PJN
ISSN 1680-5194

PAKISTAN JOURNAL OF NUTRITION

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Pakistan Journal of Nutrition, 5 (6): 522-529, 2006
ISSN 1680-5194

Nutritional Value of Balsam Apple (*Momordica balsamina L.*) Leaves

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Abstract: The objective of this study was to assess the nutritive value of *Momordica balsamina* L. leaves by analysing their proximate composition, amino acid profile and mineral constituents. The results showed that the plant leaves had high moisture content (71.00±0.95% fresh weights). The concentration of estimated crude protein and available carbohydrates on dry weight (DW) basis were 11.29 0.07% and 39.05±2.01% respectively. The leaves also have high ash (18.00±0.56% DW) and crude fibre (29.00±1.23% DW) contents; while crude lipid (2.66±0.13% DW) and energy value (191.16kcal/100g DW) were low. The study detected seventeen amino acids (isoleucine, leucine, lysine, methionine, cysteine, phenylalanine, tyrosine, threonine, valine, alanine, arginine, aspartic acid, glutamic acid, glycine, histidine, proline and serine) with glutamic acid, leucine and aspartic acid being the predominance amino acids. Isoleucine, leucine, valine and aromatic acids were found to be higher than WHO/FAO/UNU (1985) requirement pattern for children, while sulphur containing amino acids are the only limiting amino acids for adults. The results of leaves mineral composition per 100g (DW) were as follows: K (1,320.00mg), Na (122.49mg), Ca (941.00mg), Mg (220.00mg), P (130.46mg), Fe (60.30mg), Cu (5.44mg), Mn (11.60mg) and Zn (3.18mg). Comparing the leaves mineral contents with RDA values, the results indicated that the *Momordica balsamina* leaves could be good supplement for some mineral elements particularly K, Ca, Mg, Fe, Cu and Mn.

Key words: Wild leafy vegetables, *Momordica balsamina* L, amino acids and mineral elements

Introduction

Researchers, governments and other organizations charge with food and nutrition show great concern on the nutritional status of general population more especially children, pregnant and lactating mothers habiting the developing countries (Andersen *et al*., 2003; Seena *et al*., 2005). In these countries, natural disasters, bad economic policies, political instability, population explosion, high price of food commodities, poor implementation of agricultural policies and restrictions in food importation are the major factors that contribute to the burden of inadequate food intake among average people (Adebooye and Phillips, 2006). In these regions, starch-based foods are the main staples food which supply both energy and protein requirement. Thus, protein deficiency prevails among the populace as recognized by Food and Agricultural Organization, FAO (Ladeji *et al*., 1995). To alleviate the situation, efforts should be focus on exploiting under-exploited and lesser-known wild plants as sources of nutrients supplements. In this direction, many researchers (Ogle and Grivetti, 1985; Nordeide *et al*., 1996; Smith *et al*., 1996; Glew *et al*., 1997; Freiberger *et al*., 1998; Cook *et al*., 2000; Lockeett *et al*., 2000; Ogle *et al*., 2001) had reported the nutritional composition of various types of edible wild plants in use in the developing worlds.

Momordica balsamina L. commonly known as African pumpkin (or African cucumber), Balsam apple (or Balsam pear) and locally called "*Garahuni*" (Hausa Language), belongs to the family *Cucurbitaleae*. The plant is perennial herb with soft stems and tendrils that climbs up shrubs, boundary fields and fences. The green leaves are deeply palmately 5 - 7 lobed, about 12 cm long, margin toothed, stalked. The plant produces spindle shaped fruits (dark green when unripe and bright to deep orange when ripe). The seeds are embedded into a sweet edible red fleshy pulp testing like watermelon (Welman, 2004). In Hausa land of Nigeria and Republic of Niger, the leaves are cooked as part of green vegetables soup for lactating mother, where it is belief to help the mother to regenerate her lost blood during labour and to purify her breast milk. Hutchings *et al*. (1996); Roodt (1998); Bandeira *et al*. (2001) had reported various medicinal uses of *Momordica balsamina*. Despite the use of this plant in such purposes, the plant has not been given due research attention in terms of its nutritional content. Thus the aim of this work is to bridge up the gap by providing information on the proximate, minerals and amino acids compositions of this wild green leafy vegetable with hope that the information would be used in nutritional policy of the country.

