MINERAL COMPOSITION AND ANTI-NUTRITIONAL FACTORS OF SOME SELECTED FORAGES AS FEED FOR SMALL RUMINANTS

Adebayo, B. J.*[1] and Rabiu, L.A.[2]
[1]Department of Agricultural Technology, Yaba College of Technology, Yaba, Lagos, Nigeria
[2]Department of Animal Production Technology, Yaba College of Technology, Yaba, Lagos, Nigeria
*__Corresponding author__: babatunde.adebayo@yabatech.edu.ng; Phone number: +2348030559306

Abstract
The mineral composition and anti-nutritional factors of five selected plants *Alchornea cordifolia, Carica papaya, Derris trifoliata, Leucaena leucocephala* and *Heteropogon cortortus* were evaluated. Flame photometer was used to determine Na, K, and Ca while Zn and Fe were assayed. Anti- nutritional factors (ANFs) including phytate, oxalate, saponin, alkaloid and tannin were also determined using appropriate technique. The result of the mineral analysis indicates that *Heteropogon cortortus* had significantly (P<0.05) highest values for Na (0.326%), Ca (0.359%), P (0.41%), Fe (148.80ppm), Zn (81.95ppm), Mn (61.65ppm) and Cu (19.05ppm). *Derris trifoliata* had significantly (P<0.05) higher value for Mg (0.443%) while *Alchornea cordifolia* recorded a lower value of 0.242% for Mg. There were significant (P<0.05) differences in all the anti-nutritional factors analysed except in saponin. The highest saponin numerical value (0.433%) was observed in *Derris trifoliata* while the least value 0.260% was observed in *Alchornea cordifolia.* Tannin values ranged between 0.0047% and 0.0073% in *Alchornea cordifolia* and *Derris trifoliata* respectively. The significantly (P<0.05) highest oxalate value (0.315%) was recorded in *Heteropogon cortortus* while the least value (0.205%) was observed in *Alchornea cordifolia*. The results showed that the selected plants were of high nutritional quality due to the high mineral contents with moderate presence of anti-nutritional factors, and may therefore form good feed resources for ruminant animal production.

Key words: Anti-nutrient factors, Forages, Mineral composition, Ruminants, Supplements

Description of Problem

During dry season, ruminant diets are limited by shortages in amount and quality of available forage (1). Several indigenous and exotic browse species have been investigated and evaluated for inclusion in ruminant feeding system in Nigeria (2). Therefore, future hope of feeding the millions of people and safeguarding their food security will depend on the better utilization of non-conventional feed resources (3). However, most of these multi-purpose tree browse plants and their seed are available in the off season but most of them are less beneficial to livestock as they contain anti-nutritional factors. Some of these anti-nutritional factors reduce palatability and induce the toxicity into the animal when the browse leaf is consumed beyond threshold level (4). Thus, this study was undertaken to determine the mineral composition and anti-nutritional factors of *Alchornea cordifolia* (Djeke), *Carica papaya* (Pawpaw), *Derris trifoliata* (Derris), *Leucaena leucocephala* (River tamarind) and *Heteropogon cortortus* (Spear grass).

Materials and Methods

Experimental site: The experiment was carried out in the premises of Yaba College of Technology, Epe Campus, Lagos State. It is situated at latitude 6.58^{o}N and longitude 3.98^{o}E. It is 42m above the sea level along Epe Ijebu-ode road on km 16. Epe lies in lowland rain forest vegetation zone within the savanna agro-ecological zone of Southwest Nigeria (5).

Sample collection and preparation: Five native forage species *Alchornea cordifolia* (Djeke), *Carica papaya* (Pawpaw), *Derris trifoliata* (Derris), *Leucaena leucocephala* (River tamarind) and *Heteropogon cortortus* (Spear grass) 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 premises of Yaba College of Technology Epe campus. Laboratory analysis was carried out at Biochemical Laboratory, Federal University of Agriculture, Abeokuta, Ogun State South- West, Nigeria.

Experimental design: The experimental design was a completely randomized.

Mineral analysis: The mineral composition which includes sodium, potassium and calcium were determined with flame photometer while phosphorus, Zinc and Iron was assayed according to the (6) method analysis.

Anti-nutritional factor analysis: Saponin, Tannin, Oxalate, alkaloid and Phytate were determined quantitatively by the method established by *(*7).

Statistical analysis: Data were analyzed using one way analysis of variance with the use of statistical package to generate means and significant means were separated using Duncan's Multiple Range Test (8).

