International Journal of Biological Chemistry

ISSN 1819-155X

Academic Journals Inc.

www.academicjournals.com

International Journal of Biological Chemistry 1 (4): 250-255, 2007
ISSN 1819-155X

Nutritional Content of *Melochia corchorifolia* (Linn.) Leaves

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Abstract: *Melochia corchorifolia* leaves were analysed for their proximate and mineral composition. On Dry Weight (DW) basis, the leaves had the following proximate composition: crude protein (23.31±2.27%), crude lipid (13.33±2.89%), ash (10.00±0.10%), crude fibre (23.33±2.89%) and available carbohydrate (30.03±2.83%). *M. corchorifolia* leaves had high moisture content (62.16±6.11% Wet weight) with low energy value (275.66±23.20 kcal/100 g). The mineral composition in mg/100 g DW are: K (7.250±37.50), Ca (750.37±10.58), Mg (108.33±5.77) and P (101.89±0.08), Na (94.00±1.15), Cu (33.50±2.55), Fe (19.91±3.01), Mn (9.68±0.59) and Zn (6.73±0.62). When the minerals detected were compared with US Recommended Dietary Allowances, K, Cu, Fe and Mn were found to be adequate for both adults and children. Furthermore, the leaves have nutrient density >100% except for phosphorus, which is low for pregnant and lactating mothers.

Key words: Wild plants, *Melochia corchorifolia*, proximate composition, mineral elements

INTRODUCTION

The useful products obtained from plants directly or indirectly, demonstrate their importance to man. Plants serve as a source of food, medicinal product, energy and shelter to man and his livestock. In the earlier stage man depend on wild food, which is much abundant within his immediate environment. As the population grows, however, sources of food become more difficult for him, which necessitate domestication of many plants. Although more than 250,000 plant species have been described worldwide as sources of food, man depends only on a few species mainly cereals, particularly rice, wheat and corn as the major sources of his food and collectively supply nearly 60% of the world's food supply (Parvathin and Kumar, 2002; Oliveira *et al.*, 2000). In this contemporary situation focus was on vast wild under-utilised and under-exploited plants, which are the most neglected and untapped natural resource (Vadivel and Janardhanan, 2000) as a source of food to the teaming population particularly to the inhabitants of the developing world where food shortages and famine is mostly experienced.

Green leafy vegetables have been recognised as rich source of micronutrients (minerals and vitamins) and antioxidants (Kala and Prakash, 2004).

Melochia corchorifolia Linn., family *Sterculiaceae* as described by Akobundu and Agyakwa (1998), is a weed of moist or hydromorphic environment. It is an erect or prostrate bushy perennial herb with a pale brown hollow stem arising from a well-developed root system. The flowers are small, white, pale pink or yellow. The fruits are round, slightly hairy, dehiscent capsules. The seeds are small, dry and dark brown.

Despite the use of this plant as food especially by the inhabitants of the area where this plant grows, no report was available on its nutritional content. The objective of this study is to analyse *M. corchorifolia* leaves chemically to determine its proximate composition.

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MATERIALS AND METHODS

Sample Collection and Sample Treatment

Sample of *Melochia corchorifolia* used in this study was collected along the bank of River Zamfara in Jega town, Kebbi State, Nigeria. Prior to analysis, the plant leaves were destalked and washed with distilled water. The residual moisture was evaporated at room temperature. The leaves were put in large paper envelopes and oven dried at 60°C until constant weight was obtained (Fasakin, 2004). The dried leaves were ground in a porcelain mortar, sieved through 20-mesh sieve and stored in plastic container. The powdered sample was used for both proximate and mineral analyses. Fresh leaves were used for moisture content determination.

Proximate Analysis

The moisture content of *Melochia corchorifolia* leaves were determined by drying ten leaves (in triplicate) in a Gallenkamp oven at 105°C until constant weight was attained (AOAC, 1990). Ash content was determined by dry ashing in Lenton muffle furnace at 525°C for 24 h. The nitrogen (N) content was estimated by micro-Kjeldahl method and crude protein content calculated utilising 5.3 as the protein: Kjeldahl's nitrogen ratio for vegetable analysis (Asibey-Berko and Tayie, 1999). Crude lipid was quantified by the method described by AOAC (1990) using the Soxhlet apparatus and n-hexane as a solvent. Crude fibre was estimated by acid-base digestion with 1.25% H_2SO_4 (w/v) and 1.25% NaOH (w/v) solutions (AOAC, 1990). Available carbohydrate was calculated as difference between 100% DM and sum of the percentages of crude protein, crude lipid, crude fibre and ash (AOAC, 1990). The sample calorific value was estimated according to the formula:

Energy (in kcal) = (2.44×g protein) + (8.37×g lipid) + (3.57×g available carbohydrate) (Asibey-Berko and Tayie, 1999).