Materials and Methods

Sample collection: M. balsamina leaves used in this study were sampled at Nasarawa village of Jega local government area, Kebbi State, Nigeria in October 2004. The sample was transported to the laboratory in a polyethylene bag and identified by a taxonomist at Botany unit, Department of Biological Sciences, Usmanu Danfodiyo University Sokoto.

Sample treatment: The *M. balsamina* leaves were manually washed with distilled water and residual moisture evaporated at room temperature. The leaves were oven dried in paper envelope at 55°C for 24 hours (Abuye *et al.*, 2003), ground into fine powder using pestle and mortar, and sieved through 20-mesh sieve. The dried powdered sample was used for the analyses. For moisture content determination, however, fresh leaves were used.

Proximate analysis: The recommended methods of the Association of Official Analytical Chemists (AOAC, 1990) were used for the determination of moisture, ash, crude lipid, crude fibre and nitrogen content.

Determination of moisture and ash content: For moisture content determination, ten fresh leaves of the sample in triplicate were weighed in Petri dishes and dried in an oven (Gallenkamp, UK) at 105°C for 24 hours. The dried leaves were cooled in a dessicator and weighed. The percentage loss in weight was expressed as percentage moisture content. Similar determination was carried out on two grams dry sample so as to evaluate the residual moisture content, which was used latter to convert other parameters on 100% dry weight (DW) basis.

Ash content was determined by the incineration of two grams samples in a muffle furnace (Lenton Furnaces, England) at 600° C for 2 hours. The percentage residue weighed was expressed as ash content.

Determination of Crude Lipid and Crude Fibre Content: 2g (in triplicate) of dried sample were weighed into porous thimble and its mouth plugged with cotton. The thimble was placed in an extraction chamber, which was suspended above weighed receiving flask containing petroleum ether (b.p. 40-60°C) and below a condenser. The flask was heated on heating mantle for eight hours to extract the crude lipid. After the extraction, the thimble was removed from the Soxhlet and the apparatus reassembled and heated over water bath for the solvent recovery. The flask containing the crude lipid was disconnected, cleaned with dry cloth, oven dried at 100°C for 30 minutes, cooled in a dessicator and weighed. The difference in weight is expressed as percentage crude lipid content.

Crude fibre was estimated by acid-base digestion with 1.25% H_2SO_4 (w/v) and 1.25% NaOH (w/v) solutions. The residue after crude lipid extraction was put into a 600cm^3 beaker and 200cm^3 of boiling 1.25% H_2SO_4 added. The content was boiled for 30 minutes, cooled, filtered through a filter paper and residue washed with three 50cm^3 portions of boiling water. The drained residue was returned to the original beaker and 200cm^3 of boiling 1.25% NaOH added. The content was boiled for 30 minutes, filtered, washed as above, residue drained and washed with 25cm^3 ethanol. The filter paper containing the residue was dried in an oven at 130°C to constant weight and cooled in a dessiccator. The residue was scrapped into pre-weighed porcelain crucible, weighed, ashed at 550°C for two hours, cooled in a desiccator and reweighed. Crude fibre content was expressed as percentage loss in weigh on ignition.

Determination of nitrogen content: Micro-Kjeldahl method was used to determine the nitrogen content of the sample. Two grams dried powdered sample was placed into a 100 cm^3 Kjeldahl digestion flask. A Kjeldahl digestion tablet and 10cm^3 of concentrated tetraoxosulphate (VI) acid were added and the sample digested gently until frothing stopped. The mixture was boiled until the digest become clear. The content was filtered into a 100 cm^3 volumetric flask and made up to 100cm^3 with distilled water. 10cm^3 of the aliquot solution and 20cm^3 of 45% sodium hydroxide solution were put into a distillation flask and steam distilled. The ammonia liberated was collected over 50 cm^3 20% boric acid-mixed indicator solution, cooled and titrated with standard 0.01M HCl solution. Blank determination was carried in similar manner.

