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Nutrient composition of three Nigerian medicinal plants

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The leaves of three Nigerian medicinal plants, *Chromolina oduratum*, *Ipomoea aserifolia* and *Emilia santifolia*, were analysed for their nutritional contents, including crude protein, fat, carbohydrate and minerals. *C. oduratum* and *I. aserifolia* were found to have appreciable amounts of crude protein in addition to high calcium and potassium contents. The levels of lead, oxalates and phytates in the plant samples are low compared to recommended maxima for these toxicants. The high levels of these nutrients together with the low levels of toxicity of the leaves make these plants useful as supplements in human and animal diets.

INTRODUCTION

The vegetation of Nigeria is richly endowed with a wide variety of plants, some of which are yet to be fully exploited. Many of the plants are cultivated and used as food or drugs while a good number of others grow wild in the tropical forest. Recent efforts at screening some of these plants (Ekpa & Ebana, 1991; Ekpa & Okwujiako, 1996) have shown that many that have medicinal properties could also be used in supplementing regular Nigerian diets as they are rich in protein and minerals.

In continuation of our efforts to help improve the dietary needs of Nigerians, three plants, *Chromolina oduratum*, *Ipomoea aserifolia* and *Emilia santifolia*, were evaluated for their nutritional contents. *C. oduratum* is a shrub with green leaves which are of medium size. It is generally not consumed by humans, but can be used as fodder for animals. The plant is used locally for the treatment of malaria and diarrhoea. In the case of malarial treatment, a decoction of the ground leaves in local gin (30–40% ethyl alcohol, v/v) is orally administered to the patient. *I. aserifolia* is a scrambling shrub with light-green broad leaves. It has a soft stem which secretes slimy milky liquid when cut or when the leaf is plucked from the stem. The medicinal or food value of this plant is not known, although a member of the genus, *Ipomoea* sp., has been found to be active against some microorganisms, including *Staphylococcus aureus*, *Escherichia coli*, and *Bacillus megaterium* (Veliky & Latta, 1924). *E. santifolia* is a small herb with medium-sized thick leaves which also grows mainly in damp areas. The plant is used by the local population in the treatment of fever. Squeezed juice from the leaves of the plant is poured on the heads of babies very early in the morning, as a treatment for fever. High levels of *in vitro* antifungal activity have been reported for another member of this genus, *Emilia saggittata* (Sawhney *et al.*, 1978).

At present, the above plants are not known to be consumed by humans. The present study was therefore carried out to determine the suitability of these plants for human and animal consumption.

MATERIALS AND METHODS

Collection and treatment of plant samples

The leaves of the plants were collected in the early hours of the morning before the onset of the sun. The leaves of *E. santifolia* were collected from a bush in Calabar, while the leaves of *C. oduratum* and *I. aserifolia* were collected from the University of Calabar premises. The leaves were gathered while still very fresh and taken to the botanical garden of the Biological Sciences Department, University of Calabar, for identification, after which they were taken to the laboratory for analysis. The leaves were cut from the stalks and washed with distilled water to remove dirt. They were then dried in a hot-air-circulating oven at 60°C for 24 h. The dried samples were ground and then stored in air-tight plastic containers. A weighed amount of each sample was analysed for each of the nutrients, in triplicate. Fresh samples were used for the determination of moisture content.

Table 1. Nutrient composition and toxic substances of the four plants (g per 100 g dry matter, mean ± SD)

Plant samples	Proximate composition						Toxic substances			
	Moisture[a]	Crude lipid	Ash	Crude fibre	Crude protein	Carbohydrate	Hydrocyanic acid	Soluble oxalate	Total oxalate	Phytic acid
Chromolina oduartum	81.80 ± 0.61	10.50 ± 0.70	5.80 ± 0.03	5.50 ± 0.01	22.3 ± 0.34	55.9 ± 0.65	0.008 ± 0.001	0.962 ± 0.006	1.72 ± 0.130	0.119 ± 0.011
Ipomoea aserifolia	88.20 ± 0.82	8.00 ± 0.21	9.50 ± 0.00	10.0 ± 0.05	21.0 ± 0.04	51.5 ± 0.30	0.005 ± 0.001	0.440 ± 0.013	0.825 ± 0.005	0.089 ± 0.003
Emilia santifolia	94.40 ± 0.84	4.00 ± 0.00	7.35 ± 0.07	7.50 ± 0.05	12.9 ± 0.04	68.2 ± 0.71	0.011 ± 0.004	0.825 ± 0.031	1.44 ± 0.120	0.255 ± 0.020

[a]Moisture is reported as percentage wet matter.

Determination of nutrient composition

The procedures for the determination of chemical composition were those of the Association of Official Analytical Chemists (AOAC, 1975). Crude protein (N×6.25) was determined by the macro-Kjeldahl method. Crude lipid was obtained by Soxhlet extraction of 5.0 g of the oven-dried sample with hexane and the difference in weight after evaporating the hexane *in vacuo* was taken as the weight of crude lipid. Crude fibre was determined from the loss in weight on ignition of dried residue remaining after digesting the fat-free sample with 1.25% H_2SO_4 (v/v) and 1.25% NaOH (v/v) solutions. The ash content was determined by incineration of a known weight of sample at 550°C until grey-ashed. The carbohydrate content was estimated by subtracting the sum of the protein, fat, ash and fibre from the dry matter.

