Nitrogen utilization by male WAD sheep fed graded levels of boiled CST and SMD based diets

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Abstract

The study was carried out to investigate the nitrogen utilization by male West African Dwarf (WAD) sheep fed boiled Cocoa Seed Testa (CST) and Sorghum Malt Dust (SMD)-based diets. Twenty-eight male animals were divided into seven groups with similar average initial live weight in a completely randomized design. Each group contained four animals. The trial consisted of seven dietary treatments which comprised CST at 10, 20 and 30% levels, SMD at 10, 20 and 30% levels and a control. The trial lasted for 90 days. Data generated were subjected to a one-way analysis of variance. Apparent nitrogen intake (19.41g/d) and retention (9.67g/d) were significantly ($P < 0.05$) higher in the treatment with 20% SMD. Generally, dietary inclusion of CST and SMD improved the nitrogen intake by male WAD sheep with the best result from sheep fed 20% sorghum malt dust based diets.

Keywords : WAD sheep, nitrogen intake, diets, cocoa seed testa, sorghum malt dust

Introduction

The ultimate objective of the livestock industry is the conversion into animal products of food which is either inedible by man or is surplus for his immediate requirements. Forages with low crude protein cannot sustain live weight in animals and this necessitates supplementation with proteinous feedstuffs. Adegbola (1985) noted that ruminants could not meet their maintenance need on grass alone. The requirement for any nutrient is the amount of that nutrient which must be supplied in the ration to meet the needs of the animals. Such level of nutrient must be capable of meeting the requirement for maintenance of the animals (Awujoola, 1999). In sheep rations, the amount of protein is much more important than quality of protein since mature sheep like any other ruminant, use the naturally occurring protein and non-protein nitrogen (Urea) in their diets effectively (Clay,

2000). Aganga (1988) reported that the extent of protein degradation depends largely on the solubility of the feed, the physical form and the level of intake. Nitrogen is utilized by the ruminants for maintaining body tissues and also for growth processes and production. Ummuna *et al.* (1982) found that lambs fed soyabean meal (SBM) supplemented ration retained more nitrogen and those supplemented with urea alone had lower nitrogen retention than those supplemented with Corn Gluten Meal (CGM) alone or the CGM –urea combinations.

The present study investigated nitrogen utilization by WAD sheep fed graded levels of boiled CST and SMD based diets which are two readily available crop by-products.

Materials and Methods

Twenty-eight (28) West African Dwarf male sheep were used for the study. The sheep (aged 11-13 months) were sourced

from villages around Ijebu-Ode. The average live weight ranged between 10.08 and 10.66kg. The animals were dewormed with Levamisole[®] and dipped in diasuntol[®] solution to get rid of ectoparasites. The sheep were housed in disinfected and well ventilated pens. They were given feed (*Gliricidia sepium* and concentrate supplement) with free access to water for fourteen (14) days prior to the beginning of experiments in order to ensure uniform pre-experimental management.

Experimental Diets Preparation

Experimental diets used were made up of Cocoa Seed Testa (CST) and Sorghum Malt Dust (SMD) based diets as supplement to *Gliricidia sepium*. CST and SMD were boiled at 100 °C for 60 minutes to reduce the effects of anti-nutritional factors therein. Seven experimental concentrate diets were prepared using the cocoa seed testa and sorghum malt dust at 10, 20 and 30% respectively as shown in Table 1. The *Gliricidia sepium* leaves and branches were cut, chopped and sun dried for two and half hours to three hours to reduce moisture content before they were supplied to experimental animals. Twenty-eight male animals were divided into seven groups with similar average initial live weight in a completely randomized design. Each group contained four male animals. Animals were fed at 5% of their body weights in a trial that lasted for 90 days. The concentrate supplements were given to the animals in the morning while *Gliricidia sepium* was given to the animals in the evening.

Ten weeks into the feeding trials, two animals from each group were randomly selected and transferred into the metabolic cages modified for the collection of faeces and urine. The first 14 days were used to acclimatize the animals while the last seven days were used for the collection of faeces and urine for analysis. The total daily

faecal output for each animal was weighed before 10% of the sample was removed. The wet samples were dried at 65°C to constant weight and bulked for each animal for subsequent analysis. The urine samples were collected in container with 5% diluted H₂SO₄ to prevent volatilization and refrigerated till needed for analysis.

