International Journal of Nutrition and Food Sciences
2025, Vol. 14, No. 5, pp. 323-327
https://doi.org/10.11648/j.ijnfs.20251405.15

Research Article

Food Mineral Diversity Among Leafy Indigenous Vegetables

Atoyebi John Olayinka[1, 2, 3, *], Oluwasanmi Moses Odeniran[4]

[1]Department of Farm Produce and Management Services, National Centre for Genetic Resources and Biotechnology (NACGRAB), Moor-Plantation, Ibadan, Nigeria

[2]National Biotechnology Research and Development Agency (NBRDA), Lugbe, Abuja, Nigeria

[3]Federal Ministry of Science, Innovation and Technology, Abuja, Nigeria

[4]Department of Food Nutrition Dietetics and Health, Kansas State University, Manhattan, the United States

Abstract

There are five main classes of indigenous vegetables, namely: Leaf vegetables like amaranth, Fruit vegetables like African eggplant, Pulse and seed vegetables like cowpea, Tuber vegetables like sweet potato and the special class referred to as other vegetables of which for example cauliflower belongs. This work therefore examined food mineral potentials and diversity five (5) leafy vegetables namely; Water leaf (*Talinum triangulaire*), Biter leaf (*Venonia amygdalina*, Ugu leaf (*Telfaria occidentalis*), *Basella alba* (green) and *Basella alba* (red). Leafy samples each of 0.52g slurry of the vegetables above were put in clean ceramic crucibles in duplicate and were placed in a cool muffle furnace and ramp at a temperature of 5000C over a period of 2 hours. They were allowed to remain at 5000C for another 2 hours before cooling down. The samples were later transferred into a desiccator. Each of the sample was now poured into already labelled 50ml centrifuge tube. The crucibles were then first rinsed with 5ml of distilled water into the centrifuge tubes and later with 5ml of the aqua regia solution. This process was repeated, so as to make a total volume of 20ml. The supernatants were now decanted into clean vials and mineral analysis were determined using flame atomic absorption spectrophotometer. The results of the analysis revealed that the amount of iron (Fe) was highest in *Basella aalba* (species red) with 318.15ppm, followed by *Telfaria occidentalis* (ugu) with 261.22ppm; while the least amount was obtained in water leaf with 76.60ppm and *Venonia amygdalina* with 100.94ppm. For the amount of manganese (mn), the highest amount was obtained in water leaf with 320.63ppm, followed by *Venonia amygdalina* with 307.52ppm while the least amount were obtained in *Basella alba* (green species) with 135.59ppm and *Telfaria occidentalis* with 49.26ppm. For the amount of Sodium (Na), the highest amount was obtained in *Basella alba* (green speciies) with a value of 127.29ppm. Nitrogen (N) amount was highest in *Telfaria occidentalis* with 6.03% followed by *Basella alba* (red species) at 5.78%, while the least amount were found in water leaf with 4.37% and *Basella alba* (green species) with 1.65%. The work concludes that it is necessary to take these vegetables at intervals together, as this would improve the level of mineral bio-availability to be used by the body systems, and by so doing enhancing dietary diversity pattern of indigenous vegetable consumption which is needed to improve our health and eliminate deficiency diseases.

Keywords

Food Mineral, Diversity, Leafy, Vegetables

[*]Corresponding author: johnatoyebi@ymail.com (Atoyebi John Olayinka)

Received: 27 September 2024; **Accepted:** 22 October 2024; **Published:** 19 September 2025

1. Introduction

A vegetable is usually regarded as a succulent plant or portion of a Plant, which is consumed as a side-dish with the starchy staple. There is no general agreement on a strict definition of what is meant by vegetables, yet, five main groups are distinguished. These are:

1. *Leaf vegetables* (e.g. amaranth),
2. *Fruit vegetables* (e.g. African eggplant),
3. *Pulse and seed vegetables* (e.g. cowpea),
4. *Tuber vegetables (*e.g. sweet potato) and, finally,
5. *Other vegetables of which for example flowers* (e.g. cauliflower) are used.

