDN intake per W kg^{0.75} were

higher (P<0.05) in buffaloes fed C while higher (P<0.05) DCP intake per W kg $^{0.75}$ was observed in buffalo bulls fed T $_{2}$. Hence, it is concluded that the crop residue based complete rations had a significant effect on nutrient utilization in Murrah buffalo bulls compared to conventional ration.

Keywords: crop residues, complete rations, nutrient balance, nutrient utilization

INTORDUCTION

The scarcity of feed and fodder, escalating demand of concentrate feed ingredients for human consumption and ever increasing cost has led to the utilization of non-conventional and non-competitive crop residues and agro-industrial by-products in live-stock feeding (Waje *et al.*, 2010). However, these crop residues are poor in palatability and low in nutritive value which can be improved subjecting them to suitable processing methods. The concept of feeding complete rations comprising of locally available crop residues is one of the best method to provide the balanced supply of nutrients.

Complete ration not only improves the feeding value of a poor quality crop residue but

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also simplifies feeding, minimizes labour and maximizes automation, control ratio of roughage to concentrate, provides uniform feed intake, reduces the feed wastage, enhances nitrogen balance and milk production, reduces the cost of feeding (Raut *et al.*, 2002; Hundal *et al.*, 2004; Lailer *et al.*, 2010). Different crop residues are available locally which by scientific and judicious combination with the conventional concentrate feed ingredients can be utilized in the preparation of complete rations for live stock. The objective of the present experiment is to study effect of feeding locally available crop residue based complete rations on nutrient utilization in Murrah buffaloes compared to a conventional system of feeding.

MATERIALS AND METHODS

Experimental rations

The experiment was conducted at Department of Animal Nutrition, NTR College of Veterinary Science, Gannavaram, Andhra Pradesh, India. Locally available crop residues viz. maize stover, red gram straw and black gram straw were procured from the farmers' fields in nearby villages of Gannavaram. Experimental concentrate mixtures were prepared at the feed mixing plant, Department of Animal Nutrition, NTR College of Veterinary Science, Gannavaram. Three isonitrogenous complete rations viz. comprising of maize stover (T_1) , red gram straw (T_2) or black gram straw (T₂) were prepared by mixing roughages and concentrates in 60:40 ratio and compared with a conventional ration (C) comprising of 5 kg hybrid napier, 4 kg paddy straw and 1.5 kg concentrate mixture. The ingredient composition of experimental rations fed to buffalo bulls is furnished in Table 1.

Experimental design

In a 4 X 4 Latin Square Design, four graded Murrah buffaloes (5 yrs; 350±9.36 kg BW) were fed three iso-nitrogenous complete rations and compared with a conventional ration. About 6.0 kg each of respective complete rations were offered in two divided diets at 9.00 AM and 3.00 PM all through the experimental period. The buffalo bulls were fed either conventional ration or complete rations to meet the nutrient requirements (ICAR, 1998).

Each period of LSD consisted of a 21-day preliminary period and a 7-day collection period. Body weights were recorded for two consecutive days prior to start and after the metabolism trial and the average was taken as the actual body weight. During the metabolism trial, daily feed intake, feed refusals if any as well as faeces and urine voided were recorded daily at 9.00 AM. Daily representative samples of the feeds, residues, faeces and urine were collected and pooled animal wise. Samples were prepared and preserved in the respective containers for subsequent analysis.

The samples were analyzed for proximate constituents (AOAC, 2007) and fibre fractions (Van Soest *et al.*, 1991). Estimation of calcium and phosphorous in feed and faeces was done as per Talapatra *et al.* (1940) and in urine samples was done according to the methods described by Ferro and Ham (1957) and Fiske and Subba Row (1925), respectively. The data were analyzed statistically (Snedecor and Cochran, 1989) and tested for significance by Duncan's multiple range test (Duncan, 1955) using SPSS 17.0 version.

RESULTS AND DISCUSSION

The chemical composition of conventional and complete rations fed to the buffalo bulls during metabolism trial were presented in Table 2. The daily dry matter intake expressed in terms of kg/100 kg BW or as g/kg W^{0.75} was similar in all the groups (Table 2) and was higher than the requirements as suggested by ICAR (1998) and Kearl (1982). This indicated that the diets were palatable and that blending of roughages and concentrates in the form of complete rations has not affected the palatability. Gupta *et al.* (2006) and Pandey *et al.* (2009) did not find any significant difference in DM intake in fistulated crossbred male cattle.