Estimation of Crude Protein and Available Carbohydrate: Crude protein was estimated by multiplying the sample percentage nitrogen content by a factor 6.25. Available carbohydrate was calculated by difference by subtracting total sum of crude protein, crude lipid, crude fibre and ash from 100% DW sample (AOAC, 1990).

Estimation of energy value: The sample calorific value was estimated (in kcal) by multiplying the percentages of crude protein, crude lipid and carbohydrate by the recommended factors (2.44, 8.37 and 3.57 respectively) used in vegetables analysis (Asibey-Berko and Tayie, 1999).

Amino acid analysis: Amino acid determination was carried out using ion-exchange chromatography with Technicon Sequential Multisample Amino Acid Analyser, TSM (Technicon Instruments Corporation, Dublin, Ireland) at Postgraduate laboratory, Zoology unit, University of Jos, Nigeria as outline in Adeyeye and Afolabi (2004). 2g sample was defatted with petroleum ether using Soxhlet extraction methods. The defatted sample was re-dried and milled into fine powder using porcelain pestle and mortar. 30mg sample in duplicate were weighed into a glass ampoules to which 5cm^3 of 6M HCl and 5µmoles norleucine were added. The ampoules were evacuated by passing nitrogen gas (to remove oxygen so as to avoid possible oxidation of some amino acids during hydrolysis), sealed with Bunsen burner flame and hydrolyzed in an oven at 110°C

for 24 hours. The ampoules were cooled, broken at the tip and the contents filtered. The filtrates were evaporated to dryness at 40°C under vacuum in a rotary evaporator. The residues were dissolved to 5µL (for acid and neutral amino acids) or 10 µL (for basic amino acids) with acetate buffer, pH 2.2 and the solutions were dispensed into the cartridge of TMS. The chromatograms (amino acid peaks) obtained from automatic pen recorder corresponds to the quantity of each amino acid present. Quantification was performed by comparing the peak area of each amino acid in the sample to the area of the corresponding amino acid standard of the protein hydrolysate

Mineral analysis: The sample mineral elements (K, Ca, Mn, Fe, Cu and Zn) contents were analyzed using energy dispersive X-ray fluorescence (EDXRF) transmission emission technique at the Centre for Energy Research and Training, Ahmadu Bello University, Zaria, Nigeria according to the method of Funtua (1999; 2004). 0.3g powdered sample was homogenised with 3 drops of organic liquid binder (polystyrene dissolved in toluene) in a 19 mm diameter die and pressed at 10 tons with a Specac hydraulic press to form a pallet.

Measurements of the sample (in duplicates) were performed using energy-dispersive spectrometer which consist of an annuar 25 $mCi^{109}Cd$ isotopic as the excitation source that emits Ag-K X-ray (22.1 keV) and a Mo X-ray tube (50KV, 5mA) with thick foil of pure Mo used as target material for absorption correction. The system consist furthermore, of a Canberra Si (Li) detector with a resolution of 170eV at 5.9keV line, coupled to a computer controlled ADC-Card (Trump 8K). The spectra for the sample was collected for 5000S and evaluated using the AXIL-QXAS program.

P, Na and Mg were analyzed after wet digestion of one-gram powdered sample with nitric/perchloric/sulphuric acid (9:2:1) mixture. Phosphorus content was determined colorimetrically with Jenway 6100 spectrophotometer using phospho-vanadomolybdate method. Sodium was analyzed using Corning 400 flame photometer while magnesium was analyzed complexometrically (AOAC, 1990).

Results and Discussion

Proximate analysis: The results of proximate composition of *M. balsamina* leaves (Table 1) shows that the leaves have high moisture content (71 ± 0.95% wet weight) within the reported range (58.0 ± 2.5% to 93.4± 0.7%) in some leafy vegetables consumed in Sokoto, Nigeria (Ladan *et al.*, 1996). Ifon and Bassir (1980) however, reported higher range of values (81.4 - 90.3%) in some Nigerian green leafy vegetables.

