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Mineral composition and anti-nutrient contents of five selected forages fed to small ruminants in Epe Local Government Area, Lagos state

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***Target audience**: Ruminant farmers, Researchers, Livestock Extension agents*

Abstract

The mineral composition and anti-nutritional factors of five selected forages Panicum maximum (T_1), Commelina benghalensis (T_2), Chamaecoustus cupidatus (T_3), (Mimosa pudica (T_4) and Aspenlenum bulbiferum (T_5) 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 and tannin were also determined using appropriate technique. The result of the mineral analysis indicated that Commelina benghalensis (T_2) had significant ($p< 0.05$) high values for K (2.55%), Fe (0.4%), Zn (0.05%), Ca (2.19%) and P (0.56%). Aspenlenum bulbiferum (T_5) had significant ($p<0.05$) low values for K (0.83%), Cu (0.005%), Zn (0.019%) and Mg (0.15%). There were significant ($p<0.05$) differences in all the anti-nutritional factors analysed, with the highest saponin value (9.16%) observed in T_4 and the least value 2.76% in T_1. Tannin values ranged between 2.32% and 5.36% in T_3 and T_5 respectively. The results showed that the selected forages 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**: Mineral composition, Anti-nutrient factors, Ruminant animal, Forages, Supplements*

Description of problem

During dry season, ruminant diets are limited by shortages in amount and quality of available forage (1), crop residues or by-products (2) which result in reduced livestock productivity in the tropical countries mostly in the dry season (3). (4) and (5) further reported that browse forages are increasingly acknowledged worldwide and they provide protection, vitamins and frequently mineral elements which are lacking in grassland pastures. Forage plants are important sources of nourishment for grazing ruminants and as supplements to improve the productivity of herbivores fed on low quality feeds. They also form part of the complex interactions between plants, animals and crops (6), the positive aspect of which is to help balance a plant-animal-soil ecosystem from which there is sustainable source of feeds (7). The availability of a variety of these feeds and the selection process enables the herbivores especially the small ruminants to extend as well as meet their feed preferences. Traditional farmers in the semi-arid region of Nigeria allow their ruminants to browse on these forage plants in the range lands due to the availability and

they also cut and feed these plants as supplements based on experience and convenience (8). Forage plants also contains other chemical compounds such as saponin, tannin, oxalate, phytate, tyrpsin inhibitors and cyanogenic glycosides, which are known as anti-nutrient factors and are biologically active (9). Despite the handiness and proximity of these forages there is need for continuous screening to identify those with good potentials as livestock fodder that could serve as alternatives to those species which have already been evaluated (10). This study therefore examines the mineral and anti-nutrient contents of the selected forages.

Materials and methods

Location of Study

The plants were collected within the environment of Yaba College of technology, Epe campus. Epe is located at longitude $6^0$35' N and $3^0$59'N in the north of Lekki lagoon. It has a total land area of approximately 1,184km^2 with annual rainfall of 2000 – 3000mm (11)

Sample Collection

Sample of 5 Plants (*Mimosa pudica, Aspenlenum bulbiferum, Commelina benghalensis, Chamaecoustus cupidatus* and *Panicum maximum*) were collected within the aforementioned area of Lagos State before flowering and oven dried for 72 hours to constant weight to determine the dry matter. The dry matter was milled, and stored in Nylon sachets. It was sent for laboratory analysis.

Mineral analysis

The mineral composition: sodium, potassium and calcium were determined with flame photometer and phosphorus, Zinc and Iron was assayed according to the (12) method analysis.

Anti-nutritional factor analysis

Saponin, Tannin, Oxalate and Phytate were determined quantitatively by method as established by (2).

Statistical analysis: The experimental design was a completely randomized layout. Data was analysed using one way analysis of variance with the use of statistical package to generate means and standard error using Duncan Multiple Range test (24).

