Comparative nutritional and Anti-nutritional analysis of *Ocimum grattissimum* and *Ocimum basilicum*

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Abstract: *Ocimum grattissimum*(OG) and *Ocimum basilicum*(OB) are medicinal plants reputed for extraordinary therapeutic effectiveness. Both plants were analyzed for their nutritional and anti-nutritional factors, proximate composition, mineral elements and phytochemicals components using standard procedures. The result revealed the presence of phytochemicals with both preventive and curative importance in the two samples. It also indicated high concentrations of potassium, (462mg/100g) and (483mg/100g); calcium, (540mg/100g) and (460mg/100g); moderate amount of sodium, (149mg/100g) and (159mg/100g); appreciable concentrations of phosphorus, (26.9mg/100g) and (35.9mg/100g); and iron(11.4mg/100g) and (10.5mg/100g) for (OG) and (OB) respectively. The ash content, crude fiber and moisture content for (OG) and (OB) are (12.18%±0.00%), (14.96%±0.00%) and (6.93%±0.00%); and (15.73%±0.00%), (11.31%±0.00%) and (5.72%±0.00%) respectively. Higher lipid and carbohydrate content in the leaves (16.25% ± 0.01) and (20.8%± 0.01%); and(22.7%± 0.00) and (14.50% ± 0.00)give a corresponding increase in the energy value (287.3 ± 0.06 kcal/100g) and (281.5 ± 0.02kcal/100g)for scent leaf and curry leaf respectively. The study also revealed that (OB) has higher concentration of crude protein (30.00% ± 0.00) compared to (OG) (28.88% ± 0.01) which is same for their ash and carbohydrate contents. This result shows that the vegetables are rich sources of nutrients and minerals essential for human growth and development.

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1. Introduction

Plants have basic nutritional importance by their content of protein, carbohydrate, fats and oils, minerals, vitamins and water which are required for growth and development in man and animals. Much more than these, research has shown that some plants contain chemicals which are anti-nutritional and have the potential to help in reducing the risk of several deadly diseases in man (Williamson *et al*., 1997). Reports show that these phytochemicals reduce LDL i.e. the cholesterol involved in depositing fat in the arteries (Chung *et al*.,1998), prevent blood clotting which can reduce the risk for heart attack or stroke. Sulphur compounds, which are examples of phytochemicals, are known also to reduce the cholesterol production in the body and through that keep the blood pressure down (Chung *et al*., 1998; Akpanyung *et al*., 1995). They do this either by working alone or in combination with vitamins and other nutrients in foods. Reports show that the greatest sources of these phytochemicals are fruits and vegetables (Liu,2004; Altar and Adeogun,1995) hence the need to discover data for food processors and nutrition workers as well as consumers for selection of these green leafy vegetables (GLV) for consumption. There are over 3000 discovered phytochemicals in plants (Oliveri,2003). The levels of these plant chemicals may vary depending on specie and varieties of GLV. These chemicals may be affected by food processing, limiting the use of raw values for estimating the phytochemical profile (Onyeka and Nwanbekwe, 2007).

Scent leaf belongs to the Family *Labiatae/Lamiaceae* and it is the most abundant of the genus *Ocimum.* The common names of the plant are scent leaf and vernacular names include ireru (Ebira), Daidoya ta gida (Hausa), Nehonwu (Igbo), Tanmotswangiwawagi (Nupe) and Efinrin (Yoruba) (Abdullahi *et al*., 2003). The plant belongs to the Genus *Ocimum Lamiaceae* (basil) and species of *Ocimum grattissimum* (lamiaceae Africa) (Idris *et al*., 2011).It is a perennial plant that is widely distributed in the tropics of Africa and Asia. Its seed or stem are planted and they grow and develop over a year. The plant is harvested by cutting the stems at the nodes or by plucking of the leaves. 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 locally used by the Ebiras as compulsory soup ingredient for a lactating mother. It is also used by the Igbos in the management of

baby's cord and in the treatment of fungal infections, fever, cold and catarrh. The crushed leaf juice is used among peasant for the treatment of convulsion, stomach pain and catarrh. Oil from the leaves have been found to possess antiseptics, antibacterial and antifungal activities (Edeoga and Eriata, 2001; Sofowara, 1984).

Basil on the other hand belongs to the genus *Ocimum,* derived from the Greek *ozo* which means to smell, in reference to the strong odors of the species within the genus; common names include: curry leaf, odankwekwe (ebira). Sweet basil (*Ocimum basilicum*) will grow to a size of 1-2 feet in height (Boxer and Philippa,1980). Basil will prolifically produce large green leaves, measuring around 2 inches in length, throughout the summer. Basil flowers are white, and are commonly removed to increase yield of leaves. It grows as a perennial in tropical climates, and is planted as an annual in temperate regions, where it may be sown directly from seed or transplanted (Duke,1985).

