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The Nutritive Value of Some Plants Browsed by Cattle in Umudike, Southeastern Nigeria

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Abstract: Seventeen browse plants eaten by cattle in Umudike, Abia State of Nigeria were subjected to nutritional evaluation. The plants were classified into heavily, moderately and occasionally browsed species based on their frequency of browsing by cattle. The highest and the lowest crude protein (CP) values were obtained in *Napoleona vogelii* (25.55%) and *Grewia pubescens* (13.65%), respectively. Average CP was highest in the occasionally browsed species (18.62%) and lowest in heavily browsed plants (17.92%). The corresponding value for the moderately browsed plants was 18.35%. The calculated *in vitro* organic matter digestibility (IVOMD) was highest for the heavily browsed (51.32%) plants while the occasionally browsed species had the lowest value (48.69%). Generally, browses contained higher concentration of calcium than phosphorous. The average calcium content of the heavily browsed (1.57%) plants was higher than values obtained for either the moderately (1.38%) or the occasionally browsed plants (1.45%), Phosphorous concentration was however, slightly higher in the moderately browsed species (0.39%) than in either the heavily or the occasionally browsed (0.37%) plants. The digestible crude protein (DCP) followed similar pattern with CP and ranged from 9.17% in *Grewia pubescens* to 20.24% in *Napoleona vogelii*. The highest mean DCP was obtained from the occasionally browsed plants (13.78%). The acid detergent fibre (ADF) and neutral detergent fibre (NDF) values were 48.05, 55.62% for the heavily, 41.60, 48.21% for the moderately and 48.65, 46.75% for the occasionally browsed plants, respectively. CP and DCP content of browse did not necessarily influence browsing intensity or behaviour in cattle.

Key words: Browse plants, cattle feed, digestible crude protein

Introduction

Browse plants, beside grasses, constitute one of the cheapest sources of feed for ruminants. The diversity and distribution of browse plants in Nigeria have received early attention in studies carried out for the north (Saleem *et al*., 1979), southwest (Carew *et al*., 1980) and middle belt (Ibeawuchi *et al*., 2002) Nigeria. Available information on browse plants of southeast Nigeria is scanty (Mecha and Adegbola, 1985) and mostly unpublished (Okigbo, 1980; Orok and Duguma, 1987; Okafor and Fernandez, 1987). The result of an informal survey (Okoli *et al*., 2003) in this region contradicted the reports of Wahua and Oji (1987), Reynolds and Atta-Krah (1987) and Okafor and Fernandez (1987) who respectively identified 35, 30 and 27 browse plants for the entire southeast region. Their report (Okoli *et al*., 2003) indicated that there were much more browse resources in the region than the few highlighted by the preliminary studies. Through the help of animal keepers in a farmer-researcher combined survey, these investigators uncovered well over 160 browse plants found within the southeastern ecological niche. Some of these plants however, were not common to all the sites understudied.

Information on the distribution and diversity of browse plants in Abia state of Nigeria is also lacking (Ahamefule *et al*., 2006). A detailed study of the browse plants found within Abia state is essential to generate baseline data and to determine the potential browse resource within the major ecological frontiers of the state. The potential yield of browse would provide useful tool for the determination of stocking rate and indeed the carrying capacity of a range or land under grazing.

Browse plants provide vitamins and frequently mineral elements, which are mostly lacking in grassland pasture. Their year round evergreen presentation and nutritional abundance provides for year round provision of fodder (Opara, 1996; Oji and Isilebo, 2000). It also enables standing feed reserve to be built so that herds can survive critical periods of shortfall, or even prolonged periods of drought, without remarkable losses (Odoh and Adamu-Noma, 2000). Deforestation, urbanization and bush burning are some of the major factors responsible for dwindling proceeds of browse feed resource for ruminant livestock. Conservatory methods however, would ensure that locally adapted and well-established species do not become extinct.

