Rumen dry matter degradability of Yankasa rams fed *Brachiaria ruziziensis* (Congo grass) hay with different supplements

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Abstract

This study was carried out to determine rumen dry matter degradability of *Brachiaria ruziziensis* (Congo grass) by cannulated Yankasa rams fed different supplements (maize offal, wheat offal, groundnut hay). The research was carried out at Polycon Research farm, Federal Polytechnic Bauchi. Four (4) cannulated Yankasa rams were used for the study, each animal was replicated three times. In-sacco method involving small nylon bags containing experimental diets were inserted into the rumen of the cannulated rams at 0 hour, with inspection at 6, 12, 18 and 24 hours. Three (3) nylon bags marked with different colours containing different treatment diets were inserted into the cannula of the rumen to test for degradability, the small nylon bags were removed at different hours (6, 12, 18 and 24 hours, respectively) to test their degradability. The supplementary treatment diets were wheat offal (WO), Maize Offal (MO) and Groundnut Hay (GH) while *Brachiaria ruziziensis* was fed as basal diet. The rumen degradability showed significant difference ($P < 0.05$) across the treatments at different hours. Results from this study showed that MO had the highest value ($P < 0.05$) at 0 (27.20%), 6 (36.75%), 12 (38.62%) and 18 (46.15%) hours. However, WO had the highest value (64.72%) at 24 hours, but the value obtained was similar with 61.32% obtained for rams fed maize offal supplement. It was concluded from the result of this study that treatment T_2 (*Brachiaria ruziziensis* + Maize offal) had the best rumen degradability. It is therefore, recommended that maize offal should be supplemented with *Brachiaria ruziziensis* hay at 370g/day for better rumen degradability in ruminant animals.

Keywords: Yankasa rams, Nylon bag, Congo grass, *Brachiaria ruziziensis*, Degradability

Introduction

Brachiaria ruziziensis hay (Congo grass) is a valuable forage for livestock as it is palatable and has a good nutritive value. It is mainly used for direct grazing in open permanent pastures or under coconut plantations. *Brachiaria ruziziensis* can be made into hay or fed fresh to stalled ruminants (Schultze-Kraft *et al.*, 1992; Cook *et al.*, 2005). Congo grass is an important forage in the humid tropics with good nutritive value especially during the rainy season. Some authors (Ibrahim *et al.*, 1995; Herrero *et al.*, 2001; Meale *et al.*, 2012) reported crude protein concentration

between 8% and 15% and NDF concentration between 61 and 67%. However, drought has an adverse effect on its nutritive value, protein content can decrease from 16 to 5% and NDF and ADF increased from 71 to 76% and 34 to 48%, respectively between the rainy and dry season (Pamo *et al.*, 2007). Smith (1993) carried out investigation on forages, browse, crop residues and by-products in cattle, sheep and goats to assess nutritional value and potential use as feed. The 0, 2, 4, 8, 16, 24 and 48 hrs dry matter degradability obtained suggests that many items available in large amounts in humid

tropical Africa could be used as supplements to poor quality dry season forages. Wheat offal is a by-product of dry milling of common wheat (*Triticum aestivum* L.) and it is one of the major agro-industrial by-products used in animal feeding. It is suitable for livestock feeding and very palatable to most classes of animals (Fuller, 2004). Maize offal (MO) is a by-product of maize processing industries and alternative source of carbohydrates and can wholly or partially replace the conventional grains in ruminant feeding (Olorunnisomo and Ososanya, 2002). These by-products are cheap and readily available, hence can reduce the cost of feeding ruminants and minimize the effect of seasonal shortages of feeds for these animals. Costs of grains and their by-products have increased dramatically and they are often scarce in Nigeria, where commercial feeds are either not available or cost-prohibitive. Forages are readily available and cheap in the tropics; it is possible to reduce the cost of concentrates in the rations by utilizing forages that are nutritious and palatable to achieve a compromise between level of production and cost that is acceptable to producers (Eugene *et al.*, 2010).

