

Nutritional Evaluation of *Clerodendrum volubile* (Marugbo) Leaves

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ABSTRACT

The role of plants as a source of nutrients to animals for survival and development cannot be over-emphasized. Clerodendrum volubile (marugbo) is an under-utilized tropical non-conventional leafy vegetable grown in Nigeria. Nutritive, anti-nutritive, mineral and amino acid components of this plant were determined using standard analytical procedures. Proximate analysis unraveled a high percentage of carbohydrate (44.69%), protein (13.88%), ash (11.67%) and fibre (11.26%) contents. Mineral analysis showed high level of calcium (30.91%), potassium (27.69%), phosphorus (27.61%), magnesium (27.11%) and sodium (22.86%) while lead was absent. The composition of anti-nutrients were; 16.30, 3.67 and 2.19mg/100g for phytates, oxalates and tannin respectively. The amino acid analysis revealed that methionine was the limiting amino acid in Clerodendrum volubile. Amino acids observed in appreciable concentrations include Glu 9.88, Asp 8.14, Leu 7.60, Arg 4.68, Val 3.95, Lys 3.82, Ala 3.81, Phe 3.78, Gly 3.25, Thr 2.98, Ile 2.97 and Ser 2.35. The results obtained in this study suggest that marugbo leaves could be used as a good dietary source of minerals, carbohydrate, protein and essential amino acids such as leucine, isoleucine, arginine, valine, lysine and phenylalanine.

Key words: *Clerodendrum volubile*, amino acid components, anti-nutritive, minerals, vegetable.

INTRODUCTION

Clerodendrum volubile, an understudied indigenous plant, belongs to the family Lamiaceae(Verbenaceae) and it is one of the widely distributed vegetables in the warm temperate and tropical regions of the World. The plant is popularly known as “Marugbo” or “Eweta” among the Ikale, Ilaje and Apoi people found in Southern-senatorial district of Ondo State, South West Nigeria. “Obnettete”, as the plant is known among the Itsekiri and Urhobo tribes in Niger-Delta, is a green climbing shrub reported to have height of 3m and possesses numerous flowers. These are averagely about 1.5cm in length [1],[2]. The leaf of *Clerodendrum volubile* is commonly consumed as vegetables mostly blended with other vegetables as spice with sweet aroma and taste. Locally, the leaves can be blended either fresh or dried and applied as spices in cooking [3]. Interestingly, the dryer leaves produce the darker soup content. Commonly referred to as “Eweta” by the Ikales’, the leaves of *Clerodendrum volubile* have great nutritional value as well as herbal and medicinal value.

The plant has been reported to contains very huge quantity of iron and zinc; elements which are important in many enzymes for their functions and for maintenance of fresh skin. The presence of phenolic compounds and other phytochemicals has also been observed [4]. When consumed, the leaves are often noted for stimulating lost appetite as well as replenishing vitality for mothers of new born babies.

Proximate and nutrient analyses have been reported to play important role in assessing nutritional significance of edible plant and vegetables [5]. *Clerodendrum volubile* has continued to be an important plant in South Western Nigeria where it is widely consumed mainly as vegetables in soup. Evidence abounds that the plant is majorly grown as food. The increase in cultivation and consumption of *Clerodendrum volubile* may be an evidence of its rich nutritional properties. The basic nutritional value of this plant can actually be assessed by its nutrients content as

determination of plants potentials, as a therapeutic agent or food, demands knowledge of its overall nutritional worth and composition.

Although, the plant is essentially grown as food, it has continued to be an important medicinal plant [6]. Its medicinal value may be the likely reason for much of the recent attention and increased consumption of the plant as well as its spread into new areas. Over the time, a wide variety of claims have been reportedly made for its efficacious medicinal properties as a treatment for many ailments ranging from its ability to relieve pain and swelling [7] to general healing properties for clinical conditions such as oedema, rheumatism, dropsy, gout and arthritis [8]; thus its consumption will improve the health of the consumers.

Clerodendrum volubile is also cultivated as ornamental crop. "Marugbo soup" often is served as a delicacy to important dignitaries or visitors especially on unique occasions or celebration.

