NITROGEN BALANCE IN GROWING RED SOKOTO BUCKS FED SORGHUM HAY WITH OR WITHOUT CONCENTRATE

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ABSTRACT
Availability of forages for ruminant feeding and the quality of the forage which the animal utilizes continues to be studied. This research was conducted to determine the palatability of Sorghum hay in relation to its nutritive value by evaluating the chemical composition and the nitrogen balance in red Sokoto bucks. Animals were assigned to two dietary treatment groups such that each group consisted of three red Sokoto bucks. Those in treatment 1 (T1) were given sole sorghum hay at 2.5% of their body weight while those on treatment two (T2) were given sorghum hay and concentrates in a ratio of 60:40 (2.5%) of their body weight. The result of the experiment shows that the nitrogen balance of bucks in T2 was significantly ($p < 0.05$) higher than those in T1. In conclusion feeding sole sorghum bicolor hay was not adequate to meet the nutritional requirement of red Sokoto bucks. However, supplementation of sorghum bicolor hay with concentrate at 60:40 ratios increased nitrogen retention.
Keywords: Nitrogen balance, Red Sokoto, Sorghum
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INTRODUCTION
Crop residues are readily available and cheap in the tropics. The abundance of these residues could mean reduction of concentrate cost in the rations since available residues that are nutritious and palatable could be utilized. An important residue that can be found on the sorghum plant is the hay and chaff. Sorghum hay is obtained by cutting and drying Sorghum when it is between the soft-dough stages to avoid wastages (Sutti, 2000). This could encourage the cultivation of forage crops which has not been properly harnessed for the purpose of feeding small ruminants in Nigeria.

MATERIALS AND METHODS
The study was conducted to determine the palatability of Sorghum hay in relation to its nutritive quality by evaluating the chemical composition and the nitrogen balance when it is fed to red Sokoto bucks. The experiment was conducted from October to December 2016 at the experimental unit of the small ruminant research program of the national animal production research institute (NAPRI) Ahmadu Bello University Shika, Zaria. Animals were assigned to two dietary treatment groups such that each group consisted of three Red Sokoto Bucks. Those in treatment 1 (T1) were given sole sorghum hay at 2.5% of their body weight while those in treatment two (T2) were given sorghum hay and concentrates in a ratio of 60:40 at 2.5% of their body weight.

Animals were housed in individual feeding pens (metabolism cages) and fed their treatment diets. They were allowed an adjusted period of 14 days to fine-tune to the feed and metabolism cages. Animals were weighed before the commencement of the experiment and were weighed after the adjustment period prior to commencement of data collection. The bucks' mean body weight was 13.5kg and aged between 12 and 21 months of age. Four days before the experiment commenced, all the animals were de-wormed using albendazole (eagle chemical co LTD). The experiment was of completely randomize design in which the red Sokoto bucks were distributed into two groups of four animals per group. The bucks were weighed and then put into metabolism cages equipped for faecal and urine collection. Fourteen days adjustment period was allowed before faecal and urine collection was done for a period of twenty one days. For each animal, total daily urine output was collected into

plastic bottles containing10ml of 0.05N Sulphuric to prevent ammonia loss from the urine [2]. Total urine collected was measured and 10% of each day's collection was taken, bulked at the end of collection period and stored in a freezer at 0^0C until it was required for nitrogen analysis (Ajayi, 2011).

Total faecal output from each animal was collected and weighed fresh and 20% of each day's collection was taken and dried in the oven for 48 hours at 70^0c and its weight recorded before storing for proximate analysis. Water intake was also collected by using calibrated 9 liters bucket.

2.1 Experimental Diets

Sorghum hay was fed as basal diet supplemented with concentrates consisting of maize offal (MO), wheat offal (WO), cotton seed cake, bone meal and salt. The CP of the concentrate is 13.63%. The chemical composition of the dietary ingredients and concentrates are presented in table 1, while table 2 shows the proximate composition of the experimental diets.

