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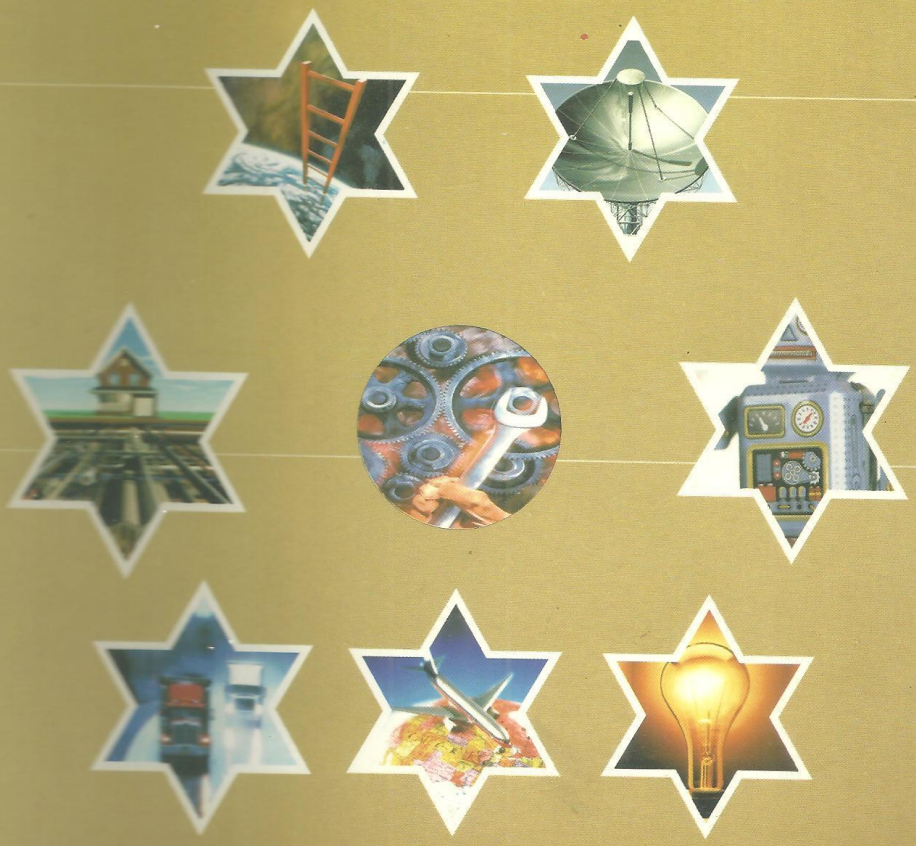

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Nutritional Composition of the Leaves and Stems of Ocimum Gratissimum

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Abstract
The leaves and stems of Ocimum gratissimum was analysed for its proximate and mineral composition. The proximate composition give the following results:82.60 ±0.01% and 82.60 ± 0.11% moisture content for leaves and stems; 13.67 ± 0.13% and 13.67 ±0.02% ash content for leaves and stems; 3.33 ± 0.07% and 1.65 ± 0.02% crude protein content for leaves and stems; 8.50± 0.04% and 3.00± 0.15% crude lipid content for leaves and stems and 9.52± 0.01% and 19.65± 0.03% crude fiber content for leaves and stems. Higher carbohydrates content in the leaves (64.98± 0.01%) and stems (62.03± 0.04%) give a corresponding increase in the energy value (343.08± 0.01 kcal/100g) for the leaves and (278.42± 0.11 kcal/100g) for the stems respectively. Potassium content was the highest among the mineral elements analysed with 1479.88± 0.01 mg//100g for the leaves and 2150.01± 0.11 mg//100g for the stems. Higher potassium content in the stems qualify it as a good source of this mineral elements for the hypertensive patient since potassium reduce the risk of been hypertensive. The leaves are good sources of Cu, Fe, Mn and Zn when compared to their respective RDA

