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EFFECT OF FEEDING WEST AFRICAN DWARF GOATS DIETS CONTAINING CORNCOB WITH UREA TREATMENT AT VARYING LEVELS ON NITROGEN UTILIZATION

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ABSTRACT

Good nutrition is essential for optimum performance of ruminant animals. Conversely, poor nutrition is one of the main constraints of livestock productivity in Sub-Saharan Africa as feed resources are limited in quantity and quality, hence the need to adopt the usage of agricultural wastes become necessary especially after subjecting them to some treatments. The study investigated the effect of feeding West African Dwarf (WAD) goats diets containing corncob with urea treatment at varying levels on nitrogen utilization. Sixteen (16) weaned and growing WAD bucks were used for the study. The animals (4 bucks/treatment) were randomly allotted to different dietary treatments which were formulated with varying inclusion levels of corncob treated with urea at 1.5%, 2.0% and 2.5% as CUT1.5, CUT2.0 and CUT2.5, respectively, while CUT0 had no corncob with urea treatment. The goats were fed at 5% of their body weight. Data were collected on feed intakes (experimental diets and Guinea grass); urine and faeces excreted. Data obtained were subjected to one-way analysis of variance at 5% probability level. Results obtained indicated that total nitrogen intake (7.89g/day), urinary nitrogen (1.11g/day), total nitrogen excreted (3.34g/day), nitrogen absorbed (NA, 5.75g/day), Nitrogen retention (NR, 4.64g/day), Metabolic NA (3.71g/day/W^{0.75}) and Metabolic NR (3.16g/day/W^{0.75}) were highest ($P < 0.05$) for CUT0 compared to other treatment groups. It could be concluded that feeding of diet without corncob treated with urea (CUT0) to WAD goats had the best nitrogen utilization values compared to other dietary treatments.

Keywords: Nitrogen absorbed, Nitrogen retention, Nitrogen digestibility, Urea treatment, Goats

INTRODUCTION

Agricultural wastes and agro-industrial biomass are produced in large quantities in the globe annually. Although, these materials are potential feed resources for ruminant animals, their use is limited due to high fibre components (Jaromi *et al.*, 2011) with low crude protein. Vast quantities of crop residues are generated as a result of agricultural practices. These residues pose both disposal and environmental pollution problems. This results in the loss of nutritionally valuable materials which when processed could improve animal feeds and human nutrients (Shereen *et al.*, 2013). Recent trends in animal nutrition in Nigeria based on the principle of minimum input indicate focus of attention on the utilization of non-conventional sources of feed such as agricultural by-products for ruminant feeding (Fasae *et al.*, 2007). Crop residues are the most abundant and readily available feed resources for livestock production (Belete, 2006). However, crop residues especially cereal by-products (e.g. corncobs) are characterized by low nutrient content and digestibility as well as poor voluntary consumption by ruminant animals (Preston and Leng, 1987). The use of urea, lye solution and poultry litter to upgrade the nutritive value of straws and other low quality crop residues have been spread worldwide in the last three decades (Chineke *et al.*, 2013). Urea is an inexpensive and valuable substitute for natural proteins in the ration. The study therefore investigated the effect of feeding West African Dwarf goats managed intensively diets containing corncob with urea treatment at varying levels on nitrogen utilization.



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MATERIALS AND METHODS

Experimental site

The study was conducted at the Small Ruminant Unit of the Directorate of University Farms, Federal University of Agriculture, Abeokuta, Ogun State, Nigeria. Farm area lies within Latitude 7°10'N, Longitude 3°2'E and Altitude 76mm above sea level (Google Earth, 2021).

Preparation of corncob treated with urea

The urea treated corncobs used for the study were prepared following the procedure of Oderinwale *et al.* (2021). The steps include: Packing of corncobs, Sun-drying, Sorting, Crushing, Sieving, Preparation of urea solutions, Mixing of crushed corncobs with respective urea solution, Bagging, Compressing, Fermentation, Air-drying, and Incorporation/Storage.

Experimental animals' management

Sixteen weaned and growing West African Dwarf goats were used for the study. The animals were tagged and placed in individual cages with slatted wooden floor equipped with individual drinking and feeding troughs. The animals (4 goats/treatment) were randomly allotted to four diets. Each animal was fed at 5% of their body

weight for a period of 12 weeks. The animals were fed concentrate at 8:00am and Guinea grass at 1:00pm. Known quantities of feed were fed, while leftovers were weighed daily to determine feed consumed/goat. Water was supplied *ad libitum*. The experimental diets are presented in Table 1.

