



Performance and Bio-Economics of Feeding Yearling West African Dwarf Goats with Cashew Nutshell Based Diets as Supplement to Bamboo Leaves

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Abstract

This study was carried out to evaluate the performance and bio-economics of yearling West African dwarf goats fed cashew nut shell diets. Four diets containing 0 (control), 5, 10 and 15 % steam-treated cashew nut shell coded as T₁, T₂, T₃ and T₄, respectively, were compared. Sixteen yearling, West African dwarf goats were randomly assigned to four (4) treatments of four (4) goats each. The goats were fed 150g of the supplement and 250g of bamboo leaves, the goats were given water ad libitum. The experimental design used was completely randomized design. Data obtained were subjected to a one way Analysis of Variance (ANOVA) and means that were significantly different were separated using least significant difference (LSD) both contained in SPSS 16.0. Samples of the diets and bamboo leaves were analyzed for their proximate composition using the methods of AOAC (2000). The study lasted for 50 days after an adjustment period of seven (7) days. Daily supplement intake, daily forage intake, total daily feed intake, daily weight gain and feed conversion ratio were not significantly ($P > 0.05$) different. Cost of supplementary diet/kg reduced significantly ($P < 0.05$) from T₁ to T₄ (40.95 – 33.00 Naira). Cost benefit ratio ranged from (0.053 – 0.060) and was not significant. This study indicated that cashew nut shell could be fed to yearling West African dwarf goats up to 15 % level of inclusion without adverse effects on feed intake and growth performance, with improved cost benefits.

Keywords: Performance, Bio-economics, Yearling West African Dwarf goats, Cashew nutshell, Bamboo Leaves

Introduction

Several factors affect livestock productivity, but the most important environmental factor that determines livestock productivity is feed (Bamikole and Ikhatua, 2007) Feeding goats well is of fundamental importance for the success of the whole goat enterprise, however provision of good nutrition is limited by feed procurement problems (Chidibele and Njondjou, 1997). Ruminant animal production is faced with seasonal fluctuations in feed materials especially in the dry season (Olatunji *et.al.*, 2011). Ruminant feeding systems is based on poor quality

tropical forages, crop residue or agro-industrial by-products, in which protein is one of the first limiting factors, it may therefore require additional protein to maintain an efficient rumen ecosystem that will stimulate nutrient intake and improved animal performance. The increasing pressure on the use of cereals by the human population and livestock feed millers, coupled with a deficit of animal protein intake especially in developing countries necessitate the use of agro by-products for livestock production. In Nigeria, crop residues, agro industrial by-products and non-conventional feeds, are still

underutilized, and this coupled with the competition between man and animals for the available grains and tubers, has greatly reduced the animal protein intake. It is essential to devise means of evaluating wastes from agro industries and crop by-products or residue for limiting nutrients, energy and nitrogen to provide growth and other needs for goat production especially during the long dry season. Cashew nutshell has significant value as a feed, and will also lower the cost of feed inputs (Fanimo *et al.*, 2004), and since ruminants are essentially recyclers the use of cashew nutshell is particularly suited to ruminants that would ultimately produce high quality products (Shroeder, 1999). Ocheja *et al.* (2013), Okolo *et al.* (2012) and Ocheja *et al.* (2020) have provided data on performance and bio-economics of rearing weaner West African dwarf goats, and therefore the need to provide similar data for yearling West African dwarf goats makes this study expedient. This study was therefore designed to evaluate the performance and feed bio-economics of yearling West African dwarf Goats fed cashew nut shell based diets as supplement to bamboo leaves

Materials and Methods

Experimental Site and Housing Facilities

The experiment was carried out at the Sheep and Goats Unit of the Livestock Teaching and Research Farm, Department of Animal Production, Kogi State University, Anyigba (Latitude $7^{\circ} 15' 17''$ and $7^{\circ} 29' N$ of the equator and Longitudes $7^{\circ} 11' 11''$ and $7^{\circ} 32' 11''$ East of the Greenwich Meridian (Ifatimehin *et al.*, 2009). It is located in the derived Savannah zone of Nigeria. The annual rainfall ranges between 1400 – 1500 mm with about 6-7 months of rainfall. The ambient temperature ranges from $25^{\circ} C$ to $35^{\circ} C$ with the highest in March and April (Kowal and Knabe, 1972).

