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NITROGEN UTILIZATION OF RED SOKOTO BUCKS FED SORGHUM HUSK SEPARATELY WITH CONCENTRATE, OR BLENDED IN A COMPLETE FEED

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ABSTRACT

The nitrogen utilization of Red Sokoto bucks fed sorghum husk separately with concentrate, or blended in a complete feed was assessed in a 10 weeks feeding trial. Sixteen (16) Red Sokoto bucks were randomly assigned to four (4) dietary treatments (T1, T2, T3 and T4), which contained four animals each in a completely randomized design (CRD). Bucks in T1 were offered sorghum husk (SH) separately and a maize offal based concentrate, whilst those in T2, T3, and T4 received a complete feed which contained 10, 20 and 30% sorghum husk (SH) respectively. The results shows that bucks in T1 had significantly ($p < 0.05$) higher nitrogen intake (18.50g/day) than those offered SH based complete feed (15-15.25g/day). Moreso, bucks in T1 had significantly ($p < 0.05$) higher nitrogen retention values (17.51g/day) than those in T2 (13.98g/day), T3 (14.67g/day) and T4 (14.41g/day). Although, there were no significant differences ($p > 0.05$) across the dietary treatments for nitrogen voided and the nitrogen efficiency ratio, bucks in T1 were observed to have higher values for these parameters. It was therefore inferred that the positive nitrogen retention observed in the animals is an indication that the diets could meet the nitrogen requirement for goats and hence can be used as a sustainable feed during periods of forage scarcity.

Key Words: Complete feed; Goat; Nitrogen utilization; Sorghum husk

INTRODUCTION

The steady supply of quality feeds and forages is one of the most important constraints to ruminant production in Nigeria. This problem has further been aggravated by higher population growth and urbanization, and in recent times, the farmer-herder crisis. This unpleasant situation is already decreasing further the animal protein intake of the average Nigerian which hitherto is far below his daily requirement.

To abate this scary trend, various ruminant production systems have been advocated by government at the Federal and state levels. Among others, the most popular include the anti-open grazing laws, the cattle colony, and the reactivation of cattle routes Nationwide. However, due to intense urbanization and declining confidence in governance, allocation of land for these production systems may not be enough. Moreso, seasonality of forages and competition between man and livestock for concentrate feed ingredients are among the issues that are needing urgent attention if such government policies would succeed.

Crop residues and agro-industrial by-products have been proven to be important ruminant feed resources. Due to their poor digestibility and nutritive value, their utilization is limited. Hence, efforts are being made to increase the efficient utilization of these low-grade feed resources to enhance economic livestock productivity. One very reliable means of increasing the feed value of crop residues is by incorporating them into total mixed ration (also called complete feed) and fortifying them with required nutrients (Sharma *et al.*, 2010). A complete feed/diet is a mixture of both roughages and concentrate ingredients, formulated and mixed thoroughly to form a balanced feed (Raja *et al.*, 2017). Incorporation of crop residues in a complete diet has been shown to be a very good alternative for ruminant feeding, because blend of feed ingredients offers little choice to the animal for selection of specific ingredients in feed. This study investigated the nitrogen utilization of Red Sokoto bucks fed sorghum husk separately with concentrate, or blended in a complete feed.



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MATERIALS AND METHODS

Location of Experiment Site

The study was carried out at the Sheep and Goat Unit of the Livestock Teaching and Research Farm, Joseph Sarwuan Tarka University, Makurdi. Makurdi is located between latitude 7°68'N and longitudes 8°62'E in the Guinea savannah Zone of West Africa. The area is warm with a minimum temperature range of 21.71±3.43°C and a maximum temperature range of 32.98±2.43°C and relative humidity ranges between 39.5±2.20 and 64.0±4.80% (TAC, 2011).

Collection and Preparation of Test Ingredients

Sorghum husk were collected from farmers in villages around Makurdi metropolis. The sorghum husks were there after dried, milled and a portion taken to the nutrition laboratory of the Department of Animal Nutrition for proximate analysis.