Despite the vast nutritional and medicinal significance of marugbo leaves, there is dearth of information on its amino acid and, only little detail is available on the nutritional composition of this plant. This study is therefore carried out to investigate the proximate, amino acid, mineral and anti-nutrients composition of marugbo leaf obtained from a south-western state of Nigeria. The contribution of such information to the expansion of scope of knowledge on the nutritional qualities and utilization of marugbo leaves in Nigeria and outside the coast of West Africa cannot be over-estimated.

MATERIALS AND METHODS

Collection and Preparation of sample

Clerodendrum volubile leaves were obtained locally within Ikale land in Okitipupa Local Government Area of Ondo State, Nigeria and identified in the Department of Microbiology and Botany, University of Ibadan, Nigeria. Herbarium specimen, with voucher number UIH22481, was deposited at the Herbarium of the University of Ibadan, Nigeria.

The leaves were removed from their stalks, thoroughly washed with tap water and rinsed with distilled water to remove sand and other impurities. They were air-dried in the laboratory for twenty (20) days. The dried leaves were subsequently ground into fine powder by using a commercial blender. The powdered samples were stored in polythene bag until used. All analyses were carried out in triplicates.

Analysis of the Sample

Proximate composition and Mineral Analysis

Crude fibre, moisture content, crude fat and total ash were carried out according to the methods of the Association of official Analytical Chemists [9]. The nitrogen was determined using the micro-Kjedahl method as described by Pearson [10] and the nitrogen content obtained was converted to protein by multiplying by a factor of 6.25.

Mineral element composition was determined using Atomic Absorption Spectrophotometer after acid digestion and measurements taken were reported as mg/100g.

Amino Acid Analysis

4g of the ground sample was defatted with chloroform/methanol mixture for 15 hours in soxhlet extraction apparatus. Between 30 – 35mg of the defatted sample was weighed into a glass test tube. 7ml of 6M HCl was added and oxygen was expelled by flushing with nitrogen gas. The glass test tube, well sealed, was put in an oven for 22hours at 110°C. This was allowed to cool before the content was filtered. The filtrate was evaporated to dryness at 40°C under vacuum using a rotator evaporator. The residue obtained was dissolved with 5ml acetate buffer (pH 2.0).

The method of amino acid was by ion-exchange Chromatography using the Technicum Sequential Multi Sample Amino Acid Analyzer (TSM) (Technicum Instruments Corporation, New York).

Anti-nutrient Analysis

The anti-nutrient levels in the sample for example phytate, tannins and oxalate were determined using the methods of Association of official Analytical Chemists [9] and [11].

Statistical Analysis

Data generated in triplicates were expressed as means of 3 determinations \pm S.D. The SPSS (15.0, SPSS 2 Inc., Chicago, Illinois, USA), was used for the analysis.

RESULTS AND DISCUSSION

The results of proximate analysis, as obtained in this study, are presented in Table 1. Our results showed average value of 44.69 ± 2.42 , 13.88 ± 1.28 , 11.67 ± 0.82 , 11.26 ± 0.56 for carbohydrate, protein, ash and fibre respectively.

Carbohydrate content is in range with the values obtained for *Vigna unguiculata*, *Aneilema aequinoctiale* and *Moringa oleifera* leaves [12], [13], [14] but higher than the values reported for *Talinum triangulare*, *Solanum anguivi* and *Garcinia kola* [15], [16] [17]. The high carbohydrate content of this plant suggests that it provides the body with adequate source of energy and fuel for daily metabolic activities such as muscle contraction and other energy-dependent processes. Usually, carbohydrates are hydrolyzed to yield glucose in the body, which can be used up immediately or stored in the liver and muscles (as glycogen) for future use. *Clerodendrum volubile* may be recommended solely (as vegetable) to vegetarians. It can also be mixed with other good sources of carbohydrate. A high content of carbohydrate in feeds is desirable because deficiency leads to depletion of body tissues [18]. The calorie value of the leaves of marugbo according to the study was 289.31 ± 9.71 Kcal/100g. This analytical value is higher than the energy content of some indigenous green leafy vegetables reported by [17].

