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Evaluation of the nutritional and anti-nutritional constituents of some selected browse plants in Kwara State, Nigeria

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ABSTRACT: Fresh leaves and apical parts of the selected browse plants: *Chromolaena odorata, Mangifera indica, Anacardium occidentale, Synedrella nodiflora, Azadirachta indica, Tridax procubens, Ficus congensis, Amaranthus spinosus, Hyptis suaveolens, Carica papaya* were collected in Ilorin, Kwara State, Nigeria and analyzed for proximate composition and some anti-nutritive component of their leaves.

A high variability was recorded in values of percentage crude protein (C.P.), the range in CP, Ash, CF, Ee, NFE and DM were 5.40 – 33.10g/kg DM, 3.00 - 34.57g/kg DM, 6.13 - 30.50g/kg DM, 1.50-13.30g/kg DM, 10.03 – 61.97g/kg DM and 54.92 – 96.54g/kg DM respectively.

The concentration of antinutritional factors were generally low, tannin content was 0.55% in *Chromolaena odorata* and 5.90% in *Synedrella nodiflora,* phytin content was 0.083 mol kg $^{-1}$ in *Hyptis suaveolens* and 1.99 mol kg $^{-1}$ in *Synedrella nodiflora*. Oxalate content was 13.93mg/100g in *Tridax procumbens* and 121.67mg/100g in *Chromolaena odorata* while hydrocyanic acid, HCN content were 49.95 mg/kg in *Amaranthus spinosus* and 201.83 mg/kg in *Mangifera indica*.

The result showed that the browse plants studies had good levels of nutrient, low and safe level of antinutritional factors, and may therefore form good feed resource for modern intensive animal production.

Keywords: Browse plants; Anti-nutritional factors; Kwara State; Nigeria.

Introduction

Browse plants are multipurpose trees and shrubs which constitute one of the cheapest sources of feed for ruminants in many parts of developing countries where animal production is limited by protein/energy deficiencies in diets. They have high potentials as feed resources for ruminants during the dry season since they are less susceptible to climate fluctuation (Dzowela *et al,* 1995) the diversity and distribution of some browse plants have received early attention in studies carried out for the north (Saleem *et al.,* 1979), Middle belt (Ibeawuchi *et al,* 2002) and Northeast (Njidda *et al.,* 2008) Nigeria, being perennial shrubs or trees, they are evergreen all the year round, thereby serving as a ready source of feed during off season feeding (Oji *et al,* 2002, Wahua & Oji, 1987).

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Tropical browse have been shown to contain varying quantities of condensed tannin and other antinutritional components that limits their utilization by animal (Njidda *et al.,* 2008). The tree and shrubs are rich in most essential nutrients such as protein and mineral and tend to be more digestible than the grasses and crop residues. Overcoming the constraints of inadequate knowledge of most browse plants nutrient composition and ant nutritional constituents would ensure their development in ruminant nutrition. The evaluation of the nutritional value of common browse plants will form the basis for their use in subsequent nutritional studies. The present study examines the nutritional composition of the browse plant in Ilorin, Kwara State, Nigeria in order to know their usefulness as a dry season feed for ruminant animal.

Materials and Methods

Fresh leaves from the apical portion of the branches of the selected browse plants were used in this study. The plants used include *Anacardium occidentale, Hpytis suaveolens, Chromolaena odorata, Carica papaya, Ficus congensis, Amaranthus spinosus, Triadax procumbens, Mangifera indica, Synedrella nodiflora,* and *Azadirachta indica.* All forages were harvested from Take, Ilorin-south metropolitans council area of Kwara State. The browse forages were collected by observation and identified in the herbarium of the department of plant biology of the University of Ilorin. The harvested samples were then pooled for each individual tree species and then oven dried of 105^{o}C for 24h to constant weight and ground to pass through a 2mm sieve. The samples were then sub-sampled to obtain three samples for each tree species and used for the laboratory analysis.

Chemical Analysis

The forage samples were analyzed for dry matter (DM), crude protein (CP), ether Extract (EE) and ash according to AOAC (2002) methods, tannin content was determined by the methods of Joslyn(1970). The presence of phytate was determined according to the methods of Wheeler and Ferrel (1971). The oxalate content was determined using the method employed by Ibeawuchi *et al.* (1995) while hydrocyanic acid (HCN) was determined by the method of AOAC (2002) . neutral detergent fibre (NDF), acid detergent fibre(ADF) and acid detergent lignin (ADL) were determined according to the methods of Van Soest *et al.* (1991).

