

UTILIZATION OF COMPLETE DIET CONTAINING SUGARCANE PEELS MEAL USED IN FEEDING GROWING KANO BROWN GOATS

Garba SALEH¹, John Adisa AYOADE²

¹Department of Agricultural Education, Federal College of Education (Technical) Bichi, P.M.B., 3473, Kano State, Nigeria

²Department of Animal Production, University of Agriculture, Makurdi, Nigeria

Corresponding author email: garbasaleh2@gmail.com

Abstract

This study was conducted for the nutritional evaluations of sugarcane peels as the replacement for maize offal in the diet of growing Kano brown goats for ninety days. Four different diets were formulated containing sugarcane peels to replace maize offal at 0, 25, 50 and 75% coded as A, B, C and D respectively, were compared. Twenty (20) growing Kano brown goats were used for the study. The goats were allocated to each treatment and used to evaluate the effect of feeding sugarcane peels diets on performance, apparent digestibility and economics of production. Results of the performance shows the average initial body weight and average final body weight were not significantly affected ($P>0.05$). Total feed cost per kg and total variable cost of production reduced as the inclusion levels of sugarcane peels increased from 0 – 75% as replacement level for maize offal without any effect on the performance of goats. Therefore, this study recommends that sugarcane peels meal can be incorporated into the diets of goats up to 75% as replacement levels without affecting the performance and nutrients digestibility.

Key words: evolution, sugarcane peels, maize offal, Kano brown goats.

INTRODUCTION

Ruminants are essential to the livelihoods of millions of farmers and critical to human health, global food and nutritional security. (FAO, 2016). In Nigeria, livestock contributes 6-8% of agricultural gross domestic product. These estimates highlight the important contribution of livestock to sustainable agricultural development. Goats play multiple roles in the livelihoods of people in Nigeria, especially the poor. They provide food and nutrition, economic and social status, and ensure environmental sustainability by providing manure to the soil. Nigeria estimates 72.5 million goats' population and has the largest goats' population in Africa (Premium Times News Paper, 2017). The breeds of Nigerian goats are Sokoto red, Sahel or Desert Goat, and West African Dwarf Goat (WAD). The Kano brown is believed to be strains of the Sokoto red goat. Saleh (2017) indicated that feeds constitute about 80% of the cost of livestock production in Nigeria and the feed is generally inadequate to meet growth and production requirements. This problem is more critical during the dry season period and affects

all categories of livestock. For ruminant animals there are inadequate availability of conventional grazing forages and very expensive industrial by-products such as wheat offal, maize offal and cotton seed cake. In this situation the search for alternative feed ingredient which is cheaper and easier to obtain as well as easier to process becomes of paramount importance. The use of sugarcane peels as feedstuff during the dry season will help in reducing the problem of feed shortage especially in the Northern part of the country where the sugarcane peels are available and unutilized at the period.

Sugarcane *Saccharum officinarum* by-product is one of such usable crop residues as ruminant feeds because of its nutritional components. Sugarcane peels is one of by-products of sugarcane and found in Nigeria as a result of local consumption of sugarcane which consist of sugarcane roots, wax, tips, leaves, fibrous materials, parenchyma cells and soil particles after sugarcane was peeled using sharp knife. Ayoade et al. (2007) revealed that, on dry matter basis sugarcane peels contained dry matter (DM) 87.6%, crude protein 6.5%, crude fibre 12.7%, ether extract 2.8%, ash 12.8% and

NFE 77.1%. However, Ochepe et al. (2012) reported the chemical composition of sugarcane peels as CP 6.56%, CF 15.22%, EE 4.79%, ash 7.31% and NFE 66.12%. The author also reported that sugarcane peels can be fed to goats at 40% dietary inclusion without significantly affecting the performance.

MATERIALS AND METHODS

Experimental location

Feeding trial was conducted at the Federal College of Education (Technical) Bichi, Department of Agricultural Education, Teaching and Research Farm, about 40 km west of Kano city in Bichi Local Government Area of Kano State. Kano is located within longitude 8°31'0.2"E and latitude 12°0'0.4"N and 13°N in the semi-arid zone of North-western Nigeria (KNARDA, 2001).