Table 1: Gross composition (%) of experimental concentrate diets

Ingredients	CUT0	CUT1.5	CUT2.0	CUT2.5
Maize	10.00	10.00	10.00	10.00
Corn Bran	20.00	20.00	20.00	20.00
Wheat offal	30.00	0.00	0.00	0.00
Corn cob	0.00	30.00	30.00	30.00
Palm kernel Cake	30.00	30.00	30.00	30.00
Bone	3.50	3.50	3.50	3.50
Limestone	3.00	3.00	3.00	3.00
Salt (NaCl)	3.00	3.00	3.00	3.00
Grower's premix	0.50	0.50	0.50	0.50
Total	100	100	100	100

Nitrogen utilization procedure

The goats were put in individual metabolic cage for fourteen days after the feeding trial. The first seven days for acclimatization, while collection of faeces and urine was done before feeding in the morning for the remaining seven days. Weight of faeces/goat was taken using a sensitive scale after which 10% aliquot was collected and oven-dried at 60°C to a constant weight, milled to pass through a 1mm sieve and kept for laboratory analyses. Urine from each goat was measured with a measuring cylinder after which 10% aliquot was taken into a sample bottle containing few drops of 10% H₂SO₄ to prevent nitrogen volatilization.

Nitrogen utilization formulae

Nitrogen intake (g/day) = Average feed intake on dry matter basis x Nitrogen in the feed

Faecal nitrogen (g/day) = Average faeces voided on dry matter basis x Nitrogen in the faeces

Urinary nitrogen (g/day) = Average urine excreted x Nitrogen in the urine

Total nitrogen output (g/day) = Faecal nitrogen + Urinary nitrogen

Nitrogen balance (g/day) = Nitrogen intake – Total nitrogen output

Nitrogen absorption (g/day) = Nitrogen intake – Faecal nitrogen

Nitrogen retention (%) = $\frac{\text{Nitrogen balance}}{\text{Nitrogen intake}} \times 100$



Laboratory analysis

Feed and faecal samples were analysed for proximate components according to standard method of AOAC (2007). Fibre fraction contents were determined by the methods of Van Soest *et al.* (1991). The urine was analysed for its nitrogen content according to AOAC (2007).

Statistical analysis

Data obtained were subjected to one-way Analysis of variance in a completely randomized design using SAS (SAS, 2012) at 5% probability level. The significant means were separated using Duncan's Multiple Range Test of the same package.

RESULTS AND DISCUSSION

The proximate analysis and fibre fraction components of the experimental concentrate diets and the Guinea grass fed to the goats for the study is presented in Table 2.

Table 2: Proximate and fibre compositions of concentrate diets and Guinea grass fed to the goats

Parameters (%)	Experimental concentrate diets				Guinea Grass
	CUT0	CUT1.5	CUT2.0	CUT2.5	
Dry matter	93.00	91.00	92.00	91.00	88.10
Crude protein	11.11	6.50	8.45	10.07	9.40
Ether extract	12.33	12.00	12.67	13.00	2.20
Ash	4.93	4.65	4.87	5.02	10.70
Crude Fibre	4.57	7.73	7.44	8.77	35.60
Nitrogen Free Extract	67.06	68.72	66.57	63.40	42.10
Organic Matter	95.07	95.35	95.13	94.98	89.30
Neural Detergent Fibre	58.67	58.67	60.00	59.33	60.41
Acid Detergent Fibre	34.67	36.67	34.67	32.00	37.84
Acid Detergent Lignin	9.33	8.67	9.33	10.67	20.71
Hemicellulose	24.00	22.00	25.33	27.33	22.57
Cellulose	25.33	28.00	25.33	21.33	17.13
*Metabolizable energy (MJ/kg DM	13.22	13.24	13.23	13.19	12.77

*Calculated using De Boever *et al.* (1997) equation; CUT0 is concentrate diet without corncob (control)

CUT1.5 is concentrate diet with corncob with urea treatment at 1.5%; CUT2.0 is concentrate diet with corncob with urea treatment at 2.0%; CUT2.5 is concentrate diet with corncob with urea treatment at 2.5%

