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Compositional Studies of *Telfairia Occidentalis* Leaves

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Abstract The methods used for food analysis was adopted for the proximate and mineral analysis of *Telfairia occidentalis* leaves. Crude fiber content of 20.17 ± 0.12% in the leaves of *Telfairia occidentalis* indicated that the leaves of this plant are good sources of dietary fibers compared to the RDA. Higher carbohydrate of 39.64 ± 0.01% lead to a corresponding increase of energy value recorded as 290.16 ± 0.03 Kcal/100g which further confirmed that this plant leaves could serve as a good source of energy. Mineral composition give the result as K (2760.05 ± 0.02 mg/100g), Cu (1.72 ± 0.01 mg/100g), Fe (15.64± 0.04 mg/100g), Mn (15.71± 0.01 mg/100g), Mg (76.46 ± 0.02 mg/100g) and Mg (5.52 ± 0.02 mg/100g) which indicated that the leaves of *Telfairia occidentalis* are good sources of K, Cu, Fe and Mn, moderate sources of Mg and Zn when compared to their RDA and they are essential in human and animal nutrition.

Keywords Fluted Pumpkin, Edikang Ikong, Photosynthesis, Seeds, Leaves

1. Introduction

In botany, a leaf is an above-ground plant organ specialized for the process of photosynthesis. Leaves are typically flat (laminar) and thin which evolved as a means to maximize the surface area directly exposed to light. Furthermore the internal organization of leaves has evolved to maximise exposure of the photosynthesis organelles, the chloroplasts, to light and to increase the absorption of carbon dioxide, all of which assist photosynthesis. These adaptations are at the expense of water loss and most leaves have stomata which regulate carbon dioxide, oxygen and water vapor exchange with the atmosphere. The shape and structure of leaves varies considerably depending on climate, primarily due to the availability of light and potential for water loss due to temperature and humidity. Leaves are also the primary site, in most plants, where transpiration takes place. Leaves can also store food and water, and are modified in some plants for these purposes. The concentration of photosynthesis in leaves makes them rich in protein, minerals and sugar. Because of their nutritional value leaves are prominent in the diet of many animals, including humans as leaf vegetables (Leaf, 2011).

Telfairia occidentalis is a tropical Vine grown in West Africa as a leafy vegetable and for its edible seeds. Common names for the plant include fluted gourd and fluted Pumpkin. It is known as Ugu (Igbo language) in eastern parts of Nigeria. *Telfairia occidentalis* leaves are sometimes called Pumpkin leaves in English. The plant is dioecious, perennial, and drought-tolerant. It is usually grown trellised. The young shots and leaves are the main ingredient of Nigerian edikang ikong soup. The large (up to 5cm), dark seed is rich in fat and protein, and can be eaten whole, ground into powder for another kind of soup, or made into a fermented porridge. The plant is cultivated for its edible seeds and young shoots and leaves. The seeds are cooked and eaten like beans and the shoots and leaves are eaten like vegetables. The leaves contain vitamins and minerals the body needs to stay healthy. The leaves are also a good source of iron (*Telfairia occidentalis*, 2009).

Since the leaves of *Telfairia occidentalis* are consumed as a leafy vegetable therefore the purpose of this work is to analyse the leaves of this plant for their proximate and mineral content in order to ascertain their nutrient contribution to human and animal.

2. Materials and Method

2.1. Sample Collection and Sample Treatment

The sample of *Telfairia occidentalis* used in this study was collected from a farm site at Chanchanga in Minna town, Niger state, Nigeria.

Prior to analysis, the leaves were washed with tap water then rinsed with distilled water. The residual moisture was evaporated at room temperature thereafter the leaves were oven dried at 60^0C until properly dried. The dried leaves were then ground in porcelain mortar, sieved through 2 mm mesh sieve and stored in polythene bag. The powdered sample was used for both proximate and mineral analysis. Moisture content was determined using fresh leaves.

2.2. Proximate Analysis

The moisture content of the leaves were determined by

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drying 5 g of the leaves (in triplicate) in a Gallenkamp oven at 105^0C until constant weight was attained (AOAC, 1990). Ash content was determined according to the method described by Ceirwyn (1995) which involved dry ashing in lenton muffle furnace at 600^0C until grayish white ash was obtained. Crude protein content was determined by multiplying the value obtained from kjeldahl's nitrogen by a protein factor of 5.3, a factor recommended for vegetable analysis. Crude lipid was quantified by the method described by AOAC (1990) using the soxhlet apparatus and petroleum ether (B.P. 60^oC- 80^oC) as a solvent. Crude fiber was determined by acid-base digestion with 1.25% H_2S04 (W/V) and 1.25% NaOH (W/V) solutions.

Available carbohydrates were calculated by difference i.e.