Experimental Diets

Four (4) diets were formulated and compounded to contain 0%, 10%, 20%, and 30% sorghum husk (SH) and these were designated T1, T2, T3 and T4 respectively as shown in (Table 1)

Table 1. Ingredients composition of experimental diets

INGREDIENT	EXPERIMENTAL DIETS			
	T1	T2	T3	T4
Maize	12.5	12.0	12.0	12.0
Maize offal	39.0	36.0	32.0	28.0
Soya bean meal	5.5	6.0	7.0	8.0
Brewer dried grain	25.0	20.0	15.5	6.0
Rice offal	19.0	13.0	10.0	5.0
Sorghum husk	0	10.0	20	30
Bone ash	2.5	2.5	2.5	2.5
Salt	0.25	0.25	0.25	0.25
Premix	0.25	0.25	0.25	0.25
Total	100	100	100	100

Experimental Animals and Management

A total of sixteen (16) growing red Sokoto bucks weighing 10.50kg on average were used for the experiment. The bucks were weighed and randomly distributed into four (4) treatment groups of four (4) bucks each in a completely randomized design. Each goat was housed in a separate compartment equipped with feed and water troughs. Animals were fed with the experimental diets and water ad libitum throughout the experimental period which lasted for 10 weeks. Each animal in T1 was offered sorghum husk in a separate trough and the concentrate in another trough. Animals in T2, T3 and T4 were offered a complete feed which contained 10, 20 and 30% SH respectively.

Data Collection and Laboratory Analysis

Samples of sorghum husk, concentrate diets, faeces and urine were taken to the Nutrition Laboratory of Department of Animal Nutrition for proximate composition determination.

The results of the proximate composition were used to derive data on nitrogen intake, nitrogen voided, nitrogen retention and nitrogen efficiency ratio using the following formula:

Nitrogen intake = [%Crude protein in feed x Feed intake per day] ÷ 6.25

Nitrogen voided = [(%Crude protein in faeces x amount of faeces voided per day) ÷ 6.25] + [%Nitrogen in faeces x volume of urine voided]

Nitrogen retention = Nitrogen intake – Nitrogen Voided

Nitrogen efficiency ratio = nitrogen intake ÷ daily feed intake



Statistical Analysis

All data generated from the experiment were subjected to one-way analysis of variance (ANOVA) in a completely randomized design (CRD) using SPSS Ver. 21.

RESULTS AND DISCUSSION

Proximate Composition of Concentrate Diets and Sorghum husk Fed to Red Sokoto Bucks

The crude protein values of the experimental diets ranged from 12.00 -12.63%. The CP values of the compounded diets in this study were comparable to 10 - 12% CP required by ruminants for optimum growth (Gatenby, 2002). This therefore suggests the adequacy of the diets to meet the protein requirement of goats. The CP values were lower than 13.20 - 18.44% CP reported by Saka (2016) for WAD goats fed diets containing graded levels of malted sorghum sprout mixed with pineapple waste-based diets, 15.40 - 16.20% reported by Ibrahim and Yashim. (2014) for red Sokoto goats fed Sabara leaf meal, and values of 15.03 - 15.67% for red Sokoto bucks fed varying levels of Irish potato peels (Yashim, *et al.*, 2016). The CF values seemed to increase slightly from T1 – T4 with increase in percentage of sorghum husk in the complete feed. The crude fibre (CF) values ranged from 13.86-17.26% and were within the recommended range for goats. The ash composition which represents the mineral concentration of the diets was relatively the same (3.02 -3.44%). Like the CF, values increased from T1 - T4 with increasing levels of sorghum husk in the diets. This is an indication that sorghum husk contains appreciable amount of inorganic minerals. The values of .3.02 – 3.44% obtained were however lower than 4.18-10.27% reported by Zakka *et al.*, (2019) for red Sokoto goats fed diets containing two varieties of sorghum hay, and 6.34 - 9.34% reported by (Odoemelam *et al.*, 2014) for WAD bucks fed *Panicum maximum* and Bambara nut seed meal. Observed values of ash were within the recommendation for goats (NRC, 1994). The Nitrogen Free Extract (NFE) values were between 63.14- 65.03% indicating that the diets contained appreciable fermentable carbohydrate available for optimum rumen microbial activities and energy production for the animals (Yashim *et al.*, 2016).

