NUTRIENT INTAKE AND DIGESTIBILITY IN WEST AFRICAN DWARF GOATS FED *Persea americana* LEAVES AS SUPPLEMENT TO *Panicum maximum*

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ABSTRACT
The objective of this experiment was to determine the nutrient intake and digestibility of diets consisting of basal *Panicum maximum* and supplementary *Persea americana* leaves. Fifteen (15) growing WAD goats (initial BW = 8.0 kg) were assigned to five treatments: A-100% *P. maximum* (control); B-75% *P. maximum*+25% *P. americana*; C-50% P. *maximum*+50% *P. americana*; D-25% *P. maximum*+75% *P. americana*; E-100% *P. americana*. Animals on treatment E had the highest DM and CP intake of 187.9 and 23.9 g day^{-1} respectively as compared with the least values of 125.1 and 20.35 g day^{-1} respectively recorded for treatment A. Nutrients digestibility were significantly higher in treatment E than treatments A, B and D. Nitrogen balance parameters were best in the treatment containing 100% *P. americana* leaves. The results showed that *P. americana* leaves are palatable and acceptable to goats and when fed as a supplement to guinea grass led to increased DM intake, digestibility and nitrogen utilization.

INTRODUCTION
In developing countries the major feed resource for ruminant animals is natural pasture. The rapidly expanding human population in these countries and the consequent rise in demand for food and shelter have markedly increased pressure on land, causing man to encroach on the best of the grazing land. In some areas this has made zero grazing a necessity in place of the traditional grazing systems, thus precluding the animals from freedom of choice of herbage. The performance of small ruminants in such condition is quite poor as the animals are undernourished for a significant part of the year (Jayasuriya, 2002). The incorporation of browse species into the diet is one of the ways of making affordable improvement to quantity and quality of feed available to goat. Browse can improve the total supply of bulk feed given to the goat; it can improve the quality of the feed and can also compensate for seasonal fluctuations. This is the reason why fodder trees and shrubs have been the focus of ruminant nutrition research in recent times, more so because these feed resources are locally available, perennial sources of feed (Singh, 1995; Leng, 1997), rich in protein and minerals and are particularly appropriate for small ruminants (Norton, 1994). The avocado pear *(Persea americana)* is a tree native to Central Mexico (Chen *et al.*, 2008) and it belongs to the family Lauraceae, along with cinnamon, camphor and hay laurel. Avocado tree is cultivated in tropical and Mediterranean climate throughout the world. The tree is grown for its nutritious fruit, which also bear the name avocado pear, botanically a large berry that contain a single seed which may be pear or egg-shaped. The matured fruit has a high oil content which gives the flesh a buttery texture; it is easily digestible and is rich in iron, vitamins A and B. The fruit is an important feed source for pig and other livestock (Seawright *et al.*, 1995). However, there is few documented work on feeding the leaves to ruminant animals. It is on this basis that this study was initiated with the objective to determine the nutrient intake and digestibility of graded levels of *Persea americana* leaves when fed as supplements to *Panicum maximum* in West African dwarf goats.

MATERIALS AND METHODS
The experiment was carried out at the Teaching and Research Farm of Federal College of Agriculture Akure, southwest Nigeria. Leaves of *Persea americana* were harvested from mature trees while *Panicum maximum* was cut at the pre-anthesis stage within the College premises and they were both partially wilted before use. Fifteen growing West African dwarf goats with average initial body weight of 8.0kg were used for the experiment. Prior to the commencement of the experiment, the animals were given prophylactic treatment consisting of antibiotic (Oxytetracycline LA), anthelmintic (Ivermectin) and multivitamins.

The animals were divided into five groups of three animals each and randomly allocated to one of the following dietary treatments: A – 100% *Panicum*, B – 75% *Panicum* + 25% *Persea*, C – 50% *Panicum* + 50% *Persea*, D – 25% *Panicum* + 75% *Persea*, E – 100% *Persea*. The goats were housed in individual metabolic cages designed for separate collection of urine and feces. After a week adjustment period, quantities of feed offered, feed left over, feces as well as the volume of urine voided were determined daily for 42 days. Fecal samples were oven-dried at 65°C to constant weight, stored in air-tight polythene bags and later bulked for each animal. About 10% of total volume of urine voided daily was stored in sample bottles after adding few drops of sulphuric acid (H_2SO_4) to prevent volatilization of nitrogen. Leaves of *Persea americana, Panicum maximum* and feces were analyzed for proximate compositions according to AOAC (2005). Urinary nitrogen was determined by the micro Kjeldahl method. Results obtained were used to calculate nutrient digestibility. Thereafter, data collected were subjected to analyses of variance (SAS 2007) and means were separated using Duncan multiple range methods.