Experimental animals and their management

Twenty (20) growing Kano brown goat bucks used in the experiment and were purchased from Bichi market, Kano State. The animals were randomly distributed to 4 groups of 5 animals each. Each animal goat served as a replicate and an adjustment period of a week was allowed for the animals before data collection commences. The feeding trial lasted for a period of 90 days; 21 days used for metabolism study. Water and salt lick were also offered *ad libitum*. The animals were quarantine in the College Farm, for two weeks, vaccinated with PPR vaccine and given prophylactic treatment with Avomec® against *endo* and *exto* parasites and also treated with oxytetracycline HCl (a broad spectrum antibiotic). Prior to the experiment, the animals were managed intensively and group-fed with groundnut haulm and wheat offal.

Experimental feed preparation

The principal ingredient for the experimental feeds is sugarcane peels which was collected from the selling points within the Bichi local government area of Kano State. The peels were sun dried on a floor for a period of 3 - 4 days depending on sunlight intensity and finally milled with a hammer mill to produce sugarcane peels meals. Other feed ingredients

include the following: maize offal, rice offal, groundnut haulm, cotton seed cake, bone meal and salt which were purchased from Kano and Bichi markets.

Four complete experimental diet were formulated to feed twenty (20) growing bucks using varying levels of sugarcane peels to replace maize offal at 0 (control), 25, 50, and 75% inclusion levels as presented (Table 1 and Table 2 present compositions and proximate analysis of sugarcane peel meals based diets fed to growing Kano brown goats). The diets were designated as diets A, B, C, and D representing experimental treatments.

Table 1. Composition of the sugarcane peels meal based diets

Ingredients (%)	Experimental treatments			
	A	B	C	D
SPM	0	8.75	17.5	26.25
Maize offal	35	26.25	17.5	8.75
Rice offal	20	20	20	20
Cotton seed cake	20	20	20	20
Ground nut haulm	20	20	20	20
Salt	2	2	2	2
Bone meal	3	3	3	3
Total	100	100	100	100
Calculated values				
CP (%)	17.11	16.71	16.29	15.89
CF (%)	16.19	17.37	18.56	19.76
ME (Kcal/Kg)	2,120	2,330	2,540	2,750

SPM = Sugarcane Peels Meal, CP = Crude Protein, CF = Crude Fibre, ME = Metabolisable Energy

Experimental design and statistical analysis

Completely randomized design was used. The data generated were subjected to analysis of variance (ANOVA) using General Linear Model in SAS (2000). Where differences in means manifest, the Fisher's least significance difference test (FLSD) was used to separate them at (P<0.05) level of probability.

Data collected

Daily feed intake was kept for the whole 90 days feeding trial.

Metabolism trial

At the end of the feeding trial, metabolism study was conducted using three (3) animals from each treatment. The animals were fed the same experimental diets used for the feeding

trial. The trial lasted for twenty one (21) days (14 days for adaptation and 7 days for collection of faeces). Daily feed intakes were kept. Harness bags were used to collect the faecal output. Total faecal output from each animal was recorded daily and 5% of it was oven-dried at 80°C for dry matter determination and proximate components determination.

Sampling and analytical procedure

Thoroughly mixed representative samples of the experimental diets, and faeces were analyzed for proximate composition as outlined by the Association of Official Analytical Chemist (AOAC, 1990). Acid Detergent Fibre (ADF) was analysed in the samples as reported by Ranjhan and Krishna (1980).

RESULTS AND DISCUSSIONS

Proximate analysis of sugarcane peel meals based diets fed to growing Kano brown goats

The proximate composition of sugarcane peels meal based diets is presented in Table 2. The values of CP in this study (16.96 - 18.87%) are within the value reported by NRC (2001).

Table 2. Proximate analysis of sugarcane peels meal based diets

Para-meters %	Experimental diets				LSD
	A (0)	B (25)	C (50)	D (75)	
DM	94.87 ^a	94.74 ^a	93.94 ^b	93.35 ^b	0.440
CP	18.87	18.86	18.86	16.96	2.19
CF	9.97 ^c	10.60 ^c	12.56 ^b	14.97 ^a	1.099
EE	6.21 ^d	8.42 ^c	9.20 ^b	9.61 ^a	0.372
Ash	5.99 ^d	6.97 ^b	6.33 ^c	7.49 ^a	0.129
NFE	58.978 ^a	55.34 ^b	53.06 ^c	51.00 ^d	41.74

a, b, c, d = Means in the same row with different superscripts are significantly different ($P < 0.05$) and LSD = Least Significant Difference, DM = Dry matter, CP = Crude Protein, CF = Crude fibre, EE = Ether Extract.