Table 1: Proximate composition (% dry weight) of *Clerodendrum volubile* (Marugbo) leaves

Composition	% by weight
Moisture	8.87 ± 0.49
Ash	11.67 ± 0.82
Crude protein	13.88 ± 1.28
Crude fibre	11.26 ± 0.56
Fat	6.12 ± 0.43
Carbohydrate	44.69 ± 2.42
Energy value (Kcal/100g)	289.31 ± 9.71

Values are means \pm SD. n = 3

The protein content of *Clerodendrum volubile* leaves (13.88 ± 1.28) was relatively high when compared to 9.58%, 6.21%, 7.23% obtained for leaf, stem and root of *Eugenia uniflora* respectively [19]. The plant also has higher crude protein content than *Xylopiya aethiopica*, *Blighia sapida*, *Parinari polyandra* and *Parkia biglobosa* [20], [21]. However, the protein content of *Clerodendrum volubile* leaves is lower than the quantities found in leaves of *Gnetum africanum* (20.12%) and *C. pepo* (20.80%) as reported by [22] and [23] respectively. Plant protein still continues to be a main source of food nutrient especially for the less privileged population in Nigeria and other developing countries. The high protein, as found in this study, is therefore beneficial.

Our result revealed that marugbo leaf has ash content of 11.67 ± 0.82 . This value is similar to the ash content of *Leucas plukenetii* [24]. Generally, ash content is regarded as a reflection of the elements present in the original food [25]. The fibre value (11.26 ± 0.56) is high when compared with the value of 4.80% reported by [26] for *Solanum verbascifolium* and 9.68 ± 0.93 by [27] for *Cnidioscolus aconitifolius* leaves. Fibre is associated with reduction of the body cholesterol level, hence reducing the risk of heart problems. Moisture content (8.87 ± 0.49) was relatively lower than the values reported by [28] for *Ocimum gratissimum*, *Veronia amygdalina*, *Telferia occidentali*, *Basella alba*, *Hibiscus sabdariffa*, *Amaranthus hybridus* and *Gongronema latifolium*. This indicates that the plant has reduced susceptibility to microbial deterioration and, thus, requires less care for appropriate preservation.

The lowest nutrient concentration (6.12 ± 0.43) was observed for fat. This may be considered as an advantage for individuals who are placed on weight reducing diet. However this value compares favourably with fat content of 6.30% for *Hibiscus sabdariffa* [28]. Addition of lipid (fat) to most of our diets is good because dietary lipids improve the taste of foods through absorption and retaining of flavors. Also, many of our body functions depend on lipids [13].

As evident in Table 2, the main minerals present in *Clerodendrum volubile* leaves were calcium, potassium, phosphorus, magnesium, zinc and sodium while lead was absolutely absent.

Lead is a known toxic element whose presence could have posed health risks. Thus, its absence in the plant may be considered as an advantage in regards to the consumption of the leaves. Potassium is the second most concentrated minerals in *Clerodendrum volubile* leaves. This result is contrary to the report of [29] and [30] who observed that potassium has the highest concentration of minerals in Nigerian agricultural products. Interestingly, potassium ranked second most abundant element in marugbo leaves. The Na/K ratio (0.83) of the leaves is less than one. However, the Ca/P ratio is slightly higher than one (1.12). A Ca/P ratio of value ≥ 0.5 is usually considered a good source whereas < 0.5 is believed to be poor sources of food. *Clerodendrum volubile* leaves contained nutritionally

essential minerals. It is therefore suggested that the leaves could be recommended as a constituent of daily diet for Nigerian population.

Table 2: Mineral composition (mg/100g) of *Clerodendrum volubile* (Marugbo) leaf

Minerals	Concentration: g/100g
Na	22.86 ± 1.38
K	27.69 ± 3.59
Ca	30.91 ± 1.14
Mg	27.11 ± 0.85
Zn	24.27 ± 5.29
Fe	6.22 ± 0.67
Pb	-
Cu	0.04 ± 0.01
Mn	6.25 ± 0.59
P	27.61 ± 0.71
Ca/P**	1.12
Na/K**	0.83

Values are means ± SD. n = 3. **Calculated values.

