Research Article

BIOMEDICAL Journal of Scientific & Technical Research

ISSN: 2574 -1241

DOI: 10.26717/BJSTR.2022.46.007420

Comparative Proximate Analysis, Mineral Composition and Phytochemical Properties of *Vernonia Amygdalina* and *Ocimum Gratissimum* Leaves

Kabir Adebayo Sanusi[1,2]*, Moshood Hamzat[2], Tajudeen Adisa Yusuff[3] and Qozeem Kolawole Sanusi[4]

[1]*Department of Chemical Sciences, Federal University of Kashere, Gombe State, Nigeria*

[2]*Department of Pure and Applied Chemistry, Kebbi State University of Science and Technology, Aliero, Nigeria*

[3]*Department of Chemistry, Obafemi Awolowo University Ile-Ife, Osun State, Nigeria*

[4]*Department of Biological Sciences, Federal University of Kashere, Gombe State, Nigeria*

***Corresponding author:** Kabir Adebayo Sanusi, Department of Chemical Sciences, Federal University of Kashere, Gombe State, Department of Pure and Applied Chemistry, Kebbi State University of Science and Technology, Aliero, Nigeria

ARTICLE INFO

Received: October 03, 2022

Published: October 28, 2022

Citation: Kabir Adebayo Sanusi, Moshood Hamzat, Tajudeen Adisa Yusuff and Qozeem Kolawole Sanusi. Comparative Proximate Analysis, Mineral Composition and Phytochemical Properties of *Vernonia Amygdalina* and *Ocimum Gratissimum* Leaves. Biomed J Sci & Tech Res 46(5)-2022. BJSTR. MS.ID.007420.

ABSTRACT

The aim of this study is to make a comparative analysis of the proximate, mineral and phytochemical compositions of the leaves of Vernonia amygdalina and Ocimum gratissimum plants. The analyses were investigated in accordance with standard procedures and compared. The results showed that Vernonia amygdalina (bitter leaf) and Ocimum gratissimum (scent leaf) contained respectively, crude protein (47.23 ± 0.13%, 16.38 ± 0.50%), moisture content (2.41 ± 0.15%, 6.58 ± 0.74%), ash (14.67 ± 0.29%, 14.33 ± 0.09), crude lipid (4.50 ± 0.23%, 2.67 ± 0.28%), crude fibre (5.33 ± 0.71%, 2.91 ± 0.66%), carbohydrate (40.43 ± 2.59%, 56.28 ± 0.44%) and the energy value (70.07 ± 1.06 kJ/kg, 69.92 ± 1.85 kJ/kg). Vernonia amygdalina had higher ($P<0.05$) crude protein, crude lipid, crude fibre, ash content and energy value but lower in moisture and carbohydrate content than Ocimum gratissimum. However, Ocimum gratissimum showed the higher composition of calcuim, Magnesium, potassium, iron, copper, and zinc content compared to Vernonia amygdalina, whereas Vernonia amygdalina had higher phosphorous value. Phytate and saponin were significantly predominant ($P<0.05$) in Ocimum gratissimum relative to Vernonia amygdalina, whereas flavonoid, alkaloid and tannin were higher ($P<0.05$) in Vernonia amygdalina.

The results showed that the two leaves evaluated contained varying amount of the proximate, minerals and phytochemicals, hence, their higher nutritional and medicinal value. Therefore, the regular use of these leaves is highly recommended.

Keywords: Vernonia Amygdalina; Ocimum Gratissimum; Minerals; Phytate; Saponins; Tannin

Introduction

Most African countries including Nigeria are blessed with a diversity of vegetable plants which play a basic role in nutrition and healthy body development. Researches have indicated that a vast number of indigenous plants play a significant role in the diet of the populace (FAO [1]). Unfortunately, an estimate of 789 million people in developing countries still suffers from malnutrition, especially infants and children of rural areas (Olumide, et al. [2]). This might be the result of high increase in human population, high prices of food items and increasing rate of poverty which are the major causes of food insecurity in most developing countries of the world (Weaver [3]). Malnutrition can be tremendously reduced with an increased use of foods rich in energy, proteins, iron and vitamin A most especially those from the rural environment. The Food and Agricultural Organization of the United Nation has suggested the need for a 4% increase in the production of nutritious food yearly, as a means of combating food scarcity for the world's projected population (FAO [1]). This has necessitated the need to incorporate non convectional food (i.e. herbal plants) into human diets as a means of alleviating nutritional deficiencies especially in rural communities.

