



Digestibility of Nutrients and Performance of Yearling West African Dwarf Goats Fed Diets Containing Graded Levels of Cashew Nut Shell

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Abstract

Sixteen (16) yearling West African dwarf bucks aged about 12 months old, with a weight range of 9.80 - 10.00 kg were used in a feeding trial to evaluate the digestibility and performance of West African dwarf goats, fed graded dietary levels of cashew nutshell as supplement to bamboo leaves. The goats were fed diets containing graded levels of cashew nut shell at 0, 5, 10 and 15% and designated as treatments T1, T2, T3 and T4, respectively, at 150 g/goat/day. The goats were fed bamboo leaves at 250 g/goat/day 2 hours before the concentrate was fed while water was served *ad libitum*. The experiment lasted for 63 days after an adjustment period of 7 days. In the last 14 days of the experiment, the goats were moved into metabolic crates for fecal collections which lasted for fourteen days. Samples of the supplementary diets and bamboo leaves were analyzed for their proximate composition using standard methods. The experimental design was a complete randomized design and data were analyzed by one-way analysis of variance using SPSS version 23. The values for all the performance parameters were not significant ($P>0.05$). The crude fibre digestibility decreased steadily from 52.91% (T1) to 41.75% (T4) and were significantly ($p<0.05$) different. All the other digestibility parameters were not significantly ($p>0.05$) different from one another. The dry matter digestibility values ranged from 77.56% (T4) - 86.73 % (T1).it was therefore concluded that the digestibility values obtained indicated that the diets were all suitable for ruminants. 15% level of inclusion of cashew nut shell in supplement for yearling West African dwarf goats is recommended as it enhanced optimal performance and digestibility.

Keywords: Digestibility, Yearling, West African dwarf Goats, Cashew nut shell.

Introduction

According to Peacock (1996) adequate nutrition is a prerequisite for good health, good reproductive performance, high milk yield, fast growth rate and a successful goat production system. However, provision of good nutrition is limited by feed procurement problems (Chidebele and Njondjou, 1997). Although, goats are considered superior to other ruminant species in its utilization of poor quality and high fibre forage for its body

maintenance and production (Howe *et al.*, 1988), an enhancement of this potential through improved utilization of supplements and agricultural wastes could enhance the productivity of goats.

The nutritive value of a feed is measured by its ability to deliver nutrients to an animal for maintenance and growth in absence of toxic factors. It is a function of feed digestibility and voluntary feed intake. (Norton, 1994).

NRC (1996) reported the critical protein requirement for goats to be 8 %. . Preston (1986) reported that for any feed stuff to be considered a ruminant feed it should have a dry matter digestibility of 40 – 50 %.

Digestibility is an important measure of the nutritive value of feed stuffs and is defined as the difference in value between the food eaten and materials voided out by the animals expressed as percentage of food eaten (Javier,1995). *In-vivo* Method that involve feeding experiments with animals and indirect laboratory estimation methods (*in vitro* nylon bag techniques) have been developed to measure digestibility of feeds (Javier, 1995). A number of factors are known to affect digestibility. They include composition of the feed, ration composition, preparation of feed, animal factor and level of feeding. From the foregoing, it is therefore expedient to evaluate the nutrient and digestibility potentials of feed materials for ruminant. Research data on performance and digestibility for Growing West African dwarf goats fed cashew nut shell based supplement diets are available (Okolo *et.al*, 2012; Ocheja *et.al*.2018), but such data for yearling West African Dwarf goats appear to be unavailable thus necessitating this study.

This study was therefore designed to determine the performance, and nutrient digestibility of concentrate diets containing graded levels of cashew nut shell as supplement to bamboo leaves fed to yearling West African dwarf goats.

Materials and methods

Location of Experiment

The feeding trial was carried out at the small ruminant Unit of the Livestock Teaching and Research Farm, Department of Animal Production, Kogi State University, Anyigba (Latitude 7° 15' and 7° 29'N of the equator and Longitudes 7° 11' and 7° 32' 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 °C to 35 °C with the highest in March and April (Kowal and Knabe, 1972).