Umudike is a major grazing route and access way from Abia to Akwa Ibom and Cross River states, for the Hausa-Fulani herdsmen who criss-cross the nation with their cattle in search of fodder. It is also the grazing habitat for Michael Okpara University herd numbering over fifty. This study was therefore designed to identify the browse plants relished by cattle in Umudike and

their nutritional status. This perhaps would help to explain the browsing behaviour or pattern demonstrated by the University herd.

Materials and Methods

Environment of study: The study as conducted within Michael Okpara University of Agriculture, Umudike and its environs. Umudike is located in Abia state of Nigeria on latitude 05°, 28^{1} North, longitude 07°, 31^{1} East and at an altitude of 122m above sea level. It falls within the rain forest zone of West Africa characterized by long duration of rainfall (7-9 months) and short period of dry season. Average rainfall is 2169 mm in 148-155 rain days while average ambient temperature is 26°C with maximum and minimum of 32° and 22°C respectively. Relative humidity ranges from 50-95%. The study was conducted within the late-dry and the early-rainy seasons of 2005 (January – April).

Collection of samples: Leaves of forage plants browsed by the University cattle herd were collected over a 30-day period. The animals were closely monitored as they grazed between 0900 - 1200 and 1400 - 1600 hr. daily. Samples of foraged plants other than grasses were isolated and screened. The familiar browses were identified in the Pasture Development Unit of the Livestock centre. Others were sent to the Department of Forestry of the University for identification.

Plan of the experiment: Twenty sample sites each measuring 5m x 5m were randomly selected from cattle grazing grounds in the University and its environs. All browse plants within each sample site were identified and classified using methods of Agishi (1984, 1985) and the trees of Nigeria by Keay (1989). All browse plants identified within each sample site were cross-checked over the list of plants collated during sample collection. Any browse plant previously identified during sample collection and subsequently found within any sample site was scored 1. For instance a given browse plant may score 0, 1, 2, 3…20 if found in none, one, two, three or all of the twenty sample sites. Based on this scoring pattern browse plants were classified as follows: 0 - 6 points (Heavily browsed), 7 - 13points (Moderately browsed) and 14 - 20 points (Occasionally browsed).

Analytical procedure: The proximate compositions of the browse plants were analyzed according to A.O.A.C. (1990) methods. Calcium and Phosphorous determinations was by Kirk and Sawyer (1998) and James (1995) methods, respectively. The acid (ADF) and neutral (NDF) detergent fibre analysis were carried out by the procedure of Goering and Van Soest (1970).

Data analysis: Means and standard deviations of the proximate and mineral compositions as well as other constituents were computed for the heavily, moderately and occasionally browsed plants. The digestible crude protein (DCP) was estimated as
DCP% = 0.93 CP - 3.52 (Demmewguilly and Weiss, 1970) while the *in vitro* organic matter digestibility (IVOMD) was estimated using the regression equation:
Y = 57.49 - 0.232X - 0.725Z (Geri and Sottini, 1970).
where Y is the true IVOMD, X is the crude fibre, and Z is the ether extract

Results and Discussion

The list of plants commonly browsed by cattle in Umudike, Abia state Nigeria are presented in Table 1. Table 2, 3 and 4 also show the summary of the chemical compositions of the heavily, moderately and occasionally browsed species, respectively. The crude protein (CP) contents of browse plants ranged from 13.65% in *Grewia pubescens* to 25.55% in *Napoleona vogelli*. The average CP content of 18.34±3.53 generally obtained for all browse plants in this study fell within the ranges of 11.20 - 18.38% (Chidolue, 1993), 11 - 20% (Bayer, 1986; Larbi *et al.*, 1993) and 15.59 - 20.99% (Oji *et al.*, 1998; Oji and Isilebo, 2000) reported for browses of southern Nigeria, but higher than 12.5% reported for West African browse plants (Le Houerou, 1980). The occasionally browsed plants were averagely higher in CP than both the moderately and heavily browsed species. This observation runs contrary to the findings of Ibeawuchi *et al.* (2002) who reported higher CP concentration in the heavily browsed species of Makurdi in Benue state of Nigeria. Saleem *et al.* (1979) had earlier reported similar findings in the browsed plants of northwest Nigeria. Browses of Nigerian rangelands differ in diversity and chemical composition owing to variability in soil types and constitution.
The average CP content of the heavily browsed species in this study was the least (Table 2). Investigation had shown that CP content of browse may influence browsing behaviour in cattle (Ibeawuchi *et al.*, 2002) but not absolutely, palatability, a taste related attribute of herbivores, contributes to relative intake and browsing behaviour in ruminants (Obioha, 1985). While CP may enhance palatability, it is not synonymous to it. Browse plants are known to contain certain levels of anti-nutritional properties like tannin which affect the palatability and intake of browse (Ibeawuchi *et al.*, 2002). It is reported (Robbins *et al.*, 1987) that tannins bind feed proteins to the salivary glands and the epithelium of the mouth, making feed unpalatable thereby depressing voluntary intake. Since the heavily browsed species contained the least CP, it confirmed the fact that some other factors other than nutritional composition was complementary to the browsing behaviour shown by cattle.
The heavily browsed plants in this study were not the