Results and Discussion

Presented in Table 1, are the mineral profile of the selected forages. There are significant variations in the mineral contents of the plants. The values observed of Calcium (Ca) varied from 0.207 to 0.359% in *Alchornea cordifolia* and *Heteropogon cortortus* respectively. The least Magnesium value (0.242%) was obtained in *Alchornea cordifolia* while the highest value (0.443%) was obtained in *Derris trifoliata*. *Heteropogon cortortus* recorded significantly ($P<0.05$) highest value (0.41%) in Phosphorus while the least value (0.32%) was observed in *Alchornea cordifolia*. The highest value (0.91%) of Potassium (K) was obtained in *Heteropogon cortortus* while *Alchornea cordifolia* had the least value (0.63%). Zinc ranged from 57.05ppm in *Alchornea cordifolia* to 81.95ppm in *Heteropogon cortortus.* The least Iron (Fe) value (128.93ppm) was obtained in *Alchornea cordifolia* while the highest significant value (148.80ppm) was observed in *Heteropogon cortortus.*

Table 1: Minerals profile (%) of the selected plants

Plant	Ca	Mg	Fe (ppm)	P	Na	K	Zn (ppm)	Mn (ppm)	Cu (ppm)
Alchornea cordifolia	0.207^{d}	0.242^{d}	128.93^{e}	0.32^{c}	0.195^{d}	0.63^{d}	57.05^{e}	32.05^{e}	11.85^{e}
Carica papaya	0.239^{c}	0.281^{c}	130.70^{d}	0.35^{bc}	0.218^{c}	0.64^{d}	59.40^{d}	34.20^{d}	13.90^{d}
Derris trifoliata	0.356^{a}	0.443^{a}	147.05^{b}	0.37^{b}	0.131^{e}	0.84^{b}	75.85^{b}	55.95^{b}	16.55^{b}
Leucaena leucocephala	0.317^{b}	0.417^{b}	134.40^{c}	0.33^{c}	0.272^{b}	0.71^{c}	70.35^{c}	42.75^{c}	15.25^{c}
Heteropogon cortortus	0.359^{a}	0.441^{a}	148.80^{a}	0.41^{a}	0.326^{a}	0.91^{a}	81.95^{a}	61.65^{a}	19.05^{a}
P value	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
SEM	0.0169	0.0236	2.26	0.0094	0.018	0.029	2.57	3.15	0.69

^{a,b,c,d,e} means along the same column with different superscripts are significantly different ($P<0.05$)
SEM= Standard error of mean.

Concentration of antinutritional factors in the selected forages are shown in Table 2, phytate levels in all the selected plants were significantly ($P<0.05$) low and ranged from 0.329 to 0.434% in *Alchornea cordifolia* and *Derris trifoliata* respectively. *Derris trifoliata* had significantly highest values (0.0073 and 0.434%) for tannin and oxalate respectively across the examined plants while the least value (00.0047%) of tannin was observed in *Alchornea cordifolia*. The percentage of saponin value range between 0.260% in *Alchornea cordifolia* to 0.433% in *Derris trifoliata. Carica papaya* and *Alchornea cordifolia* recorded the highest and lowest (0.54 and 0.25%) alkaloid concentrations respectively.

Oxalate content obtained in this study was low. Sheep and goats appear to be able to adapt to diets with relatively high oxalate contents because of the ability of the microbial population of the rumen to adapt to breaking down oxalates (9). However, if sheep and goats

are suddenly introduced to feeds containing high levels of oxalates, then the oxalate will prove toxic to them. The saponin content of the browse plants in this study was lower compared to those reported by (10) in some semi-arid browse forages. Feedstuffs containing saponin had been shown to be defaunating agents and capable of reducing methane production (7). The phytate levels reported in this study fell below the reported values by Omoniyi (11) for some selected forages in Nigeria. These levels are unlikely to have any adverse effects on ruminants.

Table 2: Secondary metabolites (%) of the selected plants

Plant	Tanin	Alkaloids	Oxalate	Phytate	Steroid	Saponin
Alchornea cordifolia	0.0047^{c}	0.25^{b}	0.205^{e}	0.329^{e}	0.0028^{b}	0.260
Carica papaya	0.005^{c}	0.54^{a}	0.211^{d}	0.365^{d}	0.0036^{ab}	0.264
Derris trifoliata	0.0073^{a}	0.297^{b}	0.284^{b}	0.434^{a}	0.0067^{a}	0.433
Leucaena leucocephala	0.0064^{b}	0.274^{b}	0.254^{c}	0.41^{c}	0.0066^{ab}	0.300
Heteropogon cortortus	0.0065^{b}	0.30^{b}	0.315^{a}	0.427^{b}	0.006^{b}	0.300
P value	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
SEM	0.000274	0.0195	0.0113	0.0108	0.00052	0.0249ns

^{a,b,c,d,e} means along the same column with different superscripts are significantly different ($P<0.05$)
SEM= Standard error of mean, ns= non-significant.

Conclusion and Application

Mineral concentration of the selected forages will enhance mineral requirement of the animals and moderate levels of anti-nutritional factors in the plants can improve the performance of ruminants especially during the period of feed scarcity.

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