Furthermore, many vegetables are defined as annuals since they are grown for one season only, whereas several of these plants are true biennials, and some are even perennials [8]. Indigenous leaf vegetables and fruits play a key role in income generation and subsistence, they generate high economic returns per unit input be it land, water or labour. For instance, results of a Darwin initiative project carried out in Benin Republic indicated that income generated per unit area for production of Africa lettuce (*Launaea taraxacifolia*) an indigenous vegetable common in Nigeria is higher than same generated for maize (*Zea mays*). Thus indigenous vegetable cultivation and output has comparative advantage where farm size is small [3, 4, 6].

Talking about nutrition diversity, apart from providing options for consumers and citizenry, the indigenous vegetables has an advantage here to be able to aggregate nutrients potentials; i.e nutrients that are lacking in one vegetable will be available in the other, if taken as a mix or blend, thus making such a better nutrients dense vegetable. Secondly, the availability of a higher amount of a particular nutrient level in one indigenous vegetable, which might be lower in another one, can serve as a yardstick towards meeting specified disease or malnourished condition that will provide a means of each of these specified vegetable to assist in alleviating such condition of health. For example *Hibiscus sabdariffa* will likely be a useful vegetable to be recommended for an anemic condition, even though the dosage requirements will have to be determined per specific case under investigation [3, 5].

2. Research Scope/ Methodology

The research design involves the selection of five indigenous leafy vegetable species:

1. *Basella alba* (red)
2. *Basella alba* (green)
3. *Telfaria occidentalis* (Ugu)
4. *Talinium triangulare* (Water leaf, Gbure)
5. *Virnonia amagdalina* (Bitter leaf, Ewuro)

They were planted in a home grown garden setting for 6 weeks, in which watering was done twice a week.

2.1. Sample Collection

Duplicate samples of each of the indigenous vegetable leaves (figure 2) were plucked from its vine, at the sixth week of growth. These were labelled appropriately during each year and kept in the refrigerator at -150C until ready for analysis.

2.2. Sample Preparation

The leaves were removed and grounded into powder by a small mortal and pestle, after which they were packed and labelled and the powdered sample were now taken to the Analytical laboratory IITA, Ibadan for subsequent food mineral analysis.

2.3. Mineral Analysis

The method described by Association of Official Analytical Chemists [1] was used for the analysis of the minerals. Initially, Aqua regia solution was prepared in a 2litre volumetric flask as follows, 1.2 litre of distilled water was added to the flask, followed by 400ml of Concentrated Hydrochloric acid and 133ml of 70% nitric acid. The resulting solution was diluted to 2 litres. 0.52g of the powdered samples above were put in clean ceramic crucibles in duplicate and were placed in a cool muffle furnace and ramp at a temperature of 5000C over a period of 2 hours. They were allowed to remain at 5000C for another 2 hours before cooling down. The samples were later transferred into a desiccator. Each of the sample was now poured into already labeled 50ml centrifuge tube. The crucibles were then first rinsed with 5ml of distilled water into the centrifuge tubes and later with 5ml of the aqua regia solution. This process was repeated, so as to make a total volume of 20ml. The samples were then vortexed for proper mixing before centrifuging for 10mins at 3000rpm. The supernatants were now decanted into clean vials and mineral analysis for zinc, iron, copper, magnesium, phosphorous and calcium were determined using flame atomic absorption spectrophotometer, AAS, using model Acusys 211 from Buck Scientific, USA.

3. Results

Table 1. Summary mean values of selected food minerals in leafy indigenous vegetables.

Parameters	N (%)	P (%)	Ca (%)	Mg (%)	K (%)
Water leaf (WTL)	4.37	0.35	1.57	0.41	3.04
Virnonia amygdalina (BTL)	4.51	0.42	1.58	0.43	2.88
Telfaria occidentalis (UGU)	6.04	0.50	2.22	0.45	2.82
Basella alba (GREEN)	1.65	0.37	1.36	0.92	3.28
Basella alba (RED)	5.78	0.14	2.60	0.95	3.75

Table 2. Summary mean values of selected food minerals in leafy indigenous vegetables.