Nitrogen utilization of West African Dwarf goats fed diets with or without corncob with urea treatment at varying levels is presented in Table 3. There were significant differences ($P < 0.05$) for all parameters determined on nitrogen utilisation except for nitrogen intake from Guinea grass; nitrogen lost through the faeces; and nitrogen digestibility. The insignificance in the faecal nitrogen among the treatments is contrary to the claim of Prvulovic *et al.* (2012) who reported that, concentrate diets high in crude protein change the pattern of nitrogen excretion towards increasing nitrogen excreted in faeces. This was contrary because CUT0 with the highest crude protein did not result into a proportionate increase in faecal voided for the study. Highest urinary nitrogen (1.11ml/day) recorded for CUT0 is in agreement with the report of Ibhaeze and Fajemisin (2015), which could be a pointer to the nitrogen intake by the animals in terms of crude protein in the diet, its digestibility/solubility thereby affecting the level of ammonia produced in the rumen and its overall utilization by the animals.

Nitrogen retention was highest in CUT0 and was lowest in CUT1.5. This could be as a result of the protein concentration in the diet and as well as highest ($p < 0.05$) total nitrogen intake by the animals. This result is supported by the report of Olorunnisomo (2007) who reported an increase in nitrogen intake and retention as the levels of protein in diets of sheep increased. The observed value of nitrogen retention/balance ranged from 2.54



to 4.64 g/day, where CUT0 had the highest value while CUT1.5 had the least value. The increment in nitrogen balance corroborates the reports of Fajemisin *et al.* (2012).

Table 3: Nitrogen utilization of West African Dwarf goats fed diets with or without corncob with urea treatments

Parameters	Experimental concentrate diets				SEM
	CUT0	CUT1.5	CUT2.0	CUT2.5	
Nitrogen Intake (gday ⁻¹):					
Concentrate	5.50 ^a	2.71 ^c	2.68 ^c	4.10 ^b	3.75
Guinea grass	2.48	2.25	2.54	2.16	2.36
Total Nitrogen Intake (gday⁻¹)	7.89^a	4.96^c	5.22^{bc}	6.26^b	6.11
Nitrogen Excretion:					
Faecal Nitrogen (gday ⁻¹)	2.22	2.00	1.85	2.28	2.09
Urinary Nitrogen (mlday ⁻¹)	1.11 ^a	0.42 ^b	0.29 ^b	0.49 ^b	0.58
Total Nitrogen Excreted (gday⁻¹)	3.34^a	2.43^b	2.14^b	2.76^{ab}	2.67
Nitrogen Absorbed (gday ⁻¹)	5.75 ^a	2.96 ^b	3.38 ^b	3.98 ^b	4.02
Nitrogen Retention (gday ⁻¹)	4.64 ^a	2.54 ^b	3.09 ^{ab}	3.50 ^{ab}	3.44
Metabolic Nitrogen Absorbed (gday ⁻¹ W ^{0.75})	3.71 ^a	2.23 ^b	2.49 ^b	2.82 ^b	2.81
Metabolic Nitrogen Retention (gday ⁻¹ W ^{0.75})	3.16 ^a	1.97 ^b	2.23 ^{ab}	2.56 ^{ab}	2.50
Nitrogen Digestibility (%)	72.06	58.15	64.44	63.68	64.58

^{abc} Means on the same row having different superscripts were significantly different ($p < 0.05$)

CUT0 is concentrate diet without corncob (control); CUT1.5 is concentrate diet with corncob with urea treatment at 1.5%; CUT2.0 is concentrate diet with corncob with urea treatment at 2.0%; CUT2.5 is concentrate diet with corncob with urea treatment at 2.5%; SEM is Standard Error of Means

CONCLUSION AND RECOMMENDATION

It could be concluded from the results of the study that concentrate diet without corncob (CUT0) had the highest values for all the parameters determined on nitrogen utilisation except for nitrogen intake from Guinea grass; nitrogen lost through the faeces; and nitrogen digestibility. Feeding of CUT0 is therefore recommended for use in ruminant production, especially goats. Similarly, concentrate diet with corncob with urea treatment at 2.5% (CUT2.5) compared favourably with CUT0 in almost all of these parameters. Consequently, CUT2.5 is a best alternative to CUT0 for feeding goats.

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