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Performance of West African dwarf goats fed *Panicum maximum* supplemented with *Myrianthus arboreus* leaf meal concentrates

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Abstract

A feeding trial was conducted to evaluate the performance of West African Dwarf goats fed Panicum maximum supplemented with Myrianthus arboreus leaf meal for 49 days. Four diets were formulated such that diet A contained 0.00% Myrianthus arboreus, diet B contained 10.00% Myrianthus arboreus, diet C contained 11.00% Myrianthus arboreus and diet D contained 12.00% Myrianthus arboreus respectively. A total of twelve (12) West African Dwarf goats were randomly allocated to the four diets with three animals per diet, each serving as a replicate. Parameters assessed were the chemical composition of the experimental diets, growth rate and digestibility coefficient of the animals. The results showed that diet D had the highest dry matter (92.55%) and crude protein (20.55%) contents. The average daily weight gain (g/day) of animals was significantly (P<0.05) influenced across the treatments. Animals fed diet D recorded the highest weight gain (19.39g/day) while the least weight gain (7.55g/day) was recorded for animals on diet B. The highest total dry matter intake (340.34g/day) was recorded for animals on diet D while the least (313.18g/day) was observed in animals fed diet C. The best feed conversion ratio (17.55) was recorded in animals fed diet D. There were significant differences (P<0.05) in the nutrient digestibility of the experimental animals. The highest dry matter (82.70%), crude protein (86.18%) digestibilities were observed in diet D while the least dry matter digestibility (72.73%) was observed in diet B. However, the least fibre fractions digestibilities were observed in diet D. It can therefore be concluded that supplementation of Myrianthus arboreus leaf meal concentrate at 12% inclusion with Panicum maximum as basal diet for goats can enhance nutrient digestibility and improve growth without any deleterious effects on the animals.

Keywords: digestibility, growth, *Myrianthus arboreus*, *Panicum maximum*, goats.

Introduction

Forages such as grasses and legumes are the main source of feeds for ruminants to meet their nutritional requirements, either for maintenance or production. However, in the tropics, inadequate nutrition is a great challenge contributing to production losses in ruminants (Ibhaze, 2016) due to the unavailability of forages throughout the year. This unpleasant situation has necessitated the search for alternative feed resources rich in energy and protein that are readily available and relatively cheap. These feed resources are incorporated in livestock diets as long as they do not have detrimental effects on the health status and production potentials of the animals (Ibhaze, 2017). In recent times, the use of leaves from multipurpose trees and shrubs as alternative feed resources has gained global recognition. Several indigenous and exotic browse species have been investigated and evaluated for inclusion in ruminant feeding systems in Nigeria (Fajemisin, 2015). Amata (2010) opined that protein from plant leaf sources is perhaps the most naturally abundant and cheapest source of protein, such that there has been growing realization in the use of plant leaf meals in livestock diets. *Myrianthus arboreus* is a dioecious tropical tree up to 15 m high with spreading

branches from a short stem. It is found in forest and damp places and a native of Angola, Cameroon, Congo, Cote d'Ivoire, Democratic Republic of Congo, Kenya, Nigeria, Sudan, Tanzania and Uganda (Orwa *et al.,* 2009). *Myrianthus arboreus* leaves are a good source of protein (18.74% DW), metabolizable energy (1333.4 kcal kg^{-1}) minerals and can be used as a supplement in compounding livestock feed, the leaves also contain appreciable level of sulphur containing amino acid and low anti-nutritional components which can be tolerated by most livestock (Amata, 2010).*Panicum maximum* (Guinea grass) is relished by ruminants especially during the wet season when forages are lush. It contains crude protein (9-12.5%), total digestible nutrients (10.2%), magnesium (0.06%) and calcium content of 0.05% (McDonald *et al.,* 1995). However, during the dry period, these nutrient concentrations decline. Gibson (2007) opined that goats are inquisitive feeders with high efficiency in energy and protein conversion from feeds. This study was therefore designed to investigate the growth and digestibility by West African Dwarf goats fed *Panicum maximum* supplemented with *Myrianthus arboreus* concentrate diets.

