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CHEMICAL COMPOSITION AND INVITRO DEGRADABILITY OF SELECTED PLANTS CONSUMED BY SMALL RUMINANT

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ABSTRACT
A study was conducted to evaluate the chemical composition and *in vitro* degradability of *Azadirachta indica, Sida acuta, Aspilia africana, Tithonia diversifolia* and *Urena lobota.* The resulting products were collected, sun-dried and kept in a polythene bags for further investigation. Samples were investigated for proximate composition, *in vitro* gas production characteristics, estimated organic matter digestibility (OMD%), metabolizable energy (ME, MJ/kgDM) and short chain fatty acid (SCFA, mol). Results obtained showed that, there was significant difference in proximate composition with crude protein (CP) ranging from 14.33 in *Azadirachta indica* to 32.48% in *Urena lobota*. The content of the neutral detergent fibre (NDF) differed significantly (P<0.05) with values ranging from 58.92 in *Azadirachta indica* to 62.44% in *Tithonia diversifolia*. The estimated OMD and ME were significantly (P<0.05) highest in *Urena lobota* (44.03 % and 4.84 MJ/kgDM) respectively. The study concluded that, the selected plants evaluated had high crude protein contents which would make them good protein supplement to poor quality feeds especially during feed scarcity without adverse effect.

Keywords: Forages, *In vitro* Gas, Metabolizable energy, Organic matter, Ruminants

INTRODUCTION
The potentials of forage plants as alternative fodder resources in ruminant nutrition have attracted the attention of researchers' worldwide. Several indigenous and exotic browse species have been investigated and evaluated for inclusion in ruminant feeding systems in Nigeria. Forage quality and availability vary greatly from season to season which however, affect the output of the animals. One possible way to mitigate this challenge and maintain production in the tropics is to introduce unconventional feeds which cannot be consumed by man but can be converted by ruminants into desirable human food. This will go a long way in reducing the cost of production without a decrease in productivity (Odeyinka, 2001).This study was undertaken to determine the chemical composition and *invitro* digestibility of*Azadirachta indica, Sida acuta, Aspilia africana, Tithonia diversifolia* and *Urena lobota.*

Materials and Methods
Sample collection and preparation
Five native forage species (*Azadirachta indica, Sida acuta, Aspilia africana, Tithonia diversifolia* and *Urena lobota)* were used for thestudy. The fresh samples of the forage species were collected after been identified as the major consumable plants by sheep and goats in the area. The plants were collected from different mature plants within the premises of Yaba College of Technology Epe campus. Laboratory analysis was carried out at Biological laboratory, Federal university of Agriculture, Abeokuta, South- West, Nigeria. A portion of the harvested samples was weighed and oven-dried at 65^0 C for 72hours, ground through a 1 mm screen and stored in a polythene bag prior to chemical and *in vitro* analysis.

Chemical analysis procedure
Chemical composition (CP, CF, EE, Ash and NFE) of the plant sample was determined according to AOAC (1995) protocol. Neutral detergent fibre (NDF), Acid detergent lignin (ADL) and Acid detergent fibre (ADF) were determined according to the procedure of Van Soest *et al*., (1991). Cellulose and hemicellulose

were derived from Neutral detergent fibre (NDF), Acid detergent lignin (ADL) and Acid detergent fibre (ADF) by simple calculation as follows: Hemicellulose = NDF – ADF, Cellulose = ADF – ADL

***In vitro* gas production**

Rumen liquor was obtained from three West African dwarf female goats through suction tube before morning feed. The preparation is buffer solutions and rumen innocula was done according to the method described by Menke and Steingass (1988). Gas production was measured three hourly and at 48h gas production, 4ml sodium hydroxide (10ml) was introduced after 24h post incubation to estimate methane production. The average of the volume of gas produced from the blank was deducted from the volume of gas produced per sample. Metabolizable Energy (ME) was calculated as ME = 2.20 + 0.136GV + 0.057CP + 0.0029CF Menke and Steingass (1998), organic matter digestibility (OMD, %) = 14.88 + 0.88Gv + 0.45CP + 0.651 XA (Menke and Steingass, 1998). Short chain fatty Acids (SCFA) as 0.0239 Gv – 0.0601 (Getachew *et al.*, 1999) was obtained where Gv, CP, CF and XA are total gas volume, crude protein, crude fiber and ash respectively. **Statistical analysis**

Data collected were subjected to One way Analysis of Variance and significant differences among means were compared using Duncan multiple Range test (SAS, 2005).