The crude protein (CP) composition of the SH was 4.5%. This CP value is comparable to 4.6% reported by Tian *et al.* (2010) and 4.90% (Addass *et al.*,2011) for SH. The 31% crude fibre (CF) composition of SH reported in this study was comparable to 32% reported by Addass *et al.* (2011). SH was observed to have appreciable quantity of inorganic minerals (2%) and rich in fermentable carbohydrates (62.34%)

Table 2. Proximate Composition (%) and Energy of Concentrate Diets and Sorghum husk Fed to Red Sokoto Bucks

Proximate Composition	EXPERIMENTAL DIETS				Sorghum husk
	T1	T2	T3	T4	
Crude Protein	12.63	12.51	12.00	12.01	4.5
Crude Fibre	13.86	14.71	15.88	17.26	30
Ether Extract	3.76	3.30	2.82	3.44	0.16
Ash	3.02	3.14	3.28	3.44	2.0
Nitrogen Free Ether	65.03	64.64	64.32	63.14	62.34
Metabolizable Energy (kcal/kg)	2312.38	2204	2087.34	1962.32	1050

T1=0% Sorghum Husk; T2=10% Sorghum Husk; T3=20% Sorghum Husk; T4=30% Sorghum Husk

Nitrogen Utilization of Red Sokoto Bucks fed the Experimental diets

Table 3 presents the nitrogen utilization of red Sokoto Bucks fed the experimental diets. Nitrogen intake of bucks in T1 was significantly ($p < 0.05$) higher (18.50g/day) than those in T2, T3 and T4. The value of nitrogen intake for these treatments (T2 – T4) ranged from 15.00 to 15.50g/day. These values could be a reflection of the CP content of the diets since a direct relationship between CP content of diet and nitrogen intake has been established (Tolera and Sundstol, 2000). The values obtained in this study were higher than 1.95 – 7.75g/day reported by Gabriel and Fajemisin (2019) for goats fed cassava peels with urea-molasses multinutrient blocks supplements



but low when compared to 22.11 – 26.53g/day (Ibrahim and Yashim, 2014) for Red Sokoto goats fed lime treated maize cobs. The nitrogen intake of animals in all the treatments was sufficient for optimum microbial protein synthesis (McDonald *et al.*, 2010)

Nitrogen retention, the proportion of nitrogen utilized by ruminants from the total nitrogen intake for body processes, was significantly ($p < 0.05$) different across dietary treatments. Bucks in T1 retained significantly higher nitrogen (17.51g/day) than those fed sorghum husk based complete feed. The nitrogen retention value was least in T2 (13.98g/day). Higher retention values in T1 could be attributed to the dietary protein concentration and higher nitrogen intake since it has been reported that the more nitrogen consumed and digested the more nitrogen retained and vice versa (Olorunnisomo, 2002). Moreover, the positive nitrogen retention values observed in this study signified that the diets were adequate in their supply of nitrogen to the rumen. The result further showed that Nitrogen efficiency ratio (NER) which ranged from 0.28 (T4) to 0.48 (T3), was not significantly ($p > 0.05$) different across dietary treatments. T3 however had the highest NER value (0.48). NER is essential in evaluating nitrogen quality in feed.

Table 3. Nitrogen Utilization of Red Sokoto Bucks fed the Experimental diets

Parameter	Treatments				SEM	p-Value
	T1	T2	T3	T4		
Daily weight gain (g)	55.0	37.50	32.50	55.00	7.01	0.593
Nitrogen intake (g/day)	18.50 ^a	15.00 ^b	15.50 ^b	15.25 ^b	0.44	0.02
Nitrogen voided (g/day)	1.01	1.02	0.83	0.84	0.04	0.120
Nitrogen retention (g/day)	17.51 ^a	13.98 ^b	14.67 ^b	14.41 ^b	0.43	0.002
Nitrogen efficiency ratio	0.33	0.40	0.48	0.28	0.01	0.053

^{a, b} means with different superscript along the same row are significantly different at $p < 0.05$, SEM = Standard error of mean; T1=0% Sorghum Husk; T2=10% Sorghum Husk; T3=20% Sorghum Husk; T4=30% Sorghum Husk

CONCLUSION AND RECOMMENDATION

Based on the findings of this study, it can be inferred that incorporating up to 30% sorghum husk in a complete feed will significantly reduce nitrogen intake, nitrogen retention and nitrogen efficiency ratio of Red Sokoto goats. However values obtained will not be below requirements for optimum performance of the animals. Further studies on ways of improving utilization of sorghum husk in complete feed by goats should be considered.

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