EFFECT OF FEEDING CHOPPED AND UNCHOPPED GROUNDNUT HAULM (HARAWA) ON NUTRIENT UTILIZATION AND THE PRODUCTION OF SOME RUMEN METABOLITES IN YANKASA LAMBS

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SUMMARY

The effect of feeding chopped and unchopped groundnut haulm (Harawa) on nutrient intake, metabolism and utilization was determined in 24 (12 each of male and female) growing Yankasa lambs. Feeding of chopped harawa significantly (P 0.05) increased feed intake, the digestibility of nutrients and liveweight gains. It also had an appreciable effect on nitrogen retention and the production of total rumen nitrogen, rumen ammonia-nitrogen and volatile fatty acids. The availability of digestible energy did not differ significantly under the two feeding regions. There was a better feed efficiency for lambs fed chopped hay.

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INTRODUCTION

Most of the ruminant animal population in Nigeria occurs in the Sudan, Sahel and Guinea Savannah zones where production is characterised by feed shortages and consequent weight losses during the dry season. However in recent times, crop residues harvested from sorghum, maize, cowpea and groundnut are used extensively as feeding inputs especially during the dry season to reduce weight losses. The use of groundnut haulm (harawa) as a feed to fatten animals has particularly assumed great importance especially in the northern parts of the country. As a result of this and coupled with discouragingly poor pod yields, some farmers now grow groundnut primarily for the haulm (Ya yock, 1978). Also the focus on large-scale groundnut production in potential areas by River Basin Development Authorities will enhance the production of the residue which can serve as cheap, bulky energy and protein feed for ruminants.

The nutritive value of a feed is influenced by several variable factors among which is the form of presentation. Orskov, Flatt and Moe (1968) reported that particle size and feed intake are primary factors affecting rumen fermentation pattern. Fermentation pattern has been little studied in the indigenous ruminant animals that normally receive diets high in crude fiber which is often poorly digested. A change in rumen fermentation pattern ultimately changes the production of rumen metabolites. Thus an improved fermentation balance should enchance better performance. This study was therefore undertaken with an all roughage diet (harawa) to determine the effect of physical form (chopped and unchopped) on feed intake, nutrient utilization and the production of some rumen metabolites in growing sheep.

MATERIALS AND METHODS

Twenty-four (twelve each of male and female) growing Yankasa lambs aged between 15 and 18 months and weighing between 14.5 and 18kg were used for the study. The animals were divided within sex into 2 groups each consisting of 6 males and 6 females. Group one was fed unchopped harawa (10—27cm long) while group two received chopped harawa (2—5cm long). The feeding lasted for 84 days during which the 2 forms of harawa were fed *ad libitum*. In addition, fresh water and mineralized salt blocks were always available to the animals.

After the 84th day, the 6 males from each treatment group were transferred into cages for metabolism study which consisted of 4 days preliminary and 7 days collection periods. The procedure for

sampling feed, the collection and sampling of faeces and urine as well as chemical analysis were as outlined by Adu and Adamu (1982).

Rumen sample was collected through fistula from 4 rams aged about 2 years, two each for the experimental feeds. The rams were on the diets for 21 days, the last 7 days of which served as the sampling period. Samples of rumen content (about 50ml) were collected between 2 and 3 hours after feeding. The samples were immediately taken to the laboratory and strained through muslin. The resulting liquor was preserved by adding mercuric chloride (about 1ml/50ml of rumen liquor) and refrigerated at approximately 2°C in air-tight bottles until analysed. The rumen liquor was processed and analysed for total rumen nitrogen and total volatile fatty acids (VFA) using the A.O.A.C. (1975) method. The phenol-hypochlorite method of Fawcett and Scott (1960) as modified by Chaney and Marbach (1962) was used for the determination ammonia-nitrogen in strained rumen liquor. Differences between treatment means were tested by "Student's t-test" (Snenedor and Cochran, 1967).

RESULTS AND DISCUSSION

The chemical composition of the feeds and the digestibility coefficients of various nutrients are given in Table 1. There were no significant differences in the composition of the 2 forms of the feed. Chopped harawa was generally

TABLE 1

Composition of feed and mean coefficents of apparent digestibility, %

Nutrients	*Unchopped harawa*	*Chopped harawa*
Chemical composition:		
Dry matter	87.5	86.7
Nitrogen	38.2	35.6
Crude fibre	38.2	35.6
Ether Extract	1.5	1.4
Nitrogen-free extract	42.2	45.2
Ash	9.4	9.7
Gross energy, Kcal/g	3.04	3.03
Digestibility Coefficients:		
Dry matter	53.4 ± 1.4	56.2 ± 1.1
Crude protein	63.7 ± 1.3[a]	68.1 ± 1.3[b]
Crude fibre	49.8 ± 0.9	51.1 ± 0.4

[a,b]Mean on the same line with different superscripts differ significantly (P 0.05).

TABLE 2

Mean Dry matter intake, liveweight gain and efficiency of utilization

Variables	*Unchopped harawa*			*Chopped harawa*		
	All	*Male*	*Female*	*All*	*Male*	*Female*
Dry matter intake, Kp/day	1.33[a]	1.41	1.15	1.66[b]	1.64	1.68
Dry matter intake, g/$W^{0.75}$/day	141.2	144.8	135.3	176.2	180.2	164.7
Liveweight gain, g/day	90.2[a]	67.9	112.5	130.7[b]	139.0	122.4
Kg feed/kg weight gain	14.8	20.8	10.2	12.7	11.8	13.7

[a,b]Means on the same line with different superscripts differ significantly (P 0.05).

more digestible than the unchopped one. The difference in digestibility coefficients was only significant (P 0.05) for crude protein. Chopping which considerably reduced particle size would seem to have increased microbial action on the fiber.

