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COMPARATIVE EVALUATION OF THE AMINO ACID PROFILE AND ANTI-NUTRITIONAL CONTENT OF THE LEAVES of FOUR SELECTED BROWSE PLANTS IN THE TROPICS

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ABSTRACT: The amino acid content and anti-nutritional content of the leaves four selected browse plants in the tropics often recommended for use as non- conventional feeding materials were evaluated, with a view to comparing their suitability as non- conventional feeding materials. Fresh leaves of *Myrianthus arboreus*, *Gmelina arborea*, *Terminalia catappa* and *Dacroydes edulis* were collected from farmlands in Asaba, Delta State, Nigeria ($6^0$14'N and $6^0$49'E). The presence of eight amino acids and some anti-nutritional factors was determined. Data collected were subjected to a one-way analysis of variance procedure, using the IRRISTAT for windows (Version 5.0) computer software. Significantly different means were separated using Duncan's Multiple Range Test Procedure. Significance was reported at 5% level of probability. Results indicate appreciable amount of amino acids .Significant ($P<0.05$) differences exist between the groups. The value of the anti-nutritional content of the leaves was low indicating that these materials can be used as leaf meals for livestock feed. Significant ($P<0.05$) differences exist between the groups.

Key Words: *Myrianthus arboreous, Gmelina arborea, Terminalia catappa, Dacroydes edulis*, anti-nutritional factors, amino acid profile.

INTRODUCTION

Increasing demand and the subsequent high cost of conventional livestock feeding materials has created Increasing demand and the subsequent high cost of conventional livestock feeding materials has created the need for sustainable alternatives, particularly natural feed resources indigenous to the tropical regions (Onwuka, *et.al*, 1989; Abubakar and Mohammed, 1992; Osagie, 1998). This search for alternative feeding materials has over the past few decades rekindled research interest in the use of tropical browse plants as sources of nutrients for livestock feeds: ruminants and non-ruminants respectively, (D'Mello, 1992; Aletor and Omodara, 1994).

Most of the feed resources used in the production of livestock feed are also used for human consumption, it is therefore necessary to seek alternative sources such as non- conventional feed resources and incorporate them into the production of animal feed(FAO,1976). However , these feed sources are still not fully and appropriately integrated into livestock feed due to an unbalanced supply of nutrients, mainly energy and nitrogen, the presence of undesirable compounds (tannins, saponins, glucosinolates and other anti-nutritional factors) and the difficulties of storage over long periods(Ben Salem *et al* 2002).

Browse plants constitute an abundant biomass in farmlands, bush fallows and forests in humid tropical environments of Africa. They are commonly used in the wild by small holder livestock farmers for feeding small ruminants. The potential of leaf meals from these tropical trees and shrubs to yield relatively higher levels of crude protein and minerals, and lower crude fiber levels than tropical grasses has also been recognized (Onwuka,*et.al*, 1989; Odunsi,*et.al*, 1996; Odunsi,*et.al*, 1998; Esonu,et.al,2003;Fashina,et.al, 2004; Okagbare,*et.al*, 2004 and Amata,2010).

Studies have shown that partial replacement of energy and protein sources from conventional feeding materials by these leaf meals does not affect productivity in terms of growth performance(Amata and Bratte,2008), growth performance and cost reduction(Amata,et.al,2009) nor hematological and serological characteristics (Amata ,2010).

Despite the amount of research carried out with non-conventional feeding materials, which could have a major impact on livestock production, they continue to be unused, underdeveloped, or under utilized. A critical factor in this regard has been the lack of proper understanding of the nutritional principles underlying their utilization.

This study looks at the amino acid content and the presence of some anti-nutritional factors of four of the more commonly studied browse plants with a view to appropriately recommending use of any of these non- conventional feeding materials in livestock feed.

MATERIALS AND METHODS

Fresh leaves of *Myrianthus arboreus*, *Gmelina arborea*, *Terminalia catappa* and *Dacroydes edulis* were collected from farmlands in Asaba Delta State Nigeria (6 º14'N and 6º49'E). The leaves were taken to the laboratory for analysis; care was taken to avoid unnecessary moisture loss. Taxonomic identification of the plants was carried out in the agronomy unit of the Delta State University Research and Teaching Laboratory. The leaves were prepared for chemical analysis by washing with distilled water to remove all impurities and dried at room temperature to remove residual moisture, then placed in an oven and oven dried at 55ºC for 24h. The dried leaves were ground into powder using a milling machine, and then sieved through 20 inch mesh sieves.

Determination of amino acids was carried out by ion exchange chromatography, using a Technicon Sequential Multisampling (TSM) amino acid analyzer as described by Adeyeye and Afolabi (2004).

Quantitative estimation of tannins in the samples was carried out using modified vanillin-HCl methanol as described by Price and Butler (1977). A standard curve of tannic acid was prepared according to AOAC (1990) methods for measurement of the concentration of tannins in the sample.