Table 1: Composition of concentrate supplement fed red Sokoto bucks

Ingredients	Percentage %
Maize Offal	40.0
Wheat Offal	31.5
Cotton Seed Cake	25.0
Bone Meal	2.5
Salt	1.0
Total	100
Crude Protein	13.63
Metabolisable Energy (kcal/kg)	2679.0

Table 2: Proximate composition of experimental feed stuffs

Parameters	T1	T2
Dry matter	95.20	93.38
Crude protein	5.36	16.13
Crude fiber	28.66	18.40
Ether extract	2.14	3.19
Ash	2.36	6.56
NFE	61.48	55.72
ADF	29.87	20.06
NDF	52.22	18.70

NFE= Nitrogen free extract, ADF= Acid detergent fibre, NDF= Nuetral detergent fibre.

Feaces were analysed for dry matter (DM), crude fibre (CF), crude protein (CP), ether extract (EA) and ash using an established procedure [(4)]. Nitrogen free extract (NFE) was calculated by difference NFE=100-(CF+CP-EE+ASH). Acid detergent fibre (ADF) and neutral detergent fibre (NDF) were determined according to the method of Van-Soest *et al*. (1991). Urine was analysed for urinary nitrogen and crude protein using Kjeldahl procedure (AOAC, 2005). Samples of experimental diets, orts and feaces were ashed by charring in muffled furnace at 500^0C for six hours. Organic matter (OM) was obtained as the difference between the dry matter and ash content.

2.2 Statistical analysis

Data collected on nitrogen intake and coefficient of nitrogen balance was analyzed by ANOVA using General Linear Model procedure of SAS (2008). Significant treatment means were separated using Duncan's Multiple Range Test (1955).

RESULTS AND DISCUSSION

Table 3: Chemical composition and metabolisable energy of experimental diets fed to growing red Sokoto bucks

	Sorghum Hay Bicolor: Concentrate		
Parameter (%)	100:0 Sorghum hay	Concentrate (NAPRI)	60:40 Sorghum hay + concentrate
Dry matter	95.20	91.11	93.38
Organic matter	92.84	85.22	86.82
Crude protein	5.36	18.94	16.13
Crude fibre	28.66	8.01	18.40
Either extract	2.14	4.60	3.19
Ash	2.36	5.89	6.56
Nitrogen free extract	61.43	62.56	55.72
M. E (Mj/kg)	11.53	11.68	11.56
Acid detergent fibre	29.87	26.12	20.06
Neutral detergent fibre	52.22	48.37	38.67

Table 3 shows the proximate composition of the experimental diets (sorghum bicolor hay/ concentrate) mixture and concentrate supplement. The dry matter (DM) contents of the experimental diets containing sorghum bicolor hay/concentrate mixture at 100:0 and 60:40 ratio are 95.20% and 93.38% respectively. The CP content was 5.36% in 100:0 diet and 16.13% in 60:40 diet. The CF content was 28.66% in 100:0 diet and 18.40% in the 60:40 diet. Ether extract for 100:0 and 60:40 were 2.14% and 3.19% respectively. The ash content was 2.36% in 100:0 diet and 6.56% in 60:40 diet.

The concentrate supplement used for the experiment had a crude protein (CP) content of 18.94%, dry matter (DM) of 91.11%, organic matter (OM) content of 85.22%, crude fibre (CF) of 8.01%. Nitrogen fibre extract (NFE) of 62.56% and metabolisable energy (ME) of 11.68% MJ/kg DM.
The ME content was similar in all treatment with 11.53MJ/kg DM in 100:0 and 11.56MJ/kg DM in 60:40. However, the highest values of 29.87% acid detergent fibre 52.22% neutral detergent fibre and 16.70% lignin were observed in 100:0 diet while low values of 20.06% acid detergent fibre, 38.67% neutral detergent fibre and 8.44% lignin were observed in 60:40 diet.