Results and Discussion

The chemical composition of the browse forage species are shown in Table 1, the dry matter (DM) ranged from 54.92% (*Chromolaena odorata*) to 96.54% (*Syndrella nodiflora*). The crude protein(CP) content range was 5.40% (*Carica papaya*) to 33.10% (*Amaranthus spinosus*), while the crude fibre (CF) ranged from 6.13% (*Tridax procumbens*) to 30.50%(*Mangifera indica*) the lowest EE, NFE, and Ash were observed in *Anacardium occidentale* (1.50%), *Chromolaena odorata* (10.03%) and *Anacardium occidentale* (3.00%) respectively.

Variations were observed between the crude protein value obtained in the present study and other reported values. *Tridax procumbens* leaves contain 6.60%CP value. *Azadirachta indica* in the present study has 21% CP which was higher than that of Esonu *et al.* (2006) with CP value of 20.68%. *Synedrella nodiflora* with a crude protein value of 20.60% was lower than that reported by Mecha and Adegbola (1980) with CP value of 21.67%. *Anacardium occidentale* with a CP of 16.30% was higher than that reported by Mecha and Adegbola (1980) with 15.54% CP. *Carica papaya* had a CP value of 5.60%. *Mangifera indica* in the present study had a CP value of 10.07% lower than that reported by Ikhimioya *et al.* (2007). *Chromolaena odorata* with 24.31% CP corroborate the report of Ikhimioya *et al.* (2007). *Amaranthus spinosus* with 33.1% CP and 10.30% in the present study compare well with Oyenuga (1968) and Ken Fern (1998) report of 31.9%CP and 9.8%CF. Although virtually unknown as animal fodder, with a 15.72% CP, *Ficus congensis* showed promise of being a useful ruminant forage feed.

The result of the anti-nutritional compounds (oxalate, hydrocyannic acid, phytin, tannin and lignin) of the browse forages are shown in Table 2. The forages varied widely in oxalate composition, it ranged from 13.93 (*Tridax procumbens*) to 121. 67mg/100gDM (*Chromolaena odorata*) the highest HCN content was found in *Mangifera indica* (201.83mg/kgDM) while the lowest was in *Amaranthus spinosus* (49.95mg/kgDM). *Synedrella nodiflora* had the highest phytin (1.99mol/kgDM) while the lowest phytin (0.008mol/kgDM) were observed in

three browse plants, *Anacardium occidentale*, *Azadirachta indica* and *Hyptis suaveolens*. The highest tannin was found in *Synedrella nodiflora* (5.90%) while the lowest was in *Chromolaena odorata* (0.55%). *Hyptis suaveolens* and *Ficus congensis* had the highest lignin value (2.24) while *Anacardium occidentale* had the lowest (0.55).

Table 1 Proximate Composition of selected Browse Plants in Kwara State, Nigeria.

SAMPLE	CP	ASH	CF	EE	DM	NFE
Chromolaena odorata	20.30^{e}±1.00	3.89^{a}±0.13	8.37^{a}± 0.05	8.32^{e}±0.05	54.92^{a}	10.03^{a}
Carica papaya	5.40^{a}±0.22	24.90^{d}±0.55	30.30^{e}± 0.38	13.30^{f}±0.50	96.42^{d}	22.32^{b}
Tridax procumbens	6.60^{a} ± 0.37	34.57^{f}±1.36	6.13^{a}± 0.37	5.20^{cd}±0.27	93.21^{cd}	41.28^{d}
Anacardium occidentale	16.30^{d} ±0.44	3.00^{a} ±0.23	24.50^{d}± 0.25	1.50^{a}±0.22	73.46^{b}	28.93^{bc}
Synedrella nodiflora	20.60^{e}±0.52	12.00^{c} ±0.16	8.54^{ab}± 0.25	1.50^{e}±0.22	96.54^{d}	50.33^{e}
Azadirachta indica	21.00^{e}±0.28	7.10^{b}±0.25	16.60^{a}± 0.42	7.10^{e}±0.23	94.42^{cd}	42.94^{d}
Hyptis suaveolens	13.44^{c}±0.44	5.68^{ab}±0.28	9.04^{ab}± 0.53	4.39^{cd}±0.40	95.30^{cd}	61.97^{f}
Mangifera indica	10.34^{b}±0.26	5.00^{ab}±0.32	30.50^{e}± 0. 60	5.00^{cd}±0.44	80.83^{bc}	30.26^{c}
Ficus congensis	15.72^{d}±0.39	17.28^{d}±0.07	15.10^{c}± 0.39	5.46^{e}±0.08	94.45^{cd}	58.48^{f}
Amaranthus spinosus	33.10^{f}±0.50	16.60^{d}±0.13	10.30^{b}± 0. 35	3.70^{b}±0.21	92.32^{cd}	27.52^{bc}

