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EFFECTS OF GRADED LEVELS OF *Faidherbia albida* LEAVES AS REPLACEMENT FOR GROUNDNUT HAY IN THE DIETS OF UDA LAMBS

S. A. Maigandi[1], M. I. Abdu[2], I. R. Muhammad[3] and R. M. Ashiru[2]

[1] Department of Animal Science, Faculty of Agriculture, Usmanu Danfodiyo University, Sokoto, Nigeria

[2] Department of Animal Science, Faculty of Agriculture and Agricultural Technology, Kano University of Science and Technology, Wudil, Nigeria

[3] Department of Animal Science, Faculty of Agriculture, Bayero University, Kano, Nigeria

ABSTRACT

Twenty (20) Uda lambs with an average weight of 16 kg were used in a 12 week feeding trial to examine the effects of different levels of *Faidherbia albida* leaves as replacement for groundnut hay on the performance of the animals in the semi-arid zone of Nigeria. The animals were divided into five groups with four animals per group and allotted to five dietary treatments designated as A, B, C, D and E, in which the forages were mixed at different ratios of 100:0, 50:50, 25:75, 75:25 and 0:100 groundnut hay and: *Faidherbia albida* leaves, respectively. Results obtained indicated treatment B to have significantly higher ($P<0.05$) average daily gain compared to the other treatments. Total dry matter intake was significantly higher ($P<0.05$) for treatment D compared to the other treatments. Intake values for total crude protein and crude fibre were significantly better ($P<0.05$) for treatment A, which was the control diet. Nutrient digestibility was not significantly affected ($P>0.05$) by the inclusion of *Faidherbia albida* leaves in the diets. The lowest ($P<0.05$) cost of feed per kg liveweight gain was obtained in treatment E, which had only *Faidherbia albida* leaves as forage. It could therefore be concluded that *Faidherbia albida* leaves could be a good source of forage compared to groundnut hay for growing lambs in the dry seasons.

Keywords: *Faidherbia albida* leaves; Groudnut hay; Uda lambs

INTRODUCTION

The problems of livestock nutrition have further been increased by competition between man and animals for scarce grains, making it very difficult to meet up with the nutritional requirements of animals at affordable costs. In addition to marked loss of weight, low disease resistance and death, there is reduced fertility and retarded growth in young animals due to poor nutrition (Nuru, 1982). It is therefore important to ensure adequate feeding in order to enhance productivity (Adebowale and Taiwo, 1996).

Leaves of tree legumes have been fed as supplements for many years to housed and tethered animals in Asia, Africa and the Pacific Islands (Norton, 1994). There is increasing

interest in the use of tree legumes as sources of protein-rich supplements to improve the productivity of livestock (Vaneys *et al*., 1986; Goodchild, 1990). *Faidherbia albida* (wonder tree) is one of such trees. Storrs (1977) stated that it is the most popular leguminous tree found in the semi-arid and arid regions of tropical Africa. It is a tall tree with thorns, ascending branches, deciduous bark tissue and greenish leaves in dry season which serve as source of feed for animals, but sheds its leaves in the rainy season. During dry season, when feeds are scarce, pastoralists feed both the leaves and pods to their livestock. The pods are produced between January and February. It is a well known fact that this plant species produces leaves at a critical time of the year when feeds are very scarce in the study area. Although Maigandi and Nasiru (2006) fed the pods to fattening Uda rams, there is no documented information on the use of its leaves as feed for Uda lambs in this area. Therefore, this study was designed to evaluate the replacement value of *F. albida* leaves in the diets of growing sheep in the semi-arid zone of Nigeria.

MATERIALS AND METHODS

Experimental Location

The study was conducted at the Livestock Teaching and Research Farm of the Usmanu Danfodiyo University, Sokoto. The farm is about 10 kilometers north of Sokoto metropolis in Wamakko Local Government Area of Sokoto State. Sokoto State is located in the Sudan Savannah zone in the extreme north western part of Nigeria, between longitudes 4°8'E and 6°54'E and latitudes 12°N and 13°58'N (Mamman *et al.*, 2000). It shares common boarders with Niger Republic to the north, Kebbi State to the southwest and Zamfara State to the east. The humidity in January is less than 20% in the weastern part and between 20-40% in the southern part. The mean annual rainfall is 750 mm and potential evapo-transpiration rate has been reported to be 162 cm. The annual mean temperature is 34.9^{o}C with the highest temperature (41.0^{o}C) recorded in April and the minimum temperature (13.2^{o}C) occurring in January. This low temperature is caused by severe harmattan winds (SSD, 2000).

