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Comparative proximate, inorganic and phytochemical analysis of *Ocimum canum* (Curry leaf) and *Ocimum gratissimum* (Scent leaf)

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Abstract

The nutritional potentials of the leaves of *Ocimum canum* (curry leaf) and *Ocimum gratissimum* (scent leaf) (Family: Lamiaceae) were assessed by estimating proximate, inorganic and phytochemical compositions. Moisture content of *O. canum* (64.0 g%) was almost twice that of *O. gratissimum* (35.0 g%) while crude protein (17.31 g% and 15.80 g%) and lipid (4.0 g% and 3.75 g%) respectively were close in value. Other results were: ash (4.65 g% and 12.5 g%), crude fibre (2.50 g% and 31.50 g%) and carbohydrate (10.04 g% and 1.45 g%) for *O. canum* and *O. gratissimum* respectively. Mineral analysis revealed *O. gratissimum* having much higher mineral content and this order in concentration: Fe >Cu > Mn > Zn > K > Na > P > Ca > Mg. For *O. canum* it was: P > Mg > Ca > K > Na > Zn > Mn > Fe > Cu. *O. gratissimum* is thus, a very good source of iron (75.0%) and copper (20.6%) as well as protein and fibre. Phytochemical screening revealed the presence of alkaloids, tannins, flavonoids and saponins in both leaves. Cardiac glycosides and anthraquinones found present in *O. gratissimun* were not detected in *O. canum*. Overall, *O. gratissimum* is rated above *O. canum* because it has higher quantities of the essential nutritive factors and bioactive molecules

Keywords: *Ocimum gratissimum, Ocimum canum,* proximate, inorganic, phytochemical, composition

INTRODUCTION

Ocimum gratissimum Linn also known as clove basil, African basil or wild basil is a species of Ocimum (Family Lamiaceae). It is a common aromatic culinary herb in West Africa known as Efinrin in Yoruba, Kunudiri in Okrika, Nchuanwu in Igbo and Daidoya in Hausa. It is an erect perennial herb or soft shrub growing to 2 m. It is multi-branched with dark green leathery leaves found in Africa, S. Asia and S. America [1]. The leaves are opposite. It is indigenous to the tropics and grows widely in West Africa, especially in the Savannah and coastal areas. It is a rich source of essential oils, the chief of which is eugenol [2]. Locally, the leaf extract is used for the treatment of gastrointestinal problems such as stomach aches, diarrhea and dysentery. It is also used in treating asthma and cough. Scientific evidence shows it has antidiabetic [3], anti-bacterial [4], antifungal [5], anti-hepatoxic [6], analgesic [7] and anticonvulsant and anxiolytic effects [8].

Ocimum canum Sims also known as *O. americanum* L., Saint-Joseph's wort, is a culinary herb of the family Lamiaceae (mint family). It is also called the "king of herbs" the "royal herb" and "hairy basil". It is an

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annual plant native to the African continent and grows to a height of 2 feet. Two important relatives with similar properties are the *Ocimum gratissimum* (basil) and *Ocimum sanctum* (holy basil). All of these are used in medicinal preparations in various parts of the world. The *Ocimum canum* was used especially for treating diabetes. This bushy herb common in tropical Africa and other areas of the tropics was later introduced into the Americas. The plant branches from the base and has an angled stem and oval pubescent leaves. Its leaves are tiny and fuzzy and have beautiful violet or white flowers, having a sweet scent resembling that of the clove. *Ocimum canum* is grown for its medicinal and culinary value and it is highly useful in treating various types of diseases including lowering blood glucose levels especially in type 2 diabetes. The herb can be used to treat colds, fever, parasitic infections on the body and inflammation of joints and headaches, fevers, dysentery and tooth problems. It was also used as an insect repellant. The leaves are used for flavouring dishes. The seeds may provide dietary fibre or relieve constipation. The oil of *ocimum canum* is composed of Linalool. In India, the herb is used with the belief that it has known antibacterial, antifungal, and antiviral properties and acts like an analgesic and rubefacient. The essential oils are used in flavouring foods, chewing gums, sweets, teas, soft drinks, energy drinks, milk products, cosmetics, shampoos, soaps, shower gels, body lotions and toothpastes. It also works as a great mosquito repellant to prevent malaria and dengue fever [9].

