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*Full Length Research Paper*

# Comparative evaluation of the nutrient profile of four selected browse plants in the tropics, recommended for use as non-conventional livestock feeding materials

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**This study is a comparative evaluation of the nutrient profile of four selected browse plants often recommended for use 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. Proximate analysis was carried out on the dried leaves to determine the levels of crude protein, crude fiber, metabolisable energy, total ash and ether extract. The presence of the following mineral elements: calcium, magnesium, iron and zinc was determined. The presence of eight amino acids was also determined. Data collected were subjected to a one-way analysis of variance procedure. Significantly different means were separated using Duncan's multiple range procedure. Significance was reported at 5% level of probability. Significant differences between the test materials were observed for all the parameters measured. Results obtained were within the ranges of reported values.**

**Key words:** Comparative evaluation, browse plants, non-conventional feeding materials.

## INTRODUCTION

Increasing demand and the subsequent high cost of conventional livestock feeding materials has created the need for sustainable alternatives, particularly natural feed sources 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 for ruminants and non-ruminants (D'Mello and Fraser, 1991; Aletor and Omodara, 1994).

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, 1999; Esonu et al., 2003; Fashina et al., 2004; Okagbare et al., 2004; Amata, 2010). Studies have shown that partial replacement of energy and protein sources from conventional feeding materials by these leaf meals neither affects 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 underutilized. A critical factor in this regard has been the lack of proper understanding of the nutritional principles underlying their utilization.

This study shows the nutrient profile of four commonly studied browse plants with a view to appropriately recommending use of any of these non-conventional feeding materials in livestock feed. Areas of interest include protein concentration, crude fiber levels, metabolisable energy values, amino acid profile, especially the

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**Table 1.** Proximate composition.

| Parameter | *Dacroydes edulis* | *Terminalia catappa* | *Gmelina arborea* | *Myrianthus arboreus* |
|---|---|---|---|---|
| Moisture content (%DM) | 69.4$^{c}$ | 74.1$^{bc}$ | 74.7$^{b}$ | 76.9$^{a}$ |
| Ash content (%DM) | 1.16$^{b}$ | 1.2$^{b}$ | 1.3$^{b}$ | 2.1$^{a}$ |
| Ether extract (%DM) | 8.3$^{c}$ | 9.8$^{c}$ | 12.7$^{b}$ | 16.1$^{a}$ |
| Energy (kcal.kg$^{-1}$) | 1457.0$^{a}$ | 1175.0$^{c}$ | 1368$^{b}$ | 1284.0$^{bc}$ |
| Crude protein (%DM) | 11.9$^{b}$ | 11.7$^{b}$ | 14.6$^{a}$ | 12.81$^{bc}$ |
| Crude fiber (%DM) | 10.6$^{a}$ | 8.3$^{ab}$ | 6.7$^{c}$ | 10.4$^{a}$ |

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

sulfur containing amino acids and mineral content.

## MATERIALS AND METHODS

Fresh leaves of *Myrianthus arboreous, Gmelina arborea, terminalia catappa* and *Dacroydes edulis* were collected from farm lands in Asaba, Delta State, Nigeria (6°14'N and 6°49'E), on the same day during the month of May, 2010. The leaves were plucked from the main branches of the different browse plants. Collected leaves were taken to the laboratory for analysis and care was taken to avoid moisture loss by placing them in polythene bags. Taxonomic identification was carried out in the Agronomy Department of the Delta State University Research and Teaching Laboratory. A portion of the fresh leaves was used for moisture content determination, according to the methods recommended by AOAC (1990). The other portion was prepared and used 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 55°C for 24 h. The dried leaves were ground into powder using a milling machine, and then sieved through 20 inch mesh sieves. Proximate analysis was carried out using the methods recommended by AOAC (1990). The following parameters were determined: total ash, crude protein, crude lipid, crude fiber, ether extract and metabolisable energy. All analyses were carried out in 5 replicates and reported as mean values on a dry matter basis.

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).

The following mineral elements: calcium(Ca), iron (Fe) and zinc (Zn) were determined using methods recommended by Funtua (1999, 2004) with energy dispersive X-ray fluorescence (EDXRF) transmission spectrophotometer, carrying an annular 25 mG 109 Cd isotope excitation source that emits Ag-k, X-rays (22.1 kv) and Mo X-ray tube (50 kv; 5 mA).

For the determination of magnesium (Mg), the samples were first subjected to wet digestion with nitric/perchloric/sulfuric acid mixture (9:2:1 v/v/v) and then analyzed using complexometric methods (AOAC).

