International Journal of Agricultural Research

ISSN 1816-4897

Academic Journals Inc.

www.academicjournals.com

International Journal of Agricultural Research 5 (8): 576-581, 2010
ISSN 1816-4897

Nutritive Value of the Leaves of *Myrianthus arboreus*: A Browse Plant

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Abstract: The young leaves of *Myrianthus arboreus* plant (2n = 28), are popularly consumed in West Africa as vegetable soup. In Delta and Edo States of Nigeria, the leaves are rated amongst the most popular indigenous vegetables. In the livestock industry in Nigeria browse plants are becoming and integral part of livestock feeds due to their high nutrient profile, seasonal availability and affordability. In this study, the fresh leaves of *Myrianthus arboreus* were analyzed to determine the nutritive value. Parameters measured include the proximate composition, amino acid profile, mineral composition, metabolizable energy and the presence of some anti-nutritional factors. Data obtained showed a crude protein content of 18.74% DW, a value which is comparable to some common Nigerian vegetables. Crude fiber content was 11.6% DW, which is also within the range of reported values for some other Nigerian vegetables. The ash content was high 16.4% DW which is an indication of high mineral content. The ether extract (13.1% DW) is also within the range of some edible Nigerian leaves and metabolizable energy values of 1333.4 kcal kg^{-1} is an indication of it's suitability as an energy provider in the diets of livestock. Nine amino acids were analyzed, two of which were sulfur containing amino acids and were found in varying proportions. The anti-nutritional factors analyzed include: alkaloids, 640 mg/100 g, tannins, 4750 mg/100 g, saponins, 1860 mg/100 g, trypsin inhibitors 341.2 mg/100 g, phytic acid 25 mg/100 g, mycotoxins, 0.006 mg/100 g, oxalate, 15 mg/100 g and phenol, 1.12%. Ranges detected were within acceptable limits.

Key words: Proximate composition, amino acid profile, mineral content, anti-nutritional factors

INTRODUCTION

Leaf meals and other non conventional feeding materials are gaining acceptance as feedstuff in livestock diets, since they are locally available and considered to be non-conventional feeding materials. The nutrient profile of these leaf meals compare favorably well with some conventional feeding materials. Protein from plant leaf sources is perhaps the most naturally abundant and cheapest source of protein, such that there has been growing realization in the use of plant leaf meals in livestock diets. These include, wildflower (Odunsi *et al*., 1996; Odunsi *et al*., 1999), *Centroceama pubescens* (Ngodigha, 1995), cassava leaf meal (Ogbonna and Oredein, 1998), *Microdemus puberula* leaf meal (Esonu *et al*., 2003) and *Vernonia amygdaliana* leaf meal (Fasina *et al*., 2004).

Okagbare *et al*. (2004) compared the use of certain plant leaves in the diet of goats and concluded that such browse leaves as *Parkia filicoidea*, *Tephrosia braceteolata* and

Gmelina arborea have great potential in livestock feeding. Amata and Bratte (2008) investigated the effect of *Gliricidia sepium* leaf meal replacement of soya bean in the diet of rabbits and observed significant growth performances and reduction in cost of feed per kilogram. In related studies, Amata *et al.* (2009) looked at the effect of replacement of growers mash with *Gliricidia sepium* leaf meal on the growth of chinchilla rabbits and found significant positive growth responses and cost reduction. In another study, Amata and Bratte (2010) observed that feeding *Gliricidia sepium* leaf meal did not affect the hematological, or the serological, or the carcass characteristics of weaned rabbits in the tropics. In a related study with browse plants Bratte *et al.* (2010) observed that replacement of maize with the seeds of the African pear (*Dacroyde edulis*) did not impart negative characteristics on the semen of broiler breeder chicks.

Despite the amount of research carried out with non-conventional feeding materials, which could have a major impact on livestock production, these materials 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. Studies on the composition of fresh fruit pulp of *Myrianthus* species reveals appreciable levels of protein, calcium, iron and phosphorous and it is also a good source of metabolizable energy (Okafor, 2004). However, there is little or no information on leaf composition.