Parameters (PPM)	Na	Mn	Fe	Cu	Zn
Water leaf (WTL)	22.25	320.6m^3	76.60	1.94	21.03
Virnonia amygdalina (BTL)	24.22	307.52	100.94	1.31	27.51
Telfaria occidentalis (UGU)	25.75	49.26	261.22	14.28	83.01
Basella alba (GREEN)	127.29	135.59	152.96	2.04	53.08
Basella alba (RED)	66.41	225.52	318.15	3.09	105.87

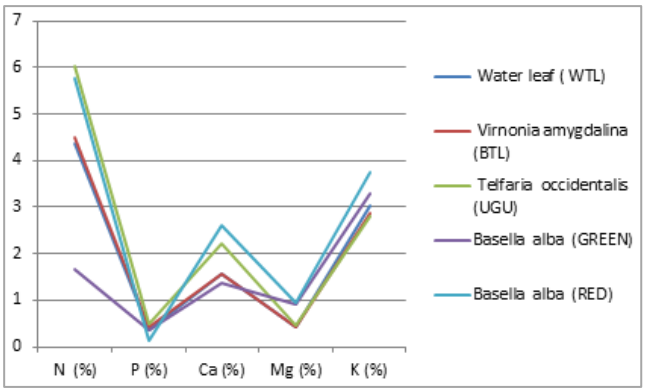

Figure 1. Chart showing food mineral diversity among selected leafy indigenous vegetables.

Figure 2. Showing Vernonia Amygdalina (Bitter Leaf), Talinum Triangulaire (Water Leaf), Telfaria Occidentalis (Ugu Leaf), Basella alba (Green) and Basella alba (Red) in that order.

4. Discussion

Indigenous leafy vegetables existing in the West African sub-region, Nigeria in particular, is very rich in vitamins and minerals [9]. This analysis done in this study showed that certain minerals are more inherent in a particular vegetable species than the other [10, 11]. For example, among the five indigenous vegetables analysed, the amount of Iron (Fe) was highest in *Basella alba* (red) with 318.15 ppm followed by *Telfaria occidentalis* (Ugu) with 261.22 ppm; while the least amount was observed in water leaf with 76.60 ppm and *Virnonia amygdaliina* with 100.94 ppm. The amount of Manganese (Mn) was highest in walter leaf with 320.63 ppm followed by *Virnonia amygdalina* with 307.52 ppm, while the least amount of Manganese was in *Basella alba* (green) with 135.59 ppm and *Telfaria occidentalis* (ugu) with 49.26 ppm. For the amount of Sodium (Na), the highest amount was found to be in *Basella alba* (green) with 127.29 ppm, followed by *Basella alba* (red) with 66.41 ppm, while the least amount of Sodium (Na) were found in *Virnonia amygdalina* (ewuro) 24.22 ppm and Waterleaf with 22.25 ppm. The amount of Nitrogen (N) in these vegetables was the highest in *Telfaria occidentalis* (ugu) with 6.03%, followed by *Basella alba* (red) with 5.78%; while the least amount was found in Water leaf with 4.37% and *Basella alba* (green) with 1.65%. As for the amount of Calcium (Ca), the highest amount was 2.60% in *Basella alba* (red) followed by *Telfaria occidentalis* (ugu) with 2.22%; while the least amount of Calcium was observed in Water leaf with 1.57%, while *Basella alba* (green) has 1.36%. For the amount of Phosphorous (P), the highest amount of 0.5% was found in *Telfaria occidentalis* (ugu) followed by *Virnonina amygdalina* (ewuro) with 0.42%; while the least amount was found in Water leaf with 0.35% and *Basella alba* (red) with 0.14%. The highest amount of Potassium (K) was found in *Basella alba* (red) with 3.75% followed by *Basella alba* (green) with 3.28%; while the least amount of 2.88?% was found in *Virnonia amygdalina* (ewuro) and 2.81% in *Telfaria occidentalis* (ugu). The amount of Magnessium (Mg) was highest in the *Basella alba* (red) with 0.95% followed by *Basella alba* (green) with 0.92%; while the least amount of 0.43% was found in *Virnonia amygdalina* (ewuro); and 0.41% found in Water leaf veggie.

5. Conclusion

Based on the results obtained, it will be necessary to take these varieties of vegetables at intervals and consume them periodically [12-14], if not together; however, those without cooking constraints such as slimy properties when cooked can be consumed together. This will improve or increase the amount or level of food mineral intakes into the body system, for enhanced dietary diversity and consumption pattern of indigenous vegetables for improved healthy living [2, 6, 7].