Experimental Animals, Feed Materials and Preparation

The experimental feed components were steam-treated cashew nut shell, bamabara nut offal, maize offal, Table salt, rice offal, wood ash, bone-meal and bamboo leaves. The steam-treated cashew nutshell was obtained from the Cashew Kernel Processing Factory, Kogi State University, Anyigba and was ground using a mortar and pestle. All the feed ingredients were mixed together in varying proportions and ground. The bamboo leaves were harvested from Kogi State University, Campus, Anyigba.

Sixteen (16) yearling West African dwarf bucks with weight range of 10.40 to 10.80 kg and aged about twelve months, were sourced from Anyigba and its environs. They were conditioned to stability by feeding them adequately for 1 week. The animals were ear-tagged for identification and were randomly divided into 4 treatments of 4 bucks each. The experiment lasted for 50 days, after an adjustment period of seven (7) days. Animals in treatments T₁, T₂, T₃, and T₄ were fed with experimental diets containing 0, 5, 10 and 15 %, levels of inclusion of cashew nut shell respectively at 150 g/goat/day. The Bamboo leaves were fed at 250 g/goat/day on cut and carry basis. All the animals were given water *ad libitum*. Dry matter intake was calculated from differences between absolute feed served and leftover. Weekly weight gains were taken in the morning before feeding. The following performance data were collected. Daily feed intake (supplement and forage), daily weight gain, Total weight gain and Feed conversion ratio. Feed cost/kg, costs of feed consumed, benefit/ live weight gain and cost- benefit ratio were also determined.

Chemical Analysis

Samples of experimental diets, steam- treated cashew nut shell and bamboo leaves (after drying in an oven) were prepared for analysis of their proximate composition. The protein content of the samples was determined by

Kjeldahl method. Ether extract, crude fibre and ash content determination were according to standard procedure (AOAC, 2000). The nitrogen free extract, (NFE) was calculated by subtracting the sum of the percentages of crude fibre, ether extracts, crude protein, ash and moisture from 100. The fibre component of each experimental diet, cashew nut shell and forage were further analyzed into, cellulose hemicellulose, lignin, Acid detergent fibre (ADF) and Neutral detergent fibre (NDF), (Van Soest *et al.*, 1991).

Experimental Design and Statistical Analysis

The experimental design was a completely randomized design (CRD). Data were analysed by a one way analysis of variance (ANOVA) and significantly different treatment means were separated by least significant difference (LSD) using SPSS (2015).

Table 1: Ingredient Composition of Experimental Diets (% DM)

Ingredients	Treatments/Diets			
	T ₁	T ₂	T ₃	T ₄
Cashew nut shell (CNS)	0.00	5.00	10.00	15.00
Maize offal	20.00	16.00	14.00	11.00
Bambara nut offal	54.00	54.00	54.00	54.00
Fish offal meal	5.00	5.00	5.00	5.00
Rice offal	15.00	15.00	12.00	10.00
Wood ash	2.00	2.00	2.00	2.00
Table salt	1.00	1.00	1.00	1.00
Bone meal	2.00	2.00	2.00	2.00
Total	100	100	100	100
Calculated nutrient content (% DM)				
Nutrients				
Crude protein	18.95	18.75	18.35	18.10
Crude fibre	15.75	16.70	15.80	15.56
ME (Kcal/kgDM)	2820	2835	2840	2850

Results and Discussion

Proximate Composition and Fibre Fractions of Experimental Diets

The proximate composition and fibre fractions of experimental diets fed to growing West Africa dwarf goats are presented in Table 2. The experimental diets were Iso-caloric and Iso-nitrogenous. The protein content of 18% was adequate for growing

goats in the tropics and also above the critical protein requirement of 8% reported by Lakpini *et al.* (2002). The ether extracts of 5.01 (T1) and 6.08 for T2 were within the range of 5 – 6% recommended by Maithison *et al.* (1997) but the 8.54% (T3) and 10.01(T4) were above recommended values and may impede feed intake and fibre digestion (Maithison *et al.*, 1997).