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 DISCUSSION

The results of the proximate composition, amino acid content and mineral content of the test materials are shown in Tables 1, 2 and 3, respectively.

Results of the proximate analysis indicate high moisture content, which is within the range of 58.0 and 93.4% as reported for some leafy vegetables consumed in Nigeria (Ifon and Bassir, 1980; Ladan et al., 1996; Abuye et al., 2003). Table 1 shows significant (P<0.05) differences in moisture content, with *M. arboreus* recording the highest value, while *Dacroydes edulis* has the lowest value. The ash contents of the test materials (Table 1), which is an indication of the presence of minerals are within the ranges reported for some other edible leaves in the tropics (Lockett et al., 2000; Hassan and Umar, 2006). Significant (P<0.05) differences exist between the test materials, with *M. arboreus* having the highest value and *D. edulis* having the lowest value. The value obtained for the ether extract content are within the ranges reported for some leafy vegetables consumed in Nigeria and Niger Republic (Ifon and Bassir, 1980). Significant (P<0.05) differences exist between the groups, with *M. arboreus* having the highest value and *D. edulis* the lowest. The crude protein content of the test materials is high, indicating a good source of protein. The values compare favorably with reported values for some known wild leafy vegetables (13.0 to 14.9%) (Hassan and Umar, 2006). Significant (P<0.05) differences exist between the test materials with *G. arborea* having higher values than the other test materials. Crude fiber content of the test materials is also within the ranges of reported values (Ifon and Bassir, 1980). Significant (P<0.05) differences exist (Table 1) with *D. edulis* having the highest values.

Results (Table 1) reveal that the test materials have appreciable levels of metabolisable energy. Significant (P<0.05) differences exist between the test materials, with *D. edulis* having the highest values.

Eight amino acids were analyzed. Six out 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 acids and four are aromatic amino acids.

Significant (P<0.05) differences (Table 2) exist between the test materials. *D. edulis* has higher values of leucine, methionine, threonine, tryptophan and phenylalanine than

**Table 2.** Amino acid content.

| Amino acid (g/100 g) | *Dacroydes edulis* | *Terminalia catappa* | *Gmelina arborea* | *Myrianthus arboreus* |
|---|---|---|---|---|
| Isoleucine | 3.1[c] | 5.6[a] | 2.7[d] | 3.4[b] |
| Leucine | 4.7[b] | 4.8[a] | 3.9[d] | 4.3[c] |
| Cysteine | 3.1[b] | 3.3[a] | 2.6[c] | 1.3[d] |
| Methionine | 5.6[a] | 2.8[d] | 4.1[b] | 3.4[c] |
| Tyrosine | 2.5[d] | 3.9[b] | 5.6[a] | 3.2[c] |
| Threonine | 6.2[a] | 4.4[d] | 5.2[b] | 4.9[c] |
| Tryptophan | 4.8[a] | 2.8[b] | 2.8[b] | 1.9[c] |
| Phenylalanine | 5.3[a] | 3.5[c] | 4.6[b] | 3.4[d] |

Means with different superscript[abc] within rows differ significantly (P<0.05).

**Table 3.** Mineral content.

| Mineral | *Dacroydes edulis* | *Terminalia catappa* | *Gmelina arborea* | *Myrianthus arboreus* |
|---|---|---|---|---|
| Zinc | 0.17[d] | 0.87[c] | 1.89[a] | 1.03[b] |
| Magnesium | 1.8[b] | 1.91[a] | 1.98[a] | 1.99[a] |
| Calcium | 3.9[d] | 7.9[c] | 28.5[b] | 51.8[a] |
| Iron | 3.9[c] | 4.1[b] | 3.0[d] | 5.9[a] |

Means within rows with different superscript[abc] differ significantly (P<0.05).

the other test materials. *T. catappa* has the highest values of isoleucine and cysteine, while *G. arborea* has the highest value for tyrosine.

## Conclusion

Studies of inclusion of leaf meals in the formulation of livestock feed as non- conventional feeding materials are increasing. Several authors have carried out studies on the effect of inclusion of leaf meals on growth performance of different breeds of livestock (Herbert, 1998; Okagbare et al., 2004; Amata and Bratte, 2008; Amata et al., 2009; Amata, 2010).

The present study compares the nutrient profile of four browse plants used as leaf meals. Results indicate that *G. arborea* is a better source of energy, while *G. arborea* and *M. arboreus* are better sources of protein than the other test materials. *D. edulis* is a better source of crude fiber than the other test materials.

The test materials are all good sources of available nutrients, however, studies should be carried out to ascertain the level of inclusion in livestock feed, acceptability, digestibility and feed efficiency ratio.

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