The ash content, which is an index of mineral contents in biota, is high (18.00 ± 0.56%DW) in *M. balsamina* leaves compared to the values reported in leaves of *Ipomea batatas* (1.8%), *Corchones tridens* (8.7%) and *Amaranthus incarvatus* (14.4%) grown in Ghana (Asibey-Berko and Tayie, 1999), but compared favourably with the values reported in some Nigerian leafy vegetables (Ifon and Bassir, 1980; Ladan *et al.*, 1996). Lockett *et al.* (2000) had also reported high ash content in some greens use by the lactating mother such as bitter leaves, *Veronia colorate* (15.86%DW) and *Moringa oleifera* (15.09%DW). This indicates *M. balsamina* leaves could be good sources of mineral elements.

Table 1: Proximate composition of *Momordica balsamina* Leaves

Parameters	Concentration (% DW)*
Moisture Contenta	71.00 ± 0.95
Ash	18.00 ± 0.56
Crude Protein	11.29 ± 0.07
Crude Lipid	2.66 ± 0.13
Crude Fibre	29.00 ± 1.23
Available Carbohydrate	39.05 ± 2.01
Calorific Value (kcal/100g)	189.22

*The data are mean value ± standard deviation (SD) of three replicates. [a]Value expressed as % wet weight

The leaves crude protein content (11.29 ± 0.07%) was higher than protein content of *Momordica foecide* (4.6%) and *Momordica involucrata* leaves consumed in Swaziland (Ogle and Grivetti, 1985) but lower than those of *Moringa oleifera* (20.72%) (Lockett *et al.,* 2000) and *Lesianthera africana* leaves (13.1-14.9%) (Isong and Idiong, 1997). Sena *et al.* (1998) also reported higher values ranging from 19.1% in "Yadiya" (*Leptadenia hastata*) to 24% in *Amaranthus vividis*, while, Abuye *et al.* (2003) reported comparable value in *Moringa stenopetala* leaves grown in Ethopia. According to Pearson (1976), plant food that provide more than 12% of its calorific value from protein are considered good source of protein. Therefore, *M. balsamina* leaves (14.56%) provide this requirement. Furthermore, adults, children, pregnant and lactating mothers required 34-56g, 13 - 19g, 71g and 71g of protein daily respectively (FND, 2002). Assuming complete protein absorption; 100g DW of *M. balsamina* leaves would contribute about 20 - 33%, 59 - 87%, 16% and 16% of their daily protein requirement respectively.

The leaves crude lipid content (2.66%) was low compared with reported values (8.3-27.0% DW) in some vegetables consumed in Nigeria and Republic of Niger (Ifon and Bassir, 1980; Sena *et al.,* 1998). However, the value is higher than 0.52-0.75% and in some *Sonchus species* (Guil-Guerrero *et al.*, 1998), 0.33-1.03% in sweet potatoes leaves (Ishida *et al.*, 2000); 3.83% obtained in *Cassia obtusifolia* leaves (Agbo, 2004) and 1.85 to 4.57% (DW) in some edible green leafy vegetables of Southern India (Gupta *et al.*, 2005). The results indicated that the leaves *M. balsamina* are poor sources of plant lipid, which is in agreement with general observation that leafy vegetables are low lipid containing food, thus advantageous health wise to avoid obesity (Lintas, 1992).

Table 2: Amino acid composition of *Momordica balsamina* L leaves*

Amino acid (Abbreviation)	Concentration (g/100g protein)
Isoleucine	2.94
Leucine	8. 38
Lysine	3.94
Methionine	0.90
Cysteine	0.56
Total Sulphur EAAs	1.46
Phenylalanine	3.94
Tyrosine	2.62
Total Aromatic EAAs	6.46
Threonine	3.13
Valine	4.11
Histidine	2.50
Alanine	4.16
Arginine	4.87
Aspartic acid	8.21
Glutamic acid	12.38
Glycine	4.66
Proline	3.21
Serine	4.00

* The data are mean of two replicates.

The estimated available carbohydrate content (39.05± 2.01%) in *M. balsamina* leaves is higher than 20% obtained in *Senna obtusfolia* leaves (Faruq *et al*., 2002), 23.7% in *Amaranthus incurvatus* leaves (Asibey-Berko and Tayie, 1999). On the other hand, *M. balsamina* leaves contain less available carbohydrate compared to *Corchorus tridens* (75.0%) and sweet potatoes leaves (82.8%) (Asibey-Berko and Tayie, 1999). The recommended dietary allowance, RDA values, for children, adults, pregnant and lactating mothers are 130g, 130g, 175g and 210g respectively. This shows that the plant is capable of contributing 31%, 31%, 23% and 19% of their respective daily requirement when 100g dried leaves are consumed.