Materials and method

Experimental site

The study was conducted at the Department of Animal Production Research Farm, Federal Polytechnic Bauchi. Bauchi lies between latitude 10,033° N and longitude 9,0031°E of the green which meridian. It is bordered by seven states, Kano and Jigawa to the north, Taraba and plateau to the South, Gombe and Yobe to the east and Kaduna to the west. It occupies a total area of 49,259.01sq kilometers, representing about 5.3% of the total land mass of

Nigeria. The state has projected population of about 4-6 million people. The state could be said to have an average of 507 people per square kilometer (NPC, 2006).

Animals and their managements

Four cannulated Rams (4), were allotted to four (4) treatments in a Completely Randomized Design (CRD). Experimental animals were allowed seven (7) days to adjust to feed and confinement before the actual start of the experiment. Yankasa rams weighing between 18.0 and 19.5kg and aged about 12 months were used for the study. During the adjustment period, the animals were de-wormed with *albendazole* de-wormer against internal parasites and *acaricide* was used for external parasite. The animals were fed supplement at 3% body weight, while *Brachiaria ruziziensis* hay, water and mineral salt lick were provided *ad libitum*. The crude protein of the feed was calculated (by multiplying the nitrogen value in feedstuffs 6.25% protein co-efficient) and the crude fiber component was determined by the method of (Van Soest, 1991).

Data collection

Rumen liquor was collected in the tenth week of the experiment by restraining the animal with fore and rear legs on ground in standing position and fluid was collected using a stomach suction tube before feeding the supplements and insertion of small nylon bag at 6, 12, 18 and 24 hours respectively. About 20 mLs of the fluid was drawn from each animal and transferred into sample bottle and the pH was taken by using a pocket size pH meter. Treatment diets were Treatment 1 (*Brachiaria ruziziensis* hay + wheat offal supplement), Treatment 2 (*Brachiaria ruziziensis* hay + maize offal supplement), Treatment 3 (*Brachiaria ruziziensis* hay + Groundnut hay supplement) and Treatment 4 (*Brachiaria ruziziensis* hay).

Table 1: Proximate composition of the experimental diet

Parameters (%)	Treatments			
	<i>B. ruzizensis</i> hay	Groundnut Hay	Wheat Offal	Maize Offal
Dry matter	90.40	88.00	89.00	92.50
Crude protein	7.68	15.31	16.00	11.00
Crude fibre	36.24	11.50	12.50	15.50
NFE	58.48	56.42	48.85	45.50
Ether extract	0.46	2.43	3.50	2.80

NFE= Nitrogen free extract

The *in sacco* method of rumen degradation which involves the sealing of feed samples within nylon bags which are then suspended in the rumen of sheep or cattle for varying periods of time followed by determination of the dry matter (DM) and protein in the washed residues was used in this study. The weight of small nylon bag was measured, then nylon bags containing three of each treatment diets were inserted into the cannula of the cannulated animal and then closed. One small nylon bag for each treatment at 6, 12, 18 and 24 hours was removed, washed thoroughly with water and then weighed with a sensitive scale to determine the weight of the degraded feed for estimation of rumen dry matter degradability. The washed nylon bag is then oven-dried at 100°C to constant weight and the dry matter determined, expressed as percentage of the original sample weighed.

Statistical analysis

The model of dry matter (DM) disappearance from the nylon bags proposed by McDonald (1981) was used to find out the degradation kinetic parameters “a” “b” and “c” and effective degradability in the exponential equation

$$Y = a + b(1 - e^{-ct})$$

Where:

Y = degradability at time(t), a =
 intercept, b = potentially
 degradable fraction
 c = rate of degradation of b

This method has proven to be simple, cheap and direct method of evaluating feed especially where laboratory apparatus is not available (Orskov *et al.*, 1980). The method gives a rapid estimate of the disappearance of the tested feed in the rumen and also allowed the disappearance of the tested sample to be studied with respect to time. This make it possible to link the degradation of a feed with its retention time in the rumen (Orskov *et al.*, 1980).

