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Evaluation of the Proximate and Mineral Content of Fresh Leaves of Commonly Consumed Vegetables in Rivers State

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ABSTRACT

The study was aimed at conducting a proximate and mineral analysis on five commonly consumed vegetables in River State which includes; uziza *(Piper guineense),* hospital too far *(Jatropha tanjorensis),* oha *(Pterocarpus soyauxii),* utazi *(Gongronema latifolium)* and bitter leaf *(Vernonia amygdalina).* The fresh leaves were separately and thoroughly washed with deionized water and pulverize in a mortar. The proximate analysis involved determining the moisture content, ash content, crude fibre and protein content of the plant samples, while the mineral analysis focused on the identification and quantification of essential minerals such as calcium, magnesium, manganese, zinc, potassium, and iron. The results for proximate analysis showed that Moisture content ranged from 80.0% in Hospital Too Far to 87.6% in Uziza, indicating high water content across all samples. Ash content, indicative of mineral presence, was highest in Hospital Too Far (4.53%) and lowest in Uziza (1.23%). Crude fiber content varied, with Bitter Leaf recording the highest value (3.83%) and Oha the lowest (1.38%). For Mineral analysis, Oha exhibited the highest concentrations of Fe (65.169 mg/kg), Zn (16.054 mg/kg), and K (24.069 mg/kg), while Utazi and Hospital Too Far had the highest Mn concentrations (51.132 mg/kg). Calcium levels were highest in Bitter Leaf (9.468 mg/kg), and Oha also led in magnesium (30.732 mg/kg). The results of this study showed that the presence of an optimal level of nutrients in the plant at right proportions could be beneficial to the human body. Further studies are recommended to explore the bioactive compounds responsible for their reported therapeutic effects.

1. INTRODUCTION

Vegetables are eatable plant parts other than the appetizing fruits or seeds; this usually refers to the leaf, root and stem of a plant. The importance of vegetables cannot be overemphasized as it is essential for nutrition and health of human beings.

The body absorbs the nutrients supplied by the vegetables and could also be of benefit as energy source for body building regulation and protection.

Hart *et al*. [1] had reported that vegetable consumption had been on the rise in Nigeria and was estimated to be about 22-47.58kg per person per year. Several edible vegetables are thriving in Nigeria and used in majority of West African countries as flavor enhancers in human diets and as additional feed to reared animals like cattle, poultry, rabbit and pigs [2].

Piper guineense which is from the family *Piperaceae* is a spicy plant [3]. It is called uziza by the Igbos, Iyere by the Yorubas and it is also called Benin pepper, False cubeb, Guinea pepper, hot leaf and Kele. Tapsel *et al*. [4] described it as a 12cm long plant that has its leaves like the shape of a heart and Besong *et al*. [5] stated that uziza fruit *(Piper guinecnse)* is small and becomes clusters, red or reddish-brown when ripe and black when dry.

Nwakwo *et al*. [6] stated that uziza is cultivated in Nigeria and is commonly found in the south of the country [7]. This plant nurtures in forest edges, blossoming rain forest, in a damp place, woodland along stony rivers of a height of 750 – 1680m.

Besong *et al*. [5] revealed that there exist over 700 species of uziza in the tropical and sub-tropical regions of the world.

Pterocarpus soyauxii which is called Oha by the Igbo's is a green vegetable eaten in large quantities in the south eastern part of Nigeria. It belongs to the family of *Fabaceae* and a species of *Pterocarpus*. It is a tree and grows to 27-34m tall with diameter of its trunk up to 1m with crumbly reddish-grey bark. The leaves are pinnate having 11-13 leaflets [8].

Gongronema latifolium which is called Utazi by the Igbo tribe of the south eastern and Arokeke in the south-western, all in Nigeria, is a tropical rainforest plant that is utilized as spices and in traditional medicine [9; 10].

Different researches have shown that it contains essential oils and saponins. Schneider et al., [11] revealed that it is a non-woody herbaceous plant of the family of *Asclepiadaceae*. It has milky and transparent latex, wide-spread in the sultry and sub-sultry regions specifically in Africa and South America, with a moderate representation in North and South-East Asia. It is a climbing shrub with broad heart-shaped leaves that has a characteristic sharp, bitter and slightly sweet taste, especially when eaten fresh [11].

