Nutritional Value of Bitter Leaf (Vernonia Amygdalina) and Scent Leaf (Ocimum Gratissimum)

Stella Eguono Oritsegbubemi Osaide[1]; Odiri Ukolobi[2] & Oghenechovwen Pela-Borke[3]

[1 & 3] Biology Department
College of Education, Warri, Delta State, Nigeria
osaidestella44@gmail.com
[2] Department of Microbiology
Delta State University of Science and Technology, Ozoro, Delta State, Nigeria

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Abstract

Nutritionally, most vegetables, including *Vernonia amygdalina* (Bitter leaf) and *Ocimum gratissimum* (scent leaf), are essential to the healthy development of the human vital organs. This study compared the nutritional values of these two vegetables. The research involved conducting mineral and proximate analyses of the *Vernonia amygdalina* (Bitter leaf) and *Ocimum gratissimum* (scent leaf). Fresh vegetable samples of Bitter leaf (*Vernonia amygdalina*) and Scent leaf (*Ocimum gratissimum*) were gathered from a personal farm in Edjeba, located in Warri South Local Government Area of Delta State. The vegetables underwent air-drying at room temperature and were ground and sieved using the 2mm sieve. They were then placed in sterile Ziploc bags and sent to the laboratory for analysis. The proximate composition was decided by the usage of the AOAC method. The findings showed that Bitter leaf had a high protein content (39.90%), while Scent leaf contained lower protein (14.80%)]. Scent leaf, however, had higher levels of essential minerals such as Calcium (28.61mg/Kg), Potassium (46.30mg/Kg) and Magnesium (16.20mg/Kg), as well as a higher moisture content of 0.52, compared to Bitter leaf's Calcium (11.33mg/Kg), Potassium (18.24mg/Kg), Magnesium (9.52mg/Kg) and moisture of 0.16. These results revealed that *Vernonia amygdalina* and *Ocimum gratissimum* could positively impact blood production in the human body and can be beneficial for both children and adults as part of a nutritious diet

Keywords: Nutritional value, Scent leaves, Bitter leaves, Vitamins, Minerals

Introduction

Leafy vegetables are considered medicinal food and are commonly included in diets in many African homes. They are often prepared as soups or stews, particularly in Southeastern Nigeria. They contain nutrients in the right proportions, making them a balanced diet. Therefore, people are encouraged to consume vegetables, especially when they are unwell. Vegetables are rich in vitamins, minerals, fibres, carbohydrates and secondary metabolites, making them valuable for maintaining health and preventing diseases (Olaposi & Adunni 2019). They also contain antioxidants, which help reduce the risk of chronic diseases. Roots, stems, leaves, fruits and seeds of vegetables can all be consumed and each group contributes to the diet in its way (Kumar, Yadav, Yadav & Yadav, 2017)

Bitter leaf (Vernonia amygdalina) has slender light green stems and dark green leaves. It is a popular vegetable in West and Central Africa and is used in various dishes. In Nigeria, it is known as *Ewuro* in Yoruba and *Onigbe* in Igbo and its leaves are commonly boiled in soups. Scent leaf (*Ocimum gratissimum*) is a plant grown for both culinary and medicinal purposes in West Africa, often found in and around village huts and gardens. Bitter leaf has several therapeutic uses and health benefits. Its antibacterial and antifungal properties make it useful for treating various illnesses, including diarrhoea, dysentery and high blood pressure (Obi, Babagana, Idris, Hadiza, Nma & Nadhiekhan, 2024).

Vernonia amygdalina is commonly used in traditional medicine to treat various health conditions. The leaf extract can be applied to wounds for faster healing and the water extract or raw leaves can be chewed to alleviate worm infestation, constipation, hiccups and kidney problems. A decoction of the leaves or roots is used locally to treat schistosomiasis, cough, hepatitis, sexually transmitted diseases and microbial infections (Okunlola, Jimoh, Olatunji, Rufai, & Omidiran, 2019; Ademiluyi *et al* 2023; Udochukwu *et al* 2015). The roots and leaves of *V. amygdalina* also address fever, hiccups and kidney problems in traditional medicine. Additionally, they are consumed as soup and water extract for digestive health (Ahn, 2017).