Keywords: nutrient density, nutrient content, plant, energy value, proximate

INTRODUCTION

Many plants are consumed as vegetables. These plants have various nutritional and medicinal values. Their activities differ and their effects on man also differ. Some of these plants are more medically valid by some people while others may only know more of their nutritional value. However, it has been discovered that most of these plants are as medicinal as nutritional. The plant *Ocimum gratissimum* is one of those plants widely known and used for both medicinal and nutritional purposes. It is a perennial plants that is widely distributed in the tropics of Africa and Asia. It belongs to the Family *Labiatae* and it is the most abundant of the genus *Ocimum.* The common names of the plant are Basil Fever plant or Tea bush and vernacular names include Daidoya ta gida (Hausa), Nehonwu (Igbo), Tanmotswangi-wawagi (Nupe) and Efinrin (Yoruba) (Abdullahi *et al.*, 2003).

The plant belong to the Genus of *Ocimum lamiaceae* (basil) and a species of *Ocimum gratissimum* (lamiaceae Africa). It is woody at the base and has an average height of 1-3 meters. The leaves are broad and narrowly ovate, usually 5-13cm long and 3-9cm wide. It is a scented shrub with lime-green leaves (USDA, 2008). The plant is consumed by the Igbos as a leafy vegetables and the nutritional importance of this plant center on its usefulness as a seasoning because of its aromatic flavor. It is also used by the Igbos in the management of the baby's cord. It is believed to keep the baby's cord and wound surface sterile. It is used in the treatment of fungal infections, fever, cold and catarrh. *Ocimum gratissimum* is used through West Africa as anti-malarial and anti-convulsant. The crushed leaf juice is used in the treatment of conlvusion, stomach pain and catarrh. Oil from the leaves have been found to possess antiseptics, antibacterial and antifungal activities (Edeoga and Eriata, 2001; Sofowara 1984). The leaves and stems of this plant could be good sources of mineral content and this research work will go a long way in making revealing and significant contribution to researches on *Ocimum gratissimum* as a means of appreciating what nature has endowed us with. There is always the need to investigate the nutrient content of different parts of valuable plants such as *Ocimum gratissimum* which could form part of the food for people and animal browse in any parts of the tropics where the plant is abundant. Therefore, the purpose/aim of this work was to determine the nutritional composition of the leaves and stems of *Ocimum gratissimum.*

MATERIALS AND METHODS

Sample Collection and Sample Treatment: Sample of *Ocimum gratissimum* was collected from a farm site at the out-sketch of Chanchaga in Minna twon, Niger state Nigeria. Prior to analysis, the leaves were separated from the stems and washed with tap water then rinsed with distilled water. The residual moisture was evaporated at room temperature thereafter the leaves and the stems were oven dried at 60^0C until properly dried. The dried leaves and stems

were then ground in porcelain mortar, sieved through 2mm mesh sieve and stored in plastic container. The powdered sample was used for both proximate and mineral analysis. Fresh leaves and stems were used for moisture content determination.

Proximate Analysis: The moisture content of the leaves and stems were determined by drying 5g of the leaves and stems (in triplicate) in a gallenkamp oven at 105^{0}C 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^{0}C until grayish white ash was abtained. Crude protean was determined by multiplying the value obtained from Kjeidahl's nitrogen by a protein factor of 6.25 (AOAC, 1990). Crude lipid was quantified by the method describe by AOAC (1990) using the soxhlet apparatus and petroleum ether (B.P. 60^{0}C-80^{0}C) as a solvent. Crude fiber was determined by acid-bases digestion with 1.25% H_2S0_4 (W/V) and 1.25% NaOH (W/V) solutions. Available carbohydrates were calculated by difference i.e total sum of crude protein, crude lipid, crude fibre and ash deducted from 100% dry matter (AOAC, 1990). Energy values were estimated as follows:

Energy value (Kcal/100g)= (Crude lipid x 9) + (Crude protein x2)+ (Carbohydrates x4) (1)
(Asibey-Berko and Taiye, 1999).