Vegetable plants are the cheapest and most available sources of important nutrients, supplying the body with minerals, vitamins and some hormone precursors, protein, energy and essential amino acids (Olumide, *et al*. [2]). Studies have revealed that many wild plants possess high minerals, vitamins, fiber and phytochemical contents that make them nutritionally important (Tukan, et al. [4]). Medicinal plants are plants that contain substances that can be used for therapeutic purposes or for synthesis of drugs (Olumide, et al. [2]). However, many of these plants are underutilized today because of the inadequate scientific knowledge of their nutritional potentials. The lack of nutritional information and inadequate development of nutritionally improved products from local raw materials have direct bearing on nutrition. Much effort has been concentrated on seeds while leafy vegetables have largely been ignored. Recently in Africa, increased interest has been observed in the use of herbs to improve health; herbs could be regarded as one of the first real functional food but has largely become forgotten food in the modern westernized diet. So many people consume vegetables because of their flavors and taste, and do not concern themselves with their nutritional composition (Olumide, et al. [2]). The role played by plants in human health and nutrition, food security and economic welfare of rural communities in developing world are of great importance.

The availability of vegetables to some extent determines the importance of plants in human diets. The consumption of plants at various seasons is associated with potential health benefits (Isabelle, et al. [5]). Among such nutritious and medicinal plants are *Vernonia amygdalina* (bitter leaf) and *Ocimum gratissimum* (scent leaf). *Vernonia amygdalina* (bitter leaf) is a shrub or small tree that grows throughout tropical Africa, and is popularly called bitter leaf because of its abundant bitter taste (Dalziel [6]). It is known among the Hausa as *'shuwaka'* Yorubas as *'ewuro'* (Eromosele, et al. [7]). The leaves contain a considerable amount of anti-nutritional factors like high level of tannic acid and saponin. Research has shown that *Vernonia amygdalina* have some beneficial effect in disease management in poultry such as anti-bacterial and anti-parasitic and antioxidant (Hassan, et al. [8]) and as growth promoter by enhancing the gastrointestinal enzymes thus increasing feed conversion efficiency (Olabatoke, et al. [9]). Beside that it is used as an indigenous vegetable in human nutrition, the plant has also acquired significant relevance in human medicine having been proven to possess potent antii-malarial as well as anti-tumorigenic properties (Guil, et al. [10]). *Ocimum gratissimum* commonly known as "scent leaf', "tea leaf" or "fever plant" belongs to the family Lamiaceae and is found mostly in the tropical countries including Nigeria, India, North and South America, Mexico and Brazil.

It is a full developed flowering plant with roots, stem, and leaves systems (Olumide, et al. [2]). It is known among the Hausa as '*musuru nzugu*,' Yorubas as '*efirin*' (Bello, et al. [11]). The leaves have strong aromatic odour, popularly used to flavour soup, spice meat and also useful for medicinal and culinary purposes. It is naturally and traditionally used to relief pains and in the treatment of rheumatism, diarrhea, high fever, convulsions, diabetes, eczema, piles, skin infections, gastroenteritis, stomachache, cuts, wounds, inflammation, diuretic and as a repellant (Okunlola, et al. [12]). Therefore, this study quantitatively analyzed the proximate, mineral, and phytochemical compositions of the leaves of *Vernonia* amygdalina and *Ocimum* gratissimum that are commonly found within the community.

Materials and Methods

Sample Collection

Fresh tender leaves of *Vernonia amygdalina* (bitter leaf) and *Ocimum gratissimum* (scent leaf) were collected from a garden in Kashere, Gombe State, Nigeria. After collection, the samples were then transported to the laboratory in a 50kg Golden Penny sack and authenticated by a certified botanist at the herbarium unit of Department of Biological Sciences, Federal University of Kashere, Nigeria. The leaves were individually washed with deionized water and oven-dried at 70ºC until a constant weight was obtained. All samples were ground using a wooden mortar and pestle to produce a fine composite powder and sieved in a mesh size of 0.5 mm to ensure smooth and homogenous surface. The powdered sample was transferred in to the clean and dried plastic containers and labeled

as *Vernonia amygdalina* leaf and *Ocimum gratissimum* leaf (Adeleye and Otokiki, 1999).

