NUTRIENTS, ANTI-NUTRIENTS DIGESTIBILITY AND NITROGEN RETENTION BY WEST AFRICAN DWARF RAMS FED *Panicum maximum* SUBSTITUTED WITH *Gliricidia sepium* AND *Acacia nilotica tomentosa*

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ABSTRACT

A study that involved five (5) West African Dwarf (WAD) rams aged 2 – 3 years with an average live-weight of 24.40kg were used to evaluate the dietary value of *Panicum maximum* substituted with varying levels of *Gliricidia sepium* and *Acacia nilotica tomentosa*. The rams were housed individually in metabolic cage in a 5 x 5 Latin Square Design and the experiment lasted 70days. Five diets were formulated such that *Panicum maximum* was substituted with *Acacia nilotica tomentosa and Gliricidia sepium* forages as follows; 100% *Panicum maximum* (A), 100% *Acacia nilotica tomentosa* (B), 100% *Gliricidia sepium* (C), 50% *Panicum maximum* + 50% *Acacia nilotica tomentosa* (D) and 50% *Panicum maximum* + 50% *Gliricidia sepium* (E) respectively. Diet B (100% *Acacia nilotica tomentosa* forage) had the highest recorded value of 21.06% CP and 18.60% CF. Nutrients, anti-nutrients digestibility and nitrogen retention were significantly ($P<0.05$) influenced by the treatments. The highest value of dry matter (232.43g/day) and crude fibre (43.21g/day) intake was observed in rams fed diet B. The crude protein were not significantly ($P>0.05$) influenced by the treatment. Though, the rams fed diet D had the best recorded crude protein (45.50g/day) compared to 40.59g/day observed in rams fed diet B. All the diets were adequately digested and utilized. Hence, the diets were palatable, acceptable and tolerable to the rams without a sign of ill-health. Rams fed diets B and C had the best nitrogen utilization of 2.21 and 2.62g/day. Thus, *Acacia nilotica tomentosa* could be a good source of protein and fibre that would enhance nutrient utilization by ruminants (especially rams) and promote preservation of the forage till dry season for ruminant' feeding.

INTRODUCTION

Livestock production accounts for 40% of the world's gross agricultural production (MOFA, 2000). This is due to the fact, that there is a shift in the dietary habits of people to increase meat consumption, especially among high income earners. Subsistence farmers in most rural communities all over the world, most of the time, keep livestock as an investment. Globally, sheep rearing is predominantly aimed at wool production. However, meat is the major product in many countries (Croston and Pollot, 1994). Sheep have a special function among the followers of Islam and are also used for funeral celebrations and dowries in Ghana (Koney, 2004). Meanwhile, the main objective of any livestock enterprise is to convert feedstuffs into animal products at a faster and cheaper rate. Akpodiete and Inoni (2000) reported that feed represents the largest segment of the total cost of livestock production from 60-70%, its inadequacy in quality and quantity could lead to a situation of low nutritional status, poor productivity, poor weight gain, poor reproductive ability, low conversion ratio and poor health status of animal. Thus, adequate supply of feed (both in quality and quantity) is very necessary for optimum livestock performance. Efforts had been made to use alternative sources of feeding materials that are locally sourced, cheap, nutritionally adequate and available year round (Fajemisin *et al.*, 2012). One of such is *Panicum maximum* (Guinea grass); it is indigenous to sub-tropical areas of southern Africa. It is tolerant of shade, it can survive during the warm season, but the nutritive value declines rapidly with increasing stages of maturity (Aganga and Tshwenyane, 2004). Other feed materials that can be sourced locally are *Gliricidia sepium* and *Tometosa*. *Gliricidia sepium* has now been widely introduced to many parts of the tropics due to its high productivity and adaptability. It is easy to establish, grows fast either as an agro-forestry species or as a pure crop and with the ability to fix nitrogen hence, improves soil fertility. *Acacia nilotica tometosa* is a multipurpose tree, the leaf contains 92.5% dry matter and 21.4% crude protein. The plant serves different purposes such

as shade, wind-break and leaf forage. This study was therefore, designed to evaluate the nutrients and anti-nutrients digestibility and nitrogen retention by West African Dwarf rams fed *Panicum maximum* substituted with *Gliricidia sepium* and *Acacia nilotica tomentosa* leaves.