Abbreviations

AAS	Atomic Absorption Spectrometry
AOAC	Association of Official Analytical Chemists
IITA	Inernational Institute of Tropical Agriculture

Author Contributions

John Olayinka Atoyebi is the main author, while Oluwasanmi Moses, the co-author proof-read and supported financially. The authors read and approved the final manuscript.

Conflicts of Interest

The authors declare no conflicts of interest.

References

[1] AOAC., Official Methods of Analysis, Washington DC As-sociation of Official Analytical Chemists, 2005 edition, ISBN 0-935584-77-3.

[2] Food and Nutrition board, Institute of Medicine. Dietary Reference intakes. Dietary functional and total fibre, Washington DC, National Academy press, 2002.

[3] US Department of Agriculture, Agricultural Research Service, Nutrient Database for Standard Reference, Release, 22 Washington DC, U. S. Department of Agriculture, August 1, 2010.

[4] Anderson JW, Baird P, Davis RH Jnr et. al. Nat. Rev. 2009; 67: 188-205.

[5] Anti-Oxidant, Anti-Inflammatory and Antinociceptive Properties of the Acetone Leaf Extract of *Vernonia Amygdalina* in Some Laboratory Animals. Adeolu Alex Adedapo*, Olujoke Janet Aremu, Ademola Adetokunbo Oyagbemi *Adv Pharm Bull*, 2014, 4(Suppl 2), 591-598, https://doi.org/10.5681/apb.2014.087

[6] Modern Nutrition in Health and Diseases (11th edition, 2013). Catherine Ross, Benjamin Caballero, Robert J. Cousins et. al. ISBN 9781469816593.

[7] Effect of ageing on important minerals and its retention level in *Telfaria Occidentalis* (ugu) leaves. Atoyebi, O. J., Olajire, O. E., Tarfa, T. I. and Afolayan, A. O. Publication at the Nigerian Journal of Horticultural Science, vol. 27(1), 2023, ISSN 1118-2733.

[8] Evaluation of Bambara Groundnut (*Vigna Subterranea verdc.*) accessions for yield performance in the rain-forest and savanna agro-ecologies of Nigeria. Sajo, A. O., Afolayan, G. O. and Atoyebi, O. J. Presentation at the 6th World Environmental Conservation conference 18th – 21st Oct, 2023 at FUTA, Nigeria.

[9] Micronutrients in African Bambara Groundnut (*Vigna Subterranea L. verdc.*) – A review. Atoyebi, John Olayinka. Presentation (poster code 120) at the 6th Global Micronutrient Forum Conference, 16th – 20th October, 2023, at Hague, Netherlands.

[10] Food Mineral Changes in home grown *Basella Alba* species. Atoyebi, J. O., Afolayan, G. O., Edagbo, D. Siddique, L. and Ajiboye, T. O. Presentation (poster code 121) at the 6th Global Micronutrient Forum Conference, 16th – 20th October, 2023, at Hague, Netherlands.

[11] Analysis of Important Food Minerals in *Morinda Citrifolia* (Noni) at NACGRAB, Ibadan medicinal garden. Atoyebi, J. O., Afolayan, G. O., Iorkyar, T., Olosunde, A. Olubiyi, M., Alowonle, A. and Priscilla, A. Presentation (poster code 122) at the 6th Global Micronutrient Forum Conference, 16th – 20th October, 2023, at Hague, Netherlands.

[12] Anti-inflammatory and analgesic activities of the aqueous extract of Acacia karroo stem bark in experimental animal-sAdedapo AA, Sofidiya MO, Masika PJ, Afolayan AJ. *Basic Clin Pharmacol Toxicol* 2008; 103(5): 397-400. https://doi.org/10.1111/j.1742-7843.2008.00317.x

[13] A cross-cultural study: anti-inflammatory activity of Australian and Chinese plants. Li RW, Myers SP, Leach DN, Lin GD, Leach G. *J Ethnopharmacol* 2003; 85(1): 25-32.

[14] The Chinese Materia Media. Beijing, China: Chinese medicine and technology press; 1996. Xu GJ.