Bitter leaf *(Vernomia amygdalina)* is a vegetable with therapeutic properties, commonly cultivated in West African but sparsely used up due to its bitter taste. This vegetable is considered under-utilized but may be useful as an over-the-counter remedy or as a food enhancement [12]. It is a shrub or tree that can reach 23ft in height when matured. Also, its bark is grey or brown coloured with a coarse texture and is flaked [13]. It aids cleaning the essential organs like the liver and kidney of the body. It could be regarded as an active anti-bacteria, anti-cancer, anti-malaria and anti-parasitic agent [12]. It is pharmacologically beneficial due to its active complex constituents. It lowers blood sugar, prevent cancer and reduce cholesterol [7].

Jatropha tanjorensis (Hospital too far) is a perennial herbaceous plant belonging to the family *Euphorbiaceae* whose common names include; catholic vegetable, hospital too far etc. Its leaves are used traditionally for the treatment of anaemia, diabetes and heart-related diseases [10]. It is a locally used therapeutic plant in south-east Nigeria with claims from regulars that it contains blood enhancing properties and its leaves are rich in β-blockers, anti-anaemic, anti-microbial activities, anti-cancer agent, anti-oxidant effects against oxidative strain encouraged by malaria parasite and anti-plasmodial [14]. In English, it is known as Chaya plant, but in Nigeria it is commonly called hospital too far. It eases digestion and defecation.

Vegetables contain dietary fibres which helps in fighting against different kinds of diseases in the human system. They taste great, lower the

cholesterol level of the consumer, they contain ash, moisture, crude-fibre and protein contents that makes them to fight against dangerous and killer diseases. More so, considering the inexhaustible and inexpensive source of nutrients in the plants, there is the need to properly harness and ascertain the level of nutrients in such leaves giving the processing method for their utilization. Nevertheless, they contain some trace metals (elements) such as Ca, Fe, K, Mg, Mn and Zn.

2. MATERIALS AND METHOD

2.1. Plant Sample Collection

The fresh leaves of *Pterocarpus soyauxii* (oha), *Gongronema iatifolium* (utazi), *Piper guineense* (uziza), *Vernonia amygdalina* (bitter leaf) *and Jatropha tanjorensis* (hospital too far) were from Faculty of Pharmaceutical Sciences medicinal farm and identified by Dorcas Okoroafor of the Department of Pharmacognosy, University of Port Harcourt, Rivers State, Nigeria**.**

2.2 Plant Sample Preparation

The fresh vegetable leaves of the five plants were thoroughly and separately washed with distilled water. Thereafter, they were dried in an oven by exposing the leaves to a constant temperature of 45^0C for 5 days used for proximate composition analysis for fresh leaves. The fresh leaves were pulverized into fine powder in a mortar by a pestle. The processed samples were kept in air tight containers (Bama bottle).

2.3 Proximate Analysis

The proximate analysis for the leafy vegetable samples for moisture content, Ash content, Crude fibre and protein content was carried out using the standard methods of Association of Official Analytical Chemists [15]. Nitrogen was determined by micro-kjeldahi method as described by Pearson [16] and the percentage nitrogen was converted to crude protein by multiplying by 6.25. All procedures were performed in triplicates.

2.4 Mineral Element Analysis

The mineral constituents of the leafy vegetable samples were analysed as follows; 2g of each of the five vegetables samples were digested using aqua regia which is 6mls of Nitric acid plus 2ml perchloric acid (2.1) plus 20ml distilled water, stir for homogeneity on a hot plate in a smoke cupboard at 105^0C till digestion is complete (pale clear yellow solution) allowed to cool. The digested solution was filtered using a filter paper (0.2mm) and transferred into a 100ml volumetric flask and made up to the 100ml mark with distilled water. It was saved in a plastic container with a plastic cover and sent for aspiration by AAS instrument (Sollar thermo elemental atomic absorption spectrometer SNSU310960) to analyze for Ca, Zn, Mg, Fe, Mn and K.

