Effect of Feeding Bypass Protein with Urea Treated Jowar Kadbi (Sorghum Straw) on Performance of Cross Bred (HF×DEONI) Calve

V. H. Kalbande* and A. H. Chainpure
Animal Nutritition Centre, NARP-phase-II, Marathwda Agricultural University
Parbhani-431 402 Maharashtra, India

ABSTRACT : A study was made of the efficiency of ammonia N retention by Jowar kadbi (sorghum straw), initially 6.41% crude protein (CP), treated with 4% urea solution. After 30 days the CP in straw that was unchaffed and had been left uncovered was 10.02, and in chaffed straw that had been covered with a polythene sheet was 10.9%. The two treated straws were each fed to six crossbred (HF×Deoni) calves, initially 12±2 months old and 86.7±3.2 kg bodyweight. They were also given two isocaloric (70% TDN) and isonitrogenous (20% CP) concentrate mixtures differing in calculated Rumen Degradable to Undegradable Dietary Protein ratio (RDP:UDP). Those fed the unchaffed uncovered treated straw (treatment C) received 65 RDP:35UDP and the other group (T1) received concentrate with a 55:45 ratio. The T1 group had the higher DM intake ($p<0.01$) in total (306 vs 268 kg), per day (4.1 vs 3.6 kg) and per unit bodyweight. Digestibility of DM, OM, CP and NDF, but not ADF, was higher in T1 and that group had the higher daily gain (517 vs 333 g) and higher total gain (38.8 vs 25.0 kg) over the 75 d of the feeding trial. It is concluded that chaffing and covering of Jowar kadbi treated with urea, not likely to be adopted by farmers because of financial constraints, does not confer important benefits. A concentrate supplement (estimated 45% of the CP as UDP) to calves given the treated straw has a beneficial effect on their growth and development. (*Asian-Aust. J. Anim. Sci. 2001. Vol. 14, No. 5 : 651-654*)

Key Words : By-Pass Protein, Urea Treated Sorghum Straw, Calves

INTRODUCTION

Attempts have been made to improve the nutritive value of poor quality roughages by urea/ammoniation (Puri and Gupta, 1990). The primary requirement is chaffing and covering of the urea-treated stack of roughage with a polythene sheet, which is not commonly adopted in rural areas due to unavailabilty of chaff cutters and financial constraints. Feeding of urea treated dry, mature grass with a concentrate mixture high (45%) in UDP/by pass protein to native Red Kandhari calves gave encouraging results (Wankhede and Kalbande, 1997). The present study was undertaken to ascertain the efficiency of ammonia-N retention by unchaffed Jowar kadbi (sorghum straw of Nilva variety) treated with a 4% urea solution without covering the stack and the effect of feeding urea treated and uncovered Jowar kadbi with a concentrate mixture high (45%) in UDP/by pass protein on the performance of native crossbred calves (HF×Deoni).

MATERIALS AND METHODS

Locally cultivated Jowar kadbi was harvested at maturity and treated with a 4% urea solution at 30% moisture level. The urea treated Jowar kadbi was not chaffed and the stack was left uncovered for a period of 30 days. A further small quantity (10 kg) was chaffed, treated with a 4% urea solution at 30% moisture level and kept in air tight condition under a polythene cover for 30 days to compare the efficiency of ammonia-N retention with that of the unchaffed, uncovered Jowar kadbi and chaffed, covered Jowar kadbi.

Based on protein degradability values (Kalbande and Thomas, 1995) for individual raw feed ingredients, two isocaloric and isonitrogenous balanced concentrate mixtures (CM-I and CM-II) varying in RDP to UDP ration were prepared (table 1).

Twelve crossbred (HF×Deoni) calves were weighed and divided into Control group C and experimental group (T1) of 6 calves each, with 1:1 male to female ratio, on equal body weight and age basis. All the calves were treated for endo- and ecto-parasites using suitable anthelmintics before the start of experiment, and were housed in a shed for individual feeding and management.