Mineral Analysis

Sample Digestion

One gram of the powdered sample was digested with 25.0 cm^3 concentrated HNO_3 using Tecator digestion block until evolution of brown fume stopped. One centimeter cube of perchloric acid was added to the mixture and the content was further heated to a clear solution. After heating, 30 cm^3 of hot distilled water was added to the digest and heated to boiling. The solution was then filtered hot into a clean 50 cm^3 volumetric flask, cooled and made up to the mark with distilled water (Tayie and Asibey-Berko, 2001). Two more duplicate digest solutions and a blank were prepared.

Mineral Quantification

K and Na were analysed by flame spectrometry (with Corning 400 spectrophotometer) KCl and NaCl were used to prepare the standards. Phosphorus was determined colorimetrically with Jenway 6100 spectrophotometer using phosphovanado-molybdate method with KH_2PO_4 as the standard. Calcium and Magnesium were analysed by titrating the samples solutions against EDTA solution using Calcon and Erochrome Black T indicators (AOAC, 1990). The concentrations of Cu, Fe, Mn and Zn were determined with a Unicam 969 model atomic absorption spectrophotometer with standard air-acetylene flame.

Nutrient Density

To evaluate the nutritional significance of mineral elements, Nutrient Density (ND) of the sampleswas computed using the equation:

$$ND\ (\%) = [(Np/Ep)/(Nr/Er)] \times 100$$

Where,

Np = Nutrient concentration (mineral element in the food).

Ep = Energy supplied by food.

Nr = Recommended daily intakes of nutrient.

Er = Recommended energy intake (3000 kcal day^{-1} for an adult male given by WHO/FAO (Cole, 1980).

RESULTS AND DISCUSSION

The proximate analysis of *Melochia corchorifolia* leaves is presented in Table 1. As with most fresh leafy vegetables, the leaves have high moisture content. The leaves also had high percentage of crude lipid when compared to most values (0.33-4.57%) obtained in some edible green leafy vegetables (Guil-Guerrero *et al*., 1998; Ishida *et al*., 2000; Agbo, 2004; Gupta *et al*., 2005). However, high crude lipid was also reported in some tropical vegetables (8.3-27.0% DW) (Ifon and Bassir, 1980; Sena *et al*., 1998).

The ash content was high in the leaves, but within the range of 9.2±1.5 to 28.0±1.1% reported in green leafy vegetables of Nigeria (Ifon and Bassir, 1980; Ladan *et al*., 1996).

M. corchorifolia leaves contain high amount of crude protein (23.31±2.27% DW) which is within the range of 17.2±0.1 to 27.03% DW reported for some Nigerian leafy vegetables (Ifon and Basir, 1980). This suggest that this leafy vegetable could be utilised as cheap source of protein supplement. When compared to the recommended dietary allowances for adult (34-56 g day^{-1}) and children (13-19 g day^{-1}), it further indicates the potential of this plant as a protein source.

Dietary fibre is an important component of food in human nutrition as it promotes gut motility and reduces serum cholesterol level, breast cancer and hypertension (Anhwange *et al*., 2004; Hassan and Umar, 2004). This ability is due to reduction in the rate of absorption of glucose and fat by fibre (Ekop *et al*., 2004). In this analysis, *M. corchorifolia* leaves were found to have high fibre content (23.33±2.89% DW). This value is comparable to the fibre content of *Gynandropsis gynandra* leaves (Hassan *et al*., 2005).

The estimated available carbohydrate is low compared to the RDA value (130 g) for adults and children (Hassan and Umar, 2006). According to Ifon and Bassir (1980), leafy vegetables may not be important sources of carbohydrate as they are eaten along with other carbohydrate rich food such as cereals. Main function of carbohydrate in the body is for energy supply. The plant leaves energy value 275.66±23.20 kcal/100 g DW (1153.30 J/100 g DW) was within the range of 84-2500 kJ/100 g reported for plant foods (Saka and Msonthi, 1994). This value is low compared to adult energy requirement (3000 kcal day^{-1}) (Cole, 1980).

Table 2 shows the mineral profile of *M. corchorifolia* leaves. Potassium is the most abundant (7.250±37.50 mg/100g DW), followed by calcium, magnesium and then phosphorous with values in mg/100g DW of 750.37±0.58, 108.33±5.77 and 101.89±0.08, respectively. With the exception of potassium, all the above mentioned elements in *M. corchorifolia* leaves are lower compared to those reported in *Gynandropsis gynandra* leaves (Hassan *et al*., 2005) and some tropical leafy vegetables (Aletor and Adeogun, 1995). Sodium content is the lowest among the macro elements determined. This observation agrees with many other reported results, that have shown sodium to be present in low concentration particularly when compared to potassium.

