



CHEMICAL COMPOSITION AND INVITRO DIGESTIBILITY OF FIVE SELECTED FORAGES USED AS FEED FOR GOATS AND SHEEP AT ODORAGUSHIN OF EPE LOCAL GOVERNMENT, LAGOS STATE.

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Abstract

Chemical composition of five selected forage species (*Mimosa pudica*, *Aspenlenum bulbiferum*, *Commelina benghalensis*, *Chamaecoustus cupidatus* and *Panicum maximum*) used as feed resources in Odoragunshin area of Epe local government, Lagos state was carried out. The result obtained showed variations ($P < 0.05$) in the proximate composition and *invitro* digestibility. The crude protein content was highest in *Commelina benghalensis* (21.46%) and was least in *Chamaecoustus cupidatus* (11.88%). Ether extract ranged from 7.70% - 15.38% in *Mimosa pudica* and *Chamaecoustus cupidatus* respectively. Highest Ash value (15.38%) was recorded in *Commelina benghalensis*. The estimated organic matter digestibility (OMD), metabolizable energy (ME) and short chain fatty acid (SCFA) were significantly different ($P < 0.05$). The result obtained in the present study showed that the selected forages could be used as part of feed for ruminants, especially during the period of scarcity.

Keywords: Forages, Nutrition, Organic matter digestibility, *In vitro* gas, 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. Unfortunately, the adoption of most of these species by farmers has been faced with several challenges such as pests and diseases attack and presence of anti-nutritional factors. There is therefore the need for continuous screening of browse plants to identify those with good potentials as livestock fodder and which could serve as alternatives to those species which have already being evaluated (Fadiyimu *et al.*, 2011). D'Mello (1992) stated that results of proximate analyses are extensively employed in research and industry for quick estimation of nutrient potentials of feedstuffs; although such results may not give a true indication of the nutritive value of a feed, they supply clues in research to plants of potential value for further *in vitro* or *in vivo* studies. Buttressing this assertion, Okoli *et al* (2003) stated that proximate analysis is specifically useful in screening the array of tropical browse plants utilized by indigenous farmers for ruminant feeding.

Thus, this study was undertaken to determine the chemical composition and *invitro* digestibility of *Mimosa pudica*, *Aspenlenum bulbiferum*, *Commelina benghalensis*, *Chamaecoustus cupidatus* and *Panicum maximum* used as feed for goats and sheep at Odoragunshin of Epe local government, Lagos State.

Material and Method

Sample collection and preparation

Five native forage species (*Mimosa pudica*, *Aspenlenum bulbiferum*, *Commelina benghalensis*, *Chamaecoustus cupidatus* and *Panicum maximum*) were used for the study. 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 aforementioned local government area of Lagos state. 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^o 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 NDF, ADF and ADL by simple calculation as follows: Hemicellulose = NDF – ADF, Cellulose = ADF – ADL

In vitro gas production

Rumen liquor was obtained from three WAD female goats through suction tube before morning feed. The preparation is buffer solutions and rumen innocula was as described by Menke and Steingass (1988). Gas production was measured three hourly and at 24h 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), 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*, 1991) was obtained where Gv, CP, CF and XA are total gas volume, crude protein, crude fiber and ash respectively. Data obtained were subjected to analysis of variance, where significant differences occurred, the means were separated using Duncan multiple range F-test of the SAS (Statistical Analysis System Institute Inc, 1988 options).

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, 1990).

RESULT AND DISCUSSION

Table 1: Proximate Composition and Crude Fiber fractions

	EE	Ash	CF	CP	NFE	ADF	ADL	NDF	Cellulose	Hemicellulose
T ₁	11.09 ^c	7.73 ^c	4.60 ^c	13.56 ^d	52.01 ^b	43.6 ^d	24.55 ^b	65.34 ^d	19.09 ^d	21.70 ^b
T ₂	12.08 ^b	15.38 ^a	1.98 ^e	21.46 ^a	38.10 ^e	30.19 ^e	18.87 ^e	61.88 ^e	11.32 ^e	31.68 ^a
T ₃	15.38 ^a	8.77 ^b	5.25 ^b	11.88 ^e	49.10 ^d	59.62 ^b	23.08 ^c	71.54 ^b	36.54 ^b	11.92 ^d
T ₄	7.70 ^e	4.64 ^d	2.99 ^b	20.25 ^b	53.49 ^a	62.26 ^a	29.06 ^a	78.23 ^a	33.20 ^c	15.97 ^c
T ₅	8.45 ^d	4.46 ^e	5.33 ^a	20.09 ^c	50.70 ^c	58.25 ^c	19.03 ^d	69.59 ^c	39.22 ^a	11.34 ^e
SEM	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003