The calves in control group C were fed untreated Jowar kadbi with concentrate mixture I and those in experimental group (T1) were offered urea treated Jowar kadbi *ad libitum* with concentrate mixture II to meet their nutrient requirements as per standard (ICAR, 1985). Fresh and clean drinking water was made available through out the experimental period. Daily records of feed and fodder offered, residue left were maintained, and fortnightly body weights of calves were recorded through out the feeding trial of 75 days Feed, fodder and fecal samples were analysed as per AOAC (1985).

* Corresponding Author: V. H. Kalbande. Tel: +024-333902, Fax: +02452-23582.
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Conventional digestion trial was conducted during the last week of the feeding experiment. Jugular blood samples were collected from each calf before feeding (0 h) and at 3 and 6 h after feeding for 3 consecutive days for determination of blood urea nitrogen (BUN) concentration as per Wybenga et al. (1971). The data were analysed statistically using Completely Randomized Design (CRD) as per Snedeeor and Cochran (1968).

RESULTS AND DISCUSSION

The crude protein (N×6.25) content of urea treated, unchaffed, uncovered Jowar kadbi was increased from 6.41 to 10.02 percent as compared to 10.9 percent in urea treated, chaffed and covered Jowar kadbi (table 2). The ammonia nitrogen retention efficiency (88%) was almost similar. An increased crude protein content by 56% and slight reduction in crude fiber and nitrogen free extract content due to urea treatment was in line with Han Verdonk et al. (1989) and Vinodkumar and Walli (1994).

The voluntary feed intake by calves in T1 increased with higher UDP level in concentrate mixture II (table 3). The average intake of dry matter per day as roughage and concentrate was significantly higher ($p<0.05$) in calves fed ration T1. This is in agreement with Preston (1982), who reported that voluntary feed intake appeared to be influenced favourably by post ruminal digestion of protein and not depressed by post ruminal digestion of energy. Further natural protein supplements, specially those with low soluble nitrogen (high in UDP), were reported to stimulate feed intake to a greater extent than the diets containing highly soluble nitrogen in the form of urea (Kwan et al., 1977). Similar findings of higher voluntary dry matter intake by crossbred calves were observed by Vinodkumar and Walli (1994) and Wankhade and Kalbande (1997).

Fortnightly body weights of experimental calves revealed that calves in group T1 had a total body weight gain of 38.8 kg over a period of 75 days and those in control group C gained 25.0 kg over the some period. A significantly higher ($p<0.01$) average daily gain in body weight of 517 g was recorded for calves in T1 group as compared to 333 g for those in control group (table 3). Since the rations were iso-caloric and iso-nitrogenous, the better performance of calves in experimental group T1 fed urea treated Jowar kadbi with concentrate mixture-II can be attributed to a higher level of UDP/by pass protein (45%) content and so better post ruminal availability of amino acids. Moreover due to urea treatment, the availability of ammonia-N might be higher in group T1, since 80% of the rumen microbes prefer nitrogen in this form for their protein synthesis. These findings are in agreement with Vinod Kumar and Walli (1994), Pachauri and Mojumdar (1995), Gupta et al. (1995), and Wankhade and Kalbande (1997).

Efficiency of feed utilization in terms of kg dry matter per kg gain in body weight was significantly superior ($p<0.01$) for calves fed experimental ration T1 as compared to those fed control ration (7.9 vs 10.7). Similar findings have been reported by Gupta et al. (1995) and Wankhade and Kalbande (1997).