Available Carbohydrates (%)
= 100 – (crude protein+ crude lipid+ crude fibre +as (1)
(AOAC, 1990)

Energy (calorific) value (kcal/100g)
= (Crude lipid x 8) + (Crude protein x 2) + (Carbohydrate x 4) (2)

(Asibey-Berko and Taiye,1999)

2.3. Samples preparation for Mineral Analysis

Six (6) gram of the powdered sample was weighed into a crucible and gently heated over a Bunsen burner until it charred. The charred sample with the crucible was transferred into a lento muffle furnace at about 600^0C and content ashed until grayish white ash was obtained. It was cooled first at room temperature and then in a desiccator. 5 cm^3 of concentrated HCl was added and heated for 5 minutes on a hot plate in a fume cupboard. The mixture was then transfer into a beaker and the crucible washed several times with distilled water. The mixture was made up to 40 cm^3 and boiled for 10 minutes over a bunsen burner. This mixture was then cooled, filtered and rinsed into 100 cm^3 volumetric flask and made up the volume to 100 cm^3 (Ceirwyn,1995). The solution prepared in triplicates.

2.4. Determination of Mineral Concentration

Sodium (Na) and Potassium (K) were analysed by flame atomic emission spectrophotometer. Phosphorus (P) was determined with Jenway 6100 spectrophotometer at 420 nm using vanadium phosphomolybdate (vanadate) colorimetric method with KH_2P0_4 as the standard (Ceirwyn, 1995). The concentrations of calcium (Ca), magnesium (Mg), copper (Cu), Iron (Fe), Manganese (Mn) and Zinc (Zn) in the solutions using Atomic Absorption Spectrophotometer AAS 969 (Bulk Scientific, MODEL VGB 210/211) (AOAC, 1990).

2.5. Nutrient Density (ND)

This was estimated using the equation below

$$ND(\%) = \frac{[Np / Ep]}{[Nr / Er]} X100 \quad (3)$$

Where Np = nutrient concentration (mineral element in the food),

Ep = energy supplied by food,

Nr = recommended daily intakes of nutrient and

Er = recommended energy intake (3000 Kcal/day for an adult male given by WHO/ FAO (Cole, 1980).

2.6. Contribution to RDA(%)

$$RDA(\%) = \frac{\text{Concentration of the elements}}{RDA} X100 \quad (4)$$

Where RDA = recommended dietary allowance (NRC, 1989)

2.7. Data Analysis

Data were generated in triplicates and the mean standard deviation determined according to Steel and Torrie (1980).

3. Results and Discussion

3.1. Proximate Composition

As shown in Table 1, the moisture content of *Telfairia occidentalis* leaves was 87.00 ± 0.6%.This value agreed with the fact that leafy vegetables have high moisture content.

The ash content of the leaves (17.2 ± 0.02%) was high and showed that the leaves contain important mineral elements since the ash content of any sample is an index of mineral content.

Table 1. Proximate Composition of *Telfairia occidentalis* Leaves

Parameter	Concentration (mg/100g dry matter)
Moisture Content[a]	87.00 ± 0.6
Ash	17.2 ± 0.02
Crude Protein	8.72 ± 0.03
Crude Lipid	14.27± 0.25
Crude Fiber	20.17± 0.12
Available Carbohydrate	39.64± 0.28
Calorific Value (K cal/100g)	290.16 ± 0.03

The data are mean values ± standard deviation (SD) triplicates.
[a]Value expressed as % wet weight.

Proteins are responsible for the formation of bones, teeth, hair and the outer layer of skin (Protein, 2010).The Crude protein content of *Telfairia occidentalis* leaves (8.72 ± 0.03%) indicated that this leafy vegetables are poor sources of protein.

The Crude lipid content of *Telfairia occidentalis* leaves (14.27 ± 0.25% dry weight) is low which is in agreement with general observation that leafy vegetables are low lipid containing food, thus advantageous health wise to avoid over weighting (Lintas, 1992).

The fiber content in the leaves of *Telfairia occidentalis* was found to be 20.17± 0.12%. Compared to the RDA of fiber which are 19-25% for children, 21-38% for adult, 28% for pregnant mothers and 29% for breast-feeding mothers, the leaves of this plant could be a source of dietary fiber in human nutrition.

Carbohydrates provide the body with a source of fuel and energy that is required to carry out daily activities and exercise. High carbohydrate content in *Telfairia occidentalis* leaves 39.64 ± 0.28% give rise to higher energy value of

290.16 ± 0.03 K cal/100g. Leafy vegetables may not be important sources of carbohydrate as they are eaten along with other carbohydrate rich food such as cereals.

3.2. Mineral Content

Table 2 shows the results of the mineral content of *Telfairia occidentalis* leaves. The potassium content in the sample was 2760.05 ± 0.02 mg/100g. The result indicated that *Telfairia occidentalis* leaves are useful potassium sources which are advantageous health wise since any diet rich in this mineral element is important in preventing hypertension as potassium depresses blood pressure.

Sodium, in combination with potassium in the body is involved in maintaining proper acid – base balance and proper nerve transmissions. The leaves of *Telfairia occidentalis* recorded 47.81 ± 1.23 mg/100g as Sodium concentration.