MATERIALS AND METHODS

The experiment was conducted at the small ruminants unit of the Teaching and Research (T & R) Farm of the Federal University of Technology, Akure (Latitude 7^0 18" and Longitude 5^0 10"E). The *Panicum maximum and Gliricidia sepium* forages were sourced from the established pasture of T & R Farm while *Acacia nilotica tomentosa* were harvested at the park gardens and cured before been fed to the rams to reduce the moisture content. Five (5) adult WAD rams aged 2 – 3 years were selected from the flock of sheep at the T & R Farm, the rams were vaccinated against *Pesté-Petit dé Ruminanté* (PPR / kata), treated against ecto-parasite using Diasuntol® and were also treated against infections by using oxytetracycline LA® at the rate of 1ml per 10kg body weight per animal. Five diets were formulated as follows; A (100% *Panicum maximum*); B (100% *Gliricidia sepium*); C (100% *Acacia nilotica tomentosa*); D (50% *Panicum maximum* + 50% *Acacia nilotica tomentosa*) and E (50% *Panicum maximum* + 50% *Gliricidia sepium*). The experimental design was 5×5 Latin square. The rams were housed individually in metabolic cages and they were fed the five (5) diets and fresh drinkable water (*ad libitum*) for seventy days. Parameters measured were nutrients and anti-nutrients intake, digestibility, and nitrogen retention. The samples of feed, faeces and urine were analysed for dry matter and dietary nutrients according to methods of AOAC (2002) procedures. All data obtained were subjected to one-way analysis of variance and where significant differences are found, the means were compared using New Duncan Multiple Range Test using SAS (2008).

RESULTS AND DISCUSSIONS

Table 1 presents the chemical composition (%) of experimental diets fed to the rams. The results of dry matter values ranged from 62.75 (diet C) to 77.71% (diet A), this observation was lower than the DM value of 90.50% and 85.71% for selected browse plants in southern Nigeria reported by Oduozo and Adegbola (1992) and Okoli *et al.* (2003) respectively. The crude protein (CP) values ranged from 16.48% to 21.06%, and this was adequate to support to growth and performance of small ruminant animals, being well above the critical level of 7% CP required by small ruminants for maintenance. The wide variation in tannin contents suggests considerable differences in the nutritional quality of the different forage species. The tannin levels obtained in this study increased with the different inclusion levels of the leguminous leaves in the diets and the values ranged from 0.49% to 4.98%. The oxalate content ranged from 1.43% to 2.52% which fell within the range of 0.01 - 2.50 mg / 100g observed in selected browses of southern Nigeria (Okoli *et al.*, 2003). In Table 2, the highest dry matter intake observed in rams fed diet B indicated that feed had a better protein quality, considerable level of fibre content that enhanced palatability, tolerance and acceptability of the diet. This is in agreement with the report of Fajemisin *et al.* (2010) that the nature of feeds with acceptability plays an important role in regulating feed intake in small ruminant livestock. Protein intake were significantly ($P<0.05$) influenced by the treatment, rams fed diet D had highest value (45.50 g/kg$W^{0.75}$). The digestibility coefficient of dry matter was noted to increase with increased quantity of crude protein intake by the rams fed the experimental diets, this agreed with the observation of McDonald *et al.* (1995) that there is a positive relationship between digestibility of feed and protein intake. Omojola (1997) reported that the extent by which the cell wall as well as the cellulose is digested in the rumen depends particularly on lignifications of the feed since lignin appear to hinder the breakdown of cellulose cell wall and that of rumen microbial flora to perform at an optimum level. However, the digestibility of the crude fibre values observed in this study increased as the crude protein content of the diets increases. It implied that presence of nitrogen and soluble carbohydrate in the diets enhanced the digestibility of the fibre contents of the diets. Hence, diet B was better utilized by the rams. Rams fed diet B and C retained nitrogen better than others, indicating that *Gliricidia sepium* and *Acacia nilotica tomentosa* are rich source of protein.

CONCLUSION

The study extends frontiers of knowledge on the potentials of *Acacia nilotica tomentosa, Gliricidia sepium* and *Panicum maximum* as nutritive forage that can be fed sole or incorporated in the diets of ruminants. The results revealed that *Panicum maximum* substituted with *Acacia nilotica tomentosa,* and *Gliricidia sepium* are good sources of protein and fibre that could enhance small ruminant production. However, the rams fed diet B (100% *Acacia nilotica tomentosa* forage) had the overall best nutrient and good nitrogen utilization.