Table 2: Proximate Composition and Fibre Fractions of Experimental Diets (% DM)

Nutrients % CNS)	Treatments/Diets			
	T1(0 % CNS)	T2(5 % CNS)	T3(10% CNS)	T4(15
Crude protein	19.80	18.75	18.55	18.15
Crude fibre	16.30	16.08	16.65	15.75
Nitrogen free extracts	48.10	45.85	46.95	45.90
Ether extracts	5.01	6.08	8.54	10.01
Ash	7.80	7.35	7.55	6.70
Dry matter	94.60	94.90	95.50	94.70
Acid Detergent fibre	16.50	17.82	17.85	17.06
Neutral Detergent fibre	30.35	30.30	29.30	29.65
Cellulose	10.40	10.80	10.55	10.20
Hemicellulose	12.75	12.45	12.25	12.50
Lignin	6.11	6.79	6.58	6.88

Performance Characteristics of Yearling West African Dwarf Goats Fed Diets Containing Graded Levels of Steam-treated Cashew NutShell as Supplement to Bamboo (*Oxythenantera abyssinica*) Leaves

The performance data of yearling West African dwarf goats fed diets containing graded levels of steam-treated cashew nut shell is presented in Table 3. The daily forage intake, daily supplement intake, total daily feed intake, total weight gain, daily weight gain and feed conversion ratio were not significantly ($P>0.05$) different. The trends among all the treatments were at variance with those obtained by Ngi (2012) for yearling West African Dwarf Goats fed sweet orange peel based diet, Adebisi *et al.* (2016) for West African dwarf goat fed *panicum maximum* supplemented with *Gmelina arborea*, Oloche *et al.* (2013), who fed sweet orange peel meal based diets to yearling West African dwarf goats, and Arigbede *et al.* (2012) who fed cassava leaf- hay based diets to West African Dwarf goats. These differences may be due to the concentrates and forages used in the experiments. Feed conversion ratio of 8.17 – 8.60 were inferior to an average of 7.50 reported by

Mafindi *et al.*, (2018) for red Sokoto goats fed cowpea husk supplemented with graded levels of *Moringa oleifera* leaves but superior to the 16.54 – 31.36 reported by Okolo *et al.*, (2012) for growing West African dwarf goats fed supplement diets containing graded levels of cashew nut shell at 0%, 10%, 20% and 30%.

Feed bio Economics of Yearling West Africa Dwarf Goats Fed diets Containing Graded Levels of Steam-treated Cashew nut Shell as Supplement to Bamboo Leaves

The bio economics data of yearling West African dwarf goats fed diets containing graded levels of steam-treated cashew nut shell is presented in Table 4. Cost of bamboo and cost of bamboo leaves consumed did not show significant ($P>0.05$) difference across the treatments, cost of supplement /kg decreased, steadily from T₁ (₦40.95) to T₄ (33.00) and showed significant ($P<0.05$) difference among the treatments.

The significant reduction in cost of supplement per kg and cost of supplement consumed was due to increasing levels of cashew nut shell from T₂ to T₄. The trend in

the results for cost of supplement /kg, cost of supplement consumed and actual cost of total feed intake, compared favourably with that obtained by Ocheja *et.al.*,(2020) when they fed growing West African dwarf goats, fed graded levels of steam treated cashew nut shell. Okolo *et al.*(2012) obtained lower feed cost /kg , but the cost benefit was best at 10% and was depressed markedly at 20 % and 30% levels of inclusion of cashew nut shell. The cost benefit ratio of 0.053 – 0.060 were much lower than those obtained by Ocheja *et.al.* (2020) and Okolo *et.al.* (2012).