Materials and methods

The experiment was conducted at the Small Ruminant Unit of the Teaching and Research Farm, Federal University of Technology, Akure, Ondo state, Nigeria. Akure is located on longitude 4.944055°E and 5.82864°E, and latitude 7.491780°N with annual rainfall ranging between 1300mm and 1650mm average maximum and minimum daily temperature of 38°C and 27°C respectively (Daniel, 2015). *Myrianthus arboreus* leaves were harvested within Akure and air dried for seven days and then milled and stored for later use. Four concentrate diets were compounded comprising 0, 10, 11 and 12% levels of inclusion of *Myrianthus arboreus* leaf meal Twelve (12) WAD bucks with average weight of 5.75±0.3kg were purchased from a reputable source and were randomly assigned to four dietary treatments of three replicates per treatment in a Completely Randomized Design.The goats werehoused in an open - sided, well-lighted and adequately ventilated building with concrete floor that had been previously disinfected with germicide. The concrete floor was covered with 5 cm layers of wood shavings to absorb urine and for easy removal of faeces. An acclimatization period of 14 days was allowed before commencement of the feeding trial. The pens and troughs were cleaned each day before offering feed and water. The animals were fed the experimental diets early in the morning (8.00am) and grass was given in the afternoon (2.00pm) and cool, fresh drinkable water (*ad libitum*) was supplied. Left over feed was weighed each morning. Animals' weights were taken using hanging scale at the start of the study, and weekly, throughout the experimental period, and the growth study lasted for forty-nine (49) days. The goats were then transferred to metabolic cages with facilities for separate collection of urine and faeces for digestibility trial. Faeces and urine were collected daily before morning feeding. The urine was collected into plaque bucket placed under each cage and to which few drops of 25% $H_2SO_4$was introduced to curtail volatilization of the ammonia from the sample. The daily volume of urine output per goat for a period of 7days was determined and 10% of daily output was saved in stopper plastic bottles, numbered and stored in a refrigerator at -5°C. Samples of feed and faeces were analyzed for proximate and fibre compositions using the method described by AOAC (1990).

Statistical analysis

All data obtained were subjected to one way analysis of variance (ANOVA) of SAS(2012)and significant means were separated using the Duncan's multiple range test of the same package.

Results and discussion

The gross composition of the experimental diets is presented in Table1. The chemical composition of the experimental diets is shown in Table 2. All the diets had crude protein values adequate for ruminant nutrition. Gatenby (2002) indicated 10–12% crude protein as requirement for growth of sheep and goats. The high ash content obtained suggests high mineral concentrationsin all the diets. The neutral detergent fibre, acid detergent fibre and acid detergent lignin values ranged from 54.12-59.71%, 32.08-36.16%, 25.52-27.80% respectively. The high fibre fraction in the diets is an indication that the diets are adequate in fibre necessary for proper rumen function.

Table 1: Gross composition (%) of experimental diets

Ingredients	Diets			
	A	B	C	D
	0%	10%	11%	12%
Maize Offal	47.00	47.00	47.00	47.00
Rice bran	27.00	27.00	27.00	27.00
Palm kernel cake	22.00	12.00	11.00	10.00
M. arboreus	0.00	10.00	11.00	12.00
Urea	1.00	1.00	1.00	1.00
Bone meal	2.00	2.00	2.00	2.00
Salt	1.00	1.00	1.00	1.00

Table 2: Chemical composition (%) of the experimental diets and *Panicum maximum*

Parameters	A	B	C	D
	0%	10%	11%	12%
Dry matter	91.33	91.91	91.34	92.55
Crude protein	19.17	19.03	19.12	20.55
Crude fibre	9.23	10.79	10.68	13.08
Ether extract	11.01	12.62	11.74	11.94
Ash	12.33	11.18	12.14	13.97
Nitrogen free extract	48.26	46.38	46.32	40.46
Neutral detergent fibre	54.12	59.71	56.53	58.50
Acid detergent fibre	36.15	34.18	32.08	38.44
Acid detergent lignin	25.04	25.52	24.65	27.80
Hemicellulose	17.97	25.53	24.45	20.06
Cellulose	11.11	8.66	7.43	7.74

Growth performance is revealed in Table 3. Significant ($p<0.05$) differences were observed in the average daily weight gain and the feed conversion ratio. Total intake by the animals ranged from 313.18 – 340.34g/day). These values were comparable to the range (291.55 – 313.42 g/day) reported for WAD goats fed cassava peels-cassava leaf meal based diets (Ukanwoko *et al*., 2009). Ahamefule and Elendu (2010) opined that factors affecting feed intake include dietary crude protein, palatability, gut fill, rumen outflow rate/retention time in the rumen. Nutrient intake is the most important determinant of an animal's performance There were significant ($p<0.05$) differences in the average daily weight gain and the feed conversion ratio which ranged from 7.55-19.39g/day and 16.55-43.84 respectively. Animals on diet D (12% inclusion) had the highest average daily weight gain

(19.39g/day) and the least (17.55) feed conversion ratio. These values are lower than the range of 35.72-64.29g/day reported by Ogunbosoye *et al*. (2016) for West African dwarf goats fed graded levels of shea nut (*Vitellaria paradoxa)* cake-based rations.