Results and Discussion

Table 1: Proximate composition of selected plants

Selected plants	DM	CP	EE	Ash	CF	OM	NFE
Azadirachta indica	85.18^{c}	14.33^{d}	2.54^{e}	11.19^{c}	4.01^{c}	88.81^{c}	67.94^{a}
Sida acuta	88.53^{a}	15.43^{c}	6.79^{a}	7.77^{e}	6.97^{b}	92.23^{a}	63.04^{c}
Aspilia africana	84.96^{c}	15.39^{c}	2.66^{d}	11.31^{b}	4.04^{c}	88.69^{d}	66.60^{b}
Tithonia diversifolia	84.41^{d}	24.04^{b}	3.12^{c}	13.61^{a}	7.06^{b}	86.39^{e}	52.17^{d}
Urena lobota	86.46^{b}	32.48^{a}	4.30^{b}	9.13^{d}	8.77^{a}	90.87^{b}	45.33^{e}
SEM	0.40	1.87	0.42	0.54	0.50	0.54	2.35

^{abcde} Means along the same column with different superscript are significantly different (P<0.05), SEM= Standard error of mean DM= Dry matterCP= Crude proteinEE= Ether extract CF= Crude fibre OM= Organic matter NFE= Nitrogen free extract SEM= Standard error of mean

Table 2: Fibre fractions of selected plants

Selected plants	NDF	ADF	ADL	Cellulose	Hemi. cellulose
Azadirachta indica	58.92^{e}	31.10^{a}	18.34^{a}	12.76^{b}	27.83^{e}
Sida acuta	61.38^{b}	27.64^{c}	12.29^{e}	15.35^{a}	33.75^{b}
Aspilia africana	60.27^{c}	27.06^{d}	17.42^{b}	9.64^{d}	33.21^{c}
Tithonia diversifolia	62.44^{a}	25.67^{e}	15.37^{c}	10.30^{c}	36.77^{a}
Urena lobota	59.39^{d}	29.67^{b}	14.36^{d}	15.32^{a}	29.72^{d}
SEM	0.35	0.52	0.58	0.65	0.84

^{abcde} Means along the same column with different superscript are significantly different (P<0.05) SEM= Standard error of mean NDF= Neutral detergent fibreADF= Acid detergent fibreADL= Acid detergent lignin

The proximate composition of the selected plants is presented in Table 1. Results showed that, there were significant differences in the parameters observed. The least significant (p<0.05) dry matter (DM) value (84.41%) was observed in *Tithonia diversifolia* while the highest value (88.53%) was obtained in *Sida acuta*. The highest crude protein (CP) content (32.48%) in all the selected plants was observed in *Urena lobota* while the least value (14.33%) was obtained in *Azadirachta indica*. The CP contents of the present study (14.33 – 32.48%) compared favourably and in some cases exceeded those reported in some literatures for some browse plants in south eastern part of Nigeria (Ahamefule *et al.*, 2006). The CP values recorded for all the plants were above 8% required to satisfy the maintenance requirement for ruminants (Norton, 2003). The differences observed in the DM values obtained in this study and those of other researchers could be as a result of the seasonal or climatic

Table 3:*In vitro* gas production (ml/200mgDM) of selected plants at forty-eight hour