Experimental Animals and their Management

Twenty (20) growing Uda lambs with an average weight of 16kg were purchased and used for the experiment. The animals were kept in the farm for two weeks prior to the commencement of the experiment during which they were fed with wheat offal mixed with cowpea husk. The animals were dewormed with Curazole (Fenbendazole 10% WW) for the control of internal parasites, sprayed against external parasites by the use of triatic and treated with oxytetracycline HCl (a broad -spectrum antibiotic administered by injection).

Preparation and Formulation of Experimental Feed

Feed ingredients used in the concentrate formulation such as cotton seed cake (CSC), maize, wheat offal, bone meal and salt were purchased from Sokoto central market. The groundnut hay used as a source of forage was purchased from the same market, while *F. albida* leaves were obtained from farm lands, within and around the Main Campus of the Usmanu Danfodiyo University, Sokoto. Fresh leaves of *F. albida* were harvested and dried for 2-3 days and used for the feeding trial.

Experimental Design and Treatments

A Randomized Complete Block Design (RCBD) was used in this study (Steel and Torrie, 1980). The experimental diets are shown in Table 1. The first treatment (designated as A) contained groundnut hay alone and served as the control diet (0%), the second treatment diet (designated as B) had a mixture of groundnut hay (50%) and *F. albida* leaves (50%) while the third treatment diet (designated as C) had groundnut hay (75%) and *F. albida* leaves (25%). The fourth treatment diet (designated as D) contained groundnut hay (75%) and *F. albida* leaves (25%) while the fifth treatment diet (designated as E) had *F. albida* leaves alone (100%). These combinations were used as basal diets. The animals were balanced for weight before they were randomly assigned to five treatment groups. Each treatment group had four lambs with each lamb serving as a replicate and housed in individually disinfected pen measuring 2m x 1 m.

Table 1: Gross composition of the experimental diets.

Ingredient (%)	Experimental Diet					
	A	B	C	D	E	Concentrate
Faidherbia albida leaves	-	50	25	75	100	-
Groundnut hay	100	50	75	25	-	-
Cotton seed cake	-	-	-	-	-	30
Maize	-	-	-	-	-	25
Wheat offal	-	-	-	-	-	33
Cowpea husk	-	-	-	-	-	10
Bone meal	-	-	-	-	-	1
Salt	-	-	-	-	-	1
Total	100	100	100	100	100	100
Calculated CP (%)	16.0	15.5	15.8	15.3	15.0	16.0
Cost /kg diet (N)	25	17.5	21.25	13.75	10	35

Daily routine health management of the experimental animals (such as cleaning and washing) was maintained during the experiment. The experimental pens, water troughs and feeders were cleaned daily before the provision of feed and water.

The concentrate was fed at 250g per animal and was offered once daily before feeding the basal diet. Water and basal diets were offered *ad-libitum*. The feeding trial including the digestibility trial lasted for 12 weeks (84 days). Feed intake was recorded daily, while liveweight changes were recorded on weekly basis.

Digestibility Trial

At the end of nine weeks, the animals were used for digestibility trial during which faecal samples were collected. Two weeks were used for adaptation during which, harness

bags were fitted. Faecal samples were collected and weighed immediately on daily basis during the last seven days of the three weeks digestibility trial. Five percent (5%) of the total faecal output was oven dried at 60^{o}C to constant weight for dry matter determination and then stored for chemical analysis.

Proximate Analyses of Feeds and Faeces

Representative samples of the concentrate diet, groundnut hay, *F. albida* leaves and faecal samples were analyzed for proximate composition using the methods of AOAC (1990).

Statistical Analysis

Analysis of variance (ANOVA) of data generated was conducted using the General Linear Model (GLM) available in Statistical Analysis System (SAS, 1990). Differences in means were determined using the Fisher's Least Significant Difference (LSD) test as described by Steel and Torrie (1980).

RESULTS AND DISCUSSION

Results of the chemical composition of experimental diets are presented in Table 2.

Table 2: Chemical composition of experimental diets.