Table 4: Nitrogen balance of red Sokoto bucks fed Sorghum Hay: Concentrate ratio

	Sorghum Hay Bicolor: Concentrate		
Parameter (g/day)	100:0	60:40	SEM
	Sorghum hay	Sorghum hay + concentrate	
Nitrogen intake	3.03[b]	10.96 [a]	0.21
Feacal nitrogen loss	1.90[b]	2.36[a]	0.20
Urinary nitrogen loss	0.45[b]	1.06[a]	0.20
Total nitrogen output	2.35[b]	3/.42[a]	0.34
Nitrogen absorbed	1.14[b]	8.60[a]	0.20
Nitrogen retained	0.69[b]	7.55[a]	0.33
Nitrogen retained as % intake	23.87[b]	68.76[a]	6.71
Nitrogen absorbed as % intake	38.15 [b]	78.46[a]	4.31

[ab]; means with different superscripts differed significantly ($p<0.05$), SEM = standard error of mean.

Table 4 reveals the nitrogen balance of red Sokoto bucks fed sorghum bicolor hay: concentrate ratio. The result showed that there were significant ($p<0.05$) differences in nitrogen balance parameters across all the treatment. There was an increase ($p<0.05$) in all parameter measured when concentrate was supplemented. There were 72%, 19%, 58%, 31%, 87%, 91%, 65% and 51% increase in nitrogen intake, feacal nitrogen loss, urinary nitrogen loss, total nitrogen output, nitrogen absorbed, nitrogen retained, nitrogen retained as % of intake in red Sokoto bucks fed 60:40 diets when compared with bucks fed 100:0 diet.
The DM content of sorghum bicolor hay concentrate mixture in Table 3 above is was above 91%. This might be due to the fibrous nature of the sorghum forage and cotton seed cake. The value of DM observed was higher than 92.5 and 91.56% reported by Ishiaku (2016) for sole sorghum almum. The CP content of sorghum bicolor hay/concentrate mixture increased with the inclusion of concentrate. The CP range from 5.36-16.13% in sole sorghum bicolor hay and sorghum bicolor hay supplemented with concentrate. The CP values observed in this study for 100:0 were lower than the requirement of 10-12% CP for sheep and goat (Wada *et al*., 2016) but above the requirement of the 60:40 diet. As argued by Munza *et al*. (2017), who stated that the low CP for sole sorghum bicolor hay may be attributed to the stage at harvest of the forage because CP content reduces as the plant advanced in age. The high CP in 60:40 diets might be due to the presence of cotton seed cake.

The CF of the diets, 28.66%, 8.01% and 18.40% were greater than the report of Ishiaku (2016) probably due to varietal difference. The neutral detergent fibre (NDF) was below 60.0% suggested by Munza *et al*. (2017) as critical limit for efficient utilization of roughages. The ME obtained ranged from 11.53-11.56MJ/kg DM. This was lower 12.17MJ/kg, reported by Ishiaku (2016).

Table 4 shows the nitrogen balance of red Sokoto bucks fed sorghum hay: concentrate ratio. The nitrogen balance parameter of Re d Sokoto Bucks fed 60:40 diets were significantly ($p<0.05$) higher than those fed 100:0. This is in line with Hassan *et al.* (2016) who reported that supplementation of protein source improve microbial nitrogen yield and retention with subsequent increase in the performance of growing red Sokoto Bucks.

The higher nitrogen absorbed and retained in Bucks fed (60:40) sorghum bicolor hay/concentrate could be (10.96%/day). Munza *et al.* (2017) stated that superior nitrogen absorbed and retained in Red Sokoto Bucks fed sorghum hay/concentrate mixture as compared to those fed sole sorghum hay might be due to the efficient utilization of nitrogen. Also, higher nitrogen retention (7.55g/day) absorbed in bucks fed 60:40 hay/concentrate mixtures indicated the favorable role of concentrate in post ruminal nitrogen metabolism and utilization compared to 100:0 (0.69g/day).

The nitrogen retention and absorbed as percentage intake were above 68.0%. This was higher than 47.98% reported by Yashim *et al.* (2014), but lower than 95.84% and 74.24% reported by Wada *et al.* (2016) and Ishiaku (2016).

The result of this study revealed that feeding sole sorghum bicolor hay was not adequate to meet the nutritional requirement of red Sokoto bucks. However, supplementation of sorghum bicolor hay with concentrates at 60:40 ratios increased nitrogen retention.

CONCLUSION AND RECOMMENDATION

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