The crude fibre content in *M. balsamina* leaves (29%) is high compared to 8.5-20.9% in some Nigerian vegetables (Ifon and Bassir, 1980). The major drawbacks to the use of vegetables in human nutrition is their high fibre content which invariability causes intestinal irritation and lower nutrient bioavailability, hence large quantities of plant vegetables have to be consumed to provide adequate levels of nutrients (Aletor and Adeogun, 1995; Plessi *et al*., 1999; Vadivel and Janardhanan, 2000). On the other hand, in take of dietary fibre can lower the serum cholesterol level, risk of coronary heart disease, hypertension, constipation, diabetes and colon and breast cancer (Ishida *et al*., 2000; Ramula and Rao, 2003). The RDA of fibre for children, adults, pregnant and lactating mothers are 19 -25%, 21 - 38%, 28% and 29% respectively. Thus the leaves of *M. balsamina* could be valuable sources of dietary fibre in human nutrition.

The calorific value of *M. balsamina* leaves is estimated to be 189.22 kcal/100g (DW), which is low compared to 248.8-307.1 kcal/100g reported in some Nigerian leafy vegetables (Isong *et al*., 1999). Asibey-Berko and Tayie (1999) also reported high energy content in some Ghanaian green leafy vegetables such as *Corchorus tridens* (283.1 kcal/100g) and sweet potato leaves (288.3 kcal/100g). This show that the plant leaves has low calorific value which is in agreement with general observation that vegetables have low energy values (Lintas, 1992).

Amino acid profile: Twenty amino acids are commonly found as components of proteins (McDonald *et al*. 1995). In this study seventeen amino acids were detected (Table 2) as a result of conversion of glutamine and asparagines to glutamic and aspartic acids respectively (Salo-Vaananen and Koivistoinen, 1996) and complete destruction tryptophan during acid hydrolysis (Wathelet, 1999). The result indicated that nonessential amino acids (alanine, arginine, aspartic acid, glutamic acid, glycine, histidine, proline and serine) are higher in concentration (59%) compared to essential amino acids (isoleucine, leucine, lysine, methionine, cysteine, phenylalanine, tyrosine, threonine, valine) which constitute 41% of the total amino acids analyzed. Among the essential amino acids, leucine and aromatic (phenylalanine and tyrosine) are the predominance acids, while glutamic acid and aspartic acid were found to be major nonessential amino acids in *M. balsamina* leaves.

To evaluate the nutritional quality of *M. balsamina* leaves, the percentages of the essential amino acids in the samples were compared with those of reference standard amino acid profile established for both adults and preschool children by WHO/FAO/UNU (1985) and the result (Table 3) indicates that all essential amino acids except sulphur containing amino acids exceeded the reference value for adults, while lysine, threonine and sulphur containing amino acids are below the standard requirement for preschool children. For both adults and preschool children, sulphur containing amino acids are the most limiting amino acids.

Mineral content: Table 4 shows the results of the mineral concentrations of *M. balsamina* leaves. The sample has low amount of sodium with relatively high concentration of potassium. A K/Na ratio in diet is an important factor in prevention of hypertension and arterosclerosis, since K depresses and Na enhances blood pressure (Yoshimura *et al*., 1991). Guil-Guerrero *et al*. (1998) indicated that a K/Na ratio of 3-4 is considered the most adequate for the normal retention of protein during growth stage. The calculated K/Na ratio in the sample was above the range, but addition of sodium chloride however, in the diet prepared with this plant leaves is expected to bring the ratio within the range.