Table 1: Plant species browsed by cattle in Umudike, Abia state

Browse plants	Family
Heavily browsed	
Tridax procumbens (Linn)	Compositae
Aspilia Africana (Pers) I. D. Adams	Compositae
Amaranthus spinosis (Linn)	Amarantheceae
Sida acuta (Schum & Thonn)	Papilionaceae
Moderately browsed	
Alchornea cordifolia (Schum & Thonn)	Euphobiaceae
Urena lobata (Linn)	Malvaceae
Asystasis gangestica (Linn) T. Anders	Acanthaaceae
Manyphyton fulvum. Mull. Arg.	Euphobiaceae
Calapogonium mucunoides. Desv.	Papilionaceae
Centrosema pubescens. Benth.	Malvaceae
Gmelina arborea. Roxb-Kennedy	Verbenaceae
Occasionally browsed	
Landolphia owariensis.	*
Milletia spp. (Schum & Thonn)	Papilionaceae
Grewia pubescens. P. Beall.	Tillaceae
Dialium guinensis. (Linn)	Caesalpinaceae
Combretum racemosum. (Diels)	Combretaceae
Napoleona vogelii	*

* could not be identified

least fibrous, having CF and ADF values of 10.45±11.51 and 48.05±11.36%, respectively. However, the NDF value, which is a measure of the digestible component of the cell wall, was relatively higher in the heavily browsed species when compared with the others. Even though CF is negatively correlated with intake (McDonald *et al.*, 1995); the high NDF value of the heavily browsed species is presumed to have positively influenced browsing response by cattle.

The lowest ether extract (EE) value was derived from *Napoleona vogelli* and the highest from *Combretum racemosum*. The occasionally browsed had slightly higher EE value than both the moderately and the heavily browsed species. The overall mean of 7.24% is higher than the values 3.6 and 4.2% reported for browses of southern Nigeria (Mecha and Adegbola, 1985) and West Africa (Le Houerou, 1980), respectively. Okoli *et al.* (2001) also reported a range of 0.95 - 5.3% which however is lower than the present result. Across ecological boundaries, significant differences exist in proximate values of plants; soil types influence the diversity and chemical composition of browses found in an environment.

The ash content of the heavily browsed plants was comparatively higher than values obtained for the moderately and the occasionally browsed. Ibeawuchi *et al.* (2002) reported similar trend in the browses of Makurdi, Benue State, Nigeria. Though their values and those of the present study differed slightly, they were however, consistent with what has been reported. The overall mean of 10.30±5.31% obtained for all browse plants in this study compared favourably with the value of 10.90% reported for middle belt browse (Ibeawuchi *et al.*, 2002) and West African browse (Le Houerou, 1980) but is higher than 6.29% (Mecha and Adegbola, 1985) and a range of 3.0 – 9.6% (Okoli *et al.*, 2001) reported for Southeast Nigerian browses.