The results of nitrogen intake, excretion (faecal and urinary) and nitrogen balance were computed and subjected to a one-way analysis of variance using SPSS (1999). Differences between treatment means were separated using Duncan's Multiple Range Test of the same statistical package.

Results and Discussion

Highest nitrogen intake value was obtained in diet 5 (19.41g/d) but was not significantly ($P>0.05$) different from all other diets except diet 7 (control diet) where the lowest nitrogen intake was observed (15.93g/d). Nitrogen excretion in faeces and urine increased with increasing concentration of CST but decreased as the level of inclusion of SMD increased in the diets for faecal nitrogen. Also, there was an increase in the value obtained for urinary nitrogen and also a decrease in value obtained in control diet. Despite the decrease in the values obtained for faecal nitrogen in diets 4, 5 and 6 there was no significant ($P>0.05$) difference in the value obtained as experienced in diets 1,2 and 3 where we have the inclusion of CST.

The total nitrogen excreted ranged from 8.10 to 10.65g/d. There was a significant difference ($P<0.05$) in the nitrogen excreted among the treatments except diets 4, 5 and 7 but there was only numerical differences in diets 2, 4, 5 and 6. Nitrogen balance was lowest (5.28g/d) in the control while the highest value was obtained in diet 5 (9.67g/d). The nitrogen balance values were not really significantly ($P>0.05$)

Table 1: Composition of experimental diets fed to West African Dwarf sheep (%)

Ingredients	Diets						
	1	2	3	4	5	6	7
Cassava Root Meal	58	48	38	58	48	38	68
Boiled Cocoa Seed							
Testa	10	20	30	0	0	0	0
Boiled Sorghum Malt							
Dust	0	0	0	10	20	30	0
Wheat Offal	30	30	30	30	30	30	30
Premix*	1	1	1	1	1	1	1
Salt	1	1	1	1	1	1	1
TOTAL	100	100	100	100	100	100	100

Diet 1 = 10% inclusion of CST, Diet 2 = 20% inclusion of CST, Diet 3 = 30% inclusion of CST, Diet 4 = 10% inclusion of SMD, Diet 5 = 20% inclusion of SMD, Diet 6 = 30% inclusion of SMD, Diet 7 = 0% inclusion of SMD and CST

Table 2: Determined analysis of experimental diets (%)

	1	2	3	4	5	6	7
Dry matter	89.59	89.48	89.66	89.91	89.78	89.55	89.63
Crude protein	15.18	14.37	14.28	14.57	14.89	14.76	12.06
Crude fibre	15.38	15.41	15.58	14.71	14.93	14.99	15.16

Diet 1 = 10% inclusion of CST, Diet 2 = 20% inclusion of CST, Diet 3 = 30% inclusion of CST, Diet 4 = 10% inclusion of SMD, Diet 5 = 20% inclusion of SMD, Diet 6 = 30% inclusion of SMD, Diet 7 = 0% inclusion of SMD and CST

Table 3: Chemical Composition of the Test Ingredients (g/100gDM)

Parameters	Unboiled CST	Boiled CST	Unboiled SMD	Boiled SMD	<i>Gliricidiase pium</i>
Dry matter	89.67	87.96	89.36	88.06	30.12
Crude protein	18.67	11.48	15.68	12.97	19.30
Crude fibre	21.29	19.37	13.23	12.17	12.80
Ash	8.75	6.28	5.74	4.38	10.12
Ether extract	0.85	0.81	3.27	2.96	2.16
Nitrogen free extract	40.11	50.02	51.44	55.58	55.62
Gross energy (Kcal/g)	2.97	2.87	2.97	2.93	4.61

*Average of 2 replicates

Table 4: Chemical composition of boiled Cocoa Seed Testa and Sorghum Malt Dust based-diets (g/100gDM)