The costs of feed (concentrate+roughage) per kg

Table 1. Percent ingredient composition of concentrate mixture (CM) with their nutritive value (calculated)

Ingredients	CM I	CM II
Jowar	20	20
Yellow maize	10	20
Wheat bran	40	07
Cottonseed cake (undecorticated)	07	40
Groundnut cake (deoiled)	20	10
Mineral mixture	02	02
Common salt	01	01
Vimicon*	25 gm	25 gm/100 kg
Total	100	100
Calculated nutritive value:		
%DCP	14.76	14.27
%TDN	70.47	73.19
ME(MJ/Kg)	10.46	11.01
%RDP	13.45	11.03
%UDP	7.12	9.06
RDP:UDP ratio	65:35	55:45

* Vimicon contained (Per 250 g) Vit. A 500000 I.U., Vit. D3, 100000 I.U., Vit. E 75 mg, Vit. B12 600 mg, Vit. K 100 g, Niacinamide 1 g, mixed at the rate of 250 g per metric ton.

Table 2. Estimated chemical composition of concentrate mixture (CM-I and CM-II), urea treated and untreated Jowar Kadbi (% DM basis)

	CM-I	CM-II	4% urea treated Jowar Kadbi	Untreated Jowar kadbi
%DM	91.79	91.65	85.98	90.19
%CP(N×6.25)	19.84	20.16	10.02	6.41
%EE	2.92	3.31	3.90	3.22
%CF	8.96	11.29	30.62	31.15
%NFE	64.19	60.15	47.73	51.00
%Total Ash	4.11	4.73	7.73	8.22
%NDF	-	-	47.88	45.29
%ADF	-	-	69.19	64.19

Table 3. Performance of Crossbred (HF×Deoni) calves offered control (C) and experimental (T1) tation

	Control group C	Experimental group T1
No. of calves selected	6	6
Initial body wt (kg)	86.2 + 2.48	87.2 + 6.34
Final body wt (kg)	111.2^a + 3.55	126.0^b + 5.46
Total gain in body wt (kg)	25.0^a + 1.98	38.8^b + 2.68
Daily gain in body wt (g)	333.0^a + 0.042	517.0^b + 0.056
Total dry matter intake (kg)	268.1^a + 2.04	306.5^b + 2.98
Dry matter intake per day (kg)	3.6^a + 0.06	4.1^b + 0.04
Dry matter intake per 100 kg body wt (kg)	3.2^a + 0.07	3.2^b + 0.14
Dry matter intake/$W^{0.75}$ kg (g)	104.6^a + 1.75	108.8^b + 3.81
Feed efficiency kg DM/kg gain in wt.	10.7^a + 1.50	7.9^b + 0.864
Cost of feed kg gain in body wt (Rs.)	39.44	32.55

Means bearing a and b superscript in column differ significantly ($p<0.01$).

gain in body weight for control ration C and experimental ration (T1) were Rs. 39.44 and 32.55 respectively. The cost of experimental ration T1 was higher (Rs. 6.57) due to urea treatment of Jowar kadbi and inclusion of protein sources with high UDP level as compared to C (Rs. 6.18), but the significantly higher growth rate, digestibility of almost all the nutrients and efficiency of feed conversion contributed substantially to lower the cost of feed per kg gain in body weight in T1 as compared to C. Wankhede and Kalbande (1997) also observed lower feed cost per kg live weight gain in Red Kandhari calves fed urea-treated grass with a concentrate mixture containing 45 percent UDP as compared to control ration C.

The digestibility coefficients of OM, CP, EE, CF, NFE ($p<0.01$) and DM, NDF ($p<0.05$) were significantly higher for the experimental than for the control ration; digestibility of ADF was not different (table 4).

Nutritive value of control and experimental rations (roughage+concentrate) in terms of DCP and TDN were 8.15, 46.04 and 10.10, 57.40 percent respectively (table 4). The nutrient intake by cross bred (HF× Deoni) calves was significantly ($p<0.01$) affected. The DM, DCP and TDN intakes (g/day) were 3573, 4068, 291.80, 411.24, and 1645.36, 2355.30 in C and T1 respectively. These differences can be attributed to higher voluntary feed intake and digestibility of all nutrients (except ADF) in T1 as compared to C. These findings are in agreement with Wankhede and Kalbande (1997).