Elemental composition was determined according to AOAC (1975) on a Perkin-Elmer SP-9 atomic absorption spectrophotometer. Potassium and sodium were determined by flame photometry, and phosphorus by the molybdovanadate method.

Determination of toxic substances

The alkaline titration method (AOAC, 1975) was employed in the analysis of hydrocyanic acid, while total and soluble oxalates were estimated by the procedure described by Dye (1956). Phytic acid content was determined by the method of McCance & Widdowson (1953).

RESULTS AND DISCUSSION

The leaves of three commonly available but largely unutilized Nigerian plants were analysed for nutrients, including protein, fat, carbohydrate and mineral contents. The three plants—*Chromolina oduratum*, *Ipomoea aserifolia* and *Emilia santifolia*—have in common the ability to maintain year-round growth which is advantageous over many of the currently consumed seasonal vegetables.

The plants have crude protein contents ranging from 12.9% for *E. santifolia* to 22.3% for *C. oduratum* (Table 1). These levels of protein could be used to supplement other sources of protein in human and animal diets. The crude lipid content for *C. oduratum* was 10.50%, while those for *I. aserifolia* and *E. santifolia* were 8.0% and 4.0%, respectively. All the plant samples were rich in carbohydrate, which ranged between 51.5% for *I. aserifolia* and 68.2% for *E. santifolia*.

Analysis of the plants for toxic substances indicates that the plants have low levels of these substances (Table 1). Hydrocyanic acid contents were between 0.005% for *I. aserifolia* and 0.011% for *E. santifolia*. The minimum lethal level of hydrocyanic acid has been given by Oke (1969) to be 35 mg%, while Bolhuis (1954), as cited by Almazan (1988), has given 50 mg kg^{-1} fresh weight as the safe level for peeled cassava. Phytic acid in the samples was in the range of 0.089–0.255%. Phytates in biological systems limit the bioavailability of divalent elements (McCance & Widdowson, 1953). Phytic acid is also said to interfere with iron absorption, although studies by Ifon (1981) have not shown any predictable relation between phytate and iron absorption. Oxalic acid exists as the highly insoluble calcium salt and as the soluble form, which is the toxic fraction. Soluble oxalate in the samples was 0.440% for *I. aserifolia*, while *E. santifolia* and *C. oduratum* contained 0.825% and 0.962%, respectively. These levels of oxalate are substantially lower than the minimum toxic level of 3 g per 100 g (Munro & Bassir, 1969), indicating that the levels of oxalate in the plant samples are within acceptable limits.

Table 2. Mineral compositions of the plant samples (dry matter basis)

Element	*Chromolina oduratum*	*Ipomoea aserifolia*	*Emilia santifolia*
Ca (%)	3.36 ± 0.11	1.20 ± 0.05	2.41 ± 0.20
Na (%)	0.10 ± 0.01	0.12 ± 0.00	0.10 ± 0.00
K (%)	2.10 ± 0.05	1.43 ± 0.13	1.71 ± 0.20
Mg (%)	0.35 ± 0.01	0.16 ± 0.02	0.42 ± 0.02
P (%)	0.10 ± 0.00	0.13 ± 0.05	0.16 ± 0.01
Fe (ppm)	48.3 ± 0.41	150 ± 0.18	146 ± 1.26
Mn (ppm)	35.3 ± 0.13	22.6 ± 0.09	21.3 ± 0.35
Pb (ppm)	0.13 ± 0.03	0.11 ± 0.00	0.15 ± 0.02

Results of the analysis also showed the plants to be rich in mineral contents, particularly calcium and potassium (Table 2). *C. oduratum* had a calcium content of 3.36%, and a potassium content of 2.20%. This was followed by *E. santifolia* with calcium and potassium contents of 2.41% and 1.71%, respectively. The high levels of these elements show that the leaves of these plants could provide alternative sources of calcium and potassium in diets. Calcium helps in cell wall formation and its absence may result in weak stunted growth (Ekpa *et al.*, 1993) as a result of poor bone development. The levels of lead were low enough (0.11–0.15 ppm) to indicate no significant adverse effect on the body.

CONCLUSIONS

The results of the present study have revealed the presence of protein, carbohydrate, fat and minerals in appreciable quantities in three Nigerian plants hitherto not considered to be consumable by humans and animals. The levels of toxicants in the plant samples, particularly lead, oxalates and phytates, are relatively low compared to the levels found in the seeds of some popular legumes (Kinc *et al.*, 1991) consumed in Nigeria. The high percentage of protein in *I. aserifolia*, with its low level of toxicity, makes it a potential vegetable for humans. The leaves could also serve as a good source of food for farm animals as a result of their high water and

nutrient contents. Further work is, however, necessary in order to determine the amino acid composition and fatty acid profile of the samples. This will, in turn, allow proper utilization of the plants based on their constituent amino and/or fatty acids.

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