The feed intake and efficiency of utilization are shown in Table 2. Feed consumption was significantly (P 0.05) higher in lambs fed chopped hay. This might be due to a more rapid prehension, mastication and hence passage of the chopped material through the gastro-intestinal track, although digestibility was not depressed by chopping. Also lambs fed chopped hay grew significantly (P 0.05) faster than those fed harawa in long form. It can be said that the higher feed intake coupled with increased rate of digestion were apparently responsible for the higher liveweight gain. On basis of metabolic size, males consistently had higher feed intake than the females. This observation is in agreement with earlier reports (Spedding, 1962; Acharya and Bawa, 1971). Lambs fed chopped hay were more efficient in the utilization of the feed.

The partition of energy and protein are presented in Table 3. The retention of nitrogen was higher in lambs fed chopped harawa, the difference was however not significant. This might be to the substantial urine nitrogen loss of 3.4 per unit intake on chopped harawa as against 2.8 in the unchopped harawa. There were no

TABLE 3

Utilization of nitrogen and energy in harawa

Nutrients	Unchopped harawa	Chopped harawa
Nitrogen, g/day:		
Intake	18.51 ± 1.60	24.17 ± 1.82
Faecal	4.14.	9.12
Urine	6.46	6.68
Retained	7.99 ± 1.14	8.37 ± 0.9
Apparently digested, %	77.63	62.27
Intake absorbed, %	55.60	55.61
Energy, Kcal/day		
Intake	4043.2 ± 26.7	50.29 ± 42.1
Faecal	1321.6	1483.3
Digested	2721.6	3246.5
Intake digested, %	67.31	64.55

TABLE 4

Mean values of total nitrogen, ammonia-nitrogen and total volatile fatty acid concentration in strained rumen liquor.

Metabolites	Unchopped harawa	Chopped harawa
Total VFA, m-equiv/100ml	5.05[a]	6.12[b]
Total nitrogen, mg/100ml	69.7[a]	76.1[b]
Ammonia nitrogen, mg/100ml	6.2[a]	7.8[b]

[a,b]Mean on the same line with different superscripts differ significantly (P 0.05).

significant differences in the amount of nitrogen intake that was absorbed under the two feeding regimes. The availability of digestible energy was higher with unchopped harawa than with the chopped type, the difference not being significant. One possible explanation for the better gains and more favourable utilization of nutrients by lambs fed chopped harawa may be related to the in vivo rumen metabolite production data presented in Table 4. The concentration of all rumen metabolite measured were significantly ($P < 0.05$) higher in lambs fed chopped harawa. Feeding chopped hay gave improvements of 21.2, 9.2 and 25.8% in the production of total VFA, nitrogen and rumen ammonia-nitrogen. Although total VFA produced was not partitioned into its various fractions in this study, it is known that under similar pH condition, feeds favouring increased total VFA production in the rumen resulted in the production higher molar proportion of propionic acid at the expense of other organic acids (Sutton and Johnson, 1969; Mba and Olatunji, 1972). Thus, chopped harawa which had a higher content of readily fermentable carbohydrate (Table 1) and gave a higher rate of total VFA production in this study would perhaps give a higher molar concentration of propionic acid which being glucogenic will enhance its better utilization for liveweight gains. This would tend to lend support to the use of harawa as a fattening feed.

It can be concluded from the results of this study that feeding harawa in the chopped form gave substantial improvement in nutrient intake, metabolism and utilization. Another added advantage of feeding chopped roughage, although not measured in this study, is the low expenditure of energy in the processes of prehension, mastication and rumination of chopped feeds (Chaturvedi, Singh and Ranjhan, 1973).

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REFERENCES

ADU, I.F. and ADAMU, A.M. 1982. Nutritive value and utilization of three tropical grass hays by sheep. Tropical Grassland **16**; 29—33.

ACHARYA, R.M. and BAWA, S.J.S. 1971. Milk production of ewes and its relationship with preweaning growth of lambs. Ind. J. Anim. Sci. **41**; 572—576.

A.O.A.C. 1975. Official methods of analysis. 12th edition. Association of official analytical chemists, Washington, D.C.

CHANEY, A.L. and MARBACH, E.P. 1962. Modified reagents for analysis of urea and ammonia. Clin. Chem. **8**; 130—132.

CHATURVEDI, M.L., SINGH, U.B. and RANJHAN, S.K. 1973. Effect of feeding chopped and ground wheat straw on the utilization of nutrients and VFA production in growing cow calves and buffalo calves. Ind. J. Anim. Sci. **43**; 382—388.

FAWCETT, J.K. and SCOTT, J.E. 1960. A rapid and precise method for determination of urea. J. Clin. Path. **13**; 156—159.

Mba, A.U. and Olatunji, 0-1972. Influence of diets on ruminal VFA production in West African dwarf goats. Nigerian J. Sci. *5:* 207—216.

Qrskov, E.R., Flatt, W.P. and Moe, P.W. 1968. Fermentation balance approach to estimate the extent of fermentation and efficiency of volatile fatty acid formation in ruminants. J. Dairy Sci. *51:* 1429—1435.

Snedecor, G.W. and Cochran, W.G. 1967. Satistical Methods 6th edition. IOWA State University Press, Ames, IOWA, U.S.A.

Spedding, C.R.W. 1962. Modern trends in animal health and husbandry. The agricultural ecology of grazing sheep Brit. Vet. J. *118:* 461—491.

Sutton, J.O. and Johnson, V.W. 1969. Fermentation in rumen of cows given rations containing hay and flaked maize or rolled barley in widely different proportions. J. Agric. Sci. Camb. *61:* 341—348.