Parameter (%)	Treatment					Concentrat
	A	B	C	D	E	
Dry Matter	87.80	88.00	87.45	90.63	89.00	91.52
Crude Protein	16.38	16.15	16.00	15.21	14.00	16.30
Crude Fibre	32.00	29.36	28.00	27.11	26.38	15.80
Acid Detergent Fibre	41.60	38.17	36.40	35.24	34.29	20.54
Ether Extract	3.56	4.11	4.34	4.89	4.87	9.26
Ash	10.12	10.16	10.00	11.00	11.07	10.23
Nitrogen Free Extract	38.24	40.02	41.66	41.79	43.68	48.41

It can be seen that dry matter content varied from 87.45% in treatment C to 90.63% in treatment D. Crude protein values varied from 14.00% in treatment E to 16.38% in treatment A. Crude fibre in the diets had the following values: 32.00, 29.36, 28.00, 27.11 and 26.38% for treatments A, B, C, D and E, respectively. Values for acid detergent fibre (ADF) content ranged from 41.60% in treatment A to 34.29% in treatment E. Ether extract levels in the diet were 3.56, 4.11, 4.34, 4.89 and 4.87% for treatments A, B, C, D and E, respectively. Ash content values ranged from 10.00% in treatment C to 11.07% in treatment E. The lowest value (38.24%) of NFE was obtained in treatment A, while treatment E gave the highest value (43.68%). The concentrate diet contained 91.52, 16.30, 15.80, 20.54, 10.23 and 48.41% dry matter, crude protein, crude fibre, acid detergent fibre, ether extract, ash and nitrogen free extract, respectively.

The crude protein levels obtained in the present study, except those for treatments D and E, whose shortages would probably been compensated by the CP in the concentrate were within the range of 16 - 18% recommended by NRC (1990), FAO (1986) and Church (1978) for growing sheep and goats. The composition of the experimental diets was expected to support growth performance of growing sheep, since the crude protein and fibre contents were within the recommended values.

The results on growth performance and dry matter intake are presented in Table 3. It can be observed that the values obtained for average daily gain (ADG) were significantly higher ($P<0.05$) in treatment B (226.03 g/day) compared to the control (treatment A, 223.02 g/day) whose value was significantly higher ($P<0.05$) than those of the remaining treatment. The lowest ($P<0.05$) ADG was obtained in treatment E (201.90 g/day) while the value for treatment C (209.21 g/day) was significantly lower ($P<0.05$) than that of treatment D (217.64 g/day). Total dry matter intake (TDMI) was significantly higher ($P<0.05$) in treatment D (754.66 g/day) compared to the other treatments. However, values for treatments A and B did not differ significantly ($P>0.05$) from each other, just as for treatments C and E. Total crude protein intake values in treatments A, B and C were the same ($P>0.05$), but the values for treatments D (128.91 g/day) and E (122.82 g/day) were significantly different ($P<0.05$) from each other. Total crude fibre intake decreased significantly ($P<0.05$) as the level of *F. albida* leaves increased in the diet.

Average daily gain (ADG) values obtained from the present study are lower than the values of 238 – 298 g/day obtained by Maigandi and Nasiru (2006) when *F. albida* pods were fed to Uda rams in the same ecological zone, but higher than 76 – 141 g/day reported by Maigandi and Wasagu (2002) in an experiment in which *Ficus sycomorus* leaves were fed to Yankasa rams. However, the values are within the range of 163 – 270 g/day reported by Maigandi and Bibi Farouk (2008) when *F. albida* pods were fed to growing Uda lambs in the same ecological zone.

Nutrient intake obtained from the present study seems to follow the patterns of nutrient content in the diets. For example, CP contents were lower in diets D and E, which subsequently affected the total CP intake in these treatments. Similarly, the total CF intake decreased as the level of CF content decreased as seen from the results in Tables 2 and 3. The result seems to be in line with those of Maigandi and Nasiru (2006); Maigandi and Bibi-Farouk (2008) when pods of a similar tree were fed to fattening and growing Uda sheep, respectively in a similar ecological condition. The higher levels of crude fibre in the forage diets contributed to the higher crude fibre intake recorded. This confirms the reports of McDonald *et al*. (1995) that the fibre fraction of a food has great influence on its intake. Likewise, Hue and Preston (2006) found that feed intake increased with increasing level of fibre content in the diet until the requirements were met.

Table 3: Growth performance of growing Uda lambs fed *Faidherbia albida* leaves.