Experimental Animals, Feed Materials and Experimental Procedure

The experimental feed materials were cashew nut shell, bamabara nut offal, maize offal, table salt, rice offal, fish offal meal, wood ash, bone-meal and bamboo leaves. The cashew nut shell was collected from the Cashew Kernel Processing Factory, Kogi State University, Anyigba. The cashew nut shell was pounded 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, Anyigba campus.

Sixteen (16) yearling West African dwarf bucks with weight range of 9.80 to 10.00 kg and aged about 12 months old, were sourced from Anyigba and its environs. They were conditioned to stability by feeding them adequately for 1 week. The goats were ear-tagged for identification and were randomly divided into 4 treatments of 4 goats each. The experiment lasted for 63 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 (Table 1). The Bamboo leaves were fed at 250 g/goat/day on cut and carry basis after wilting for 24 hours to reduce the moisture content. 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.

Table 1: Composition of Experimental Diets (% DM)

Ingredients	Composition/Treatments			
	T ₁	T ₂	T ₃	T ₄
Cashew nut shell	0.00	5.00	10.00	15.00
Maize offal	22.00	18.00	14.00	10.00
Bambara nut offal	54.00	54.00	54.00	54.00
Fish offal meal	5.00	5.00	5.00	5.00
Rice offal	14.00	13.00	12.00	11.00
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	18.40	18.15	18.05	17.90
Crude fibre	15.75	15.95	15.90	16.30
ME (Kcal/kgDM)	2890	2930	2955	2980

Digestibility Procedure

In the last two weeks (14 days) of the feeding trial, each animal was moved into a metabolic crate. Faecal collection began after an adjustment period of one week (7 days) in the metabolic crates. Faecal collection from each

animal (which lasted 7 days) were bulked, oven dried, and pooled for each treatment, weighed and samples analysed for their proximate constituents and thereafter used to compute dry matter and nutrient digestibilities using the formula:

$$\text{Nutrient Digestibility (\%)} = \frac{\text{Nutrient in feed} - \text{Nutrient output}}{\text{Nutrient in Feed}} \times 100$$

Chemical Analysis

Samples of experimental diets, 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 were 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 and ash 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 treatment means were separated by Least Significant Difference (LSD) using SPSS (2015).

Results and Discussion

Proximate Composition of Supplement Diets and Bamboo Leaves

The proximate composition of supplement diets and Bamboo leaves is presented in Table 2

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

Nutrients	Treatments/Diets				
	T1	T2	T3	T4	
Bamboo					
Crude protein	18.45	18.05	18.00	17.95	13.00
Crude fibre	15.10	15.30	16.05	16.75	20.50
Nitrogen free extracts	48.15	45.80	46.88	45.90	40.50
Ether extracts	5.05	6.08	8.54	10.01	4.50
Ash	7.75	7.45	6.90	6.70	21.50
Dry matter	94.50	94.70	94.85	94.55	65.00
Acid Detergent fibre	16.44	17.65	19.20	17.05	17.88
Neutral Detergent fibre	30.36	30.33	30.53	29.65	31.00
Cellulose	10.30	10.70	11.25	10.80	11.65
Hemicellulose	12.75	12.45	11.58	12.50	11.80
Lignin	6.11	6.79	6.90	6.88	8.50

Dry Matter and Nutrient Digestibility

The dry matter and nutrient digestibility values for yearling West African dwarf goats fed diets containing graded levels of cashew nut shell is presented in Table 3. Dry matter, organic matter, Crude protein, nitrogen free extracts and ether extract digestibilities were not significantly ($p > 0.05$) different from one another.