Plants have been found to be important, as good sources of food, because of their ability to replenish the body's lost nutrients. In addition, organic substances found in plants have been shown by studies through phytochemical screening to be of medicinal importance to man. Almost one quarter of all medicines are derived from the 250,000 flowering plants on the earth's surface [10]. The ability of plants to show pharmacologic characteristics depends on presence of secondary metabolites, such as saponins, tannins, alkaloids, flavonoids, triterpenes, anthraquinones, steroids and cardiac glycosides. The knowledge of the medicinal importance of plant secondary metabolites triggered the search for these compounds in various plants, which resulted in some being formulated as drugs e.g. reserpine, an alkaloid is used in treating hypertension.

Thus, the objective of this study is to screen for the presence of some of the organic constituents of therapeutic importance and to determine the nutritive composition of the leaves of *Ocimum gratissimum* and *Ocimum canum* for comparative purposes.

EXPERIMENTAL

Chemicals. All chemicals used were of analytical grade.

Plant materials. The samples were bought at New Benin Market, Benin City and subsequently identified by Dr. Bamidele at the Department of Plant Biology and Biotechnology, University of Benin, Benin City, as *Ocimum canum* and *Ocimum gratissimum*. They were then washed, sun-dried and further dried in the oven (Gallenkamp, UK) 35 - 60 °C until a constant weight was maintained. The leaves were ground into powder (Hamilton Beach Scovill, USA) and stored separately in airtight containers until required for analysis.

Proximate analysis. Proximate analysis to determine moisture, crude protein, crude fat, crude fibre and ash content of the leaves were carried out in triplicates according to the method described by AOAC [11].

Moisture content. This was determined by gravimetric method (difference in weight between wet and dried samples)

Moisture (%) = {loss in weight (g)/ initial weight of sample (g)} x 100

Ash content. Ash content of each sample was determined by dry ashing in a muffle furnace at 600°C (Gallenkamp, UK)

Ash (% dry weight) = {weight of ash (g)/ weight of sample (g)} x 100

Ether extract. The Soxhlet extracting procedure as described by Bligh and Dyer [12] was adopted for the determination of crude lipid content of the leaf samples. The procedure is based on the extraction of fats by the non-polar solvent n-hexane.

Ether extract (% dry weight) = {weight of lipid (g)/ weight of sample (g)} x 100

Crude protein content. Crude protein of leaf samples were estimated using the semi-micro Kjeldahl method of Markham [13] as reported by Pearson [14]. It involves digestion, distillation and titration. The percentage crude protein was calculated by first calculating the total organic nitrogen (N) and multiplying by a protein conversion factor of 6.25.

% Nitrogen = {Titre value x 1.4 x dilution factor/ weight of sample (g)} x 100

∴ % crude protein = % N x 6.25

Where 1.4 is nitrogen value equivalent to 0.1M HCl used in filtration.

Crude fibre. Crude fibre is the plant polysaccharide and lignin, which are resistant to hydrolysis by digestion with acid and alkali. The residue was ignited in the furnace at 600°C for 20 min. The loss in weight during incineration is equivalent to the weight of crude fibre in the sample.

Crude fibre (%) = {weight of fibre (g)/ weight of sample (g)} x 100

Carbohydrate content. Carbohydrate content of the leaf samples were determined by "difference". This was done by summing up percentages of all proximate components and subtracting from 100.

Total carbohydrate (%) = 100 – (% moisture + % ash + % lipid + % protein)

The carbohydrate estimated in this fashion includes fibre [15].

Energy value. The calorie values (kcal/100g) of the samples were calculated using the Atwater factors of 4, 9, 4 for protein, lipid and carbohydrate respectively [16].

Gross energy = (% carbohydrate x 4) + (% crude fat x 9) + (% crude protein x 4).

Mineral analysis. Sodium (Na) and Potassium (K) were determined by flame photometry (Digital flame analyzer, Perkin Elmer Model 703, Gallenkamp, UK). Calcium, Zinc, Copper. Iron, Manganese and Magnesium, were determined using the EDTA complexometric titration method. A spectrophotometric method, which depends on the conversion of phosphorus to orthophosphoric acid, in acid solution, was used in determination of phosphorus content [17].

Phytochemical analysis. The powdered samples of *O. canum* and *O. gratissimum* were screened for tannins, saponins, alkaloids, flavonoids, cardiac glycosides, and anthraquinones using standard phytochemical procedures [18-20].

Statistical analysis. Data where applicable were expressed as Means ± SEM of triplicate determinations.

RESULTS AND DISCUSSION

The leaves of both plants, *O. canum* and *O. gratissimum*, are used worldwide for culinary and medicinal purposes. An understanding of the nutritional and phytochemical properties of these two economic plants was the stimulus for this research. Proximate composition of the leaves of *O. canum* and *O. gratissimum* is as shown in Table 1.