Calcium and phosphorous are associated with each

Table 3: Amino acid score for *Momordica balsamina* leaves

Essential Amino Acid	Amino acid concentration (g/100g protein)	WHO Ideal Protein		[(% Amino Acid)/ Ideal] x 100	
		A	B	Children	Adult
Isoleucine	2.98	2.8	1.3	105	226
Leucine	8.38	6.6	1.9	127	441
Lysine (Lys)	3.94	5.8	1.6	68	246
Total Sulphur EAAs	1.46	2.5	1.7	58	86
Total Aromatic EAAs	6.46	6.3	1.9	103	340
Threonine	3.13	3.4	0.9	92	348
Valine	4.11	3.5	1.3	117	316
Histidine*	2.5	1.9	1.6	132	156

A = WHO/FAO/UNU ideal protein for pre school children aged 2 - 5 years. B = WHO/FAO/UNU ideal protein for adult. EAAs = Essential amino acids. * Essential for Children.

Table 4: Mineral Composition of *Momordica balsamina* L Leaves

Element	Concentration (mg/100g DW)*
Potassium	1,320.00
Sodium	122.49
Calcium	941
Magnesium	220
Phosphorus	130.46
Manganese	11.6
Iron	60.3
Copper	5.44
Zinc	3.18
K/Na	10.78
Ca/P	7.21

* The data are mean value of two replicates.

other for growth and maintenance of bones, teeth and muscles (Dosunmu, 1997; Turan *et al.,* 2003). The calcium level in the *M. balsamina* leaves was higher than the values reported in some green leafy vegetables consumed in Sokoto (Ladan *et al.,* 1996) and some wild edible leaves grown in Eastern Anatolia, Turkey (Turan *et al.*, 2003). On the other hand, the value is lower than 3,500mg/100g obtained in sickle pod (*Cassia obtusifolia*) leaves (Agbo, 2004) and 1,010mg/100g in bitter leaf (*Vernonia amygdalina*) (Ibrahim *et al.*, 2001). The leaves phosphorous content (130mg/100g) was low compared with 166 - 640 mg/100g found in some green leafy vegetables consumed in Sokoto (Ladan *et al.,* 1996). According to Guil-Guerrero *et al.* (1998), for good Ca to P intestinal absorption, Ca/P ratio should be close to unity. This ratio is high in favour of Ca. Thus, *M. balsamina* leaves appear to be good source of Ca but poor source of P.

Magnesium is an important mineral element in connection with circulatory diseases such as ischemic heart disease and calcium metabolism in bone (Ishida *et al.,* 2000). In this study, high Mg in the leaves could be as a result of it present as component of chlorophyll (Dosunmu, 1997; Akwaowo *et al.,* 2000). The leaves' Mg is within the range reported in some green vegetables (Ladan *et al.,* 1996).

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 Otokiti, 1999). From the results, *M. balsamina* leaves had low iron content compared with other green leafy vegetables (110-325mg/100g DW) (Ifon and Bassir, 1979; Ladan *et al.,* 1996; Ibrahim *et al.,* 2001), but within the range (4.3-119.1mg/100g) found in underutilized leafy vegetables of Republic of Niger (Sena *et al.,* 1998). The result is conversely higher than those of some herbal plants (30-59mg/100g DW) of Nigeria (Isong and Idiong, 1997).

The bioavailability of iron is affected by the presence of antinutritional factors (Ladan *et al.,* 1996). According to Ishida *et al.* (2000), the intestinal absorption of haeme-iron and non-haeme-iron differs (37% Vs 5%), and about 90% of the iron in food is non-haeme-iron. This shows that only about 3.02mg of leaves iron will be absorbed. Nonetheless, the amount is more than adequate as 1.00mg/day of iron is suitable for adult human to maintain the daily balance of intake and excretion (Bothwell *et al.,* 1989). The high percentage of iron in the sample could probably be the reason for the used of this plant by the lactating mothers to regenerate lost blood.

Copper is an essential trace element in human body where it exists as an integral part of copper proteins ceruloplasmin, which is concerned with the release of iron from the cells into the plasma and is involved in energy metabolism (McDonald *et al.*, 1995; Adeyeye, 2002). The Cu content of *M. balsamina* leaves was higher than 2.32 mg/100g found in bitter leaf (*Vernonia amygdalina*) (Ibrahim *et al.,* 2001), 1 - 2.5mg/100g in some leafy vegetables found in Cross Rivers State, Nigeria (Ifon and Bassir, 1979), 1.2-1.8mg/100g in Yola, Nigeria (Barminas *et al.*, 1998) and in some wild leafy vegetables of Republic of Niger (Sena *et al.,* 1998), but within the range of 3 - 10mg/100g reported in wild lettuce (*Launaea taxaracifloria*), and comparable to that of *Xanthasomes mafaffa* (5.43 mg/100g), *Ipomoea involucrate* (5.83 mg/100g), but lower than 14.7mg/100g found in *Eraphorbia hirta* respectively (Wallace *et al.*, 1998).