RESULTS AND DISCUSSION

The proximate compositions of *Persea* and *Panicum* leaves are shown in table 1. Crude protein (CP) content of *Persea americana* obtained in this study is lower than that reported by Arukwe *et al* (2012) probably because the leave was harvested at a very matured stage as reflected in its high dry matter (DM) content of 34.3%. The higher CP content in *Panicum maximum* than reported in other studies is probably because tender leaves which are known for higher nutrient contents were used in this study. The highest DM intake recorded for treatment E was probably as a result of high proportion of *P. americana* leaves in the treatment relative to other treatments, since *P. americana* leaves has higher DM content than *Panicum*. It is not likely due to higher crude fiber (CF) content of *Panicum* compared with *Persea* leaves, since CF intake did not differ among the treatments. Muinga *et al.* (1992) reported lower DM intake with increased proportion of CF in the diet. Although the values were not significantly different, the fact that DM intake increased progressively as the level of supplement inclusion increases probably reflects the better palatability and/or acceptability of *Persea* by WAD goats than *Panicum*. This might also be attributed to the coarser nature of the former due to its higher DM content since goats have been reported to prefer coarse feeds (Quedrago 1996). Table 2 shows that nutrients' digestibility were better in goats on *Persea*-supplemented diets than those on sole *Panicum*. This is probably due to the higher crude fibre content of *P. maximum* (table 1) which reduces the rate of microbial colonization of the feed (Silva and Orskov, 1988). It is also an indication that *P. americana* probably contains more digestible components than *Panicum* and could therefore serve as supplement to the latter in ruminant diets (Fadiyimu *et al.* 2010). In table 3, N intake of goats on 100% *Persea* was higher than that of goats fed 100% *Panicum* while N output gave a contrasting picture. This probably indicates that inclusion of *Persea* leaves enabled better utilization of N in the supplemented feed whereas the fibrous nature of *Panicum* impaired N digestibility making the goats to pass out the undigested N as feces hence the higher N output and lower N balance in treatment A. However all the treatments showed positive N balance and retention values indicating that the dietary treatments met the protein requirement for maintenance in small ruminants.

CONCLUSION

Findings in this study revealed that *Persea americana* has a good nutrient profile which is adequate for feeding small ruminant animals. The results also showed that *P. americana* leaves are palatable and acceptable to WAD goats and when fed as supplement to guinea grass led to increased dry matter intake, nutrient digestibility and nitrogen utilization.

Table 1: Proximate composition (%) of *Panicum maximum* and *Persea americana* leaves

Parameter	*Panicum maximum*	*Persea americana*
Dry matter	24.27	34.25
Crude protein	16.26	12.72
Crude fibre	26.84	16.98
Ether extract	7.34	7.28
Ash	5.67	9.71
NFE	47.97	57.64

Table 2: Nutrient intake (g/day) and digestibility (%) of *Persea americana* leaves by WAD Goats

Parameter	Treatments					Mean
	A	B	C	D	E	±SEM
Panicum intake	125.14[a]	104.03[a]	67.66[b]	22.04[c]	-	79.72±2.31
Persea intake	-	37.32[c]	89.93[b]	141.88[a]	187.92[a]	114.26±56.35
DM intake	125.14	141.36	157.59	172.92	187.92	156.99±22.22
CP intake	20.35	20.66	22.47	21.64	23.90	21.80±1.29
CF intake	33.59	34.26	33.43	30.01	31.91	32.64±1.52
NFE intake	60.03[b]	71.42[ab]	84.29[a]	92.35[a]	108.32[a]	83.28±16.68
DM digestibility	59.99[b]	62.58[b]	68.88[ab]	73.02[a]	74.91[a]	64.63±4.61
CP digestibility	62.18	76.87	76.31	80.00	76.40	73.76±5.25
CF digestibility	58.62	59.04	60.19	63.80	65.32	56.44±7.78
EE digestibility	37.90	49.90	47.99	41.91	46.63	44.87 ±4.37
NFE digestibility	69.42	69.68	69.88	77.99	81.47	71.84±5.13

[ab] Means along the same row with different superscripts are significantly different (P<0.05)

Table 3: Nitrogen balance in WAD goats fed graded levels of *Persea americana* leaves

Parameter	Treatments					Mean
	A	B	C	D	E	±SEM
N intake, g/day	3.25[b]	3.47[ab]	3.59[ab]	3.47[ab]	3.82[a]	3.50±0.61
Fecal N, g/day	1.24[a]	0.80[b]	0.85[ab]	0.69[b]	0.77[b]	0.89±0.19
N digestibility, g/day	2.02[b]	2.66[a]	2.74[a]	2.78[a]	3.05[a]	2.61±0.18
Urinary N, g/day	0.41	0.43	0.34	0.49	0.38	0.41±0.09
Total N output, g/day	1.65[a]	1.23[ab]	1.19[b]	1.18[b]	1.15[b]	1.27±0.17
Nitrogen balance, g/day	1.60[b]	2.24[a]	2.40[a]	2.29[a]	2.67[a]	2.20±0.22
Nitrogen retention, %	79.48	83.93	87.42	87.42	87.56	84.03±3.71

[ab] Means along the same row with different superscripts are significantly different (P<0.05)

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