Sample 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 crucibles was transferred into a lento muffle furnace at about 600^{0}C and content ashed until grayish white ash was obtained. It was cooled first at room temperature and then in a desiccators. 5 cm^3 of Conc. HCl was added and heated for 5 minutes on a hot plate in a fume cupboard. The mixture was then transferred into a beaker and the crucible washed several times with distilled water. The mixture was made upto 40 cm^3 and boiled for 10 minutes on a bunsen burner. This mixture was then cooled, filtered and rinsed into a 100cm^3 volumetric flask made upto the 100cm^3 mark with distilled water (Ceirwyn, 1995). The solution prepared in triplicate.

Determination of Concentration of Minerals: Sodium (Na) and potassium (K) were analyzed by flame atomic emission spectrophotometer using NaCl and KCl to prepared the standards. 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 Ca, Mg, Cu, Fe, Mn, and Zn in the solution were determined using atomic absorption spectrophotometer AAS 969 (Bulk scientific, MODEL VGP 210/211) (AOAC, 1990).

Nutrient density (ND): This was estimated using the equation below

$$ND(\%) = \frac{(Np/Ep)}{(Nr/Er)} \times 100 \quad (2)$$

Where Np=nutrient concentration (mineral element in the food)
Ep= energy supplied by food
Nr= recommended daily intakes of nutrient.
Er= recommended energy intake (3000Kcal/day for an adult male given by WHO/FAO) (Cole, 1980).

$$\text{Contribution to RDA (\%)} = \frac{\text{Concentration of the element}}{\text{RDA}} \times 100 \quad (3)$$

RDA= recommended dietary allowance (NRC, 1989).

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

RESULTS AND DISCUSSION

Proximate Composition:

The proximate composition of the leaves and stems of *Ocimum gratissimum* was shown in table 1. The leaves and stems contain the same amount of moisture content (82.60±0.01% and 82.60±0.11%). The value is high compared to 14.20±0.06% and 11.23±0.02% reported for the leaves and stems of *Balanites aegyptiaca* (Idris *et al.*,2010). The study indicated that the ash content of the leaves and stems is of equal amount of 13.67±0.13% and 13.67±0.02% which implies that the leaves and stems of *Ocimum gratissimum* are good sources of mineral element since the ash content of a plant material is an index of total mineral content.

Table 1: Proximate composition of the leaves and stems of *Ocimum gratissimum*

Parameter	Concentration(% Dry weight) Leaves	Stems
Moisture content[a]	82.60±0.01	82.60±0.11
Ash	13.67±0.13	13.67±0.02
Crude protein	3.33±0.07	1.65±0.02
Crude lipid	8.50±0.04	3.00±0.15
Crude fiber	9.52±0.01	19.65±0.03
Available carbohydrate	64.98±0.01	62.03±0.04
Calorific (Energy) value (Kcal/100g)	343.08±0.01	278.42±0.011

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

Proteins act as enzymes, hormones, and antibodies. Protein are responsible for the formation of bones, teeth, hair and the outer layer of skin and they help maintain the structure of blood vessels and other tissues (Protein, 2010). The protein content of the leaves (3.33±0.07%) was higher than 1.65±0.02% of the stems. The result revealed that the leaves and

stems of this plant are poor sources of protein. The leaves crude lipid contents of 8.50±0.04% was higher than 3.00±0.15% of the stems. The findings showed that the leaves and stems of *Ocimum gratissimum* are poor sources of plant lipid, which is in agreement with general observation that leafy vegetables are low lipid containing foods, thus, advantages health use in avoiding obesity (Lintas, 1992).