Parameters	Diets						
	1	2	3	4	5	6	7
Dry matter	89.59	89.48	89.66	89.71	89.78	89.55	89.63
Crude protein	15.18	14.37	14.28	14.57	14.89	14.76	12.06
Crude fibre	15.38	15.41	15.58	14.71	14.92	14.99	15.16
Ether extract	2.55	2.59	2.64	2.66	2.58	2.61	2.53
Ash	11.16	10.68	10.76	10.96	10.91	10.46	11.13
Nitrogen Free Extract	45.32	46.43	46.4	46.81	46.48	46.78	48.75
NDF	1.51	1.46	1.42	1.38	1.32	1.34	1.41
ADF	1.46	1.37	1.33	1.26	1.29	1.28	1.38
ADL	0.18	0.17	1.01	0.08	0.06	0.11	0.13

Diet 1 = 10% inclusion of CST, Diet 2 = 20% inclusion of CST, Diet 3 = 30% inclusion of CST, Diet 4 = 10% inclusion of SMD, Diet 5 = 20% inclusion of SMD, Diet 6 = 30% inclusion of SMD, Diet 7 = 0% inclusion of SMD and CST

affected by the dietary treatments except for treatments 3 (30%inclusion of CST) and 7 (control).

The N-intakes recorded in this study were higher than 13.85 ± 0.58 obtained for sheep fed *Panicum maximum* and also 10.05 ± 0.02 obtained for sheep fed *Vetiveria nigeritana* by Aderinola *et al* (2008). Higher nitrogen intake in the study was as a result of *Gliricidia sepium* used as basal feed because supplementation of ruminant feed with leguminous tree is a way of

alleviating nitrogen deficiencies (Mc Sweeney *et al.*, 1999).

Nitrogen balance and retention values were higher in all the diets and this shows the potentiality of CST and SMD in conjunction with other feed ingredients to enhance N utilization. Values obtained in this study were lower than previously reported values in sheep fed shrimp waste meal and soya bean stover based diets (Oduguwa *et al.*, 2007) but higher than those fed *Panicum maximum* as well as

Table 5: Nitrogen utilization by WAD sheep fed graded levels of boiled CST and SMD-based diets

Parameters	Diets							SEM
	1	2	3	4	5	6	7	
Nitrogen intake (g/d)	17.70 ^{ab}	18.28 ^a	17.47 ^{ab}	18.68 ^a	19.41 ^a	18.26 ^a	15.93 ^b	2.10
Nitrogen excretion (g/d)								
Faecal	6.49 ^b	7.28 ^b	8.87 ^a	7.94 ^{ab}	7.93 ^{ab}	7.23 ^b	8.92 ^a	1.01
Urinary	1.61 ^b	1.64 ^b	1.73 ^a	1.79 ^a	1.81 ^a	1.76 ^a	1.73 ^a	0.08
Total	8.10 ^b	8.92 ^b	10.60 ^a	9.73 ^{ab}	9.74 ^{ab}	8.99 ^b	10.65 ^a	1.58
Nitrogen balance	9.60 ^a	9.36 ^a	6.87 ^b	8.95 ^a	9.67 ^a	9.27 ^a	5.28 ^c	0.92
Nitrogen balance (g/dW ^{0.75})	5.45 ^a	5.35 ^a	4.24 ^{bc}	5.17 ^{ab}	5.48 ^a	5.31 ^{ab}	3.48 ^c	1.08
Nitrogen balance (%)	54.23 ^a	51.20 ^a	39.32 ^b	47.91 ^a	49.81 ^a	50.76 ^a	33.14 ^b	6.35

^{abc}Means on the same row having different superscripts are significantly different (P < 0.05)

Diet 1 = 10% inclusion of CST, Diet 2 = 20% inclusion of CST, Diet 3 = 30% inclusion of CST, Diet 4 = 10% inclusion of SMD, Diet 5 = 20% inclusion of SMD, Diet 6 = 30% inclusion of SMD, Diet 7 = 0% inclusion of SMD and CST

Vetiveria nigeritana (Aderionla *et al.*, 2008). The levels of nitrogen retention may be as a result of the digestibility of nutrients in all the diets containing CST and SMD. The result of the study shows that the experimental animals had the best nitrogen utilization on 20% sorghum malt dust based diets.

Conclusion

The levels of nitrogen retention may be as a result of the digestibility of nutrients in all the diets containing CST and SMD. Available nitrogen in the experimental diets was better utilized by the animals that consumed boiled Sorghum Malt Dust than those that consumed boiled Cocoa Seed Testa.

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