Microelements play a vital role in human nutrition, as they are dietary essential. However, high concentration above the safe level is toxic to the body. Iron is the second most abundant found among the trace element analysed. When compared with other green leafy vegetables, *M. corchorifolia* leaves

Table 1: Proximate composition of *Melochia corchorifolia* leaves

Parameters	Concentration (Dry weight %)
Moisture (Wet weight %)	620.16±6.11
Ash	100.00±0.10
Crude lipid	130.33±2.89
Crude protein	230.31±2.27
Crude fibre	230.33±2.89
Available carbohydrate	300.03±2.83
Energy (kcal/100 g)	275.66±23.2

Values are mean±Standard deviation of three determinations

Table 2: Mineral Composition of *Melochia corchorifolia* Leaves

		Recommended dietary allowances**			
Mineral elements	Concentration (mg/100 g dry weight)*	Adult (Male)	Adult (Female)	Children (7-10 years)	Pregnant and breast-feeding mothers
K	7.25±37.50	2000	2000	1600	2000
Na	94.00±1.15	500	500	400	500
Ca	750.37±10.58	800	800	800	1.200
Mg	108.33±5.77	350	280	170	355
P	101.89±0.08	800	800	800	1.200
Cu	33.50±2.55	1.5-3	1.5-3	1-3	1.5-3
Fe	19.91±3.01	10	15	10	13
Mn	9.68±0.57	2-5	2-5	2-3	2-5
Zn	6.73±0.62	15	12	10	19

*: The data are mean value±standard deviation (SD) of three replicated, **: Source: Thangadurai *et al.* (2001)

have lower value than 110-325 mg/100 g DW found in some Nigerian leafy vegetables (Ifon and Bassir, 1979; Ladan *et al*., 1996), but within the range of 4.3-119.1 mg/100 g found in underutilized leafy vegetables of Republic of Niger (Sena *et al*., 1998). Iron is an essential trace element for haemoglobin formation, normal functioning of the central nervous system and in the oxidation of carbohydrates, proteins and fats (Adeyeye and Otikiti, 1999). Comparing the amount found in this study with the reference value (Table 2), the level of Fe in the leaves are adequate to supply the daily iron requirement for adult, children, pregnant and breast-feeding mothers. Furthermore Copper is the most abundant microelement found in the plant leaves. High content could be due to intake of the element by the plant from the soil. The Cu in the leaves is higher than the reported values (1-2.5 mg/100 g) for some tropical leafy vegetables (Ifon and Bassir, 1979; Barminas *et al*., 1998; Sena *et al*., 1998). Copper is an essential trace element which exists as an integral part of copper proteins ceruloplasmin which is a copper-transport protein.

Manganese acts as activator of many enzymes (McDonald *et al*., 1995) while zinc is involved in normal function of immune system. The Mn content in leaves is within the range reported for some tropical plants (Ifon and Bassir, 1979; Sena *et al*., 1998) and considered to be adequate if bioavailable when compared with recommended dietary allowances (Table 2). Zinc on the other hand is low compared to recommended dietary allowances.

For all the elements analyses, except phosphorus for pregnant and lactating mothers, the percentage of Nutrient Densities (ND), were higher than 100% (Table 3). According to Karakaya *et al.* (1995), food material with ND of 100% supplies the nutrient need in the same proportion, as the caloric needs. Also if this index is above 100%, then the food provides the nutrients in greater proportion than the caloric need. On the other hand, values of ND below 100% indicate that food fails to provide a proportionate amount of the nutrient. Thus, the result confirm that *Melochia corchorifolia* leaves are adequate rich sources of mineral elements, without evaluating the effect of other antinutrient factors.

Table 3: Mineral nutrient density of melochia corchorifolia leaves

Mineral elements	Adult		Children (7-10 years)	Pregnant and breast-feeding mothers
	Male	Female		
K	3900	3900	4900	3900
Na	205	205	256	205
Ca	1021	1021	1021	681
Mg	337	421	694	332
P	139	139	139	92
Cu	4897	4897	4897	4897
Fe	2167	1445	2167	1667
Mn	2107	2107	3512	2107
Zn	488	610	732	385

CONCLUSION

From the result it can be seen that *Melochia corchorifolia* leaves could be used as protein supplement, sources of dietary lipids, fibre and minerals. Furthermore as potassium depresses blood pressure while sodium enhances, based on the results, the plant leaves could be recommended for hypertensive patients.

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