The samples crude fiber content of the stems (19.65±0.03%) was higher than 9.52±0.01% found in the leaves. The crude fiber content in the stems is higher compared to 12.10±0.03% recorded for the stems of *Balanites aegyptiaca* (Idris *et al.*, 2010). Intake of fiber can reduce serum cholesterol level, hypertension, diabetes, breast cancer and constipation (Ishida *et al.*, 2000; Ramula and Rao, 2003). Thus, the stems of *Ocimum gratissimum* could be a valuable sources of dietary fiber than its leaves. Carbohydrates are the human body's key source of energy, providing 4 calories of energy per gram. The study revealed the carbohydrates content of the leaves to be 64.98±0.01% which is higher than 62.03±0.04% of the stems.This confirmed the corresponding increase in the energy value of the leaves over that of the stems. These values are higher than 55.22±0.03% and 58.35±0.12% reported for the leaves and stoms of *Balarites aegyptiaca* (Idris *et al.*, 2010).

Calorific (Energy) value of the leaves (343.08±0.01 Kcal/100g) was higher than 276.42±0.011 Kca/100g recorded for the stems. This is in agreement with higher value of carbohydrates content reported for the leaves than the stems of the vegetable.

Mineral content: The mineral composition of the leaves and stems of *Ocimum gratissimum* was presented in table 2. Potassium is necessary for the function of all living cells and is thus present in all plant and animal tissues. Epidemiological studies and studies in animals subject to hypertension indicates that, diets high in potassium can reduce the risk of hypertension and possibly stroke. The study revealed that the potassium content of the stem (2150.01±0.11 mg/100g) was higher than 1479.88±0.01/mg/100g of the leaves. Thus, the stems of this plant could serve as a good source of potassium for the hypertensive patient especially pregnant woman that are prone to high blood pressure toward the period of delivery. Sodium is an essential element that is necessary for humans to maintain the balance of the physical fluids system. It is also required for nerve and muscle functioning. Sodium content of the stems (163.37±0.03 mg/100g) was higher than (75.85±0.23 mg/100g) of the leaves. These values are lower than 805.60±0.01 mg/100g and 196.80±0.02 mg/100g reported for the leaves and stems of *Balanites aegyptiaca* (Idris *et al.*, 2010).

Tables 2: Mineral composition of the leaves and stems of *Ocimum gratissimum*

Mineral Elements	Concentration (mg/100g dry matter)	
	Leaves	Stems
K	1479.88±0.01	2150.01±0.11
Na	75.85±0.23	163.37±0.13
Ca	5.20±0.02	3.73±0.01
P	4.25±0.17	3.05±0.03
Mg	0.53±0.01	0.33±0.12
Cu	1.17±0.11	1.60±0.03
Fe	13.92±0.03	6.67±0.01
Mn	7.67±0.15	19.17±0.05
Zn	12.84±0.01	34.17±0.14

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

Calcium is an important component of a healthy diet and a mineral necessary for life. It plays an important role in building strong and dense as well as in the keeping of healthy bones and teeths both early and later in life. Calcium content (5.20±0.02 mg/100g) was found to be higher in the leaves than in the stems ((3.73±0.01 mg/100g).

The main function of phosphorus in the human body is in the formation of bones and teeth. It plays an important role in the body's utilization of carbohydrates and fats and in the synthesis of protein for the growth, maintenance and repair of cells and tissues. The finding showed that the leaves phosphorus content of 4.25±0.17 mg/100g was higher than 3.05±0.03 mg/100g recorded for the stems. According to Guil-Guerrero *et al.* (1998), for good calcium and phosphorus intestinal utilization, Ca/P ratio must be close to unity. The leaves and stems of *Ocimum gratissimum* have a high ratio of 1.22 indicating that the diet based on this leaves and stems required to be supplemented in favour of phosphorus. Magnesium is essential to all living cells, where they play a major role in the functioning of important biological polyphosphate compounds like ATP,DNA and RNA. The research showed that the leaves and stems of this plant are poor source of Mg with values of 0.53±0.01 mg/100g and 0.33±0.12 mg/100g obtained respectively.

Copper has a number of important functions in the human body. It helps to produce red and white blood cells and triggers the release of iron to form haemoglobin- the substance that carries oxygen around the body. Copper content in the leaves and stems of this plant was found to be 1.17±0.11 mg/100g and 1.60±0.03 mg/100g respectively. From the result, the leaves and stems of *Ocimum gratissimum* are good sources of copper relative to its recommended dietary allowance (RDA) of 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).