Oxalate was determined by acid digestion, using 15µH_2SO_4, followed by filtration using a Whatman No.1 filter paper. The filtrate was titrated hot (80 – 90ºC) against 0.1 N $KMnO_4$ solutions to a faint pink color that persists for 30seconds.

Trypsin inhibitor activity was measured using the method developed by Kakade et al (1974). This method uses α-N-benzoyl-DL-arginin-p-nitoanilide hydrochloride (SigmaB 4875 or BAPNA) as substrate for trypsin.Trypsin inhibitor from bovine pancreas was used to release P-nitroanilide. Absorbance was measured at 410nm against a blank and Trypsin Inhibitory Activituy (TIA) expressed as Trypsin Inhibitory Units (TIU)/mg DM calculated. One trypsin unit is defined as 0.01 unit increase in absorbance.

For the determination of alkaloids, extraction was carried out using 3ml solution of methanol containing 10% acetic acid. Ammonium hydroxide was added drop- wise to the extract. Formation of a precipitate was taken as an indication of the presence of alkaloids

.Saponin was determined by extraction in 50% aqueous methanol, followed by transfer to a test tube with constant vigorous agitation. Formation of persistent foam at the surface was taken as an indication of the presence of saponin. Phenol was determined using the methods recommended by AOAC (1990).

Data collected were subjected to a one-way analysis of variance procedure, using the IRRISTAT for windows (version 5.0) computer software. Significantly different means were separated using Duncan's Multiple Range Test procedure (Duncan, 1955). Significance was accepted at 5% level of probability.

RESULTS AND DISCUSSIONS

The amino acid contents of the test materials are shown in Table 1. Eight amino acids were determined. Six out of the eight, are essential amino acids, while two are sulfur containing amino acids. Of the six essential amino acids, two are mono-amino, mono-carboxylic amino acids and four are aromatic amino acids. Values obtained for all the test materials compare favorably well with WHO/FAO (1993) protein standards, the values obtained are also within the ranges of reported values for some leafy vegetables (Kubmarawa et al , 2008). Significant ($P<0.05$) difference exists between the groups. *Terminalia catappa* has the highest value for isoleucine, while *Gmelina arborea* hast the lowest value. *Dacroydes edulis* has the highest value for leucine, while *Gmelina arborea* has the lowest value. Results show that *Dacroydes edulis* has the highest values for methionine, threonine, tryptophan and phenylalanine.

Table 1 Amino Acid Profile of the Test Materials

Amino acid (g/100g)	***Myrianthus arboreus***	***Gmelina arborea***	***Terminalia catappa***	***Dacryodes Edulis***
Isoleucine	3.40^{b}	2.74^{d}	5.61^{a}	3.05^{c}
Leucine	4.31^{c}	3.91^{d}	4.74^{b}	4.79^{a}
Cysteine	1.31d	2.67c	3.35a	3.14b
Tyrosine	3.23c	5.60a	3.94b	2.58d
Methionine	3.47c	4.11b	2.85d	5.60a
Threonine	4.95b	5.25b	4.42b	6.22a
Tryptophan	1.87c	2.84b	2.86b	4.83a
Phenylalanine	3.41d	4.61b	3.47c	5.31a

Means with different superscripts^{abc} within rows differ significantly ($P<0.05$)

Table 2 Anti-nutritional content of the test materials

Anti-nutritional factor (mg/100g)	Myrianthus arboreus	Gmelina arborea	Terminalia catappa	Dacroydes edulis
Tannin	0.142^{a}	0.127^{b}	0.091^{c}	0.082^{d}
Saponin	0.273^{b}	0.313^{a}	0.257^{c}	0.249^{d}
Alkaloid	1.138^{b}	0.695^{c}	0.561^{d}	4.217^{a}
Oxalate	0.110^{c}	0.122^{b}	0.110^{c}	0.128^{a}
Trypsin inhibitor	0.033^{b}	0.021^{c}	0.017^{c}	0.120^{a}

Means with different superscript^{abc} within rows, differ significantly ($P<0.05$).

A major factor limiting the wide use of many plants is the presence of compounds commonly referred to as anti-nutritional factors which occur naturally and are widely distributed (Osagie,1998). The anti-nutritional factors; tannins, saponins, alkaloids, oxalates and trypsin inhibitors were present in varying amounts (Table 2).The concentrations detected were low and within the ranges reported for leafy vegetables(Kubmarawa *et al,*2008). Results show significant ($P<0.05$) differences between the groups, with Dacroydes edulis having the highest value for alkaloids,trypsin inhibitor and oxalates.

Conclusion

The study has revealed that the test materials, the leaves of *Myrianthus arboreus, Gmelina arborea, Terminalia catappa* and *Dacroydes edulis* can contribute useful amounts of protein with particular reference to amino acids, for livestock diets in the form of leaf meals. It is interesting to note that the anti-nutritional content of the leaves is low, implying that the overall nutritional value of the leaves will not be affected. There is need however to carry bout metabolic trials with meals made from these leaves to determine the level of inclusion in livestock feeds and the effect of inclusion on growth performance indices of livestock.

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