The digestibility co-efficient (Table 3) of dry matter (DM), organic matter (OM), crude protein (CP), ether extract (EE), crude fibre (CF) (P<0.01) and NFE (P<0.05) were higher in bulls fed complete rations as compared to conventional ration. These observations corroborated with the findings of Kumar et al. (2010) in lactating Murrah buffalo bulls who reported increase digestibility of nutrients (P<0.01) on sheanut cake based complete diets compared to conventional system of feeding and Khan et al. (2010) in lactating cross bred cows fed wheat straw based complete rations. Further, the digestibility of fibre fractions (Table 2) increased (P<0.01) in buffalo bulls fed complete ration compared to those fed conventional ration. Similar to these observations earlier workers (Reddy et al., 2001; Sahoo et al., 2002; Samanta et al., 2006) reported improvement in the digestibility of fibre fractions in cattle and buffaloes fed complete rations.

The Digestible Crude Protein (DCP) intake (g/ W kg^{0.75}) was higher (P<0.01) in buffalo bulls fed complete ration than those fed conventional ration. The higher DCP intake observed in buffalo

bulls fed complete ration may be attributed to their higher CP digestibility. Similarly, the TDN content expressed as percent in the diet consumed or as g/W kg^{0.75} increased (P<0.05) in buffalo bulls fed complete ration as compared to the conventional ration which may be a reflection of increased nutrient digestibility in buffaloes fed complete ration.

All the buffalo bulls were positive nitrogen. calcium and phosphorous balance (Table 4). The N retention expressed as (g/d) or as % of intake or as of % absorbed was higher (P<0.01) in animals fed complete rations than those fed conventional ration. This might be due to the better digestibility of nutrients leading to optimum utilization of N by dietary microbes (Reddy et al., 2002). Lailer et al., 2010 in Murrah male calves; Pandya et al., 2009 in cross bred calves; Thakur et al., 2006 in buffalo calves and Reddy et al., 1994 in crossbred heifers also reported similar observations. The calcium retention expressed as g/d was similar among bulls fed complete and conventional rations. However, the calcium retention expressed either as % of intake or as % absorbed was higher (P<0.01) in buffalo bulls fed complete rations compared to conventional ration. This is in agreement with the findings of earlier workers (Pandya et al., 2009 in cross bred calves; Kaur et al., 2004 and Thakur et al., 2006 in buffalo calves). The phosphorus retention expressed either as g/d or as % of intake or as % absorbed was similar among the buffalo bulls fed complete and conventional rations. Similar to these observations earlier workers (Pandya et al., 2009; Reddy et al., 2002) reported positive phosphorus balance in animals fed complete rations.

To conclude, incorporation of crop residue based complete rations in the daily rations of livestock had improved digestibility of nutrients and balances of nitrogen, calcium and phosphorous

Table 1. Ingredient composition of conventional and complete rations fed to Murrah buffalo bulls.

Ingredient	Conventional ration	Complete rations			
ingreuient	С	T ₁	T ₂	T ₃	
Roughage (Kg)					
Hybrid napier	5.0	-	-	-	
Paddy straw	4.0	-	-	-	
Maize stover	-	60	-	-	
Red gram straw	-	-	60	-	
Black gram straw	-	-	-	60	
Concentrate (Kg)					
Maize grain	30.0	5.5	6.5	8.5	
De-oiled rice bran	25.0	5.5	6.5	7.5	
Cotton seed cake	22.0	11.0	12.0	11.5	
Gingelly cake	20.0	16.0	13.0	10.5	
Mineral mixture	2.0	1.5	1.5	1.5	
Salt	1.0	0.5	0.5	0.5	
Overall CP (%)	12.38	12.77	12.62	12.82	

Table 2. Chemical composition (% DM basis except for DM) of conventional and complete rations fed to Murrah buffalo bulls.

	Conv	Complete rations				
Parameter	Hybrid Napier	Paddy straw	Concentrate Mixture	T ₁	T ₂	T ₃
Organic matter	89.2	87.5	90.6	90.8	93.8	90.2
Total ash	10.7	12.5	9.39	9.20	6.12	9.75
Crude protein	7.88	2.90	18.5	12.7	12.6	12.8
Ether extract	2.24	1.50	2.10	1.20	1.41	1.68
Crude fibre	32.4	32.2	18.4	42.4	53.0	45.5
Nitrogen free extract	46.7	50.9	51.5	34.3	26.8	30.2
Neutral detergent fibre	73.8	74.7	44.3	58.8	66.1	55.3
Acid detergent fibre	47.2	46.6	17.1	33.7	44.2	37.9
Hemi-cellulose	26.6	28.1	27.1	25.1	21.8	17.4
Cellulose	39.3	38.1	9.34	24.7	32.8	25.2
Acid detergent lignin	5.90	8.90	7.08	8.38	11.5	12.3
Calcium	1.12	0.59	1.73	1.17	1.14	1.15
Phosphorus	0.59	0.36	0.78	0.74	0.73	0.72

Table 3. Effect of feeding conventional and complete rations on intake, digestibility of nutrients and plane of nutrition in buffalo bulls.