This study looks at the nutritional profile of the leaf of *Myrianthus arboreus*, to ascertain its potential as an alternative source of feeding materials for livestock.

MATERIALS AND METHODS

Fresh leaves of *Myrianthus arboreus* (2n = 28) were collected from farmlands in Asaba, Delta State Nigeria (6°14 N and 6°49 E). The leaves were taken to the laboratory for analysis; care was taken to avoid unnecessary moisture loss. In the laboratory, a portion of the fresh leaves was used for moisture content determination, according to the methods recommended by AOAC (1990). The other portion of the leaves was 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 55°C for 24 h. The dried leaves were ground into powder using a milling machine and then sieved through 20 mesh sieves. Proximate Analysis was carried out using the methods recommended by AOAC (1990). The following parameters were determined: total ash, crude lipid, crude fiber, nitrogen free extract, crude protein and metabolizable energy. All analyses were carried out in 5 replicates and reported as mean values on a dry weight basis.

Determination of amino acid 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), Potassium (K) and Zinc (Zn) were determined as recommended by Funtua (1999, 2004), using Energy Dispersive X-Ray Fluorescence (EDXRF) transmission Spectrophotometer, carrying an annular 25 mCi 109 Cd isotope excitation source that emits Ag-K, X-rays (22.1 KeV) and Mo X-ray tube (50 Kv, 5 mA).

Phosphorus (P), Sodium (Na) and Magnesium (Mg) were analyzed after wet digestion with nitric/perchloric/sulphuric acid mixture (9:2:1 v/v/v). Phosphorus was determined colorimetrically with a Jemway 6100 spectrophotometer. Sodium was analyzed with a corning 400-flame photometer, while magnesium was analyzed complexometrically (AOAC, 1990).

The following anti-nutritional factors were determined: Oxalate, trypsin inhibitor, tannins, phytic acid, alkaloids, saponins, phenols and mycotoxins.

Quantitative estimation of tannins in the samples was carried out using modified vanillin-HCl methanol as described by Price and Buttler (1977). A standard curve of tannic acid was prepared according to AOAC (1990) for measurement of the concentration of tannins in the samples. Phytic acid was determined according to the method described by Wheeler and Ferrel (1971). A standard curve of different Fe $(NO_3)_3$ concentrations were plotted against the corresponding reading on the spectrophotometer, to calculate the ferric ion concentration. The phytate phosphorous was calculated from the concentration of ferric ion, assuming a 4:6, iron: phosphorus molar ratio.

Oxalate was determined by acid digestion, using 15 μ H_2SO_4, followed by filtration using a Whatman No. 1 filter paper. The filtrate was titrated hot (80-90°C) against 0.1 N $KMnO_4$ solution to a faint pink color that persists for 30 sec.

Trypsin inhibitor activity was measured using the method developed by Kakade *et al.* (1974). This method uses α-N-benzoyl-DL-arginin-p-nitroanilide hydrochloride (Sigma B 4875) or BAPNA as substrate for trypsin. Trypsin inhibitor from bovine pancreas was used to release P-nitroanilide. Absorbance was measured at 410 nm against a blank and Trypsin Inhibitory Activity (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 3 mL 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.

Saponins were 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 saponins. Phenol and mycotoxins were determined by the methods recommended by AOAC (1990).