Table 2. Mineral composition of *Telfairia occidentalis* leaves

Mineral elements	Concentration (mg/100g dry matter)
K	2760.05 ± 0.02
Na	47.81 ± 1.23
Ca	27.48 ± 0.04
P	13.02 ± 0.08
Mg	76.46 ± 0.02
Cu	1.72 ± 0.01
Fe	15.64 ± 0.04
Mn	15.71 ± 0.01
Zn	5.52± 0.02

The data are mean value ± standard deviation (SD) of triplicates.

Calcium plays an important role in building strong and keeping healthy bones and teeths both early and later in life. The calcium level in the *Telfairia occidentatis* leaves was 27 ± 0.04 mg/100g. Main function of Phosphorus in the human body is in the formation of bones and teeth. The leaves Phosphorus content was found to be 13.02 ± 0.08 mg/100g. According to Guil – Guerrero *et al.* (1998), for good calcium and phosphorus intenstinal utilization, Ca/P ratio must be close unity. *Telfairia occidentalis* leaves had a high ratio (2.11). This showed that the leaves are good sources of Ca over that of P; consequently the diet based on this leaves required to be supplementent with other food material rich in phosphorus.

In this study, Mg content was found to be 76.46 ± 0.02 mg/100g. High Mg concentration in these leaves is expected since Mg is a component of leaves chlorophyll.

The copper content in the *Telfairia occidentalis* leaves was found to be 1.72 ± 0.01 mg/100g. The recommended dietary allowances (RDA) for copper are 1.5-3 mg/day for adult male and female, pregnant and lactating mothers and 1-3 mg/day for children (7-10 years) (NRC, 1989). However based on the RDA, the leaves of *Telfairia occidentalis* are good sources of copper.

The human body needs iron for the formation of the oxygen carrying protein haemoglobin and myoglobin. 15.64 ± 0.04 mg/100g was recorded as iron content in *Telfairia occidentalis* leaves. The leaves of this plant are good sources of this mineral element based on the RDA for iron which are 10 mg/day for adult male and children (7-10 years), 13 mg/day for pregnant and lactating mothers and 15 mg/day for adult female respectively (NRC,1989).

Manganese activates various enzymes which are important for proper digestion and utilization of foods. The leaves of *Telfairia occidentalis* were found to contain 15.71 ± 0.01 mg/100g of manganese. The RDA for manganese are 2 – 5 mg/day for adult male and female, pregnant and lactating mother, 2 – 3 mg/day for children (7 – 10 years) (NRC, 1989), based on the RDA, it clearly indicated that *Telfairia occidentalis* leaves are good source of manganese.

Zinc help to speed up the healing process after an injury. The concentration of zinc in *Telfairia occidentalis* leaves was 5.52 ± 0.02 mg/100g. Compared to the RDA of zinc which is 10-19 mg/day, the leaves of *Telfairia occidentalis* are moderate sources this mineral element.

The contribution of mineral elements by *Telfairia occidentalis* leaves to the dietary intake of essential elements was evaluated and presented in table 3. The leaves were rich sources of Iron, Copper, Potassium and Manganese, Moderate source of Zinc and Magnesium and Poor source of Sodium, Calcium and Phosphorus when compared with their respective recommended dietary allowances. This indicated that the leaves supplement other dietary sources of iron, Copper, Potassium, Manganese, Zinc and Magnesium.

Table 3. Contribution of mineral elements by *Telfairia occidentalis* leaves to the dietary intake

Minerals	RDA(mg)	Contribution to RDA (%)
K	2000	138
Na	500	10
Ca	1200	2
P	1200	1
Mg	350	22
Cu	1.5 – 3	57-115
Fe	10 – 15	104-156
Mn	2 – 5	314-786
Zn	12 – 19	29-46

Table 4. Nutrient density of mineral elements in *Telfairia occidentalis* leaves

Minerals	RDA(mg)	ND(%)
K	2000	1816
Na	500	126
Ca	1200	30
P	1200	14
Mg	350	288
Cu	1.5 – 3	755-1509
Fe	10 – 15	1372-2059
Mn	2 – 5	4135-10339
Zn	12 – 19	382-605

Nutrient density (ND) was used to measure the significant contribution of *Telfairia occidentalis* leaves as source of mineral nutrients and showed in table 4. Food materials with nutrient density of 100% supply the nutrient needed in the same proportion as the caloric needed. Thus, base on this, *Telfairia occidentalis* leaves are good source of K, Na, Mg, Cu, Fe, Mn and Zn.

4. Conclusions

The result of this findings revealed that *Telfairia occidentalis* leaves are good source of carbohydrates and energy. The leaves are good source of Iron, Copper, Potassium and Manganese which meet the recommended daily allowance. Higher Potassium content further confirmed that the leaves of this plant can serve as better diets for hypertensive patients since any food material rich in this mineral element will protect from being hypertensive. Thus adequate consumption of this plant leaves may help in preventing adverse effects of dietary deficiencies.

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