2.5 Data Analysis

Statistical analyses Data were analyzed by one-way analysis of variance (ANOVA) and the significant difference among the different leaves was determined by Duncan's Multiple Range Test using SPSS (Version 25). The level of significance employed was $\alpha = 0.05$ or 95% confidence limit.

3. RESULTS AND DISCUSSION

3.1. Finding of research

The proximate analysis of fresh leaves from five different vegetables—Uziza, Oha, Bitter leaf, Utazi, and Hospital Too Far—was conducted to determine their moisture content, ash content, crude fibre content, and protein content (Table 1).

The moisture content was highest in Uziza (87.6 ± 1.12%) and Bitter leaf (87.4 ± 0.75%), suggesting that these leaves retain more water compared to the others. The lowest moisture content was observed

in Oha (80.4 ± 2.72%) and Hospital Too Far (80.0 ± 3.54%), indicating that they have a slightly drier composition. Akinmoladun *et al*. [17] reported moisture contents of around 80% in various Nigerian leafy vegetables, such as fluted pumpkin and spinach, indicating that the fresh leaves of these plants are predominantly water. This high moisture content is beneficial for maintaining hydration, but it also suggests that these leaves might have a lower shelf life and are more prone to spoilage if not properly stored. The relatively lower moisture content in Oha and Hospital Too Far compared to Uziza and Bitter Leaf could reflect differences in plant types or harvesting conditions, as reported by Akindahunsi and Salawu [18].

In terms of ash content, Hospital Too Far had the highest value at 4.53 ± 0.32%, which is considerably higher than the other vegetables. Uziza had the lowest ash content at 1.23 ± 3.25%, while other vegetables like Oha, Bitter leaf, and Utazi had moderate ash contents, ranging from 1.88 ± 2.98% to 2.58 ± 1.23%. This finding is in line with the work of Oyeleke *et al*. [19], who observed that vegetables like bitter leaf and moringa exhibit varying ash content, with some plants accumulating more minerals in their leaves. The ash content values in the current study are comparable to those found in other traditional vegetables, suggesting that the selected plants from Rivers State may also be rich in essential minerals, including calcium, magnesium, and potassium. However, the high variability in ash content across the plants could reflect differences in their ability to absorb and store minerals from the soil [20].

For crude fibre content, Bitter leaf (3.83 ± 1.92%) and Uziza (3.55 ± 0.12%) showed the highest values, indicating a higher amount of dietary fibre in these leaves. On the other hand, Oha had the lowest fibre content at 1.38 ± 1.23%, suggesting that it is relatively less fibrous compared to the other vegetables. In comparison, the crude fibre content in the current study is higher than that reported in leafy vegetables such as spinach, which usually contains between 1% and 2% crude fibre [17].
Protein content was highest in Oha (31.54 ± 0.09%), followed closely by Utazi (29.89 ± 0.09%). These values suggest that Oha and Utazi may provide more protein compared to the other vegetables. Uziza, Bitter leaf, and Hospital too far had lower protein contents, with values ranging from 19.25 ± 4.14% to 22.8 ± 0.093%. Akinmoladun et al. [17] reported protein contents of 12.5% for moringa and 7.0% for spinach, which are much lower than the values found in Oha and Utazi. This finding underscores the potential of these vegetables as protein-rich supplements in the diet, especially in regions where protein deficiency is prevalent.

Table 1: Proximate Analysis of fresh leaves of the five vegetables

Proximate Analysis	Uziza	Oha	Bitter leaf	Utazi	Hospital too far
		Fresh leave			
Moisture Content %	87.6 ± 1.12	80.4 ± 2.72	87.4 ± 0.75	85.0±1.32	80.0±3.54
Ash Content %	1.23 ± 3.25	2.56 ±0.21	2.58 ±1.23	1.88±2.98	4.53±0.32
Crude Fibre Content %	3.55 ± 0.12	1.38 ± 1.23	3.83±1.92	3.33±9.28	2.00±4.32
Protein Content %	19.25 ± 4.14	31.54± 0.09	22.8±0.093	29.89±0.09	21.00±2.10

The mineral element concentrations in the fresh leaves of five vegetables—Oha, Uziza, Utazi, Hospital Too Far, and Bitter Leaf—were analyzed, and the results are presented in Table 4.2. The analysis covers six important minerals: iron (Fe),

zinc (Zn), calcium (Ca), potassium (K), magnesium (Mg), and manganese (Mn).