Proximate Analysis

Moisture content was determined by drying 2 g of the sample in preweighed crucible at 105°C for 24 h in a convection oven (model OV-160, Gallenkamp BS, England) and determined according to standard protocols (Okunlola, et al. [12]). Ash content was determined at 550ºC. Crude protein was determined from total organic nitrogen using the Kjeldhal procedure and crude protein value was obtained by multiplying the total nitrogen value by a factor of 6.25. Crude lipid (fat) was determined by extracting 2 g of the sample with petroleum ether for 12 h. The extract was reduced to half by evaporation and dried at 105°C in an oven until a constant weight was obtained. The percent lipid content was calculated by dividing the weight obtained after drying with the weight of the sample for estimation of the lipid (fat) content (Okunlola, et al. [12]). Crude fibre content were determined according to the procedures of AOAC [13]. while the estimation of carbohydrate content was calculated from the differences in the sum of protein, fat, moisture, and ash content subtracted from 100:

$$CHO = 100 - (\%\ ash + \%\ crude\ protein + \%\ crude\ lipid + \%\ fibre) \quad (1)$$

The total energy value of *Vernonia amygdalina* leaf (VAL) and *Ocimum gratissimum* leaf (OGL) in Kcal/100 g was estimated following the method of FAO [1].

$$Energy\ (kcal) = \left[(\%\ CHO\ x\ 4) + (\%\ CP\ x\ 4) + (CL\ x\ 9)\right] \quad (2)$$

Where CHO, CP and CL stand for carbohydrate, crude protein and crude lipid respectively (Hassan, et al. [8]).

Mineral Analysis

The sample was digested into solution by wet digestion using a mixture of conc. Nitric, perchloric and sulphuric acids in the ratio 9:2:1 respectively. Fe, Zn, Cr, Co, Mg, Ca, Cu and Mn were determined by AAS, while Na and K were determined using atomic emission spectrometer and colorimetric method was used to determine phosphorus in the samples.

Phytochemical Analysis

Determination of total flavonoid in the leaf extract was carried out following Sun et al. (1999). The extract (1 mL) was incubated at room temperature for 5 min after mixing with 1.7 mL of 30% methanol, 0.3 mL of 0.5 M $NaNO_2$ solution and 0.3 mL of 10% $AlCl_3$. With addition of 2.0 mL of 4% NaOH (w/v), absorbance was estimated at 500 nm. The total flavonoid concentration was calculated from a standard calibration curve. To determine saponins content extracts of each sample were boiled together with 20 mL of distilled water in a water bath, and vigorously shaken. Appearance, and persistence, of frothing before and after warming indicated presence of saponins (Okunlola, et al. [12]). Tannin was determined by the Folin-Denis colorimetric method. About 0.5 g of extracts of each sample were boiled in 20 mL of water in a test tube and filtered through filter paper under gravity. A few drops of 0.1% ferric chloride was added. A brownish green or a blue-black coloration indicated presence of tannins (Okunlola, et al. [12]). Means were separated by standard error. Phytate was determined by the AOAC method [13].

Results and Discussion

Analysis of Proximate Composition

Table 1: Analysis of Proximate Composition of *Vernonia Amygdalina* and *Ocimum Gratissimum*.

Component analyze	Vernonia amygdalina	Ocimum gratissimum
Crude protein (%)	47.23 ± 0.13[a]	16.38 ± 0.50[b]
Moisture content (%)	2.41 ± 0.15[a]	6.58 ± 0.74[b]
Ash (%)	14.67 ± 0.29	14.33 ± 0.09
Crude lipid (fat) (%)	4.50 ± 0.23	2.67 ± 0.28
Crude fibre (%)	5.33 ± 0.71	2.91 ±0.66
Carbohydrate (CHO) (%)	40.43 ± 2.59a	56.28 ± 0.44[b]
Energy value	70.07 ±1.06	69.92 ±1.85

Note: amean ± SE of 3 replicates. Means with different alphabets along the rows were significantlly different (p≤0.05) level of probability.