Iron makes up part of many proteins in the body. It plays a vital role in many metabolic reactions. Concentration of iron in the leaves of this plant was

found to be 13.92±0.03 mg/100g which indicated that the leaves of this plants are good sources of iron compared to the RDA of 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 (NRC, 1989).

Manganese plays an important role in number of physiologic processes as a constituent of some enzymes and an activator of other enzymes. The concentration of manganese in the stems (19.17±0.05 mg/100g) was higher than that of the leaves (7.67±0.15 mg/100g). When compared to the RDA for manganese which are 2-5 mg/day for adult male and female, pregnant and lactating mothers and 2-3 mg/day for children (7-10 years) (NRC, 1989), the stems of this plant cannot serve as a manganese supplement because of excessive manganese it contain which exceeded the RDA.

Different enzyme systems in the body require mineral zinc as cofactor. These enzyme systems are responsible for every major physiological function that necessitates catalytic activity from enzyme at the molecular level. Zinc concentration in the stems (34.17±0.14 mg/100g) was found to be higher than 12.84±0.01 mg/100g of the leaves. Zinc content of the leaves of this plant can serve as a zinc supplement when compared to the zinc RDA of 10 mg/day for children (7-10 years), 12 mg/day for adult female, 15 mg/day for adult make and 19 mg/day for pregnant and lactating mothers (NRC, 1989).
The contribution of mineral elements by the leaves and stems of *Ocimum gratissimum* to the dietary intake was evaluated and presented in table 3. The leaves and stems are good sources of potassium, copper, iron, manganese and zinc, the stems are moderate source of sodium while the leaves and the stems are poor sources of calcium, phosphorus and magnesium respectively.

Table 3: Contribution of mineral elements by the leaves and stems of *Ocimum_gratissimum* to the dietary intake

Minerals	RDA (mg)	Contribution to RDA(%)	
		Leaves	Stems
K	2000	74	108
Na	500	15	33
Ca	1200	0.4	0.3
P	1200	0.4	0.3
Mg	350	0.2	0.1
Cu	1.5-3	39-78	53-106
Fe	10-15	93-139	44-67
Mn	2-5	153-384	383-959
Zn	12-19	68-107	180-285

(NRC, 1989)

The nutrient density (ND) is the index of nutritional quality used to evaluate the nutritional significance of mineral elements and shown in table 4. Food materials with ND of 100% supply the nutrient needed in the same proportion as the caloric needed. Potassium, sodium, copper, iron, manganese and zinc have nutrient density greater than 100% which indicated that the leaves and stems of this plant can serve as source of supplement for this mineral element.

Table 4: Nutrient density of mineral elements in the leaves and stems of Ocimum gratissimum

Minerals	RDA (mg)	Nutrient density (%)	
		Leaves	Stems
K	2000	647	1158
Na	500	133	352
Ca	1200	4	3
P	1200	3	3
Mg	350	1	1
Cu	1.5-3	341-682	575-1149
Fe	10-15	811-1217	479-719
Mn	2-5	1341-3353	4131-10328
Zn	12-19	591-936	1938-3068

(Cole, 1980)

CONCLUSION

The proximate and mineral composition of the leaves and stems of *Ocimum gratissimum* was analyzed using standard methods of food analysis. The result show higher carbohydrate content in the leaves and stems which give a corresponding greater calorific (energy) values for the leaves and stems of this plant. Mineral composition indicated that the leaves and stems of this plant are good sources of potassium, copper, iron, manganese and zinc when compared to their respective RDA values. ND greater than 100% is also recorded by K, Na, Cu, Fe, Mn and Zn in the leaves and stems of this plant. The finding revealed that higher potassium contents in the stems of this plant make the stems better for hypertensive patient since potassium reduces blood pressure.

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