



IN VITRO GAS FERMENTATION ASSESSMENT OF PERSEA AMERICANA LEAF AND ACCEPTABILITY BY WAD SHEEP



Mako, Adejoke, A., Akinwande, Victor. O., and Anyimukwu, Obioma. G

Department of Agricultural Science,
Tai Solarin University of Education, Ijagun. Ijebu-Ode
jokemako2006@gmail.com 08023292736

Abstract

Ruminants in the tropics are slow growing, resulting from low quality feed. The use of indigenous multipurpose plants is a good strategy for an improved livestock performance. Chemical composition and Coefficient of preference of green, yellow and brown leaves of *Persea americana* (PA) by West African Dwarf Sheep were determined. *In vitro* gas production (IVGP) of green, yellow and brown leaves of PA were carried out over a period of 24 hr incubation. Metabolizable energy (ME), organic matter digestibility (OMD) and short chain fatty acids (SCFA) were predicted. 10 M NaOH was introduced into the inoculums after 24 hrs from which methane (CH₄) production was measured. Results indicated that chemical composition ranged significantly ($p < 0.05$) among the different forms of PA leaves. Dry matter ranged between 88.75 and 91.22% in green and brown leaf respectively, same trend was observed for neutral detergent fibre, it ranged from 59.48 to 60.01% in green and brown leaf respectively, while the crude protein ranged between 23.59 and 25.85% in brown and green leaf respectively.

The CoP ranged between 1.58 and 2.01 in brown and green leaf respectively. The IVGP, ME, OMD, SCFA and methane production were not significant ($p > 0.05$). Same trend was observed for all the *in vitro* gas fermentation characteristics with the green leaf recording the highest value, while the lowest values were obtained in the brown leaf. They ranged between 6.25 and 8.50 ml/200mg DM; 3.73 and 3.96 MJ/Kg DM; 38.66 and 41.67%; 0.18 and 0.22 μ mol; 2 and 4 ml/200mg DM in brown and green leaf respectively.

The result of this study showed that all forms of *Persea americana* leaf have potential as prospective forage for ruminant production in the tropics.

Introduction

Browse plants, besides grasses constitutes one of the cheapest source of feed for ruminants (Okah and Anita, 2016).

Browns have been used as feed by both domestic and wild life (Ukanwoko and Ironkwe 2013).

They provide year round evergreen fodder for browsing animals and supply vitamins and frequently mineral element mostly lacking in grasses (Ahamefule *et al.*, 2006).

It is therefore necessary to research into ways of managing browse plants to balance forage quality and quantity.

In vitro fermentation has been used to evaluate digestibility and nutritional value of feed.

It is cheaper, less laborious and most importantly, allows experimental conditions more accurately than the *in vivo* methods (Ajayi and Babayemi, 2008).

This study focuses on evaluating the nutritive potential in three different forms of *Persea americana* leaf as feed supplements for ruminants using *in vitro* gas production technique to predict gas production parameters: (Metabolizable energy (ME), Short chain fatty acid (SCFA), Organic matter digestibility (OMD)) and characteristics: insoluble degradable fraction (b), potential (a+b) and rate of degradation (c), and acceptability by West African Dwarf Sheep

Materials and Methods

Twenty *Persea americana* trees within the environment of Government Science and Technical college Ijebu-Ode. were marked randomly for collection of samples. Green and yellow leaves are plucked from each *Persea americana* tree. The brown leaves were picked from the floor around the root of each plant. Reasonable numbers of each leaf type were collected and taken to the laboratory for analysis.

Incubation was as reported (Menke and Steingass 1988).



Pix 1: Collection of rumen liquor through from an animal



Pix 2: Flushing of the rumen liquor with carbon dioxide to make prevent the micro organisms from dying.