Vernonia amygdalina is widely used traditionally for the treatment and management of many ailments. The leaf extract may be applied to wounds, especially when fresh for quick healing. Water extract from the leaves or the raw leaves may be chewed to reduce worm infestation, constipation, hiccups and kidney problems. A decoction of the leaves or the roots is also locally used for the treatment of schistosomiasis, cough, hepatitis, sexually transmitted diseases and microbial infections (Okunlola *et al* 2018; Ademiluyi *et al* 2023; Abdulmalik, *et al* 2016) The roots and the leaves of V. amygdalina are used in traditional medicine to treat fever, hiccups and kidney problems. They are also consumed as soup and water extracted as juice (Semerdjieva & Zheljazkov 2019).

"Bitter leaf is a popular leafy vegetable in tropical Africa, known for its richness in nutrients like β-carotene and vitamin C, which are essential for human health. *Ocimum gratissimum*, also called clove basil or African basil, it is used in modern medicine and traditional remedies for treating ailments like fever, cough, and body aches. It is also grown for its essential oil with antibacterial properties. Both bitter leaf and *Ocimum gratissimum* are used in different ways, but this study aims to compare their nutritional compositions to determine their food values and recommend their intake and uses (Ajao *et al 2017*).

Bitter leaf is a type of leafy vegetable that has been used to address micronutrient deficiencies and malnutrition, and it is particularly popular in tropical Africa. The leaves are relatively inexpensive and rich in several nutrients, especially β-carotene and vitamin C, which are essential for human health (Ajao *et al* 2017).

The basil species *Ocimum gratissimum*, also known as clove basil, African basil and wild basil in Hawaii, is commonly used for its leaves in cooking. It is a member of the spice plant family and is also used in traditional medicine to treat ailments such as fever, cough and body aches (Ademiluyi *et al* 2022). *Ocimum gratissimum* is cultivated for the essential oil in its leaves and stems, which possesses antibacterial properties. It is

widely used in folk medicine to treat various illnesses including respiratory infections, diarrhoea, headache, eye diseases, skin conditions, pneumonia, cough, fever and stomach ache. Additionally, it is used as a febrifuge and is a component of anti-malarial treatments. The essential oil of *Ocimum gratissimum* leaf is used as a general tonic and as an antiseptic for wound dressing and skin infections. An infusion of the leaves, known as "Ocimum tea," is administered as a treatment for fever and sweating. The roots are used as sedatives for children (Ojewumi *et al* 2021; Mgbemena & Amako, 2020).

These two vegetables are used differently in many households due to the belief that their nutritional functions are the same. Therefore, this study focuses on analysing the concentrations of proximate, minerals, vitamins and secondary metabolites present in each vegetable leaf to determine their nutritional and food values.

Materials and Methods

Study Area

The study was carried out in Edjeba town in Warri South Local Government Area in Delta State, Nigeria, latitude 5°31N and 5.517° and Longitude 5045'E and 5.750°E. The town is central to most major towns and communities in the district and experiences less oil pollution than most parts of the Niger Delta (Othman *et al* 2019).