Selected plants	3h	6h	9h	12h	15h	18h	21h	24h	27h	30h	33h	36h	39h	42h	45h	48h
Azadirachta indica	1.00	1.00^{b}	1.33^{b}	2.67^{b}	3.00^{b}	3.00^{bc}	3.33^{bc}	4.00^{b}	4.33^{b}	5.00^{b}	5.00^{b}	5.33^{b}	5.33^{b}	5.67^{b}	6.00^{b}	6.00^{b}
Sida acuta	1.00	2.33^{a}	3.33^{a}	4.67^{a}	5.67^{a}	7.67^{a}	8.33^{a}	9.67^{a}	10.33^{a}	11.00^{a}	11.33^{a}	11.67^{a}	12.00^{a}	12.00^{a}	12.00^{a}	12.67^{a}
Aspilia africana	1.00	1.00^{b}	1.67^{b}	2.67^{b}	3.00^{b}	3.67^{b}	4.67^{b}	5.00^{b}	6.33^{b}	6.67^{b}	6.67^{b}	7.67^{b}	7.67^{b}	7.67^{b}	7.67b	8.00^{b}
Tithonia diversifolia	1.00	1.00^{b}	1.67^{b}	2.33^{b}	3.00^{b}	3.67^{b}	3.67^{bc}	5.00^{b}	5.33^{b}	6.00^{b}	6.33^{b}	6.67^{b}	7.00^{b}	7.33^{b}	7.33^{b}	7.67^{b}
Urena lobota	1.00	1.00^{b}	1.00^{b}	1.00^{c}	1.33^{b}	1.33^{c}	1.67^{c}	3.00^{b}	4.00^{b}	4.67^{b}	6.00^{b}	7.00^{e}	8.00^{b}	8.33^{ab}	9.00^{b}	9.67^{ab}
SEM	0.00	0.15	0.26	0.35	0.42	0.59	0.65	0.69	0.71	0.74	0.73	0.73	0.75	0.74	0.70	0.76

^{abcd} Means along the same column with different superscript are significantly different (P<0.05) SEM= Standard error of mean

Table 4: Methane gas (CH_4) production estimated short chain fatty acid (SCFA), organic matter digestibility (OMD) and metabolizable energy (ME) of the selected plants

Selected plants	CH_4	OMD	ME	SCFA
Azadirachta indica	1.33^{b}	33.95^{d}	3.84^{b}	0.08^{b}
Sida acuta	3.67^{a}	38.14^{bc}	4.82^{a}	0.24^{a}
Aspilia africana	2.33^{a}	36.28^{bc}	4.18^{ab}	0.13^{b}
Tithonia diversifolia	1.67^{b}	41.37^{ab}	4.63^{a}	0.12^{b}
Urena lobota	2.67^{ab}	44.03^{a}	4.84^{a}	0.17^{ab}
SEM	2.33	38.76	4.46	0.15

^{abcd} Means along the same column with different superscript are significantly different (P<0.05) SEM= Standard error of mean CH_4 =Methane OMD = Organic matter digestibility ME = Metabolizable energy SCFA = Short chain fatty acid

factors, stage of growth, maturity, soil type, species or variety as well as the ambient temperature and growth environment as supported by Agriculture (2011).

Table 2 shows fibre fractions of the selected plants. *Tithonia diversifolia* recorded significant highest value of 62.44% in NDF while the least value (58.92%) was observed in *Azadirachta indica*. ADF values ranged from 25.67 to 31.10% in *Tithonia diversifolia*and *Azadirachta indica* respectively. The range of the NDF values in the present study was higher than the safe upper limit of 60% (Meissner *et al*., 1991) for forage intake by sheep.Table 3 shows the *in vitro* gas production (ml/200mgDM) of selected plants at forty-eight hour. Steady increment in the *in vitro* gas production of the selected plants was observed as incubation period progressed from 3 hour to 48 hour. At 3 hour of incubation there was no significant ($P>0.05$) variation in the volume of gas produced in all of the plants recorded. Gas production by *Sida acuta* was consistently high ($P<0.05$) throughout the incubation period from 6 – 48 hour.Methane gas production, estimated short chain fatty acid, organic matter digestibility (OMD) and metabolizable energy (ME) of the selected plants are presented in Table 4. Metabolizable energy (ME) values obtained in this study (3.84 – 4.84 MJ/kgDM). was higher than the reported values by Babayemi (2007) for *Leuceana leucocephala* (8.31 MJ/kgDM), *Gliricidia sepium* (11.88 MJ/kgDM) and *Centrosema pubescens* (9.95 MJ/kgDM). The differences in ME value reported when compared with other reports mentioned could be ascribed to some certain secondary metabolites in the selected plants as corroborated by Aregheore and Abdulrazak (2005).

Conclusion The selected plants have potential to boost inadequate feed supply and improve low level of nutrients encountered by ruminants especially in the dry season.

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