RESULTS AND DISCUSSION

Proximate composition of *Myrianthus arboreus* leaves are shown in Table 1. The leaves have high moisture content (83.90% wet weight) however these values are within the ranges (58.0-93.4% wet weight) as reported for some leafy vegetables consumed in Nigeria (Ifon and Bassir, 1980; Ladan *et al*., 1996; Abuye *et al*., 2003). The ash content (16.4% DW) for *M. arboreus* which is an index of mineral content is comparable to values reported for other edible leaves, such as, *Vernonia colorata* (15.86% DW) and *Moringa oleifera* (15.09%) reported by Lockett *et al*. (2000) and *Momordica balsamina* leaves (18% DW), Hassan and Umar (2006). The crude fiber content of the leaves (11.6% DW) is within the range of reported values of some edible Nigerian vegetables (Ifon and Bassir, 1980). Ether extract of the leaves (13.1% DW) is within the ranges (8.3-27.0% DW) reported for some leafy vegetables consumed in Nigeria and Niger Republic (Ifon and Bassir, 1980). The crude protein content (18.74% DW) is high, similar to what has been reported for some known wild leafy vegetables such as *Momordica balsamina* (11.29% DW), *Moringa oleifera* (20.72% DW), Lockett *et al*. (2000) and *Lesianthera Africana* (13.1-14.9% DW) Hassan and Umar

Table 1: Proximate composition of *Myrianthus arboreus* leaves

Components	Composition (%)
Moisture	83.90±1.27
Crude fiber	11.60±2.07
Ether extract	13.10±0.92
Crude protein	18.74±2.32
Ash	16.40±0.44
Gross energy (kcal kg^{-1})	1333.40±14.74

Table 2: Amino acid profile of *M.Arboreus* leaf

Amino Acid	Concentration (g/100 g)
Isoleucine	1.08
Leucine	1.54
Methionine	0.98
Cysteine	0.90
Phenylalanine	1.12
Tyrosine	1.96
Threonine	1.10
Tryptophan	0.84
Valine	0.67

Table 3: Mineral composition of *Myrianthus arboreus* leaf

Mineral component	Concentration
Ca (%)	0.054
Mg (%)	0.460
K (%)	2.013
P (%)	0.500
N (%)	3.380
Na (ppm)	156.200
Mn (ppm)	6.957
Fe (ppm)	44.125
Cu (ppm)	3.550
Zn (ppm)	1.820

Table 4: Anti-nutritional factors present in *M. arboreus* leaf

Components	Concentration (mg/100 g) dried	Concentration (mg/100 g) cooked
Alkaloids	640.00	470.5
Tannins	4750.00	1450.7
Saponins	1860.00	542.2
Trypsin inhibitors	341.20	138.77
Phytic acid	25.00	22.00
Mycotoxins	0.0063	Nil
Oxalic acid	15.00	10
Phenol (%)	1.12	1.24

(2006). It also compares avorably well with fluted pumpkin leaves (21.8% DW) reported by Okoli and Mgbeogu (1983). The metabolizable energy value of the leaves was estimated to be 1333.4 kcal kg^{-1}, which is an indication it could be an important source of dietary calories.

The amino acid content of the leaves is shown in Table 2. Among the essential amino acids, leucine was predominant followed by threonine and isoleucine. The presence of sulphur containing amino acids is a good indication of its nutritive value.

The mineral content of the leaves is shown in Table 3. The leaves are rich in minerals, most especially, potassium, magnesium, phosphorous and calcium.

Table 4 shows the concentrations of the anti-nutritional factors present in the leaves of *Myrianthus arboreus* plant. Highest values were recorded for tannins while mycotoxin concentrations were found to be very low.

CONCLUSIONS

Myrianthus arboreus leaves are a good source of protein (18.74% DW) and can be considered as a supplement in compounding of livestock feed. Where the anti-nutritional factors exceed the acceptable limits, elimination processes should be embarked upon, as with other leaf meals already studied. Nastis *et al.* (1981) have indicated a threshold for tannins of 2-5% for cattle and 9% for goats. The present studies reveal a concentration of 4.75%, which is within the range of acceptable limits. Onwuka (1983) studies indicated a level of

16.5% for oxalic acid, the concentrations obtained in these present studies is much less than this value, indicating that *Myrianthus arboreus* leaf meals can be well tolerated by most livestock. The mineral content in the leaves are quite high, indicating that *M. arboreus* leaves are a good source of minerals and can be used as a supplement in compounding livestock feed. The leaves also contain appreciable levels of sulphur containing amino acids, which makes it a good source for livestock feed supplementation in regions where chronic deficiency of sulphur-containing amino aids occur.

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