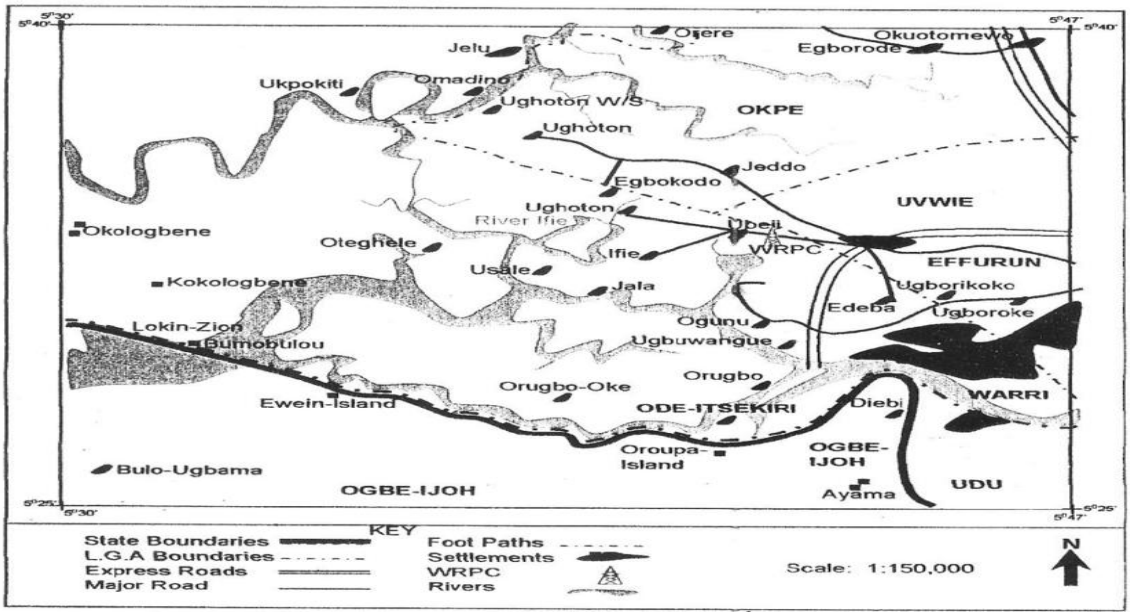

Fig. 2.0 GPS map of samples

Sample Collection

Some fresh bitter leaf (Vernonia amygdalina) and scent leaf (*Ocimum gratissimum*) were collected from a personal garden in Edjeba, Delta state. The leaves were dried for two weeks at room temperature before use in the study.

Sample Preparation

The leaves of *Vernonia amygdalina* and *Ocimum gratissimum* were carefully separated from the stems, washed with tap water and then rinsed with distilled water. After air-drying, the leaves were oven-dried at 60°C until fully dehydrated. The dried leaves were finely ground in a porcelain mortar, passed through a 2mm mesh sieve and stored in a plastic container for further analysis. Fresh leaves were used to determine the moisture content.

Proximate Analysis

The AOAC method was used to determine the proximate composition of both vegetables.

Determining Moisture Content

For the moisture content determination, 5g of each bitter leaf and scent leaf sample labelled A, B, C, D and E was put in five separate, dried, clean and pre-weighed glass dishes and labelled accordingly. When figuring out the moisture content material of a meal, its miles critical to save you any loss or advantage of water. The weight loss was determined and expressed as a percentage of moisture for the three samples. The percentage moisture was determined for each of the samples as explained above. The percentage moisture was determined as follows: Moisture = (mw/m sample) x 100 Where mw is the mass of the water.

Protein Determination

2g each of all bitter leaf and scent leaf samples were weighed and placed in five separate, clean, dry Kjeldahl digestion flasks with a selenium-based catalyst and an anti-bumping agent (asbestos) added. Samples were again cooled to room temperature and then transferred into five separate 100ml flasks and distilled water was added to the 100ml mark. Using a funnel, 10 ml of the digested samples were measured and transferred into the distillation apparatus. Ammonia produced in the decomposition flask during the distillation was collected in a 2% boric acid solution for 5 minutes. Percentage protein was obtained from the sample since the percentage of nitrogen was known. The bitter leaf sample percentage nitrogen content was multiplied by a factor of 6.25 to determine the crude protein estimate (AOAC, 2005).

Crude fat Determination

To determine the crude fat content, 5g of each bitter leaf and scent leaf samples A, B, C, D and E were finely ground and placed into five separate thimbles, which were then sealed with glass wool to prevent sample loss. The crude fat content was calculated by finding the difference in weight between the final weight of the bitter leaf sample and its initial weight. This difference was then expressed as the percentage of crude fat using the following formula.

Where W= weight of bitter leaf sample; M1 = Weight of empty flask; M2 = weight of flask + fat

The bitter leaf and scent leaf samples were placed into five 750ml Erlenmeyer flasks and labelled A to E appropriately. 200ml of boiling 1.25% H_2SO_4 was added to each flask and placed on the hot metal plate with condensers connected. After 30 minutes the flasks were removed and contents were filtered through a clean linen cloth in a funnel and washed with boiling water. The flasks were:
Where X1=weight of de-fatted
Bitter leaf and scent leaf sample before washing; X2=weight of de-fatted bitter leaf and scent leaf sample after washing; W=weight of actual bitter leaf and scent leaf sample before de-fatting.