Parameter	Treatment					
	A	B	C	D	E	SE
Initial weight (kg)	16.01	16.00	16.02	16.00	16.03	-
Final weight (kg)	30.06	30.24	29.20	29.70	29.02	-
Weight gain (kg)	14.05	14.24	13.18	13.70	12.72	-
Av. daily gain (g/day)	223.02^{b}	226.03^{a}	209.21^{d}	217.46^{c}	201.90^{e}	23.21
Feed intake from conc. (g/day)	235.40	240.00	245.00	240.32	250.00	4.06
Feed intake from forage (g/day)	603.00^{a}	596.72^{b}	600.21^{ab}	590.00^{c}	586.24^{c}	26.85
Total feed intake (g/day)	838.40	836.72	845.21	830.32	836.24	5.92
Feed efficiency	0.27^{a}	0.27^{a}	0.25^{b}	0.26^{ab}	0.24^{bc}	0.01
Dry matter intake from conc. (g/day)	215.44	219.65	224.22	219.94	228.80	6.12
Dry matter intake from forage (g/day)	529.43^{b}	525.11^{b}	524.88^{bc}	534.72^{a}	521.75^{d}	21.07
Total Dry matter intake (g/day)	744.87^{c}	744.76^{c}	749.10^{b}	754.66^{a}	750.55^{b}	19.45
Crude protein intake from conc. (g/day)	38.37	39.12	39.94	39.17	40.75	1.34
Crude protein intake from forage (g/day)	98.77^{a}	96.37^{b}	96.03^{b}	89.74^{c}	82.07^{d}	9.62
Total crude protein intake (g/day)	137.14^{a}	135.49^{a}	135.97^{a}	128.91^{b}	122.82^{c}	17.23
Crude fibre intake from conc. (g/day)	37.19	37.92	38.71	37.97	39.50	3.10
Crude fibre intake from forage (g/day)	192.96^{a}	175.20^{b}	168.06^{c}	159.95^{d}	154.65^{e}	39.85
Total crude fibre intake (g/day)	230.15^{a}	213.12^{b}	206.77^{c}	197.92^{d}	194.15^{e}	26.13

Means in a row followed by same letter (s) in superscript are not significantly different ($P>0.05$).

Table 4: Cost of feed per kilogram liveweight gain of Uda lambs fed *Faidherbia albida* leaves

Parameter	Treatments				
	A	B	C	D	E
Cost of concentrate per kg diet (₦)	35.00	35.00	35.00	35.00	35.00
Cost of forage per kg diet (₦)	25.00	17.50	21.25	14.02	10.00
Total cost of feed per kg diet (₦)	52.00	42.00	37.00	47.00	32.00
Cost of concentrate consumed (₦/kg)	8.24	8.40	8.58	8.41	8.75
Cost of forage consumed (₦/kg)	15.08[a]	10.44[c]	12.75[b]	8.27[d]	5.86[e]
Total cost of feed consumed (₦/kg)	23.32[a]	18.84[c]	21.33[b]	16.68[d]	14.61[e]
Cost of feed per kg live weight gain	104.56[a]	83.35[b]	101.95[a]	76.70[c]	72.36[d]

Means in a row followed by same letter (s) in superscript are not significantly different (P>0.05).

The cost of feed per kg liveweight gain is presented in Table 4. Cost of concentrate consumed did not differ significantly (P>0.05) between treatments. However, cost of forage consumed and total cost of feed consumed decreased significantly (P<0.05) as the level of *F. albida* leaves increased in the diets. Cost of feed per kg liveweight gain was significantly higher (P<0.05) in treatments A and C, whose values did not differ significantly (P>0.05). The lowest (P<0.05) value of cost of feed per kg liveweight gain was obtained in treatment E, which had only *F. albida* leaves as source of forage.

The present study revealed that the cost of feed per kg liveweight gain was reduced by feeding *F. albida* leaves alone as source of forage for growing lambs. The reduction in the cost of fed per kg liveweight gain in diet E could be attributed to the fact that it is extremely cheaper to obtain *F. albida* leaves than groundnut hay during the study period (January to April). The results therefore suggest that *F. albida* leaves could be a good dry season feed for growing sheep in the study area. The findings of the present study are in complete agreement with those of Maigandi and Nasiru (2006) and Maigandi and Bibi Farouk (2008) who obtained reductions in the cost of feed per kg liveweight gain by including the pods of *F. albida* in the diets of fattening and growing Uda sheep in a similar ecological condition.

Nutrient digestibility in the present study was not adversely affected by the inclusion of *F. albida* leaves as source of forage in the diets of growing lambs (Table 5). The digestibility values for DM, CP, EE and NFE were close to values reported by Maigandi and Nasiru (2006).

Table 5: Nutrient Digestibility by uda lambs fed *Faidherbia albida* leaves

Nutrient Digestiblity (%)	Treatment				
	A	B	C	D	E
Dry matter	77.02	75.11	72.62	78.00	78.21
Crude protein	79.14	79.00	78.22	79.34	79.81
Crude fibre	78.00	72.11	77.03	78.96	78.56
Acid Detergent fibre	78.23	76.90	79.00	78.00	77.02
Ether Extract	78.00	72.96	78.00	71.91	76.00
Ash	67.02	67.23	66.42	67.11	69.24
Nitrogen free Extract	89.34	82.00	85.82	87.00	89.22

CONCLUSION

The results of the present study revealed that growing Uda lambs tolerated complete replacement of groundnut hay with *F. albida* leaves in their diets without any negative effects on growth performance, nutrient intake, nutrient digestibility and cost of feeding.