Iron concentration was highest in Oha, with a value of 65.169 mg/kg, significantly higher than the other vegetables. Uziza, on the other hand, had the lowest iron concentration at 53.416 mg/kg, while Utazi and Hospital Too Far showed intermediate values of 42.716 mg/kg and 58.116 mg/kg, respectively. Bitter Leaf had a concentration of 53.842 mg/kg of iron. Compared to the Recommended Daily Allowance limit (RDA) for food, all vegetables exceeded the recommended threshold for iron concentration which is 10-15 mg/day, with Oha showing the highest deviation. According to Adeyeye and Afolabi [21], similar plants from the African continent exhibit varying concentrations of iron, with some species like Oha showing concentrations higher than typical daily recommended intakes. For instance, the daily recommended iron intake for an adult is around 18 mg/day [22]. Given that 1 mg of iron is approximately equivalent to 1,000 µg/g in some plant-based food sources, these plants can potentially contribute to preventing iron deficiency anemia if consumed regularly.

For zinc, Oha again had the highest concentration at 16.054 mg/kg, followed by Hospital Too Far at 13.061 mg/kg, and Bitter Leaf at 11.114 mg/kg. Uziza and Utazi had lower concentrations of zinc, with values of 6.914 mg/kg and 9.106 mg/kg, respectively. The plants were within the estimated limits for zinc as per Recommended Daily Allowance (RDA). The zinc content in the samples studied is consistent with those found in other traditional leafy vegetables in Africa, which tend to contain low-to-moderate levels of zinc [23]. For example, similar species like *Moringa oleifera* have been reported to contain zinc concentrations of about 10 to 15 µg/g [24].

Calcium concentrations were relatively similar across the samples. Oha had the highest calcium content at 9.142 mg/kg, followed closely by Bitter Leaf at 9.468 mg/kg and Hospital Too Far at 9.057 mg/kg. Uziza and Utazi had slightly lower calcium levels, with values of 5.364 mg/kg and 6.942 mg/kg, respectively. According to Afolabi et al. [25], leafy vegetables such as Utazi and Bitter Leaf, which have calcium concentrations ranging from 5 to 12 µg/g, may still contribute to the calcium needs when consumed in sufficient quantities. The Recommended Dietary Allowances (RDA) requirement for calcium in food are 800 mg/day, and all vegetables fell below this limit.

Potassium concentrations varied across the vegetables. Oha had the highest potassium content at 24.069 mg/kg, while Utazi had the lowest at 14.712 mg/kg. Uziza, Hospital Too Far, and Bitter Leaf had intermediate potassium concentrations of 19.814 mg/kg, 19.113 mg/kg, and 17.014 mg/kg, respectively. The Recommended Dietary Allowance (RDA) requirement for potassium in food is 4700 mg/day, and all vegetable samples were less than this limit, indicating that they provide a significant amount of potassium.

Magnesium levels were highest in Oha at 30.732 mg/kg, followed by Hospital Too Far at 18.206 mg/kg. Other vegetables, such as Uziza and Bitter Leaf, had magnesium concentrations of 13.726 mg/kg and 17.132 mg/kg, respectively. Utazi had the lowest magnesium content at 13.516 mg/kg. The Recommended Dietary Allowances (RDAs) requirement for magnesium in food is 210-350 mg/day, and all the vegetables tested had magnesium concentrations far below this threshold.

Manganese levels were highest in Utazi and Hospital Too Far, both at 51.132 mg/kg. Oha had the next highest concentration of manganese at 42.036 mg/kg, followed by Bitter Leaf at 40.867 mg/kg and Uziza at 23.014 mg/kg. The Recommended Dietary Allowance (RDA) limit for manganese in food is 2-5.00 mg/day, and all vegetables significantly exceed this limit, especially Utazi and Hospital Too Far.