Mineral Content Determination
The mineral content in the samples was determined using an atomic absorption spectrophotometer, which gave the ash content present. We used the following formulas: B = weight of crucible + sample, C = weight of crucible + ash. In determining the amount of calcium ion (Ca^{2+}) present, 100ml of solution A was put in a beaker, and an ashes sample of air-dried bitter leaf and scent leaf dissolved in water was put in each beaker. Two drops of a buffer solution were added to each beaker. For determining the amount of potassium (K) present, 25ml of solution A was put into a test tube. The results of the composition of *V. amagdalina* are presented in Table 3.1. The result revealed that bitter leaf is very rich in protein (39.90%). *Vernonia amagdalina* also contained 9.70% and 6.51% of crude fat and crude fiber, respectively. This information provides insight into the nutritional value of *Vernonia amagdalina*.

Results
The composition of *V. amagdalina* is shown in table 3.1, indicating that bitter leaf is highly rich in protein (39.90%). Additionally, *Vernonia amagdalina* contains 9.70% crude fat and 6.51% crude fiber. This demonstrates the nutritional and medicinal value of *Vernonia amagdalina.*

Table 1: Composition of *Vernonia Amagdalina* and *Ocimum Gratissimum*
Parameter Bitter leaf Scent Leaf

Parameter	Bitter leaf	Scent leaf
Moisture content (%)	0.16	0.52
Crude Fat (%)	9.70	6.00
Crude Fiber (%)	6.51	7.50
Protein (%)	39.90	14.80
Calcium (mg/kg)	11.33	28.61
Potassium (mg/kg)	18.14	46.30
Magnesium (mg/kg)	9.52	16.20

Nutritional Value of *Ocimum gratissimum*
Presented in table 1 is the composition of *Ocimum gratissimum*. It contained 6.00% of crude fat and 7.50% of crude fiber. In a comparative analysis between *Vernonia*

amagdalina and Ocimum gratissimum, the Bitter leaf had a higher protein content (39.90%) compared to the Scent leaf (14.80%).

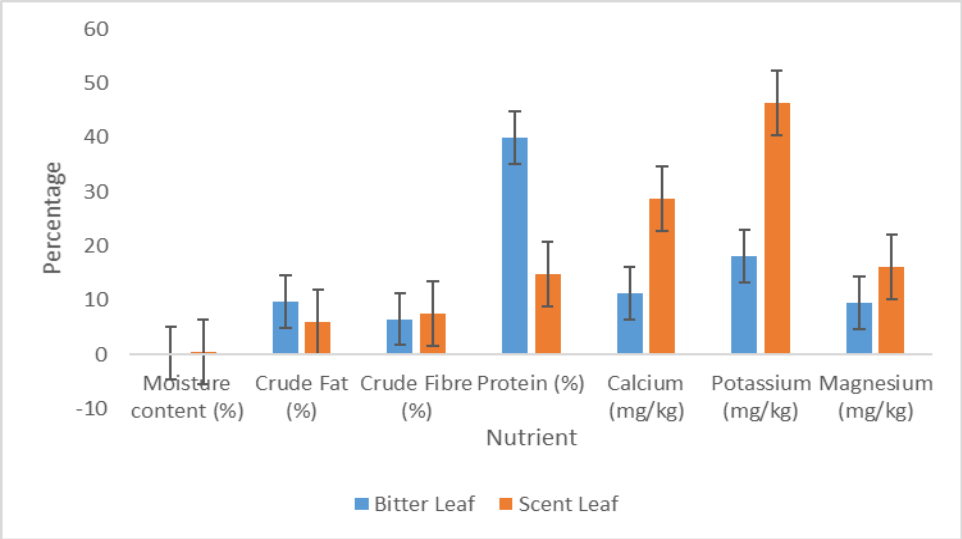

Figure 1: Comparative nutritional profile of Bitter leaf and Scent Leaf

Discussion

Vernonia amagdalina has been found to contain significant amounts of lipids (Abdulmalik, 2016), carbohydrates, proteins with high essential amino acid scores, fiber, iron, phosphorus, copper, calcium, potassium, cobalt and manganese (Edo *et al* 2023a). The protein's nutritional profile in *Vernonia amagdalina* observed in this study was within the range (> 20%) reported by Ojimelukwe & Amaechi (2019).

The moisture content of the bitter leaf observed in this study was much lower than the values reported by Ojimelukwe & Amaechi (2019), who reported 10 for Calcium, Potassium and Magnesium in fresh bitter leaves (Alara *et al* 2017). Tannins, like many other polyphenols, function as antioxidants, helping to prevent and repair cellular damage caused by free radicals (Rumengan *et al.*, 2020). Saponins are compounds found in large quantities throughout the cells
of leguminous plants. Additionally, the properties of saponins make them suitable for use in the treatment and prevention of cerebrovascular and cardiovascular diseases (Larayetan *et al* 2019).