REFERENCES

A. O. A. C. (1990). *Official Methods of Analysis (15th edition)*. Association of Official Analytical Chemists, Arlington, V. A., USA.

Adebowale, E.A. and A.A. Taiwo (1996). Utilization of crop residues and agro-industrial by-product as complete diets for West African dwarf goats and sheep. *Nig. J. Anim. Prod.*, 23 (1): 153-160.

Church, D.C. (1978). *Livestock Feeds and Feeding*. Oxford Press, Portland, Oregon. USA.

FAO (1986). Food and Agriculture Organization of the United Nations. Energy and protein requirements. Reports of a Joint Expert Consultation. Technical Report series No. 724, Geneva, WHO.

Goodchild, A.V. (1990). Use of leguminous browse foliage to supplement low quality roughages for ruminants. Ph.D. Thesis, University of Queensland.

Hue, K. T. and T. R. Preston (2006). Effect of different sources of supplementary fiber on growth of rabbit fed a balanced diet of fresh water spinach (*Ipomea aquatica*). *Livestock Research for Rural Development*, 18 (4).

Maigandi, S. A. and A. Nasiru (2006). Replacement value of *Faidherbia albida* pods fed to Uda sheep in a semi-arid zone, Nigeria. *Proceedings of the Nigerian Society for Animal Production, 31: 439 - 443.*

Maigandi, S. A. and R. Abdullahi (2003). Morning glory *(Ipomea asarifolia)* as a source of forage for rabbits in a semi-arid zone, Nigeria. *Nigerian Journal of Basic and Applied Sciences*, 12: 1-8.

Maigandi, S. A. and F. Bibi-Farouk (2008). The replacement value of *Faidherbia albida* pods fed to growing Uda lambs in a semi-arid zone, Nigeria. *Journal of Biological and Environmental Sciences*, 5 (4): 235 -238.

Maigandi, S. A. and A. A. Wasagu (2002). Intake and digestibility of nutrients by Yankasa rams fed varying levels of *Ficus sycomorus* leaves. *Proceedings of the 27th Annual*

Conference of the Nigerian Society for Animal Production, Federal University of Technology, Akure March, 17 – 21. Pp 82 - 184

Mamman, A. B., J. O. Oyebanji and S. W. Petters (2000). *Nigeria: A people United, A Future Assured (Survey of States)*. Vol. 2. Gabumo Publishing Co. Ltd., Calabar, Nigeria.

McDonald, P., R. A. Edward and J. F. GreenHalgh (1995). *Animal Nutrition (5th ed)*. Longman Group Ltd., London and Basintoke.

Norton, B. W. (1994). The nutritive value of forage legumes. *In: Forage Trees in Tropical Agriculture*. R.C. Gutteridge and H.M. Shelton (Eds). CAB International, Wallingford, U.K.

NRC (1990). National Research Council. The Nutrient Requirements of Ruminant Livestock. Technical Review by an Agricultural Research Council Working Party. C. A. B. International, Wallingford, Oxon.

Nuru, S. (1982). Problems and Prospects of the Nigerian Beef Industry. In: Osinowo, O. A.; Ikhatua, U. J. and Ehoche, W. O. (Eds.) *Beef Production in Nigeria*. Proceedings of the National Conference on Beef Production: July 27 -30 Kaduna, Nigeria.

SAS (1990). Statistical Analysis System SAS/STAT. Guide for Personal Computers, 6th edition, Carry N. C., U.S.A Pp. 967 - 978.

SSD (2000). Sokoto State Diary, Al Umma Printing Press Publication, Sokoto. pp 1-2.

Steel, R. G. D. and J. H. Torrie (1980). *Principles and Procedures of Statistics*. McGraw Hill Book Co. Inc. N. Y.

Storrs, A. E. G. (1977). *Know Your Trees*. Zambia Forest Department, Ndola.

Vaneys, J.E., I.W. Mathius, P. Pingsapan and W.L. Johnson (1986). Foliage of the tree legumes *Gliricidia, Leucaena and Sesbania* as supplement to Napier grass diet for growing goat. *J. Agric. Sci. (Cambridge),* 17