Particulars	С	T ₁	T ₂	T ₃	SEM
Dry matter intake					
Kg/100 BW	1.80	1.70	1.68	1.67	0.04
g/kg W ^{0.75}	74.33	73.09	74.13	73.08	0.33
Digestibility of nutrients (%)					
Dry matter**	52.86°	56.01a	53.99 ^{bc}	54.20 ^b	0.35
Organic matter*	57.32 ^b	58.77ª	58.19 ^{ab}	57.49ab	0.24
Crude protein**	56.26 ^d	66.57a	61.16°	63.75 ^b	1.00
Ether extract**	55.03°	59.36a	57.37 ^b	58.32 ^b	0.44
Crude eibre**	48.33°	54.82ª	51.75 ^b	52.92 ^b	0.63
Nitrogen Free Extract*	62.69 ^b	62.88 ^b	65.08 ^a	61.69 ^b	0.45
Neutral detergent fibre**	48.50 ^d	53.91a	51.51°	52.75 ^b	0.55
Acid detergent fibre**	44.64°	49.31a	46.75 ^b	47.93 ^b	0.51
Hemi-cellulose**	53.99 ^b	63.22a	57.90 ^b	63.25 ^a	1.19
Cellulose**	59.13°	62.85 ^{ab}	61.75 ^b	64.43ª	0.55
Nutrient intake (g/kg W ^{0.75})					
DCP intake**	5.18 ^d	6.36a	5.72°	5.97 ^b	0.12
TDN intake*	40.59 ^b	42.78ª	41.17 ^b	41.19 ^b	0.29
Plane of nutrients					
DCP (%)**	6.96 ^d	8.50a	7.72°	8.17 ^b	0.15
TDN (%)**	54.61°	57.15a	55.54 ^{bc}	56.36ab	0.29

^{abcd} Values in the rows bearing different superscripts differ significantly.

^{*}P<0.05 **P<0.01

Table 4. Effect of feeding conventional and complete rations on intake and balance (g/d) of N, Ca and P in buffalo bulls.

Particulars	C	T ₁	T ₂	T ₃	SEM
Nitrogen, g/d				,	
Intake**	123.2ª	114.56 ^b	113.68 ^b	115.2 ^b	0.25
N outgo, g/d					
In faeces**	54.11°	45.14ª	44.01 ^b	41.52 ^b	0.37
In urine**	22.25ª	15.75°	20.15 ^b	21.79ª	0.29
Total**	76.36a	60.89°	64.16 ^b	63.31 ^b	0.31
N balance				•	
Retention, g/d**	46.84 ^d	53.67ª	49.52°	51.89 ^b	0.31
Percent of intake**	38.01 ^b	46.84ª	43.56ª	45.01a	0.37
Percent of absorbed**	67.79°	73.31a	71.08 ^b	70.43 ^b	0.54
Calcium, g/d					
Intake **	51.39 ^d	65.52ª	64.13°	64.63 ^b	1.50
Ca outgo, g/d					
In faeces**	27.49°	43.00a	41.17 ^b	40.99 ^b	1.61
In urine**	8.87ª	6.81°	7.62 ^b	8.42ª	0.23
Total**	36.36°	49.81ª	48.79 ^b	49.41 ^{ab}	1.46
Ca balance					
Retention, g/d	15.03	15.71	15.34	15.22	0.12
Percent of intake**	29.25ª	23.97 ^b	23.92 ^b	23.55b	0.63
Percent of absorbed**	62.90°	69.76ª	66.81 ^b	64.38 ^{bc}	0.76
Phosphorus, g/d					
Intake**	41.87a	41.44 ^b	41.07°	40.46 ^d	0.13
P outgo, g/d					
In faeces**	22.50a	21.73 ^b	20.83°	20.94°	0.20
In urine	7.47	7.59	7.89	7.26	0.13
Total*	29.97ª	29.32ab	28.72 ^{bc}	28.20°	0.21
P balance					
Retention, g/d	11.90	12.12	12.35	12.26	0.13
Percent of intake	28.42	29.25	30.07	30.31	0.34
Percent of absorbed	61.44	61.49	61.01	62.77	0.56

^{abcd} Values in the rows bearing different superscripts differ significantly.

^{*}P<0.05 **P<0.01

without any adverse effect on feed intake as compared to that of conventional system of feeding.

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