Effect of feeding sugarcane peels meal based diets on performance of growing Kano brown goats.

The effect of feeding sugarcane peels meal based diets on performance of growing Kano brown goats is presented in Table 3.

The average initial body weight and average final body weight were not significantly affected ($P > 0.05$) by the inclusion of sugarcane peels, while average daily feed intake and feed

conversion ratio (FCR) were affected ($P < 0.05$). Also affected ($P < 0.05$) were average daily weight gain, total body weight gain and average daily water intake. Average daily weight gain (ADWG) of 32.22 - 45.89 g/day reported in this study is lower than ADWG of 90.58 g/day reported by Bawala et al. (2008) when they replaced sugarcane tops (grass) with *Leucaena leucocephala* (legume) foliage to West African dwarf sheep and 94.9 g/day reported by Ramli et al. (2005) for goats fed fermented sugarcane bagasse feed.

Also the present values were higher than the values of 7.50 - 24.30 g/day reported by Ochepe et al. (2012) on the utilization of complete diet containing sugarcane peels by goats. The values for average daily feed intake (ADFI) 280.74 - 349.77 g/day is lower than 723.1 g/day reported by Saleh (2010) for 30% sugarcane peels diet fed to Yankasa sheep.

The variation in the above mentioned is that, feed intake could be as a result of individual differences in the feeding habits of the animals. Values of average daily water intake ranged from 665.59 ml to 838.55 ml/day in this study. These values are within 0.8520 - 1.257 liters/day reported by Ochepe et al. (2012) and 680 ml/day reported by Devendra and Mc Leroy (1982) for pen fed *Katjang* goat raised for meat production.

The values of feed to gain ratio (FGR) of 7.67 - 9.32 (intake/kg gain) reported by this study is lower than 11.12 - 28.36 reported by Ochepe et al. (2012) and 13.3 reported by Ramli et al. (2005) for goats fed fermented sugarcane bagasse feed. In this study, FGR was best obtained in treatment A (7.67) and C (7.98). The lower value of feed to gain ratio in treatments A and C in this study is an indication that the diets were better utilized by animals fed and that the animals on the diets had better ability to convert feed to meat.

Dry matter and nutrient digestibility of growing Kano brown goats fed sugarcane peels based diets

The dry matter and nutrient digestibility of growing Kano brown goats fed sugarcane peels based diets is presented in Table 4. The crude protein digestibility was significantly affected by the level of sugarcane peels inclusion ($P < 0.05$), while the other digestibility

parameters were not significant ($P>0.05$). Values for dry matter digestibility which ranged from 69.32% (D) - 74.32% (A) as reported in this study were within the values of 68.85 - 78.35 reported by Ashiru (2014) who fed Yankasa rams with sugarcane waste based diets. Values of crude protein digestibility (CPD) ranged from 86.09% (D) - 91.84% (A) in this study and were higher than the values of 80.63 - 86.76% reported by Ashiru (2014) for Yankasa rams fed sugarcane waste based diets. The high CP digestibility values reported in this study indicates that dietary protein was highly utilized by animals. Another reason for efficient CPD in this study is that all the experimental diets contained the recommended CP levels of 16 - 18% recommended by NRC (2001).

Values for crude fibre digestibility (CFD) ranged from 57.3% (B) - 61.77% (D) reported in this study were lower than 24.2 - 54.21% reported by Ochebo et al. (2012). McDonald et al. (1988) also indicated that fibre fraction of a food as well as the species of animal concerned have the greatest influence on digestibility. The high digestibility of all nutrients agreed with the report of FAO (1990) which classified digestibility of feeds as high (>60), medium (40 - 60) and low (<40). Therefore, the digestibility of all the nutrients was high and this indicates that, the quality of the feeds in all the treatments could be which for goat production.

Effect of feeding sugarcane peels based diets on economics of production of growing Kano brown goats

The effect of feeding sugarcane peels based diets on economics of production of growing Kano brown goats is presented in Table 5.

Feed cost per kg gain, gross margin and cost benefit ratio were highly significant ($P<0.05$) and so also the rest of their parameters. Values for feed cost per kg ranged from ₦39.25 (D) - ₦57.10 (A) reported in this study and was within the range of ₦21.43 - ₦43.19 reported by Saleh (2010) for sugarcane peels based diets fed to Yankasa sheep.