Table 3: Growth performance by West African dwarf goats fed experimental diets

	Diets				
	A	B	C	D	
Parameters	0%	10%	11%	12%	± SEM
Average Initial weight (kg)	6.03	6.03	5.20	5.75	0.13
Average Final Weight (kg)	6.63	6.40	5.70	6.70	0.19
Average daily weight gain (g/day)	12.24^{b}	7.55^{c}	10.20^{bc}	19.39^{a}	1.53
Concentrate intake(g/day)	206.33	193.30	186.38	210.17	10.41
Panicum maximum intake(g/day)	131.83	137.70	126.80	130.71	4.62
Total intake (g/day)	338.16^{a}	331.00^{ab}	313.18^{b}	340.34^{a}	12.72
Feed conversion ratio	27.75^{b}	43.84^{a}	30.70^{b}	17.55^{c}	5.92

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

The nutrient digestibility of the experimental diets by the West African dwarf goats is presented in Table 4. The highest dry matter digestibility was observed in diet D. Bakshi and Wadhwa (2004) reported that high neutral detergent fibre and acid detergent lignin depress dry matter intake and dry matter digestibility. This therefore suggests that the fibre content of the diets was adequate to promote intake and digestibility. The dry matter digestibility obtained in this study was higher than the range of 43.05-50.04% reported by Ibhaze *et al*. (2014) for West African dwarf goats fed ensiled mixtures of corncobs, cassava peels and brewers' grain. The crude protein digestibility was higher than the range of 56.2-63.10% reported by Olorunnisomo (2010) for lambs fed cooked or fermented cassava-urea meal. Fibre is important in the diet of farm animals and some level of fibre enhances proper bowel movement (Odoemelam and Ahamefule, 2006). The crude fibre digestibility values ranged between 76.27-86.18%. This was probably so because the rumen micro-organism were able to effectively digest the nature of fibre in the diets. This observation were comparable with 78.40-80.62% reported by Maigandi and Abubakar (2004) for Red Sokoto goats fed diets containing graded levels of *Faidherbia albizia* pod. The ether extract digestibility (73.25-84.81%) obtained in this study is similar to the values reported for WAD bucks fed mucuna seed meal and *P. maximum* (Ukpabi, 2007) and Kano brown goats fed graded levels of rice milling waste (Nayawo *et al.*,2010*).*

Table 4: Apparent nutrient digestibility (%) of West African dwarf goats fed experimental diets

	Diets				
Parameters	A	B	C	D	
	0%	10%	11%	12%	SEM
Dry matter	80.69ab	72.73	77.16bc	82.70a	1.32
Crude protein	86.10^{a}	77.19^{b}	86.14^{a}	86.18^{a}	1.30
Crude fibre	85.85^{a}	76.27^{b}	81.98^{a}	86.18^{a}	1.34
Ether extract	80.71^{ab}	73.25^{c}	77.67^{bc}	84.81^{a}	1.44
Neutral detergent fibre	86.44^{a}	79.54^{b}	81.42^{b}	75.07^{c}	1.27
Acid detergent fibre	83.28^{ab}	86.48^{a}	79.73^{bc}	78.71^{c}	1.06
Acid detergent lignin	80.78^{a}	81.26^{a}	71.13^{b}	71.92^{b}	1.55
Hemicellulose	86.29^{a}	87.03^{a}	83.84^{b}	79.22^{c}	0.96
Cellulose	91.52	91.11	88.32	86.35	0.98

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

Conclusion

From the result of the study, it can be concluded that *Myrianthus arboreus* leaf meal possesses adequate nutritive value to support good growth of West African Dwarf goats, especially during the period of drought and the forage can effectively serve as alternative feed ingredient in West African dwarf goats diets with inclusion level of up to 12 % without any deleterious effect. The authors therefore suggest that further research should be carried out using *Myrianthus arboreus* at higher levels of inclusion in the diets of goats and other livestock to substantiate its suitability and utilization by the animals.

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