The proximate composition of the leaves of *Vernonia amygdalina* and *Ocimum gratissimum* varied and were presented in (Table 1). The results showed that the crude protein, moisture content, crude lipid, crude fibre and carbohydrate composition values of the two leaves were significantly different (p≤0.05) level of probability. However, it could be noticed from the results that that the ash content and energy values of the leaves were not significantly different (p≤0.05) level of probability. Between the two leaves, *Vernonia amygdalina* had the higher crude protein (47.23%), crude lipid (fat) (4.50%) and ash content (14.67%), crude fibre (5.33%) and energy value (70.07 kJ/kg) but lower moisture content and carbohydrate composition (2.67 and 40.43 %,) respectively. The low level of moisture in the *Vernonia amygdalina* leaves favours their preventive properties against microbial attach which suggests that the leafy vegetables would store for long without spoilage since a higher water activity could enhance microbial action bringing about spoilage. However, *Ocimum gratissimum* contained the higher percentage of moisture and carbohydrate (6.58 and 56.28% respectively). The higher moisture content recorded for *Ocimum gratissimum* leaves (wet form) could promotes greater activity of

water-soluble enzymes and co- enzymes needed for metabolic activities. The high moisture contents makes the leafy vegetable aid the digestion of food (Okunlola, et al. [12]).

Comparatively, moisture content recorded in this study is significantly higher than the value obtained for *Ocimum gratissimum* (13.60%) and (14.50%) for Vernonia amygdalina leaves by (Olumide, et al. [2]) and similar to the values for O. *gratissimum* (6.5%) and Vernonia amygdalina (2.4%) obtained by (Okunlola, et al. [12]). The fat contents of Vernonia amygdalina and *Ocimum gratissimum* were also comparably low suggesting that the vegetable plants cannot serve as oil vegetables but may be useful for individuals on weight-reducing diets (Okunlola, *et al*. [12]). The high crude protein content and ash values recorded for both *Vernonia amygdalina* (47.23, 14.67%) and *Ocimum gratissimum* (16.38, 14.33%) leaves were found to be higher than the values reported by (Olumide, et al. [2]). for *Vernonia amygdalina* (21.00, 7.10%) and *Ocimum gratissimum* (14.35, 10.50%). These high protein content and ash value suggests that both leafy vegetables are potential source of protein and minerals, hence could be utilized as protein and vitamin supplement in the diet (FAO [1]). The high values of ash content may indicate that the leaves contain some nutritionally essential minerals essential for growth and development of human and livestock (Ladan, et al. [14]). More so, *Vernonia amygdalina* contain higher crude fibre compared to *Ocimum gratissimum* indicating the former could be utilized in the preparation of spicy foods.

Mineral Element Composition

The results of mineral elements composition in the leaves of the two plants (*Ocimum gratissimum* and *Vernonia amygdalina)* were shown in (Table 2). The results showed that Ocimum gratissimum was significantly higher ($P<0.05$) in calcuim, magnesium, potassium, sodium, copper and iron concentration (3417.90, 268.72, 180.67, 136.54 mg/g, 10.75 µg/g and 598.02 µg/g) respectively, compared to Vernonia amygdalina leaf. However, Vernonia amygdalina was significantly higher in zinc (50.02 µg/g), Chromium (0.86 µg/g) and phosphorus (61.56 µg/g) respectively. For macronutrients, calcium and magnesium were higher than other macronutrients for both *Ocimum gratissimum* and *Vernonia amygdalina* (Table 2). The presence of calcium and magnesium in the two leafy vegetable plants indicate that their consumption could be good sources of minerals for human health. Calcium is necessary for the strong bones and teeth. Calcium and phosphorus are essential in human diet and play vital role in building healthy and dense bones, blood clotting and normal functioning of the heart, nervous system and muscles (Idris et al. 2011). Magnesium plays a major role in relaxing muscle along the airway to the lungs thus, allowing asthma patients to breathe easily. It also plays fundamental roles in most reactions involving phosphate transfer; essential in the structural stability of nucleic acid and while its deficiency in man is responsible for severe diarrhoea and migraines (Oluyemi, et al. [15]). This indicates that the two leaves can provide part of the daily required calcuim in the body when consumed.