From the result in Table 3, anti-nutrients such as tannin and oxalate were seen to be low whereas phytate has a concentration of 16.30 ± 1.14 mg/100g. Tannins, as phenolics compounds found in plants, can complex with macromolecules (polysaccharides and proteins) and metals ions [31], [32]. High concentration of tannin in diet has been reported as a reason for poor palatability [33]. The concentration of phytate (16.30 ± 1.14mg/100g) and oxalate (3.67 ± 0.1314mg/100g) observed in this study are lower than 513 and 4.11±0.05mg/100g reported by [34] and [35] for phytate and oxalate in *P. chilensis* and *Cirina forda* respectively. Anti-nutritional factors are known to be toxic and may negatively alter the nutrient value of foods via impairment of mineral availability and protein digestibility. However, the high anti-nutrients levels in *Clerodendrum volubile* can be lowered through some processing methods including soaking and boiling [36].

Table 3: Anti-nutrient content (mg/100g) of *Clerodendrum volubile* (Marugbo) leaf

Anti-nutrient	Concentration (mg/100g)
Tanin	2.19 ± 0.06
Phytic acid	16.30 ± 1.14
Oxalate	3.67 ± 0.13

Values are means ± SD. n = 3

The amino acid results are presented in Table 4. Glutamic acid, aspartic acid and leucine were the amino acids with the highest concentration in *Clerodendrum volubile* having 9.88, 8.14 and 7.60g/100g values respectively. This makes leucine the highest essential amino acid in the sample.

Table 4: Amino Acid composition (g/100g protein) of *Clerodendrum volubile* (Marugbo) leaf

Amino Acid	Concentration: g/100g protein
Lysine*	3.82
Histidine*	2.19
Arginine*	4.68
Aspartic acid	8.14
Threonine*	2.98
Serine	2.35
Glutamic acid	9.88
Proline	2.20
Glycine	3.25
Alanine	3.81
Cystine	0.83
Valine*	3.95
Methionine*	0.97
Isoleucine*	2.97
Leucine*	7.60
Tyrosine	2.81
Phenylalanine*	3.78
Tryptophan*	0.83

* Essential amino acids

Arginine level (4.68g/100g) was considerably high and the essential amino acid is good for infants [37]. It is also required as a precursor for nitric oxide; the intercellular signaling molecule which serves as smooth muscle relaxant, neurotransmitter and vasodilator. Phenylalanine concentration (3.78g/100g) was also high. Phenylalanine is an

essential amino acid used as a precursor for synthesis of pigments such as melanin found in eyes, hair and tanned skin and some hormones. Methionine is essential for choline synthesis; a precursor for phospholipids (including lecithin) in the body. Histidine, considered as a semi-essential amino acid, is particularly needed for forming histamine which is usually present in small amount in cells [37]. The percentage ratio of total essential amino acid to the total amino acid in the sample is 50.37% while that of non-essential amino acid is 49.63%. This value is far above the 39% considered as an adequate level for ideal protein food for infants, 26% for children and 11% for adults [38]. The amino acid component of *Clerodendrum volubile* obviously revealed that the plant can serve as a rich dietary source of essential amino acids. The plant contain amino acids that can be utilized by the body cells to synthesize all the various proteins needed for cellular functions and also to provide energy [39].

Taken together, the nutrients and other components of this plant such as proteins, carbohydrates and fats play a crucial role in satisfying the energy needs of man and other life processes [40].

CONCLUSION

Based on the results of this study, it is evident that *Clerodendrum volubile* is a good dietary source of nutrients such as carbohydrate, protein, minerals (Calcium, phosphorus and magnesium) and essential amino acids in appreciable quantities. These nutrients pose health-promotion benefits. The absence of heavy metal (lead) also confirms its safety for consumption. Therefore, the plant may be recommended for consumption, to combat the challenges of nutrient/protein malnutrition in developing countries, particularly among the economically less-privileged sections of the populations.

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