Pix 3: filling the syringe with inoculums and samples



Pix 4: syringes with inoculums and samples set in the incubator



Persea Americana Fruit

Acceptability Trial

The green and yellow leaves were harvested fresh each day, while the brown leaves were picked from the fallen ones around the base of *Persea americana* trees, 4 kg each of the leaves were introduced on cafeteria basis to the animals in three different containers. The positioning of the leaves was changed daily to prevent bias by the animals taking a particular part of the pen as the position for a particular form of leaf. The amount consumed was monitored for eight hours daily and the quantity consumed for each form of leaf was recorded. The animals were then released for grazing. Feed preference was determined from coefficient of preference (CoP) value calculated from the ratio between the intakes of each individual feed sample divided by the average intake of three feed samples (Mako, 2009). On this basis, a feed was taken to be relatively preferred if the CoP value is greater than unity.

$$\text{CoP} = \frac{\text{intake of individual forage offered}}{\text{mean intake of all the forage offered}}$$

Data obtained were analyzed and subjected to analysis of variance procedure (ANOVA) of SAS (2012). Significant treatment means were separated by Duncan's multiple range test of the same package.

Results and Discussion

Table 1 shows the *in vitro* gas production parameters and characteristics of green, yellow and brown leaf of *Persea americana* estimated from gas production. No significant differences was observed among the different forms of leaves for metabolizable energy (ME), organic matter digestibility (OMD) and short chain fatty acid (SCFA). These results are comparable and in agreement with the values of 4.74 MJ/Kg DM; 38.03 % and 0.22 μ mol reported for *Spondia mombin* leaf (Omoniyi *et al.*, 2013). Chemical composition in combination with *in vitro* digestibility and ME content can be considered useful indicators for preliminary evaluation of potential nutritive value of forages (Kafilzadeh and Heidary, 2013). Same trend was observed for *in vitro* gas production characteristics, except for soluble degradable fraction (a) that varied significantly. The values of ME, OMD and SCFA obtained here is an indication that animals will be able to obtain energy from the leaves. ($p < 0.05$) among the leaf forms. Gas production is an indication of degradability of samples (Arifuddin *et al.*, 2017). The degradation observed in the samples is an indication that *Persea americana* leaf can be used as feed supplement for ruminants in the tropics. Methane production indicates an energy loss to the ruminant and many tropical feedstuffs have been implicated to increase methanogenesis (Babayemi and Bamikole, 2006).

Table 2: Preference of experimental animals introduced to green, yellow and brown leaf of *Persea americana*

Leaves	<i>In vitro</i> gas production parameters					<i>In vitro</i> gas production characteristics			
	ME	SCFA	OMD	TIVGP	CH ₄	a	b	C	a+b
Green	3.96	0.22	41.67	8.50	4.00	4.00 ^a	7.78	0.22	11.78
Yellow	3.81	0.20	39.76	6.75	3.00	4.00 ^a	7.65	0.13	10.94
Brown	3.73	0.18	38.66	6.25	2.00	2.50 ^b	6.94	0.10	10.15
SEM	0.24	0.04	1.55	1.05	1.02	0.83	1.61	1.21	1.74

Persea americana leaf

^{a,b} = means on the same column with different superscript differed significantly ($p < 0.05$)
a (ml/200 mg DM) = soluble degradable fraction; b (ml/200 mg DM) = insoluble degradable fraction; a+b (ml/200 mg DM) = Potential degradability; c (ml/h) = rate of degradation; ME = Metabolizable energy (MJ/Kg DM); SCFA (μ mol) = Short chain fatty acid; OMD (%) = Organic matter digestibility; TIVGP (ml/200 mg DM) = total *in vitro* gas production; CH₄ (ml/200 mg DM) = Methane; SEM = standard error of mean

Table 2: Preference of experimental animals introduced to green, yellow and brown leaf of *Persea americana*

Form	Mean daily (kg DM) Consumption of all animals	Coefficient Of preference	Ranking
Green	3.23	2.01	1
Yellow	2.05	1.60	2
Brown	1.93	1.58	3

The preference level of animals fed the green, yellow and brown *Persea americana* leaves are on display in Table 2. A coefficient of preference (CoP) value higher than unity was taken to be preferred or accepted while the converse was true for a CoP value less than unity. For this reason, all the leaf forms were accepted by the animals, the green leaf was mostly preferred with CoP of 2.01. Furthermore, the NDF of a forage or sample is a good indicator of how much forage/sample an animal will consume. As the NDF content of forages increases, forage intake and net energy decreases (Tadele, 2015).

Conclusion

In vitro digestibility and acceptability can be considered as useful indicators for preliminary evaluation of the likely nutritive value of this browse plant. It can therefore be concluded that *Persea americana* leaf has potential as a forage for ruminants in the humid tropics, especially during the off season.

References

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