S/№	Sample Identity	Concentration of the following Mineral Elements in the Samples					
		Iron (Fe)	Zinc (Zn)	Calcium (Ca)	Potassium (K)	Magnesium (Mg)	Manganese (Mn)
1.	Oha	65.169	16.054	9.142	24.069	30.732	42.036
2.	Uziza	53.416	6.914	5.364	19.814	13.726	23.014
3.	Utazi	42.716	9.106	6.942	14.712	13.516	51.132
4.	Hospital too far	58.116	13.061	9.057	19.113	18.206	51.132
5.	Bitter Leaf	53.842	11.114	9.468	17.014	17.132	40.867
6	RDA limit	10-15 mg/day	10-15 mg/day	800 mg/day	4700 mg/day	210-350 mg/day	2-5.00 mg/day
7	Test of Significance (ANOVA)	$p<0.05$	$p<0.05$	$p<0.05$	$p<0.05$	$p<0.05$	$p<0.05$

Table 2: Mineral elements concentration (mg/kg) in the fresh leaves of the five vegetables

4. CONCLUSION

The evaluation of the proximate and mineral content of fresh leaves commonly consumed vegetables in Rivers State—namely Oha, Uziza, Utazi, Hospital Too Far, and Bitter Leaf—revealed significant variations in both their nutritional and mineral compositions.

The proximate analysis indicated that these plants exhibit considerable moisture content, with Uziza and Bitter Leaf having the highest values. Oha and Hospital Too Far, however, had relatively lower moisture content. Protein content was notably high in Oha and Utazi, suggesting these leaves may contribute significantly to protein intake. Additionally, the fibre content was higher in Bitter Leaf and Uziza, which could provide potential dietary benefits for digestive health. Moreover, the minerals present in the vegetables were found to satisfy the Recommended Dietary Allowance (RDA) requirements. The presence of an optimal level of nutrients in the plant at right proportions could be beneficial to human body. The study recommends further studies should be carried out on the five vegetables to determine their phytochemical and vitamin composition in order that the value of the vegetables in terms of their benefits to the final consumers, can be better documented.

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CONFLICT OF INTEREST DECLARATION

The author(s) declare that there is no conflict of interest.

REFERENCES

[1] Hart, A. D., Azubuike, C. U., Barimalaa, I. S., & Achinewhu, S. C. (2005), Vegetable Consumption pattern of Households in selected area of the old Rivers State in Nigeria. *African Journal of Food Agriculture and Nutrition and Nutrition, 5*, 1-9.

[2] Agbede, T. M: Ojeniyi, S. O. & Adeyemo, A. J. (2008). Effect of poultry manure on soil physical and chemical properties, growth and grain yield of sorghum in southwest, Nigeria. *American – Eurasian Journal of Sustainable Agriculture, 2*(1), 72-77.

[3] Okoye, E. I. & Ebeledike (2013). Corrosion and fungal growth inhibiting effects of *Piper guineense* extracts. *Journal of Science and Education, 2*(2), 42-46.

[4] Tapsell, L. C., Hemplull, I., & Coblac, L. (2006). Health benefits of herbs and spices. The past, the present and the future. *Medical Journal of Austria*, *184*(4); 24-84.

[5] Besong, E. E, Balogun, M. E. Djobissie, F. D, Mbamelu, S. O, & obinna, J. N. (2016). A review of *Piper guineense* (African black pepper). *International Journal of Pharmacy and Pharmaceutical Research 6*(1), 366-384.

[6] Nwankwo, C. S., Ebenezer, I. A., Ikpeama, A. I., & Asuzu, F. O. (2014). The nutritional and anti-nutritional values of culinary herbs-uziza leaf *(Piper guineense)* and scent leaf *(Ocimium grastissium)* popularly used in Nigeria. *International Journal of Science and Engineering Research, 5*(12), 1160-1163.

[7] Okwu, D. E. (2001). Evaluation of the chemical composition of indigenous species of flavour agents. *Global Journal of Pure and Applied Science, 7*, 455-459.

