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Rumen Characteristics and Nitrogen Utilization of West African Dwarf Sheep as Influenced by Guinea Grass and Dried Pineapple Pulp

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Abstract: The study was conducted to determine rumen characteristics and nitrogen utilization of West African Dwarf (WAD) Sheep. Fifteen (15) intact weaned ram lambs with an average weight of 12.25 kg and aged between 9 and 11 months old were randomly allotted to 3 dietary treatments (T_A = Guinea grass, T_B = equal ratio of Guinea grass and dried pineapple pulp and T_C = dried pineapple pulp) with five (5) rams per treatment. Ammonia nitrogen (NH_3-N) concentration (mg/liter) in rumen fluid was significantly ($p<0.05$) affected across treatments, with animals on T_A recorded the highest value when compared to T_B and T_C. No significant difference ($p>0.05$) was observed in pH study in the rumen fluid across treatments. Nitrogen utilization parameters were significantly affected ($p<0.05$) across dietary treatments. Animals on T_A were the highest in nitrogen intake, urinary nitrogen, total nitrogen excreted, nitrogen balance (g/day) and nitrogen retention (%), but feacal nitrogen (g/day) was the highest in animals on T_B. The inclusion of Dried Pineapple Pulp (DPP) to Guinea grass in equal ratio (T_B) improved rumen parameters and better nitrogen utilization of West African Dwarf Sheep.

Key words: Dried pineapple pulp, rumen characters, nitrogen utilization, West African dwarf sheep

INTRODUCTION

Ruminant animal production is a very important component of agricultural sector in Nigeria economy. The nation's meat supply is almost exclusively derived from ruminant livestock. The major constraint of increasing small ruminant productivity, is the improvement of ruminant animal nutrition and feed supply (Akangbe and Adeleye, 2002). The provision of good quality forage all year round is a major problem of small ruminant livestock production in the tropics. It is a known fact that, the availability of good quality green feed to ruminant animal is seasonal in the dry tropics. This explains why must ruminant animals under extensive system of rearing have low productivity and poor body conditions at the peak of the dry season (Rosiji and Iposu, 2002).

In an attend to alleviate ruminant feed supply problems and looking for potential feed resources, particularly those which survive during the dry season call for the use of conventional feedstuffs for the production of ruminant animals. Research had shown that, these conventional sources may not be profitable due to the escalating cost of production and competition between man and livestock. In this regards, the necessity to search for cheaper and locally available alternative feed materials among nutritionists that can meet the nutritional requirements of ruminant animals arise. Such feed materials should have the advantage of cost, availability as well as posses very low human food preference to eliminate competition between man and animals. The current practice among animal scientist of feeding unconventional feedstuffs (agro-industrial by-products) as alternative feedstuffs for ruminant animal production in Nigeria holds inestimable potential for the development of the sub-sector. The problem lies with harnessing, processing and utilization of these by-products (Ahamefule *et al*., 2002).

Pineapple pulp is respective example of such agro-industrial by-product, that can be explicated to a good advantage for ruminant animal nutrition in Nigeria. Pineapple pulp that is usually discarded as waste after processing, is a rich source of energy but low in protein (Fadel *et al*., 2000), yet to be probably harnessed for ruminant animal production due to its bulkiness and water content. It is hoped that, the use of this pineapple pulp or a combination with forage could result in an edible material that can be used to feed small ruminant animals. This study was therefore designed to determine the rumen characteristics and nitrogen utilization of West African Dwarf (WAD) sheep as influenced by Guinea grass and dried pineapple pulp.

MATERIALS AND METHODS

Site of study: The research was carried out at the Teaching and Research Farm of the University of Ibadan-Nigeria with latitude 7° 27^N and longitude 3° 45^E at an attitude between 200 m and 300 m above sea level. The areas has a tropical humid climate with mean temperature of 25-29°C and average annual rainfall of about 1250 mm.

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Experimental animals: Fifteen (15) West African Dwarf weaned raw lambs averagely 12.25 kg in weight and aged between 9-11 months were used for the experiment. The experimental animals were procured from local livestock market in Ibadan.

Experimental diets: Fresh leaves of Guinea grass were harvested individually chopped into thin pieces with matched to a lengths of approximately 4 cm. Pineapple pulps were freshly obtained from a local processing company in Ibadan, sun dried for 10 days and milled. The composition of the supplementary concentrate diet was as follows: Wheat offal 80%, brewery dried grain 18%, Oyster shell 0.75%, bone meal 0.50%, salt 0.05% and vitamin premix 0.25%. The calculated crude protein and metabolizable energy of the supplement were 16.84% and 16.32.4 Mekcal/kg respectively.