Studies have revealed the anti-viral, anti-microbial, antioxidant, and anti-cancer properties of the oils of basil. Its leaves are very nutritious as it contains several vitamins and minerals, and gives energy as it has high carbohydrate content(Bozin,2006).Basil has been used as a folk remedy for an enormous number of ailments, including boredom, malaria, cancer, convulsion, deafness, diarrhea, epilepsy, gout, hiccup, impotency, insanity, nausea, sore throat, toothaches, and whooping cough. Basil has been reported in herbal publications as an insect repellent. This research seeks to determine the nutritive and anti-nutritive values of *O.grattissimum* and *O.basilicum*.

2. Materials and Methods

The leaves of *O. grattissimum and O.basilicum* were collected in September 2012, from a local farmland at Orozo in Abuja Municipal Area Council (AMAC), Nigeria. The samples were identified and authenticated by Dr. J. A. Ibrahim of the herbarium and ethno botany unit, National Institute for Pharmaceutical Research and Development (NIPRD). The leaves were separated from the stems, air dried for a month and pulverized into fine powder.

2.1 Proximate Analysis

The methods described by AOAC (1990) were adopted for the determination of moisture and ash contents, crude fiber and crude protein. The method of Onyeike and Osuji (Onyeika and Nwanbekwe,2007)was used for Protein digestion while carbohydrate content was determined by subtracting the total crude protein, crude fibre, ash and lipid from the total dry matter. The calorific value of the two samples were estimated (in kcal) by multiplying the percentage crude protein, crude lipid, and carbohydrate by 2, 9 and 4 respectively.

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

2.2 Mineral Determination

Fifteen (15) ml of concentrated HNO_3 was added to five (5) ml of perchloric acid. The mixture was added to 1g of the dried sample in a conical flask. The mixture was placed in a fume cupboard and gradually heated on an electric heater until a light colored solution was obtained. The sample was then dissolved into the solution. It was then cooled and filtered into a 100ml volumetric flask and made to mark with deionized water. Calcium and Iron compositions were determined using Atomic Absorption Spectrophotometer after acid digestion of the samples as described by AOAC (AOAC, 1990).Sodium and Potassium were determine using Flame Atomic Emission Spectrophotometer (model SM6410A surgienfield). Phosphorus was determined with SM6410A spectrophotometer using vanadium phosphomolybdate (Vanadate) colorimetric method with KH_2PO_4 as the standard.

2.3 Phytochemical Screening

Phytochemical analysis was done using the standard method of Trease and Evans (Trease *et al* 1989) using ethanol.The compounds analyzed for were tannins, terpenoid, phenol, saponins, phlobotannins, triterpenoids, flavonoids, cardenolides, steroids and anthraquinone.

3 Results and Discussion

Table 1: Proximate composition of *Ocimum grattissimum and Ocimum basilicum*

Parameters	Concentrations (mg/100g)	
	Ocimum grattissimum	*Ocimum basilicum*
Ash Content (%)	12.18 ± 0.001	15.73 ± 0.004
Crude lipid(%)	16.25 ± 0.011	14.50 ± 0.003
Moisture Content(%)	6.93 ± 0.002	5.72 ± 0.003
Crude fibre(%)	14.96 ± 0.001	11.31 ± 0.008
Crude protein (%)	28.88 ± 0.012	30.00 ± 0.000
Carbohydrate (%)	20.8 ± 0.002	22.7 ± 0.012
Caloric value (kcal)	287.3 ± 0.062	*281.5 ± 0.022*

Values are in triplicate ± standard deviation

The study reveals that the moisture contents of *O. gratissimum* (6.93 ± 0.002%) is higher than that of *O. basilicum* (5.72 ± 0.003%), these values are more than the (4.80±0.74%) reported for *Ficus polita* (Musa and Itodo, 2010) but lower than 11.20% for *oryza sativa* leaves (Akiniyi and Waziri, 2011). The ash content of *O. basilicum (*15.73 ± 0.004%) is higher than that of *O. gratissimum (*12.18 ± 0.001%), which indicates that both are good sources of mineral element since the ash content of a plant material is an index of total mineral content.