± Standard Deviation

The tannin content in *Chromolaena odorata* and *Mangifera indica* was similar to that previously observed by Ikhimioya *et al.(*2007) while the phytin content in *Chromolaena odorata* (5.0%) and *Mangifera indica* (1.7%) were higher than that reported by Ikhimioya *et al* (2007) i.e 4.88% and 1.34% respectively, the oxalate content was also higher than that of Ikhimiya et al. (2007) in *Mangifera indica* (0.77%) and *Chromolaena odorata* (1.89%). Phytin level reported in the present study (0.08 - 1.99mol/kg) were similar to those reported by Aletor and Omodara (1994) but higher than that observed by Oduguwa *et al* (1999). This level was unlikely to have any adverse consequences in ruminants although they could be of dietary importance to monogastic animals since they lack the phytase needed to breakdown the phytin to release phosphorus (Okoli *et al.,* 2003).

Although the composition of oxalate in the tested leaves were comparatively high, they however were within reported range of Onwuka (1996). Phytic acid level in the plant were generally lower than the threshold levels of less than 5% prescribed by Laurena *et al* (1994) . Feeding of plant with low to moderate levels of tannin usually results in little or no nutritional problems with ruminants although concentration above 10% could be problematic (Chang and Fuller, 1964).

The HCN content of the browses were equally as low as that reported by Selger *et al.* (1989). The level in most of these species were too low to pose a major animal health risk (Kumar and D'mello, 1996). Generally only plants that produce more than 20mgHCN/100g fresh weight are considered deleterious (Everist, 1981).

Conclusion

The browse plants analyzed in this study have good levels of nutrients particularly protein and contained low levels of toxic constituent such as phytin, hydrocyanic acid, oxalate and tannin, there is need to expand the study to other antinutritional factors such as nitrite, saponins, heamagglutinins and the alkaloids. Feeding trials using ruminants and monogastric animals are recommended in order to fully ascertain the nutritional value of these browse plants.

Table 2. Estimate of the content of antinutritional compounds in the selected browse plants in Kwara State, Nigeria

SAMPLE	OXALATE (mg/100g)	HCN (mg/kg)	PHYTIN (mol/kg)	TANNIN (%)	LIGNIN (%)
Chromolaena odorata	121.67^{f}±0.70	110.70^{c}±1.60	0.50^{b}± 0.16	0.55^{a}±0.23	1.02^{ab}±0.09
Carica papaya	67.80^{d}±0.19	184.95^{e}±1.16	0.75^{c}± 0.19	3.52^{b}±0.33	1.09^{b}±0.23
Tridax procumbens	13.93^{a}±0.68	111.38^{c}±0.47	0.17^{a}± 0.09	4.72^{c}±0.26	0.88^{ab}±0.71
Anacardium occidentale	104.48^{e} ±1.44	$64..13^{a}$ ±0.98	0.08^{a}± 0.13	5.20^{a}±0.55	0.55^{a}±0.22
Synedrella nodiflora	99.77^{e} ±0.37	111.38^{c} ±1.01	1.99^{d}± 0.07	5.90^{a}±0.63	0.81^{ab}±0.07
Azadirachta indica	31.51^{b} ±0.66	89.78^{b}±0.66	0.08^{a}± 0.04	5.35^{d}±0.34	1.16^{b}±0.09
Hyptis suaveolens	$68\ 85^{d}$ ±1.41	126.23^{c} ±0.10	0.08^{a}± 0.04	5.50^{d}±0.32	2.24^{c}±0.24
Mangifera indica	106.51^{e} ±0.86	201.83^{a} ±1.27	0.17^{a}± 0.09	3.12^{b}±0.26	2.22^{c}±0.22
Ficus congensis	51.20^{e} ±0.51	159.98^{d} ±0.07	0.16^{a}± 0.07	3.23^{b}±0.46	2.24^{c}±0.13
Amaranthus spinosus	103.23^{e} ±0.75	49.95^{a} ±1.15	0.25^{a}± 0.19	3.280^{b}±0.27	0.86^{ab}±0.13

± Standard Deviation

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