Experimental design and treatment: Fifteen (15) weaned ram lambs were randomly allocated based on their weight into three (3) treatment groups (T_A, T_B and T_C) of five (5) animals each in a completely randomized design. The dietary treatments consist of basal and concentrate diets which were offered to the animals at 4% of their body weight in a ratio of 70:30 respectively. Guinea grass was fed as basal (control) diet to animals on T_A, equal ratio (35:35) of Guinea grass and dried pineapple pulp were fed as basal diet to T_B. Dried pineapple pulp constituted the only basal diet on T_C. Concentrate supplement was fed to all the experimental animals on the treatments.

Feeding and management: Pens were swept, cleaned and disinfected two weeks prior to the arrival of the experimental animals. Prior to the commencement of the experiment, animals were treated, against ecto and endo-parasites. Experimental animals were housed in pens with concrete floors and roofed with asbestos sheet during the experimental period. The house walls had wide windows. Pens were cleaned morning and the evening as a daily routine. Animals had access to clean cool water and mineral salt lick. The study comprises 14 days of feed adaptation, follow by 12 weeks feeding trial. Feed was offered once daily at 17 hrs. At 10 weeks, each animal was placed in individual cage modified for separate collection of feaces and urine voided and sampled for chemical analysis. A week was allowed for the adjustment of the animals to the cages before collection of feaces and urine that lasted for a period of 7 days. However, before animals were withdrawn from the experiment, rumen fluid samples were collected from the (3) animals per treatment in the morning and evening before feeding for three (3) consecutive days. Oesophageal tubes with a large syringe attached to provide the suction needed for the liquor flow. The fluid or liquor samples were kept in labeled bottles and frozen immediately for further analysis.

Chemical analysis: Guinea grass and pineapple pulp were oven dried at 105°C for 24 hrs to determine the dry matter. Their chemical composition of then Guinea grass and pineapple pulp were determined using the procedures of AOAC (1980), neutral and acid detergent fibre contents of samples that were estimated as prescribed by Van Soest *et al.* (1991).

Statistical analysis: Data obtained on rumen characteristics and nitrogen utilization were subjected to Analysis of Variance (ANOVA) to determine the significance of treatment effects following the methods described by SAS (1997). Duncan multiple range test was used to separate the means at ($p<0.05$) to determine the difference between means.

Table 1: Chemical composition (% DM basis) of Guinea grass and Dried Pineapple Pulp (DPP)

Nutrients	Guinea grass	Dried Pineapple Pulp (DPP)
Dry Matter (DM)	78.43	81.41
Crude Protein (CP)	7.00	4.66
Ether Extract (EE)	0.90	1.21
Crude Fibre (CF)	37.00	26.00
Ash	10.00	7.00
Nitrogen free extract	45.11	61.13
Acid detergent fibre	49.00	27.00
Neutral detergent fibre	77.00	57.00

Table 2: Rumen characteristics of West African dwarf sheep fed experimental diets

	Treatments			
Nutrient	T_A	T_B	T_C	SEM±
NH_3-N conc. (Mg/litre)	86.10^a	72.48^b	56.30^c	10.55
pH (Morning)	6.71	6.62	6.70	0.15
pH (Evening)	6.74	6.59	6.73	0.17

Means with different superscripts rows are significantly different ($p<0.05$). SEM = Standard Error of Mean. NH_3-N conc. = Ammonia nitrogen concentration

RESULTS AND DISCUSSION

Table 1 shows the chemical composition of Guinea grass and Dried Pineapple Pulp (DPP) used in the study. All the parameters observed under chemical composition with exception of Either Extract (EE) and Dry Matter (DM) content were higher in Guinea grass when compared with dried pineapple pulp.