The blood urea nitrogen (BUN) concentrations, mg percent at 0 h and 3 and 6 h after feeding were

Table 4. Estimated nutrient digestibility in calves feed control and experimental rations (concentrate plus Jowar kadbi) with their nutritive value

	Control ration (C)	Experimental ration (T1)
DM**	48.15±0.90	58.78±1.75
OM**	52.13±1.08	56.36±2.27
CP**	57.30±1.07	63.50±1.56
EE**	67.02±1.06	78.27±0.91
CF**	62.31±1.71	67.28±1.92
NFE**	42.71±0.73	46.94±1.32
NDF*	55.67±3.19	62.21±2.24
ADF^{NS}	53.66±2.17	51.58±0.38
Nutritive value		
DCP**	8.15±0.19	10.10±0.02
TDN88	46.04±0.74	57.40±1.51

** $p<0.01$, * $p<0.05$, NS=Non significant.

26.90, 34.77 and 24.47 in calves fed control ration C and 12.01, 19.33 and 12.20 mg in experimental ration (T1), the differences being significant ($p<0.01$) at all intervals. Similar findings have been reported by Gupta et al. (1995) and Wankhede and Kalbande (1997).

Overall the results showed that urea treatment of unchaffed Jowar kadbi is possible without covering the stack, with minimum losses of ammona-N, if properly done. The efficiency of retention of ammonia-N by unchaffed, uncovered Jowar kadbi and that in a chaffed and covered stack is almost similar. If native crossbred (HF×Deoni) calves are fed urea-treated Jowar kadbi with a concentrate mixture having 20 percent CP, 70 percent TDN and 45 percent UDP/by pass protein, a higher growth rate with better economic efficiency can be obtained in an early stage of growth. These results emphasize the need for indicating UDP/by pass protein content in a concentrate mixture in addition to total protein percent and for expressing the protein requirements of growing calves, particularly in their early stage of growth.

REFERENCES

A.O.A.C. 1985. Official Method of Analysis 13th Ed. Association of Analytical Chemists, Washington D.C.

Gupta, R., S. S. Dahiya, T. R. Chauhan and V. N. Tripathi. 1995. Proceedings VII Animal Nutrition Research Workers Conference, Mumbai Abstr. No. 321.

Han Verdonk, G. P. Singh and B. G. Gupta. 1989. Nutrient utilization and passage rate of digesta on feeding of urea supplemented and urea ammoniated wheat straw in cross bred cattle. Indian J. Anim. Nutr. 6:295.

I.C.A.R. 1985. Nutrient Requirements of Livestock and Poultry, Indian Council of Agricultural Research, New Delhi.

Kalbande, V. H. and C. T. Thomas. 1995. Effect of by-pass protein on yield and composition of milk in cross bred cows. Ph. D Thesis. submitted by Senior author Kerala Agril. University, Mannuthy, Trichur.

Pachauri, V. C. and A. B. Mojumdar. 1995. Proceedings VII Animal Nutrition Research Workers Conference, Mumbai, Abstr. No. 92.

Puri, S. P. and B. N. Gupta. 1990. Effect of feeding ammonia (urea) treated rice straw on growth and nutrient utilization in cross bred calves. Indian J. Anim. Nutr. 7:191.

Preston, T. R. 1982. Nutritional limitations associated with feeding of tropical forage. J. Anim. Sci. 54:877.

Snedecor, G. W. and W. B. Cochran. 1968. Statistical Methods, 6th Edn. Oxford and IBH Publishing Co. Calcutta.

Vinodkumar and T. K. Walli. 1994. Effect of feeding urea treated wheat straw supplemented with formaldehyde treated groundnut cake on growth performance of cross bred calves. Indian J. Anim. Nutr. 11:29.

Wankhede, S. M. and V. H. Kalbande. 1997. Proceeding National Symposium on Feeding Strategies for Eco-friendly Animal Production In India. IVRI, Izatnagar, Sovenir, Abstr. No. 13:199.