Results and Discussion

Table 1: Mineral composition of the selected forage plants

	Na	K	Fe	Cu	Zn	Mn	Ca	P	Mg
T_1	1.36^c	1.32^c	0.27^c	0.018^a	0.04^b	0.093^b	0.97^c	0.48^c	0.19^d
T_2	2.66^b	2.55^a	0.40^a	0.007^d	0.05^a	0.067^c	2.19^a	0.56^a	0.31^b
T_3	2.72^a	1.53^b	0.20^e	0.073^a	0.03^c	0.43^a	0.12^e	0.34^e	0.40^a
T_4	0.97^e	0.89^d	0.22^d	0.011^c	0.04^b	0.054^d	1.28^b	0.53^b	0.23^c
	1.2l4^d	0.83^e	0.34^b	0.005^b	0.019^d	0.051^e	0.69^d	0.47^d	0.15^e
SEM	0.00031	0.00030	0.00029	0.00029	0.00028	0.00026	0.00032	0.00026	0.00028

^{abcde} means along the same column with different superscripts are significantly different ($P<0.05$)

T_1– *Panicum maximum*, T_2 – *Commelina benghalensis*, T_3 – *Chamaecoustus cupidatus*, T_4 – *Mimosa pudica*, T_5 – *Aspenlenum bulbiferum*

Na – Sodium, K – Potassium, Fe – Iron, Cu – Copper, Zn – Zinc, Mn – Manganese, Ca – Calcium, P – Phosphorus, Mg – Magnesium, SEM: Standard Error Mean

Table 2: Anti-nutritional factors of the selected forage plants

	Oxalate	Phytate	Saponin	Tannin
T_1	2.77[b]	1.25[c]	2.76[e]	3.43[b]
T_2	4.01[a]	1.49[b]	8.34[b]	2.77[d]
T_3	2.00[c]	2.73[a]	6.11[d]	2.32[e]
T_4	3.89[a]	4.31[e]	9.16[a]	2.92[c]
	2.20[d]	6.24[d]	7.96[c]	5.36[a]
SEM	0.44	0.003	0.003	0.21

[abcde] means along the same column with different superscripts are significantly different ($P<0.05$)
T_1– *Panicum maximum,* T_2 – *Commelina benghalensis,* T_3 – *Chamaecoustus cupidatus,* T_4 – *Mimosa pudica,* T_5 – *Aspenlenum bulbiferum,* SEM: Standard Error Mean

The mineral profile of the selected plants is shown in table 1. Mineral analysis of a plant gives the idea of possibility either the plant should be used for any feeding trial purpose. There is significant variation in all the elements measured. The range of Potassium 0.83% to 2.55% in the present study fall within the recommended value of 0.80% for grazing animals (13). Potassium helps to maintain body weight and regulate water and electrolyte balance in the blood and tissues (14). The Calcium contents of the selected forage plants was higher than the values obtained by (15). The Calcium values found in this study was considered adequate for the optimum performance of ruminants. The range of phosphorus content of the plants (0.34 to 0.56%) investigated was higher compared to the NRC recommendation of 0.15% for phosphorus (16). Phosphorus plays a vital role in normal kidney functioning and transfer of nerve impulse. Phosphorus also plays an important role in carbohydrate, lipid and amino acid metabolism. Phosphorus is also required for blood coagulation, satisfactory bone calcification, optimum growth rate and optimum utilization of both calcium and phosphorus (17). The forage magnesium found in this study was above 0.12-0.20% of the requirement of ruminant's diet (16). Magnesium plays an important role in relaxing muscles along the air way to the lungs of animals; it plays important roles in most reaction involving phosphate transfer (18).

Table 2 shows the level of anti-nutrient factors in the selected plants. There is significant variations in all the parameters measured. The phytate obtained in this study was higher than that of (19). High dietary phytate is reported to cause growth reduction (20). Phytate are found to inhibit the protease and analysis of the intestinal track (21). Oxalate content of the selected plants is higher than the reported value by (15). Forage containing oxalate is less a problem for ruminants, but at a high concentration may cause digestive disturbance (22) and even kidney failure and death (23). The differences observed in the mineral values as well as the antinutritional constituents when compared with other studies could be as a result of the seasonal or climatic factors, drying methods, stage of growth, maturity, soil types, specie or variety as well as the ambient temperature and growth environment as supported by (25).

Conclusion and Applications

1. The selected plants have the potential to offer better nutritional value.
2. High content of minerals and moderate levels of anti-nutritional factors in the leaves can improve the performance of ruminants.
3. Though browse forage species are useful in providing animals with feed

during the dry season, attempt should be made to process them thoroughly before use to reduce their negative effects on rumen microbes.

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