This could be due to differences in the levels of inclusion of cashew nut shell in the supplement diets as well as the classes of goats used for the feeding trial. This result showed that the inclusion of cashew nut shell in supplement diets for goats had significant and positive influence on the cost parameters of goat feeding. Okpanachi *et al.* (2016) also reported a cost benefit-ratio range of 1.180 (T3) -1.210 (T4), and further added that farmers could derive more benefits and less cost from the use of sun-dried cashew pulp as feed stuff for livestock.

Table 3. Performance of Yearling West African Dwarf Goats Fed Diets Containing Graded Levels of Steam- Treated Cashew Nut Shell as Supplement to Bamboo Leaves

Parameters	Treatments/Diets				SEM
	T ₁ (0 % CNS)	T ₂ (5 % CNS)	T ₃ (10 % CNS)	T ₄ (15 % CNS)	
Initial weight (kg)	10.6	10.4	10.65	10.8	0.01 ^{NS}
Final weight (kg)	12.98	12.73	12.93	13.05	1.09 ^{NS}
Total weight gain (kg)	2.38	2.33	2.28	2.25	0.89 ^{NS}
Daily weight gain (g)	47.6	46.6	45.6	45	1.01 ^{NS}
Daily supplement intake (g)	148.65	145	143.3	140	1.07 ^{NS}
Daily forage intake (g)	243	245.6	248.7	246.35	1.05 ^{NS}
Total daily feed intake (g)	391.65	390.6	392	386.35	3.55 ^{NS}
Feed conversion ratio	8.23	8.37	8.6	8.59	1.06 ^{NS}

SEM = Standard Error of the Means.
CNS=Cashew Nutshell

Table 4. Bio Economics of Yearling West African Dwarf Goats Fed Bamboo leaf and supplementary Diets Containing Graded Levels of Steam-Treated Cashew Nut Shell

Parameters	Treatments				SEM
	T ₁ (0 % CNS)	T ₂ (5 % CNS)	T ₃ (10 % CNS)	T ₄ (15 % CNS)	
Cost of supplement/kg (₦)	40.95 ^a	37.20 ^b	35.35 ^b	33.00 ^c	0.45
Cost of supplement consumed (₦)	60.87 ^a	53.94 ^b	50.30 ^b	46.20 ^c	0.50
Cost of forage/kg (₦)	40.00	40.00	40.00	40.00	----
Cost of forage consumed (₦)	97.20	98.00	99.48	97.44	1.02
*Actual cost of total feed intake (₦)	157.87 ^a	151.94 ^b	149.84 ^b	143.64 ^c	2.25
**Benefit/live weight gain (₦)	2856.00 ^a	2796.00 ^a	2736.00 ^b	2700.00 ^b	38.10
***Cost-benefit ratio	0.060	0.055	0.054 ^c	0.053	0.08

a, b, c, d – Means on the same row with different superscripts differ significantly (P<0.05)
SEM = Standard Error of the Means.
* Cost of supplement intake plus cost of forage intake (on actual basis)
** Total weight gain multiplied by cost of a kg of Goat meat at ₦ 1200
*** Actual cost of total feed intake (₦) ÷ Benefit/ live weight gain

Conclusion

Supplementary diets containing graded levels of steam-treated cashew nut shell at 15 %, level of inclusion fed to yearling West African Dwarf Goats as supplement to Bamboo leaves, had no adverse effect on supplement intake, daily weight gain, feed conversion ratio, and it also improved cost parameters. Thus, cashew nut shell at 15 percent level of inclusion can be incorporated into supplement diets for yearling West Africa Dwarf Goats for optimum performance at reduced cost of feed

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