Thus, the control diet (0% sugarcane peels) was more expensive in terms of cost when compared to others and this shows that

sugarcane peels based diets were less expensive hence of reduce in cost of production.

The feed cost per kg gain ranged from ₦323.42 (D) - ₦403.12 (A); thus goat was higher than ₦112.74 - ₦274.58 reported by Saleh (2010) for sugarcane peels based diets fed to Yankasa sheep. This indicates that there was a reduction of cost per kg gain as the levels of sugarcane peels is increased in all the treatments. The total feed cost values obtained from this study ranged from ₦1133.02 (D) - ₦1797.51 (A) and total variable cost of production ranged from ₦5317 (D) - ₦5990 (A). This is an indication that incorporating sugarcane peels in the diet of goats will yield more profit since the treatment D which has the highest level of sugarcane peels has the least cost of production.

Gross margin ranged from ₦2573.7 (A) - ₦3533.4 (D) and also indicates that more profit was obtained from each diet as sugarcane peels increased. The cost benefit ratio ranged from 1.43 (A) - 1.66 (D) and showed decrease in cost (₦/kg) of feed production as inclusion levels of sugarcane peels increased from 0 - 75% as replacement level of maize offal. Therefore more benefit can be generated by goats' farmers with increased level of sugarcane peels. This trend was in confirms with the reports of Adesoji (2012) on the study of sugarcane peels in diet of growing rabbits (*Oryctolagus cuniculus*) and Ochebo et al. (2012) on the utilization of complete diet containing sugarcane peels by goats.



Figure 1. A typical Kano brown goat buck

Table 3. Effect of feeding sugarcane peels meal based diets on performance of growing Kano brown goats

Parameters	Experimental treatments				LSD
	A	B	C	D	
Average initial Body Weight (kg)	w	8.75	8.37	8.21	3.20
Average final Body Weight (kg)	12.33	11.65	12.2	11.38	3.02
Total Body Weight Gain (Kg)	4.13 ^a	2.9 ^b	3.83 ^a	3.17 ^a	36.51
Average Daily Weight Gain (g/day)	45.89 ^a	32.22 ^c	42.56 ^{ab}	35.22 ^b	8.21
Average Daily Feed Intake (g/day)	349.77 ^a	280.74 ^b	338.19 ^b	310.94 ^c	79.14
Average Daily Water Intake (ml)	838.55 ^a	782.42 ^c	752.09 ^{ab}	665.59 ^b	8.21
Feed Conversion Ratio (kg intake/kg gains)	7.67 ^b	9.11 ^a	7.98 ^b	8.82 ^a	2.19

a, b, c, = Means on the same row with different superscripts are significantly different (P<0.05); LSD = Least Significant Difference.

Table 4. Dry matter and nutrient digestibility of growing Kano brown goats fed sugarcane peels meal based diets

Parameters %	Treatments diets				LSD
	A (0)	B (25)	C (50)	D (75)	
Dry matter (DM)	74.32	69.87	70.99	69.32	5.18
Crude Protein (CP)	91.84 ^a	87.88 ^b	90.11 ^a	86.09 ^b	2.12
Crude Fibre (CF)	61.34	57.32	60.71	61.77	7.36
Ether Extract (EE)	70.13	68.25	68.86	68.20	5.46

a, b = Means in the same row with different super scripts are significantly different (P<0.05); LSD = Least Significant Difference.

Table 5. Effect of feeding sugarcane peels meal based diets on economics of production of growing Kano brown goats

Parameters	Experimental diets				LSD
	A	B	C	D	
Feed Cost per kg (₦/Kg)	57.10 ^a	51.15 ^b	45.20 ^c	39.25 ^d	N/A
Feed Cost per kg Gain (₦/Kg)	403.12 ^b	527.02 ^a	358.74 ^b	323.42 ^b	99.71
Total Feed Cost (₦)	1797.51 ^a	1292.39 ^{bc}	1375.59 ^b	1133.02 ^c	165.44
Total Variable Cost of Production (₦)	5990 ^a	5485 ^c	5568 ^b	5317 ^d	N/A
Gross Margin (₦)	2573.7 ^b	2681.8 ^{ab}	2948.6 ^{ab}	3533.4 ^a	925.34
Cost Benefit Ratio	1.43 ^b	1.49 ^b	1.52 ^{ab}	1.66 ^a	0.162

a, b, c, d = Means in the same row with different super scripts are significantly different (P<0.05). LSD = Least Significant Difference. N/A = Not Analyzed.