Table 2: Mineral Composition of leaves of *Vernonia Amygdalina* and *Ocimum Gratissimum*.

Element	Vernonia amygdalina	Ocimum gratissimum
Macrominerals (mg/100 g DW)		
Ca	2857.60 ± 0.05[a]	3417.90 ± 1.55[b]
Mg	260.12 ± 0.31[a]	268.72 ± 0.06
Na	123.45 ± 0.09[a]	136.54 ± 1.22[b]
K	175.58 ± 0.36	180.67 ± 0.49
P (µg·g^{-1})	61.56 ± 0.08	53.14 ± 0.01
Microminerals (µg/100 g DW)		
Fe	520.01 ± 0.65[a]	598.02 ± 0.010 [b]
Zn	50.02 ± 0.04[a]	37.65 ± 0.123[b]
Cu	10.20 ± 0.002	10.75 ± 0.026
Cr	0.86 ± 0.045	0.254 ± 0.014

Note: [a] mean ± SE of 3 replicates. DW: dried weight

Potassium is responsible for nerve action and some osmo-regulation in the body fluid while iron is an essential trace element for hemoglobin formation, normal functioning of central nervous system and in oxidation of carbohydrates, protein and fats (Olumide, et al. [2]). Zinc is an essential trace element for protein and nucleic acid synthesis and vital in infancy and adolescence body development (Melaku [16]). The higher values for the elemental minerals recorded for the two leafy samples indicates that both Vernonia amygdalina and Ocimum *gratissimum* can contribute these minerals and enhance their availability in daily life.

Phytochemical Properties Screening

The analysis of the leaves of the two vegetable plants revealed that they contained appreciable amount of phytochemicals. The phytochemical screening as shown in (Table 3) revealed that phytate, saponin, flavanoid, tannin and alkaloid were present in the leaves in either or both plants. The results showed that phytates are present in both *Vernonia amygdalina* and *Ocimum gratissimum*, but higher in *Ocimum gratissimum* leaves (205.93mg/g). Specifically, phytate and alkaloid were significantly predominant ($P>0.05$) in *Ocimum gratissimum* relative to Vernonia amygdalina whereas flavonoid, tannin and saponin were present in Vernonia amygdalina. The saponins are a group of compounds containing glycones linked with biological effects including erythrocyte haemolysis, depressed growth, and acid metabolism (Chai, et al. [17]). Saponins are used in medicine and pharmaceutical industries because of its

foaming ability with frothy effect while flavonoids are well known antioxidants (FAO [1]). (Okunlola, et al. [12]) reported that high level of tannin and saponin in Vernonia amygdalina were responsible for the bitter taste of the plant. The nutritional effect of tannins is mainly related to their interaction with protein (Miroslav, et al. [18]).

Table 3: Phytochemical Properties Leaves of *Vernonia Amygdalina* and *Ocimum Gratissimum*.

Parameter	*Vernonia amygdalina*	*Ocimum gratissimum*
Phytate (mg/100 g DW)	56.75 ± 0.025a	205.93 ± 0.421b
Phytochemicals		
Saponins	+	-
Tannins	++	+
Flavanoid	+	++
Alkaloid	-	+

Note: [a] mean± SE of three replicates + = Present ++ = concentration

Tannins are known to have antiviral, antibacterial, antitumor and antidiabetic properties via carbohydrate modulation, hence suggesting the presence of the phytochemical has made *Vernonia amygdalina* and *Ocimum gratissimum* useful medicinal plants (Hassan, et al. [19]). More so, the presence of tannins and alkaloids are responsible for the astringent flavour in these leaves.

Conclusion

The study revealed that Vernonia amygdalina and *Ocimum gratissimum* leaves are good sources of crude proteins, crude fat and minerals with levels particularly higher in most cases in *Vernonia amygdalina than Ocimum gratissimum*. *Ocimum gratissimum* had the higher level of calcium, magnesium, sodium, potassium, iron and copper but *Vernonia amygdalina* has a higher level of phosphorus, zinc and chromium. These leaves also contain high levels of some phytochemicals. Vernonia amygdalina had predominantly flavanoid and tannin and saponin while phytate, flavanoid and alkaloid were higher in *Ocimum gratissimum*. In conclusion, these commonly available plants leaves are good sources and potent bioactive compounds which could be used for therapeutic purpose or as precursors of synthetic drugs.