^{a,b,c,d,e} means along the same column with different superscripts are significantly different (P<0.05)

T₁– *Panicum maximum*, T₂ – *Commelina benghalensis*, T₃ – *Chamaecostus cupidatus*, T₄ – *Mimosa pudica*, T₅ – *Aspenlenum bulbiferum*, EE – Ether extracts, CF – Crude fiber, CP – Crude protein, NDF – Neutral detergent fiber, ADL– Acid detergent lignin, NFE – Nitrogen free extracts, ADF – Acid detergent fibre, SEM – Standard error of mean

Table 2: In vitro Gas Production and Characteristics



Sample	3h	6h	9h	12h	15h	18h	21h	24h	ME	SCFA	OMD	CH ₄
T1	1 ^a	2 ^a	8 ^a	9 ^a	11 ^a	14 ^a	21 ^a	28 ^a	8.64 ^a	0.61 ^a	50.91 ^a	5.33 ^a
T2	1 ^a	2 ^a	5 ^{bc}	8 ^a	9 ^{ab}	11 ^{ab}	13 ^b	18 ^b	5.78 ^c	0.37 ^b	50.55 ^a	3.33 ^b
T3	1 ^a	2 ^a	3 ^c	5 ^a	6 ^b	9 ^b	10 ^b	16 ^b	7.38 ^b	0.32 ^b	40.16 ^c	3.33 ^b
T4	1 ^a	2 ^a	6 ^{ab}	7 ^a	9 ^{ab}	13 ^a	15 ^b	18 ^b	6.36 ^c	0.37 ^b	43.02 ^b	3.67 ^{ab}
T5	1 ^a	2 ^a	5 ^{bc}	9 ^a	11 ^a	13 ^a	14 ^a	19 ^b	7.83 ^{ab}	0.39 ^b	43.7 ^b	3.67 ^{ab}
SEM	0	0	0.45	1	0.73	0.68	0.9	1.09	0.45	0.078	2.92	0.96

^{a,b,c} means along the same column with different superscripts are significantly different (P<0.05)

Table 1 shows the proximate composition and crude fibre fractions of *Mimosa pudica*, *Aspenlenum bulbiferum*, *Commelina benghalensis*, *Chamaecoustus cupidatus* and *Panicum maximum*. The CP was best in *Commelina benghalensis* (21.46%) and least in *Chamaecoustus cupidatus* (11.88%). Highest CP value observed in *Commelina benghalensis* was higher than 14.6% reported for *Gmelina arborea* (Amata and Lebari, 2011). Least CP value (11.88%) observed in *Chamaecoustus cupidatus* when compared with *Panicum maximum* value (13.56%) negates the report of Getachew *et al.*, (2004) that browse forages are higher in CP than tropical grasses and roughages such as hay, straw and stover but this value is above 8% required to satisfy the maintenance requirement for ruminants (Norton, 2003). NDF ranged from 38.10% in *Commelina benghalensis* to 53.49% in *Mimosa pudica*, these values compared favourably with the report of Okoli *et al.*, (2003), Ahamefule *et al.*, (2006) as well as Ogunbosoye and Babayemi (2010) for some selected browse plants in Nigeria. NDF observed in *Commelina benghalensis* and *Panicum maximum* was lower than the safe upper limit of 60% (Meissner *et al.*, 1991) for guaranteed forage intake by sheep. The values reported for cellulose across the examined forage species compared favourably to the report of Odedire and Babayemi (2008). Disparity observed could be probably due to differences in species, climatic and edaphic factors as confirmed by Fadiyimu *et al.*, (2012).

Aspenlenum bulbiferum relatively showed higher (P<0.05) gas production values from 9th – 24th hour Of incubation (Table 2). The organic matter degradability of the forages differ significantly (P<0.05) ranging between 40.16 and 50.91 (Table 2). The amount of gas released when feed are incubated in *invitro* has been reported to be closely related to digestibility of feed for ruminants (Mebratu and Tenaye, 1997). Thus, the gas volume can be considered a good reflection of substrate fermentation to Volatile fatty acids and an estimate of potential digestibility in the rumen.