Ash and crude fibre contents were higher in *O. gratissimum* than *O. canum* leaves (Fig 1). The ash content of a foodstuff

is the percentage of inorganic residue after ignition, which suggests *O. gratissimum* would have higher content of minerals, which indeed was the case as showcased in Table 2.

While the ash content of *O. canum* (4.65 g%) falls within the range of most commonly consumed leafy greens [21] that of *O. gratissimum* is rather high (12.5g%) but compares favourably with the 12.0% of *Cochorus olitorius* (ewedu). It is however lower than the 20.05% reported for *Talinum triangulare* by Akindahunsi and Salawu [22]. While crude fibre of 2.5 g% recorded for *O. canum* leaf in the present study is typical of other commonly consumed leafy vegetables, that of *O. gratissimum* leaf (31.5 g%) is atypical but, compares favourably with the reported value of 33 g% for *Gnetum africanum* leaf (Okazi) [21]. Crude fibre increases stool bulk and moves waste materials faster in the gastrointestinal tract, which helps, prevent digestive tract diseases such as constipation, diverticulosis and colon cancer, apart from other health benefits such as decreasing rate of sugar uptake, decreasing blood cholesterol and binding carcinogens [23].

Crude protein content for the leaf samples under study 17.31 g% for *O. canum* and 15.8 g% *O. gratissimum* are similar and high compared to other leafy greens but compare favourably with the 15.2 g% of *Gnetum africanum* (okazi). The values are however lower than the reported 22.7 g% raw value of *Cochorus olitorius* (ewedu) [21]. In general, most fresh leafy vegetables are not good sources of protein and have crude protein content ranging from 1.5 to 1.7% but when dried samples are used the crude protein content can range from 15.0 to 30 % [24]. Protein deficiency causes growth retardation in children, muscle wasting, abnormal swelling of the belly and collection of fluids in the body [25]. Thus, *O. canum* and *O. gratissimum* are positioned to ameliorate protein deficiency symptoms when included in the diet.

The ether extract observed for the leaves in this study, like protein are similar in value. Most of the commonly consumed leafy vegetables have values for lipid in the range of 0.1 g% for *Solanum Africana* (raw) to 4.2 g% for *Cochorus olitorius* (raw). Values recorded for both leaves are however lower than the values reported for raw/white *Hibiscus* sabdarrifa (6.0 g%) and the 7.5 g% of *Gnetum africanum*. Leafy vegetables are known to be poor sources of fat although contents of dry matter can range from 1 – 30% [21]. Fats play useful roles in membrane structure amongst other functions.

As is well known, leafy vegetables are not good sources of dietary energy and the leaves under study herein have proved it so (Table 1) by recording both low values for carbohydrate and caloric energy. Thus weight watchers and diabetic patients need not fear the inclusion of these leaves in their diet.

Mineral composition of the leaves of *O. canum* and *O. gratissimum* is as presented in Table 2. Of all the minerals analysed only Phosphorus (P), Calcium (C_a) and Magnesium (M_g) were lower in *O. gratissimum* than in *O. canum*. Table 2 also shows that *O. gratissimum* contains high levels of Iron (75%), Copper (20.6%) and moderate levels of Manganese (M_n), Zinc (Z_n) and Potassium (K) but relatively low levels of Magnesium (M_g) and Calcium (C_a). Lack of red blood cells (anaemia) results in failure to maintain an adequate oxygen supply to tissues [26]. Iron is required for energy and endurance because it delivers oxygen throughout the body. Mineral content of plants depend on the soil, time of planting and harvesting as well as the amount of water available in the soil [27].

Evidence for the presence or absence of secondary metabolites from phytochemical procedures are shown in Table 3. Cardiac glycosides and anthraquinones were undetected in *O. canum* while alkaloids,

tannins, flavonoids and saponins were present. All the phytochemicals screened for were found present in *O. gratissimum* (Table 3). Phytochemicals are natural and non-nutritive bioactive compounds produced by plants that act as protective agents against external stress such as pathogenic attack [28]. These phytochemicals are reported to exhibit anti-mutagenic, antimicrobial, anti-inflammatory and antioxidant properties [29].