According to Del Prado-Audelo *et al* (2020), bitter leaves may be highly beneficial in treating illnesses in both humans and animals when taken in sufficient quantities. Bitter leaves contain flavonoids, which are naturally occurring molecules with various phenolic structures. These flavonoids have been found to have free radical scavenging, coronary heart disease prevention, hepatoprotective, anti-inflammatory and antiviral properties (Mainka, *et al* 2021). Additionally, the sour leaf plant produces flavonoids in response to microbial infection.

Bitter leaf has various biological properties such as antioxidation, anti-cancer, cholesterol-lowering, improved digestion and anti-diabetic effects. The antioxidants in

bitter leaves can neutralise harmful free radicals that cause tissue damage (Edo *et al 2023*a). Studies have shown that bitter leaf extracts have potent anticancer properties by affecting specific cellular pathways (Atanasov *et al* 2021).

Bitter leaf has been found to decrease the viability of MCF-7 breast cancer cells and induce DNA damage in a dose-dependent manner (Hassan *et al.,* 2020). Similarly, water-soluble fraction of bitter leaf was observed to inhibit DNA synthesis and the growth of BT-549 cancer cells in a dose-dependent manner (Edo *et al* 2023b). Bitter leaf extracts have antimicrobial properties and demonstrate inhibitory actions against bacteria, fungi and viral microorganisms. The presence of quercetin in bitter leaf helps alleviate inflammatory bowel disease (IBD) and improve digestion (Loshali *et al* 2021). Bitter leaf is also a good source of fiber, crucial for gut health. Additionally, bitter leaf extracts aid in regenerating pancreatic beta cells and promoting the uptake of glucose by liver and muscle cells (Kunnumakkara *et al* 2023).

Studies have indicated that bitter leaf extracts can effectively lower blood sugar levels, reduce high blood pressure, promote weight loss and enhance reproductive health in men (Achuba, 2018, Mgbemena *et al* 2020).

Nutritional Value of *Ocimum Gratissimum*

Ocimum gratissimum (heady fragrance leaf) is maximum typically applied for its leaves in food. gratissimum observed in the present study was similar to the value (14.73 %) obtained in scent leaf from Oshogo, in Osun State, Nigeria by Okunlola *et al* (2019). The moisture content of the scent leaf observed in this study was significantly lower than the value (6.5%) reported by Okunlola *et al* (2019). In contrast, to protein and moisture contents, the crude fat content determined in the present was higher than the value reported for the scent leaves collected from Osogbo. Contents of mineral elements for Calcium, Potassium and Magnesium in the leaves were 28. 61 mg/kg, 46. 30 mg/kg and 16. 20 mg/kg.

The mineral nutrients in the scent leaves from this study were found to be lower than those reported in fresh scent leaves from Osogbo by Okunlola *et al* (2019). The amount of *O. gratissimum* observed in this study was lower than that reported in Amaranthus hybridus. A flavanol called rutin, found in fragrant leaves, has shown a variety of biological effects, such as cytoprotective, antioxidant and anticancer effects (Jakimiuk *et al* 2022). Most of these types of plants are a rich source of phenolic compounds and possess anti-cancer, antiviral and antibacterial properties (Iruoghene *et al* 2022).

Scent leaf extracts have anticonvulsant and potential antiviral properties, as well as potential antifertility effects. They delay seizures, protect against seizure-related death and may have broad-spectrum antiviral activity. Further research is needed to fully understand these effects (Edo *et al* 2023b).

Conclusion

The findings revealed that bitter leaf and scent leaf contribute useful amounts of nutrients to the human diet. It contains high levels of protein and mineral nutrients for human and

animal health. Bitter leaf meal (BLM) enhanced the gastrointestinal enzyme thereby improving digestion and assimilation of nutrients. It is, therefore, best to eat these vegetable leaves combined or as mixtures in a controlled ratio. They can also be made into tea infusions for good health.

Recommendation for Future Work

Additional research could be pursued to explore the medicinal properties of these vegetables, as well as to isolate, characterise and purify the bioactive compounds present in each one. This would help pharmaceutical companies in utilising these compounds for the development and production of drugs.

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