Presented in Table 2, is the data on the rumen characteristics of the experimental animals on each of the treatment. Significant difference ($p<0.05$) was observed in the values obtained for NH_3-N concentration in the rumen fluid. It was observed that T_A (86.10 mg/litre) was significantly higher ($p<0.05$) followed by T_B (72.48 mg/litre) and T_C (56.30 mg/litre). This probably could be due to the extent of crude protein degradation and nitrogen uptake by the rumen microbes. The values obtained for NH_3-N concentration in the rumen fluid in this study were compared favourably with the findings of

Alvarez *et al.* (1983). They reported that the generally recommended minimum level of rumen ammonia nitrogen concentration to support effect use of fermentable carbohydrate for microbial growth was 50 mg/litre. When a basal diet of wheat straw that had been sprayed with urea was fed to increase the wool growth of sheep. The NH_3-N concentration values obtained in this study was not in consistent with the published report of Birds and Hang (1985). Who stated that to ensure the level of rumen NH_3-N concentration is above 150 mg/litre in rumen fluid a supplement that is a source of fermentable nitrogen (usually urea or ammonia) should be considered.

The apparent pH in the rumen fluid (morning and evening) for all the treatments were similar, hence there was no significant different ($p>0.05$) across the treatments. The non significant difference ($p>0.05$) observed in the rumen fluid high pH values, could be due to ammonia nitrogen concentration in animals on the treatments which might have neutralized some of the acid in the rumen fluid. The implication of this higher rumen fluid pH values observed in animals on T_A and T_C was that cillate protozoa populations might thrive well in such rumen environment and discourage defaunation that are very nutritionally important in the rumen of the animals. The pH values in this study agrees with the findings of Wells and Russels (1996). Whose values (5.5-7.5) ere recommended to be the standard rumen pH values.

Table 3 shows the result of nitrogen utilization of the experimental animals. There where significant difference ($p<0.05$) observed in all the parameters. Nitrogen intake was significantly different ($p<0.05$). among the treatment effects, with animals on T_A (26.62 g/day) the highest, followed by T_B (18.69 g/day) the highest, followed by T_B (18.69 g/day) and the least was T_C (12.43 g/day). The reduced nitrogen intake observed with increasing levels of DPP on treatments (T_B and T_C respectively) might have been as a result of low C.P % in DPP. This result was in agreement with the report of Ariza *et al.* (2001). Who observed significant difference ($p<0.05$) in nitrogen intake of ram lambs fed citrus pulp plus maize feed with concentrates. Faecal and urinary Nitrogen (N) values were significantly different ($p<0.05$) across the treatments. The higher values of faecal-N observed on T_B and T_C than T_A, could probably be due to DPP C.P % content that was not well utilized and thus was excreted. The higher loss of urinary-N observed on T_A (10.69 g/day) when compared to T_B (8.26 g/day) and T_C (5.53 g/day) could be a reflection of higher N-intake from Guinea grass. This was in conformity with the findings of Kerchgessner *et al.* (2001), who reported that nitrogen consumed in excess of animal requirement was excreted in urine and faeces. Generally as found in the Table 3, the treatments promoted positive N-balance with animals on T_A (13.83 g/day) having the highest followed by T_B (6.81 g/day) and T_C (3.58/day). The positive nitrogen balance observed, suggested that nitrogen absorbed was well tolerated and utilized as a fermentable nitrogen source for microbial growth in their rumen. Nitrogen retention values ranged from 28.80-51.88%. The higher values obtained in animals on T_A and T_B might have been as a result of the amount of nitrogen used in protein deposition. The values reported by Otaru *et al.* (2011). When different level of energy sources were fed to red Sokoto goat.

Table 3: Nitrogen utilization by West African dwarf sheep fed experimental diets

	Treatments			
Nutrient	T_A	T_B	T_C	SEM±
Nitrogen intake (g/day)	26.62[a]	18.69[b]	12.43[c]	2.55
Facecal nitrogen (g/day)	2.15[b]	3.62[a]	3.32[ab]	0.53
Urinary nitrogen (g/day)	10.64[a]	8.26[ab]	5.53[b]	1.87
Total nitrogen excreted (g/d)	12.79[a]	11.88[b]	8.87[c]	2.40
Nitrogen balance (g/day)	13.83[a]	6.81[b]	3.58[c]	1.89
Nitrogen balance $W^{0.75}$ (g/d)	7.17[a]	4.22[b]	2.60[c]	1.69
Nitogen retention (%)	51.88[a]	36.44[b]	28.80[c]	1.35

Means with different superscripts rows are significantly different ($p<0.05$). SEM = Standard Error of Mean

Conclusion: This study has shown that inclusion of dried pineapple pulp to Guinea grass of equal ratio (35:35) improved rumen parameters and better nitrogen utilization of West African Dwarf Sheep without any adverse effect on the productivity.

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