**Feed cost/kg was calculated on the bases of prevailing market prices of ingredients as at December, 2017 (\$1Dollar = ₦360.00).*

CONCLUSIONS

The results of the study clearly showed that inclusion levels of sugarcane peels from 0 - 75% as replacement for maize offal in goats' diet enhanced performance and improved nutrient digestibility without affecting the performance and health challenge to the animals. Therefore, sugarcane peels can be used as a feeds under smallholder farmers' condition, where accesses to conventional energy sources are limited. Based on this study, it can therefore be recommended that farmers should incorporate sugarcane peels at 75% inclusion level for small ruminants as replacement for maize offal during the period of scarcity to alleviated body weight losses

usually experienced during the dry season. Moreover, the result of the experiment could be used to improve sugarcane production and utilizations.

REFERENCES

- Adesoji A.T., 2012. Utilisation of Sugarcane Peels in diet of Growing Rabbits (*Oryctolagus cuniculus*). Unpublished M.Sc. Dissertation, Department of Animal Science, Bayero University, Kano, Nigeria. 75.
- AOAC, 1990. Official Method of Analysis (15th edition). Association of Official Analytical Chemists. Vol. 1 Arlington, Virginia, USA.
- Ayoade J.A., Carew S.N., Ameh A.E., 2007. The feed value of sugarcane scrapping meal for weaner rabbits: Growth, meat yield and cost of production: Proceedings of the 3rd annual conference of the

- Nigerian Society for animal production, University of Calabar, March 18-21, 2007, 227 – 299.
- Bawala T.O., Aina A.B.J., Onwuka C.F.L., Oni A.O., Adebisi Y., Alli M.A., 2008. Studies on performance of sheep fed sugarcane *Saccharum officinarum* tops supplemented with varying level of *Leuceana leucocephala* Foliage: Proceedings of Animal Production, Ayetoro, Nigeria, 575 – 578.
- Chesworth J., 2002. Ruminant Nutrition: The Agriculturalist: Published in co-operation with the Technical Centre for Agriculture and Rural Co-operation, Wageningen, The Netherlands.
- Devendra C., McLeroy G.B., 1982. Sheep and Goats Production in the Tropics, Longman Scientific Group Ltd. London.
- FAO, 2016. Food and Agricultural Organization: Reducing enteric methane for improving food security and livelihoods. Rome, Italy, www.fao.org.
- FAO, 1990. Upgrading crop residue for effective utilization by ruminant livestock Food and Agricultural Organization. Rome, Italy In: 46 1 APH202. Pdf. Htm.
- McDonald P., Edward R.A., Greenhalgh J.F.D., Morgan C.A., 1998. Animal Nutrition 5th Edition, Longman, London.
- NRC (National Research Council), 2001. Nutrient requirements of dairy cattle. 7th revised edition. National Academy Press, Washington, D.C.
- Ochepo C.O., Ochepo G.O., Ayoade J.A., 2012. The utilization of complete diet containing sugarcane peels by goats. Proceedings of the 37th annual conference of the Nigerian Society for animal production, University of Agriculture, Makurdi, March 18-21, 507 – 511.
- Premium Times News Paper, 2017. Premium Times News Paper, Thursday, May11, 2017, Lagos, www.premiumtimesng.com.
- Ramli M.N., Higashi M., Imura Y., Takayama K., Nakanishi Y., 2005. Growth, feed efficiency, behaviour, carcass characteristics and meat quality of goats fed fermented Bagasse Feed. Asian-Aust. J. Anim. Sci., 18 (11), 1594-1599.
- Ranjhan S.K., Krishna G., 1980. Laboratory Manual for Nutrition Research. Vicks Publishing House PVT, New Delhi.
- Saleh G., 2010. Utilisation of Sugarcane Peels By Yankasa Lambs in Savannah Zone. Unpublished M.Sc. Dissertation, Department of Animal Science, Bayero University, Kano.
- Saleh G., 2017. Nutritional Evaluation of Sugarcane Peels for Feeding Goats. Duetschland/Germany, LAMBERT Academic Publishing, ist ein imprint der / is a trade mark of Omni Scriptum GmbH & Co. KG
- SAS Institute Inc., 2000. Statistical Analysis System SAS/STAT. Guide for Personal Computers, Version 6th edition, Cary N.C, USA, 967-978.