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Table 1: Nutrients and Anti-nutrients composition of the experimental diets

Parameter (%)	Diet A	Diet B	Diet C	Diet D	Diet E
Dry matter	77.71	30.30	62.75	69.51	70.28
Crude protein	11.81	21.06	20.62	16.58	16.48
Crude fibre	16.50	18.60	16.90	11.98	16.21
Ether extract	1.31	3.50	1.64	1.51	0.69

Ash	11.37	9.90	13.65	14.36	12.00
Nitrogen free extract	56.01	50.19	58.71	52.56	54.62
Oxalate	1.42	2.33	2.52	1.94	1.53
Phytate	0.68	4.98	3.67	2.67	2.18
Akaloid	1.16	3.43	2.80	1.45	1.19
Saponin	1.02	2.69	2.71	1.86	1.62
Tannin	0.49	4.86	4.97	2.73	2.56
Phenol	0.79	2.31	2.67	2.15	1.68

Table 2: Nutrients and Anti-nutrients intake by WAD rams fed the experimental diets

Components	Diet A	Diet B	Diet C	Diet D	Diet E	±SEM
Dry matter	201.36	232.34	170.54	188.93	156.58	14.47
Crude protein	29.82	40.59	36.87	45.50	33.30	3.45
Crude fibre	33.21^{ab}	43.21^{a}	28.82^{ab}	22.63^{b}	25.40^{b}	2.57
Ether extract	2.64^{b}	4.07^{a}	2.79^{ab}	2.85^{ab}	1.30^{c}	0.26
Ash	22.89	23.00	23.26	27.20	18.79	1.79
Nitrogen free extract	112.76	116.64	100.79	99.37	85.79	7.78
Oxalate	3.26^{bc}	5.41^{b}	8.58^{a}	$3.67b^{c}$	2.39	0.58
Phytate	19.74^{a}	11.63^{bc}	6.44^{c}	14.77^{ab}	9.67^{bc}	1.35
Alkaloid	2.54^{ab}	3.32^{a}	3.07^{ab}	2.74^{ab}	1.86^{b}	0.20
Saponin	0.65	1.93	2.60	1.97	1.09	0.08
Tannin	8.00	11.75	8.74	8.93	8.14	0.64
Phenol	1.97^{c}	5.37^{a}	2.85^{bc}	4.04^{ab}	2.63^{bc}	0.33

a, b, c, = means within the same row with different superscripts are significantly (P<0.05) different

Table 3: Apparent digestibility (%) by WAD rams fed the experimental diets

Nutrients	Diet A	Diet B	Diet C	Diet D	Diet E	±SEM
Dry matter	66.55	64.95	58.68	67.61	62.91	4.16
Crude protein	78.08	81.84	73.47	80.24	86.60	2.51
Crude fibre	67.66	76.91	66.94	65.45	66.25	3.95
Ether extract	56.45a	70.16a	67.67a	65.69a	22.72a	5.29
Nitrogen free extract	62.90	58.71	63.57	59.71	62.26	4.65
Oxalate	69.16	80.37	88.74	77.68	68.09	3.32
Phytate	69.60^{ab}	78.18^{a}	56.82^{ab}	74.28^{ab}	52.25^{b}	3.52
Alkaloid	58.94	71.22	63.74	55.42	61.51	3.68
Saponin	58.46	72.59	60.26	63.25	65.84	2.52
Tannin	65.49	73.40	61.38	67.40	67.71	3.58
Phenol	75.00^{c}	90.62^{a}	78.17^{bc}	90.11^{ab}	88.13^{ab}	2.07
Nitrogen Utilization (g/day)						
Nitrogen intake	6.37^{b}	7.45^{ab}	6.69^{ab}	7.19^{ab}	9.26^{a}	0.40
Faecal nitrogen	3.6^{b}	4.11^{ab}	4.17^{ab}	3.69^{b}	6.41^{a}	0.40
Urinary nitrogen	1.55^{ab}	1.12^{ab}	0.9^{b}	1.85^{a}	1.2^{ab}	0.12
Nitrogen balance	1.19^{b}	2.21^{a}	2.62^{a}	1.66^{ab}	1.65^{ab}	0.10

a, b, c, = means within the same row with different superscripts are significantly different (P<0.05).