Results and discussion

Table 2 shows the experimental diets ratio fed to Yankasa Rams during the experimental period. *Brachiaria ruziziensis* was fed *ad libitum* in all the treatments. Wheat offal was supplemented in treatment 1 (T₁) at the rate of 370g, maize offal was supplemented in treatment 2 (T₂) at the rate of 350g and Groundnut hay was supplemented in treatment 3 (T₃) at 390g, while sole *B. ruziziensis* without supplement was fed to animals in treatment 4 (T₄). Bone meal was given to all the animals in all the treatments at the rate of 0.05g while mineral salt and water were fed *ad libitum*. The supplements were fed at 2 allocations in the morning and evening for each of the treated supplements, while other feed component were fed *ad libitum*. The crude protein of all the dietary treatment (14%) met the requirement for growing or weaned Yankasa Rams (NRC, 2007).

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Table 2: Experimental diet ratio fed to Yankasa rams during the experimental period

Feed Component	Treatments			
	T ₁	T ₂	T ₃	T ₄
<i>Brachiaria ruziziensis</i>	<i>ad libitum</i>	<i>ad libitum</i>	<i>ad libitum</i>	<i>ad libitum</i>
Wheat offal (g)	370	-	-	
Maize offal (g)	-	350	-	
Groundnut hay (g)	-	-	390	
Bone meal (g)	0.05	0.05	0.05	0.05
Mineral salt Lick	<i>ad libitum</i>	<i>ad libitum</i>	<i>ad libitum</i>	<i>ad libitum</i>
Water (Litres)	<i>ad libitum</i>	<i>ad libitum</i>	<i>ad libitum</i>	<i>ad libitum</i>
Crude protein (%)	14%	14%	14%	14%

T₁= Treatment 1 (*B. ruziziensis* + Wheat offal), T₂ = Treatment 2 (*B. ruziziensis* + maize offal), T₃ = Treatment 3 (*B. ruziziensis* + Groundnut hay), T₄ = Treatment 4 (sole *B. ruziziensis* hay)

Table 3 below represent the rumen pH values of cannulated Yankasa rams at different hours. The highest value (6.2) was obtained at 0hr (before feeding) for wheat offal followed by 6.1 and 6.0 for *B. ruziziensis* and Groundnut hay, respectively, while the lowest value of 5.9 was recorded for maize offal and there was no significant difference ($P>0.05$) in rumen liquor pH between the treatment diets.

At 6hrs (after feeding) the rumen pH value ranged from 5.9 in rams fed maize offal to 6.3 in those fed wheat offal. The rumen pH at 12hrs shows no significant difference ($P>0.05$) and ranged from 6.1 in other treatments to 6.2 in treatment fed maize

offal supplement. At 18hrs (after feeding), it was 6.0 in maize offal and control (*B. ruziziensis* hay) with rams fed groundnut hay and wheat offal having 6.1, the values had no significant difference ($P>0.05$). Similarly, the rumen liquor pH at 24hrs (after feeding) shows no significant difference ($P>0.05$) and ranged from 6.0 in groundnut hay to 6.2 in *B. ruziziensis* hay and maize offal. The rumen pH values obtained in this study showed that the rumen pH was not significantly ($P>0.05$) influenced by treatment diets and values obtained are within the normal range of 6.0-7.0 for effective cellulolytic bacterial activity in the rumen (Ndlovu and Hove, 1995).

Table 5: Rumen liquor pH before and after feeding the cannulated rams

Treatments diets	Control	pH After feeding			
	0hrs	6hrs	12hrs	18hrs	24hrs
<i>B. ruziziensis</i> hay	6.1	6.1	6.1	6.0	6.2
Groundnut Hay	6.0	6.2	6.1	6.1	6.0
Maize Offal	5.9	5.9	6.2	6.0	6.2
Wheat Offal	6.2	6.3	6.1	6.1	6.1
S.E.M.	0.1	0.1	0.1	0.2	0.1

a, b, c = Means on the same row having different superscript are significantly ($p<0.05$) different

The results as shown in Table 3 indicated that at 6hrs of incubation period, maize offal had significantly ($P<0.05$) higher dry matter degradability (36.75%) than other treatments, wheat offal (26.28%) and groundnut hay (25.36%) were significantly