Manganese is another microelement essential for human nutrition, it acts as activator of many enzymes (McDonald *et al.,* 1995). The Mn content in *M. balsamina* leaves (11.60 mg / 100g) is lower than values

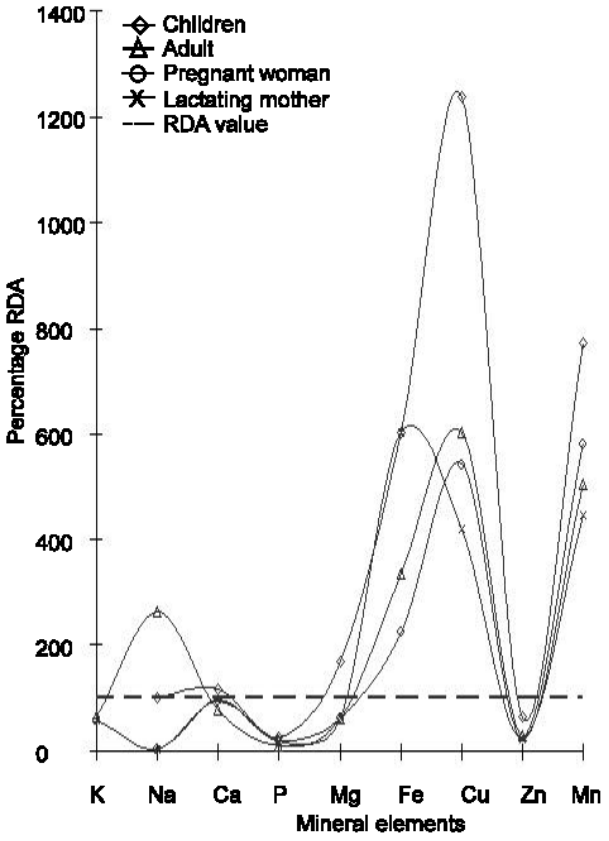

Fig. 1: Mineral contribution to the recommended dietary allowance (RDA) by Momordica balsamina leaves

(15-115mg/100g) reported in some leafy vegetables found in Cross Rivers State, Nigeria (Ifon and Bassir, 1979), but within the range (0.98 - 38.0mg/100g) reported by Sena *et al.* (1998). The manganese content is also higher than that of bitter leaf (*Vernonia amygdalina*) (Ibrahim *et al.*, 2001) and some cultivated green leafy vegetables such as spinach (0.5mg/100g), lettuce (0.3mg/100g) and 0.2mg/100g in cabbage (Turan *et al.*, 2003).

Zinc is involved in normal function of immune system. The leaves zinc content in the sample compared favourably to most values reported for green leafy vegetables in literatures (Ifon and Bassir, 1979; Ibrahim *et al.*, 2001).

Nutritional significant of mineral elements is usually compared with the standard recommended dietary allowance. When compared with standard values of FND (2002) as shown in Fig. 1, *M. balsamina* contain more than adequate level of Na (for adults and children), Ca, Fe, Cu, Mn and Mg (for children). Thus, the plant leaves could be good source of such mineral elements particularly the micro elements.

Conclusion: From the results of the analyses it canbe shown that *M. balsamina* leaves could be important green leafy vegetables as a source of nutrients to supplements other major sources. So based on this findings, we recommend continues used of the leaves of *M. balsamina* in making vegetable soups especially for pregnant, lactating mothers and children so as to meet up the body nutrient demand. Chemical analysis alone however, should not be the sole criteria for judging the nutritional importance of a plant parts. Thus, it becomes imperative to consider other aspects such presence antinutritional and toxicological factors and biological evaluation of nutrients content. Study on antinutritional factors of this plant leave is on progress.

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