Carbohydrates are the human body's key source of energy. The carbohydrate, lipid and fibre contents contribute greatly to their calorific values. This confirmed the corresponding increase in the energy value of the *O.grattissimum* over that of *O.basilicum*. They also contain appreciable amount of protein. *O. grattissimum* contained 28.88±0.012% and 30.00±0.00% for *Ocimum basilicum,* values higher than 10.71±0.25% and 10.83±0.80% obtained for *Ficus polita* and *Ipomoea aquatic* forsk leaves (Musah and Itodo,2010; Umar.,2007).Proteins act as enzymes, hormones, and antibodies. Protein is 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 .Intake of fiber can reduce serum cholesterol level, hypertension, diabetes, breast cancer and constipation (Ramula and Rao, 2003). Thus, the leaves of *O. grattissimum* (14.96 ± 0.001%) could be valuable source of dietary fiber than *O. basilicum* (11.31 ± 0.008%). Both are good in reducing obesity but the low lipid in the leaves especially *Ocimum basilicum* as compared to *O.grattissimum* makes it better in reducing obesity.

Elemental analysis of *Ocimum grattissimum and Ocimum basilicum*

Table 2: Elemental analysis of*Ocimum grattissimum and Ocimum basilicum*

Elements	Concentrations (mg/100g)	
	Ocimum grattissimum	*Ocimum basilicum*
Calcium	540	460
Iron	11.4	10.5
Potassium	462	483
Sodium	149	161
Phosphorus	26.9	35.85

The leaves are good sources of calcium and potassium, moderate sources of sodium and appreciable sources of Iron and phosphorus. *O. grattissimum* contained higher concentrations of calcium (540mg/100g) and iron (11.4mg/100g), while those of potassium (483mg/100g), sodium (161mg/100g) and phosphorus (35.86mg/100g) were higher in *O.basilicum.* Also, all the parameters analyzed were found to be more in scent leaf than curry leaf except for the potassium content. Higher potassium content in the leaves qualify them as a good source of this mineral elements for the hypertensive patient since potassium reduce the risk of being hypertensive. Concentration of iron in the leaves of these plants indicates that they are good sources of iron.

Minerals are very important in human nutrition. Calcium (Ca) and potassium (K) are reported to be responsible for the repair of worn out cells, strong bones and teeth, building of red blood cells and for body mechanisms. WHO(1996). Epidemiological studies and studies in animals subject to hypertension indicate that, diets high in potassium can reduce the risk of hypertension and possibly stroke (Yoshimura *et al*., 1991). It is good for pregnant women especially at the time of delivery.

Sodium is an essential element that is necessary for humans to maintain the balance of the physical fluids system. Iron makes up part of many proteins in the body. It plays a vital role in many metabolic reactions as it reacts with haemoglobin to form oxy-haemoglobin which is needed for the formation of red blood cells. *O.basilicum* has higher value of sodium (161mg/100g) compared to149mg/100g in *O. grattissimum.* These values are lower than the 702.02±0.02mg/100g reported for *Caesalpinia pulcherrima* seeds(Musah *et al*.,2014).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 phosphorus content was higher in *O.basilicum* than in *O.grattissimum.*

Anti-nutritional factors of *Ocimum grattissimum and Ocimum basilicum*

Table 3: Phytochemical screening of*Ocimum grattissimum and Ocimum basilicum*

Phytochemicals	*O.grattissimum*	*O.basilicum*
Tannins	+	+
Steroid	-	-
Triterpenoids	-	-
Anthraquinones	-	-
Saponins	-	-
Phenol	+	+
Cardenolides	-	-
Terpenoids	-	-
Flavonoids	-	-
cardiac glycosides	-	-
Phlobatannins	+	+

Note: + = present: - = absent

The phytochemical analysis indicates the presence of tannins, phenols and phlobotannins in both samples. But Terpenoid, saponins, triterpenoids, flavonoids, cardenolides, steroids and anthraquinone were not detected.

Phytochemicals are valuable sources of food and medicine for the prevention of illness and maintenance of human health (Aliyu *et al* 2008). Phytochemicals are either the product of plant metabolism or synthesized for defense purposes. They may be useful or toxic to human body. Tannins are stringent bitter plant polyphenols that bind, precipitate and shrink proteins and various organic compounds. Tannins are known to have anti – viral, anti-tumor, anti -inflammatory and healing properties on wounds, kidney etc. (USNND,2010; Amokaha *et al*.,2002).

4. Conclusion

The leaves of *O. grattisimum* and *O.basillicum* contain an appreciable amount of nutrients (protein, fibre) and mineral elements (calcium, potassium and sodium) and should be included in diets to supplement the body's daily need.

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