($P<0.05$) higher than the value obtained for *Brachiaria ruziziensis* (16.73%). This is in contrast with the finding of Alikwe *et al.*, (2011) in a study who compared the digestibility and nitrogen balance of maize bran (MB), rice bran (RB) and wheat offal

(WO) in West African dwarf goats and reported that wheat offal (WO) had the highest dry matter (DM) digestibility which was significantly ($p < 0.05$) higher (56.00%) in goats fed wheat offal (WO). Incubation period also significantly ($P < 0.05$) affected the experimental treatments at 12hrs, the highest value for dry matter degradability was recorded for maize offal (38.62%) and the lowest value (27.71%) was for *Brachiaria ruziziensis*. Mehrez and Orskov (1977) reported that protein supplements of vegetable origin are normally degraded more slowly in the rumen of animals fed high concentrate diets compared with roughage diets. This was probably the reason maize offal generally had significantly ($P < 0.05$) higher dry matter degradability across hours except for 24 hours than wheat offal (36.30%), groundnut hay (31.38%) and *Brachiaria ruziziensis* (27.71%). At 18hrs, groundnut hay (43.14%), maize offal (46.15%) and 43.74% for wheat offal recorded statistically the same and only differ with that of the control (sole *Brachiaria ruziziensis* hay) which was 32.97%. The result also revealed that at 24hrs of incubation period wheat offal and maize offal has the highest value of 64.72% and 61.32%, respectively and recorded significantly ($P < 0.05$) higher value dry matter degradability than groundnut hay

(60.31%) and the lowest value was in the control (*B. ruziziensis*) 51.03%. Ndlovu and Hove (1995) supplemented groundnut hay to goats and recorded *in vivo* dry matter degradability of 50% for those fed 405g. Smith (1993) in another study found the digestibility of other diets to be higher than those for 5 dry season forages (mean of 56%).

From the result, it shows that the treatment diets were significantly ($P < 0.05$) affected by the incubation periods at 0hr, 6hrs, 12hrs, 18hrs, and 24hrs. Mehrez and Orskov (1977) in a related study reported that the greatest source of variation in the disappearance of dry matter from the bags was between individual sheep (age) followed by that between days (hours). The least variation was found between the bags (3.3%) incubated together and withdrawn at the same time. Also, nutrient composition of feedstuffs is known to influence *in-vitro* gas production and related parameters (Kilic and Saricicek, 2006). The differences in proximate composition of the supplements in this study could be attributed to the differences in dry matter degradability of the treatment diets. Similarly, the highest value for dry matter degradability obtained in maize offal could be attributed to the highest dry matter and crude fibre percentage in the supplement compared to other treatment supplements (Table 1).

Table 3: Actual rumen dry matter degradability (%) of the experimental diets at different incubation period

Incubation Period	Treatments				S.E.M.
	<i>B. ruziziensis</i>	Groundnut Hay	Maize Offal	Wheat Offal	
0hrs	11.68 ^c	17.52 ^b	27.20 ^a	24.32 ^a	1.09
6hrs	16.73 ^c	25.36 ^b	36.75 ^a	26.28 ^b	1.15
12hrs	27.71 ^c	31.48 ^{bc}	38.62 ^a	36.30 ^{ab}	1.75
18hrs	32.97 ^b	43.14 ^a	46.15 ^a	43.74 ^a	1.38
24hrs	51.03 ^c	60.31 ^b	61.32 ^{ab}	64.72 ^a	1.15

a, b, c = Means on the same column having different superscript are significantly ($p < 0.05$) difference

Conclusion and Recommendation

This study showed that the rumen pH of the cannulated rams was not influenced by treatment diets. However, the rumen dry matter degradability of the experimental diets was influenced by experimental diets. Rams fed *Brachiaria ruziziensis* hay supplemented with maize offal had the highest rumen dry matter degradability at 0, 6, 12 and 18 hours except 24 hours. It is therefore, recommended that Yankasa rams be fed *Brachiaria ruziziensis* hay supplemented with maize offal at 370g/day for better dry matter degradability.

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