The calcium contents of browses ranged from 0.92% in *Combretum racemosum* to 1.88% in *Alchornea cordifolia*. Averagely, the concentration of this macro mineral in the heavily browsed species was comparatively higher than levels obtained in the occasional and the moderately browsed. This observation is in consonance with the findings of Mecha and Adegbola (1985) and Ibeawuchi *et al.* (2002) for southeast and middle belt browses. The phosphorous concentrations in the three browse categories were fairly similar but generally lower than levels of calcium content. Ibeawuchi *et al.* (2002) reported that the calcium content of browse plants is usually higher than that of phosphorous, and may not like in the latter, require supplementation. The findings of Okoli *et al.* (2001) however contradict this view. The ca : p ratio of 1 : 0.3 obtained generally for the browse plants in this study is below the optimum level of 1:2 required for the effective utilization of these minerals in forages. Except for phosphorous however, animals browsing trees and shrubs of natural vegetation may have no need for mineral supplementation owing to the relative high contents of minerals in browses (Saleem *et al.*, 1979). Digestible crude protein (DCP) value was lowest in *Grewia pubescens* and highest in *Napoleona vogelii*. The highest average concentration recorded for the occasionally browsed plants; supported the earlier observation that browsing behaviour in the ruminant animal was complemented by some other intrinsic factor other than nutritional composition (Obioha, 1985). DCP values for most Nigerian browses are adequate and meet the nutritional needs of our ruminant livestock, especially the range animals, during the dry months of the year. The seasonal rains ensure that browses derive basic nourishment from the soil. However, in situations of severe drought or inclement weather which tends to affect fodder composition and nutritional value, DCP approaches zero value for feedstuffs containing 4% or less of CP (Ibeawuchi *et al.*, 2002). Also, forages and feedstuffs containing less than 7% CP are usually poorly digested by ruminants due to insufficient nitrogen to stimulate rumen microbial functions (Ahamefule *et al.*, 2002).

The *in vitro* organic matter digestibility (IVOMD) values were fairly high. The lowest and the highest values were obtained from *Combretum racemosum* and *Amaranthus spinosis*, respectively. The comparatively higher value recorded for the heavily browsed plants relative to the moderately and the occasionally browsed in this study, suggest perhaps, that the heavily browsed species would be better utilized by cattle. The high correlation between *in vitro* and *in vivo* values in digestibility studies make the former true estimates of the later, which can be used in situations like the present, where it was not

Table 2: Chemical composition of heavily browsed plants by cattle in Umudike in late-dry/early-rainy season (Jan-April, 2005)

Browse species	Chemical composition (DM%)									IVOMD
	CP	CF	EE	ASH	NDF	ADF	Ca	P	DCP (%)	(%)
Tridax procumbens	17.80	7.50	5.20	12.90	43.50	55.40	1.80	0.25	13.03	51.98
Aspilia afrcana	14.70	2.10	6.40	14.60	69.50	57.40	1.28	0.50	10.15	52.37
Amaranthus spinosis	18.55	4.80	3.80	18.10	34.50	47.00	1.64	0.50	13.73	53.63
Sida acuta	20.65	27.40	5.30	20.80	75.00	32.40	1.56	0.25	15.68	47.30
Mean	17.92	10.45	5.17	16.60	55.62	48.05	1.57	0.37	13.14	51.32
SD ±	2.46	11.51	1.05	3.53	19.67	11.36	0.21	0.14	2.29	2.77

CP = Crude protein, CF = Crude fibre, EE = Ether extract, NDF = Neutral detergent fibre, ADF = Acid detergent fibre, DCP = Digestible crude protein, IVOMD = *In vitro* organic matter digestibility

Table 3: Chemical composition of moderately browsed plants by cattle in Umudike in late-dry/early-rainy season (Jan-April, 2005)