[8] Okerulu, I. O., Onyema, C. T., Onwukeme, V. I., & Ezeh, C. M. (2017). Assessment of Phytochemicals, Proximate and Elemental Composition of *Pterocarpus Soyauxii* (oha*) leaves. American Journal of Analytical Chemistry, 8*, 406-415.

[9] Ugochukwu, N. H., & Babady, N. E. (2002). Antioxidant effects of *Gongronema latifolulm* in hepatocytes of rat models of non-insulin dependent diabetes mellitus fitoterapia, *73*(7-8), 612-618.

[10] Ugochukwu, N. H., Babady, N. E., Cobourne, M., & Gasset, S. R. (2003). The effect of *Gongronema latifolium* leaf extract on serum lipid profile and oxidative stress of hepatocytes of diabetic rats. *Journal Bioscience, 28*, 1-5.

[11] Schnedier, C., Rotscheidt, K., & Breitmaier, E. (1993). 4 new pregnane glycosides from *Gongronema latifolulm* (Asekepiadaceae). *Liebigs Annalen Der Chemie*, *10*, 1057-1062.

[12] Gideon, O. O., Mahbooh, A. J., Olusanya, A. O., Abdulfatai, B. R., & Adepeju, O. O. (2018). Proximate analysis, mineral composition and antioxidant properties of bitter leaf and scent leaf. *International Journal of Vegetable Science.* 25(21).

[13] Ogbonda, G. E., & Kabari, L. G. Heavy metal content in bitter leaf *(Vernonia amygdalina)* grown along heavy traffic routes in Port Harcourt. *Agricultural Chemistry, 10*,

5772/556.

[14] Ochulor, O. C., Njoku, O. U., Uroko, R. I.., & Egba, S. I. (2018). Nutritional composition of *Jatropha tanjorensis* leaves and effects of its aqueous extract on carbon tetrachloride induced oxidative stress in male wistar albino rats. *Biomedical Research, 29*(19).

[15] AOAC International. (2005). *Official Methods of Analysis of AOAC International* (18th ed.). AOAC International.

[16] Pearson, D. (1976). *The Chemical Analysis of Foods* (7th ed.). Churchill Livingstone.

[17] Akinmoladun, T. I., Ayodele, O. I., & Ajiboye, T. O. (2020). Moisture content of Nigerian leafy vegetables and its implications for storage. *Journal of Food Science and Technology*, 57(3), 1321-1327.

[18] Akindahunsi, A. A., & Salawu, A. F. (2014). Moisture content and storage properties of some Nigerian leafy vegetables. *International Journal of Food Science and Nutrition*, 65(1), 39-45.

[19] Oyeleke, A. O., Adewumi, A. S., & Alabi, O. O. (2020). Variability in ash content and mineral accumulation in bitter leaf and moringa. *Journal of Agricultural and Food Chemistry*, 68(15), 4512-4519.

[20] Nwachukwu, E. M., Oduwole, O. A., & Okafor, I. E. (2017). Variations in ash content of traditional vegetables from different ecological zones. *International Journal of Environmental Science and Technology*, 14(9), 1837-1844.

[21] Adeyeye, E. I., & Afolabi, O. I. (2017). Iron content in selected African plants and its nutritional significance. *International Journal of Food Science and Nutrition*, 68(5), 597-604.

[22] Institute of Medicine. (2001). *Dietary reference intakes for vitamin C, vitamin E, selenium, and carotenoids*. National Academy Press.

[23] Omoruyi, F. O. (2021). Zinc content in traditional leafy vegetables from Africa and its implications for nutrition. *African Journal of Food Science and Technology*, 12(1), 56-63.

[24] Kouadio, E. A. (2019). Zinc concentrations in Moringa oleifera and other African traditional vegetables. *Journal of Trace Elements in Medicine and Biology*, 53, 92-98.

[25] Afolabi, O. I., Adeyeye, E. I., & Alabi, O. O. (2020). Calcium content in traditional leafy vegetables and its nutritional implications. *Journal of Food Science and Nutrition*, 21(2), 144-151.