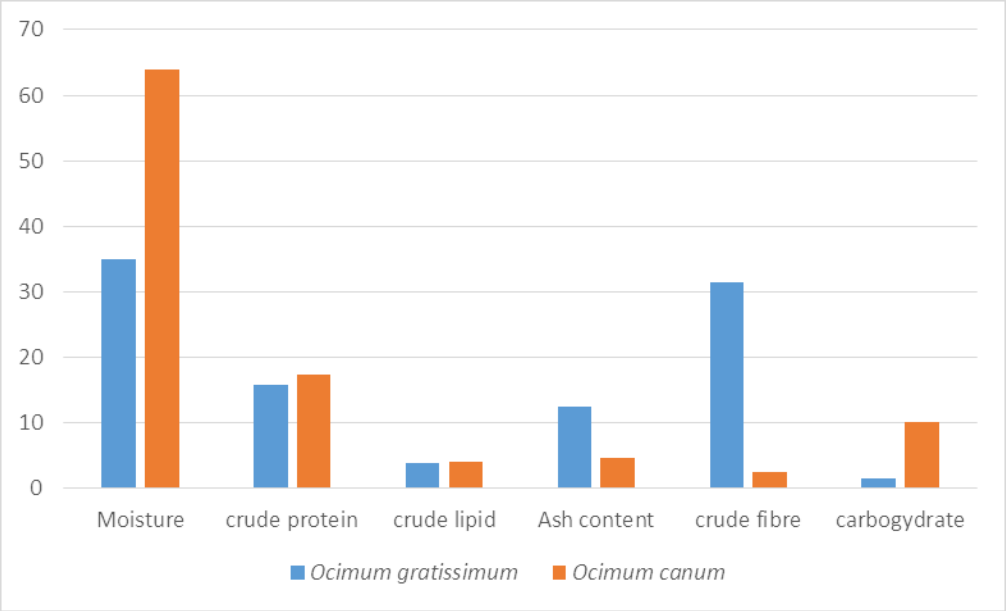

Fig 1: Proximate composition of *Ocimum gratissimum* and *Ocimum canum* leaves

Table 1: Proximate composition of *Ocimum gratissimum* and *Ocimum canum* (g%) dry weight

Component	*Ocimum gratissimum*	*Ocimum canum*
Moisture	35.00 ± 1.35	64.00 ± 0.82
Crude Protein	15.80 ± 1.30	17.31 ± 1.50
Crude lipid	3.75 ± 0.05	4.00 ± 1.50
Ash	12.50 ± 1.09	4.65 ± 0.17
Crude fibre	31.50 ± 1.03	2.5 ± 0.08
Carbohydrate	1.45 ± 0.02	10.04 ± 0.21
Energy value	102.75 kcal/100g	145.4 kcal/100g

Values are means ± SEM of triplicate determinations

Table 2: Mineral content of leaves of *Ocimum gratissimum* and *Ocimum canum*

Component	*Ocimum gratissimum* %	*Ocimum canum* %
Sodium, Na	0.183 ± 0.00	0.048 ± 0.02
Potassium, K	2.32 ± 0.02	0.078 ± 0.00
Phosphorus, P	0.21 ± 0.03	1.41 ± 0.03
Zinc, Zn	2.33 ± 0.00	0.039 ± 0.04
Calcium, Ca	5.4×10^{-5} ± 0.00	0.0832 ± 0.00
Magnesium, Mg	3.4×10^{-5} ± 0.02	0.112 ± 0.02
Copper, Cu	20.60 ± 1.03	0.0022 ± 0.02
Manganese, Mn	5.00 ± 0.08	0.0058 ± 0.00
Iron, Fe	75.00 ± 2.50	0.0028 ± 0.00

Values are means ± SEM of triplicate determinations

Table 3: Phytochemical screening of leaves of *Ocimum gratissimum* and *Ocimum canum*

Metabolites	Test	*Ocimum gratissimum*	*Ocimum canum*
Alkaloids	Mayer's	+	+
	Dragendorff's	+	+
Tannins	Ferric chloride	+	+
	HCl	+	+
Flavonoids	Lead acetate	+	+
	Ferric chloride	+	+
Saponins	Frothing	+	+
Cardiac glycosides	Lieberman's	+	–
	Salkowski	+	–
	Keller-Killiani	+	–
Anthraquinones	Borntrager's	+	–

Key: + = present - = absent

As antioxidants, their mode of action involves protecting the cell constituents against oxidative damage, inhibition of oxidative and hydrolytic enzymes, thereby limiting the risk of various degenerative diseases [28, 30]. Thus, the presence of phytochemicals in both leaves support their wide use in traditional medicine.

Conclusion. This study has shown that both leaves of the Ocimum species investigated contain appreciable levels of protein, lipid and phytochemicals. Furthermore, the study revealed *Ocimum gratissimum* is a good source of not just protein and lipid but of fibre and minerals such as iron and copper. Comparatively, *Ocimum gratissimum* has higher amounts of most parameters investigated indicating more potency in terms of medicine and sharper flavours and aroma in culinary use.

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