Browse species	Chemical composition (DM%)									IVOMD
	CP	CF	EE	ASH	NDF	ADF	Ca	P	DCP (%)	(%)
Alchornea cordifolia	16.10	2.10	5.60	5.20	42.50	42.50	1.88	0.50	11.45	52.95
Urena lobata	13.66	6.70	9.10	7.00	57.50	22.20	1.16	0.50	9.18	49.35
Asystaia gangetica	16.80	3.90	4.80	12.30	41.00	30.60	1.00	0.25	12.10	53.11
Manniphyton fulvum	17.15	17.10	11.60	16.80	33.00	79.90	1.68	0.25	12.42	45.12
Calapogonium mucunoides	23.10	2.30	8.20	6.00	64.00	61.70	1.56	0.25	17.96	51.02
Centrosema pubescens	24.85	6.20	4.50	12.60	54.50	20.10	1.48	0.50	19.59	52.80
Gmelina arborea	16.80	3.10	10.10	16.00	45.00	34.70	0.96	0.50	12.10	49.46
Mean	18.35	5.91	7.70	10.84	48.21	41.60	1.38	0.39	13.54	50.54
SD ±	4.04	5.25	2.77	4.78	10.81	21.90	0.35	0.13	3.76	2.87

CP = Crude protein, CF = Crude fibre, EE = Ether extract, NDF = Neutral detergent fibre, ADF = Acid detergent fibre, DCP = Digestible crude protein, IVOMD = *In vitro* organic matter digestibility.

Table 4: Chemical composition of occasionally browsed plants by cattle in Umudike in late-dry/early-rainy season (Jan - April, 2005)

Browse species	Chemical composition (DM%)									
	CP	CF	EE	ASH	NDF	ADF	Ca	P	DCP (%)	IVOMD (%)
Landolphia owariensis	16.10	8.80	7.30	5.90	52.00	50.00	1.68	0.50	11.45	50.16
Milletia spp	16.20	23.60	9.00	4.80	46.00	55.20	1.65	0.25	11.40	45.50
Grewia pubescens	13.65	8.10	6.90	7.20	36.50	35.80	1.36	0.25	9.17	50.65
Dialium guinensis	21.70	4.30	7.60	5.50	59.00	59.70	1.38	0.25	16.66	50.99
Combretum racemosum	18.55	10.70	14.00	5.10	48.00	68.00	0.92	0.75	13.73	44.86
Napoleona vogelii	25.55	20.50	3.80	4.30	39.00	23.20	1.76	0.25	20.24	49.99
Mean	18.62	12.66	8.10	5.46	46.75	48.65	1.45	0.37	13.77	48.69
SD ±	4.34	7.62	3.35	1.01	8.30	16.45	0.31	0.20	4.05	2.75

CP = Crude protein, CF = Crude fibre, EE = Ether extract, NDF = Neutral detergent fibre, ADF = Acid detergent fibre, DCP = Digestible crude protein, IVOMD = *In vitro* organic matter digestibility

convenient to carry out *in vivo* studies. The relative digestibility values obtained in this study may be a true reflection of the utilization index of the three browse categories, first for the heavily, then the moderately and subsequently the occasionally browsed plants. Meanwhile, the present range (44.86-53.63%) compared favourably with the values of 41.70-52.24; 32.72-52.44 and 37.50-54.0% reported for browse plants in Abia (Ahamefule *et al*., 2006), Benue (Ibeawuchi *et al*., 2002) and Enugu (Carew *et al*., 1980) states of Nigeria. These values are however lower than the range of 54.0-70.0% obtained for Ghana browse plants (Carew *et al*., 1980). The disparity in values may arise due to differences in diversity and composition of browse or to differences in analytical methods. The present values were derived from regression equation.

Conclusion and recommendation: Browse plants constitute an extremely valuable source of feed for the ruminant livestock. In view of the nutritive value of browse plants, there is need to plant and nurture them in grazing reserves where they would provide the nutritional needs and readily supply vitamins and mineral elements lacking in grassland pasture especially during the dry months. Though browse plants are not planted or cultivated in plantations in Nigeria, the seasonal loss of weight of the University cattle and other range animals, their low productivity, generally make the establishment of browse plantations a necessity. For optimum utilization of browse plants, it is essential that details of the of browse production, palatability and nutritive value of the prominent species be made. It is therefore recommended that more research be carried out on the

establishment; management, production and toxicity of browse plants, not only in Umudike but also along major grazing routes and sites in all the states of Nigeria. This would generate a data bank on the potentials of browse as feed resource for ruminant livestock in Nigeria.

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