The dry matter digestibility of 76.30 – 79.15% obtained in this study were higher than the 65.20 % - 67.80% reported by Arigbede *et al.*, (2012) for West African Dwarf bucks fed cassava leaf-maize offal based-diets, but lower than 91.44 % to 95.44 % reported by Okpanachi (2014) for West African Dwarf Goats fed cashew pulp meal based diets, as well as 87.88 – 88.06% obtained by Adebisi *et. al.* (2016) for West African dwarf goats fed *Panicum maximum* supplemented with *Gmelina arborea* leaf-

mixture. These disparities could be due to the nature of supplements and forages fed to the goats. The crude fibre digestibility ranged from 48.65 – 59.72, the values decreased steadily from T1 to T4, the values were significantly ($P < 0.05$) different from each other for all the treatments. The increasing levels of ether extracts of diets T₂, T₃ and T₄ (i.e. all above 6%) could be responsible for the decreasing crude fibre digestibility. Maithison *et al.* (1997) reported a decrease in crude fibre digestibility when ether extracts level in ruminant diets exceeded 6%. The dry matter digestibility values obtained in this study qualifies the experimental diets as suitable ruminant diets. Preston (1986) had reported that for any diet to be considered a ruminant diet, it should have a dry matter digestibility of 40 - 50 %. The digestibility values for T1 were generally better than those of other treatments.

Table 3. Dry Matter and Nutrient Digestibility (%) of Yearling West African Dwarf Goats Fed Bamboo Leaf and Supplement Diets Containing Graded Levels of Cashew nut Shell.

Nutrients	Treatments/Diets				SEM
	T ₁	T ₂	T ₃	T ₄	
	(0 % CNS)	(5 % CNS)	(10 % CNS)	(15 % CNS)	
Dry matter	79.15	77.84	76.30	76.50	2.75 NS
Organic matter	73.99	71.42	72.90	73.60	2.05 NS
Crude protein	82.77	81.60	81.05	80.00	2.00 NS
Crude fibre	59.72 ^a	55.40 ^b	54.35 ^b	48.65 ^c	2.45*
Nitrogen free extract	73.85	72.80	73.00	71.65	3.01 NS
Ether extracts	90.00	89.65	89.35	88.45	1.99 NS

a, b,c Means on the same row with different super scripts differ significantly (P<0.05).
 NS= Not Significant (P<0.05) * Significant (P>0.05)
 SEM Standard Error of the Means

Performance Characteristics of Experimental Animals

The performance characteristics of the experimental goats is presented in Table 4 All the performance parameters determined were not significantly (P>0.05) different from one another. The values also did not follow any particular trend for all the performance parameters determined.. This result was at variance with the reports of Okolo *et.al.*(2012), Ocheja *et.al.*,(2018) and Ocheja

et.al.(2020) who all obtained significant (P>0.05) differences in nearly all the performance parameters evaluated with growing West African dwarf goats fed supplement diets containing graded levels of cashew nutshell. The observed discrepancies may be due to the levels of inclusion of cashew nutshell in the supplement diets used in the studies. Treatment 1 (T1) had better numerical values for nearly all the performance parameters measured.

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

Parameters	Treatments/Diets				SEM
	T ₁ (0 % CNS)	T ₂ (5 % CNS)	T ₃ (10 % CNS)	T ₄ (15 % CNS)	
Initial weight (kg)	9.90	9.80	10.00	9.85	0.07
Final weight (kg)	11.60	11.55	11.70	11.50	0.95
Total weight gain (kg)	1.70	1.75	1.70	1.65	0.90
Daily supplement intake (g)	150	150	148	145	1.35
Daily forage intake (g)	240	245	240	242	2.62
Total daily feed intake (g)	390.00	395.00	398.00	387.00	6.75
Feed conversion ratio	14.43	14.51	14.75	14.77	0.77

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

Conclusion

The digestibility values obtained indicated that the diets were suitable ruminant diets. Fifteen percent (15%) level of inclusion of cashew nutshell in supplementary diets for yearling West African dwarf goats produced optimum feed intake, growth performance and digestibility values. Thus, fifteen percent (15%) level of inclusion of cashew nut shell is recommended in supplementary diets for yearling West African dwarf goats for optimum performance and digestibility.

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