References

1. (2008) FAO. Utility of Tropical Foods: Tropical Beans. Food and Agricultural Organization Publication Pp: 22-26.
2. Olumide MD, Ajayi OA, Akinboye OE (2019) Comparative study of proximate, mineral, and phytochemical analysis of the leaves of Ocimum gratissimum, Vernonia amygdalina and Moringa oleifera. Journal of Medicinal Plants Research 13(15): 351-356.
3. Isabelle M, Lee BL, Lim MT, Koh WP, Huang D, et.al (2010) Antioxidant activity and profiles of common fruits in Sigapore. Food Chemistry 123: 77-84.
4. Weaver LT (1994) Feeding and weaning in the developing world: Problems and solutions. Int J Food Sci Nut 45:127-134.
5. Tukan SK, Takruri HR, Al-Eisaw DM (1998) The use of wild edible plants in Jordanian diet. Int J Food Sci Nutr 49:225-235.
6. Dalziel JM (1955) Useful Plants of West Tropical Africa. Crown Agents for Oversea Publication London p. 401-402.
7. Eromosele IC, Eromosele CO, Kuzhkuzha DM (1991) Evaluation of mineral elements and ascorbic acid contents in fruits of some wild plants. Plant Food Human Nutr 41: 53-57.
8. Hassan LG, Dangoggo SM, Umar KJ, Saidu I, Folorunsho FA (2008) Proximate, minerals and anti-nutritional factors of Daniellia oliveri seed kernel. Chemclass J 5: 31-36.
9. Olabatoke RY, Oloniruba JA (2009) Haematological assessment of bitter leaf (Vernonia amygdalina) efficiency in reducing infections in cockerels. Proceeding of the World Congress on Medicinal and Aromatic Plants November 9-14 Cape Town South Africa Pp: 472- 413.
10. Guil JL, Isasa MET (1997) Nutritional composition of leaves of Chenopodium species. Int J Food Sci Nutr 48: 321-327.
11. Bello MO, Farade OS, Adewusi SRA, Olawore NO (2008) Studies of some lesser-known Nigerian fruits. Afr J Biotechnol 7: 3972-3979.
12. Okunlola Gideon O, Jimoh Mahboob A, Olatunji Olusanya A, Abdulfatai B Rufai, Adepeju O Omidiran (2018) Proximate analysis, mineral composition, and antioxidant properties of bitter leaf and scent leaf. International Journal of Vegetable Science Pp: 1-9.
13. (1990) AOAC. Association of Official Analytical Chemists official method of analysis, 14th (Edn.)., Washington DC USA.
14. Ladan MJ, Bilbis LS, Lawal M (1996) Nutrient composition of some green leafy vegetables consumed in Sokoto. Nig J Basic Applied Sci 5: 39-44.
15. Oluyemi EA, Akilua AA, Adenuya AA, Adebayo MB (2006) Mineral contents of some commonly consumed Nigerian foods. Sci Focus 11: 153-157.
16. Melaku G (2005) Development of molecular marker for pro vitamin A Carotenoid (pVAC) genes in cassava. Abstract submitted to ISTRC-AB 11th symposium Kinshasa.
17. Chai W, Liebman M (2004) Assessment of oxalate absorption from almonds and black beans with and without the use of an extrinsic label J Urol 172: 953-957.
18. Miroslav R, NB Vladimir (2016) Practical Environmental Analysis. Royal Society Chemistry UK 2: 263-273 and 357-377.
19. Hassan LG, KJ Umar (2004) Proximate and mineral composition of seeds and pulp of African locust bean (Parkiabiglobosa). Nig J Basic Applied Sci 13: 15-27.

ISSN: 2574-1241

DOI: 10.26717/BJSTR.2022.46.007420

Kabir Adebayo Sanusi. Biomed J Sci & Tech Res