CONCLUSION

The forage species investigated have appreciable nutrients above recommended minimum levels to support growth and maintenance of ruminants. These plants have potential to boost inadequate feed supply and low level of nutrients encountered by ruminants especially in the dry season.

REFERENCES

- Ahamefule F.O, Ibeawuchi J.A, Agu M (2006). Comparative evaluation of some forages offered to goats in Umudike, Southeastern Nigeria. *Journal of Sustainable Tropical Agricultural Research* 18: 79-86.
- Amata, I. A. and Lebari, T.A 2011. Comparative evaluation of the nutrient profile of four selected browse plants in the tropics, recommended for use as non-conventional livestock feeding materials. *African Journal of Biotechnology*. 10(64). Pp. 14230- 14233
- AOAC, 1995. Official methods of analysis of the Association of Official Analytical Chemists. 16th ed. Arlington, Virginia, U.S.A



- D'Mello J. P. F. (1992). Nutritional potentialities of fodder trees and shrubs as protein sources in monogastric nutrition. In: Legume trees and other fodder trees as protein sources for livestock. A Speedy and P Pugliese (Editors) FAO Animal Production and Health Paper 102. FAO Rome, Italy. pp 115 – 127. <http://www.fao.org/DOCREP/003/T0632E/T0632E08.htm>
- Fadiyimu, A. A, Fajemisin, A. N. and Alokun, J. A. (2011). Chemical composition of selected browse plants and their acceptability by West African Dwarf sheep, *livestock research for rural development* 23(12)
- Getachew, G, E, DePeters and Robinson, P.H. (2004). *In vitro* gas production provides effective methods for assessing ruminant feeds. Research article, *California Agriculture*, 58(1): 54-58.
- Mebrahtu, O. and Tenaye, S.B. (1997). Analytical methods for Feeds Animal Excrements and Animal Tissues. International Livestock Research Institute (ILRI) Nutrition Laboratory ILRI-Ethiopia, Addis Ababa, Ethiopia.
- McDonald, P. Edwards, R.A. Greenhalgh, J.F.D. and Morgan, C.A. (1995). Animal nutrition, 5th edition, Longman, U.K., 607 pp.
- Meissner, H. H, Viljoen, M. O. and van Niekerk W. A. (1991). Intake and digestibility by sheep of Anthephora, Panicum, Rhodes and Smooth finger grass In: *Proceedings of the IVth International Rangeland Congress*, September 1991, Montpellier, France pp 648-649.
- Menke, K.H. and Steingass, H (1988). Estimation of the Energetic Fed. Value from Chemical Analysis and *in vitro* Gas Production using Rumen Fluid. *Anim Res. Dev.* 28:7-55.
- Norton, B.W. (2003). Tree legumes and Dietary supplements. In: *Forages Tree legumes in Tropical Agriculture*, Gutteridge, R.C. and H.M Shelton, (Eds) CAB International, Wallingford, Oxon, pp:192- 201
- Odedire, J. A. and Babayemi, O. J. (2008). Comparative studies on the yield and chemical composition of *Panicum maximum* and *Andropogon gayanus* as influenced by *Tephrosia candida* and *Leucaena leucocephala*, *Livestock Research for Rural Development* 19(9) <http://www.lrrd.org/lrrd19/9/oded19128.htm>.
- Ogunbosoye, D.O. and Babayemi, O.J.(2010). Potential values of some non-leguminous browse plants as dry season feed for ruminants in Nigeria. *African Journal Biotechnology* 9 (18): 2720-2726.
- Okoli, I. C. Anunobi, M. O. Obua, B. E. and Enemu, V. (2003). Studies on selected brouses of southeastern Nigeria with particular reference to their proximate and some endogenous anti-nutritional constituents. *Livestock Research for Rural Development* 15(9). <http://www.lrrd.org/lrrd15/9/okol159.htm>
- SAS {Statistical Analysis System}. (1990). *SAS/STAT User's guide*, version 6 <http://www.mekarn.org/proprf> (Volume 2; Fourth Edition). Cary North Carolina, SAS Institute, Incorporated 846p.
- Van Soest, P.J., Robertson, J.B. and Lewis, B, (1991). Methods for dietary fiber, and non-starch polysaccharides in relation to animal nutrition, *Journal of Dairy Science* 74: 3587-3597.