



## Comparative Study of Mineral Composition of Some Selected Nigerian Green Leafy Vegetables from Two Different Regions

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### Authors' contributions

This work was carried out in collaboration among all authors. Author AAO designed the study, performed the statistical analysis, wrote the protocol and wrote the first draft of the manuscript. Authors OAA, SM and ASA managed the analyses of the study. Authors OTI and AAF managed the literature searches. All authors read and approved the final manuscript

### Article Information

DOI: 10.9734/AJAAR/2019/v11i330057

#### Editor(s):

(1) Dr. Daniele De Wrachien, Retired Professor, Department of Agricultural and Environmental Sciences, The State University of Milan, Italy.

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Complete Peer review History: <http://www.sdiarticle4.com/review-history/52622>

Original Research Article

Received 02 September 2019

Accepted 09 November 2019

Published 14 November 2019

### ABSTRACT

Vegetable often mean an edible part of a plant other than a sweet fruit or seed, which typically implies the leaf, stem or root of a plant. This study was carried out to evaluate the contributions of Nigerian leafy vegetables to nutrition and health. The mineral composition of four selected green leafy vegetables; water leaf (*Talinum triangulare*), fluted pumpkin (*Telfaria occidentalis*), bitter leaf (*Vernonia amygdalina*) and ukazi (*Gnetum africanum*) from two different locations (Awka in Anambra State and Ado-Ekiti in Ekiti State) were investigated. The result of the experiment showed that the mineral content of the investigated vegetables are not significantly different by ( $p < 0.05$ ). Generally, *Gnetum africanum* sourced from Awka has the highest content of all the explored

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minerals with magnesium content being highest (245.96±0.33). The result indicated that the four investigated green leafy vegetables from these locations are good sources of minerals with *Gnetum africanum* having the highest content. Hence, the consumption of *Gnetum africanum* should be encouraged owing to its high content of minerals.

**Keywords:** Green leafy vegetable; mineral; southeast; southwest.

## 1. INTRODUCTION

Vegetables are known to be important sources of protective foods [1,2]. Green leafy vegetables are succulent plants parts grown in gardens and consumed as a side dish or soup with starchy staples among the tribes in Nigeria [1]. The importance of dietary components of leafy vegetables is significant in African population since they are generally comparatively rich in fiber while cereals, root vegetables and other foodstuff are relatively poor sources [3,4]. Several vegetables species abound in Nigeria which is utilized rather as condiments or spices in human diets or as supplementary feeds to livestock such as rabbits, poultry, swine and cattle [5]. Vegetables have also been reported to be good sources of nutrients such as carotene, protein, vitamins, calcium, iron, ascorbic acid and tangible concentration of trace minerals [6,7]. According to George [8], the potassium content of leafy vegetable is good in the control of diuretic and hypertensive complications. He also ascertained that the proteins in vegetables are superior to those in fruits but inferior to those in grains. Vegetable fats and oils are known to lower blood lipids thereby reducing the occurrences of diseases associated with the damage of the coronary artery [6]. Leafy vegetables are highly beneficial for maintenance of health and prevention of diseases [7]. They serve as valuable source of food ingredients that can be utilized to build up and improve the body successfully [9]. For years, there has been increasing demand for fresh vegetables mainly because of their convenience as ready-to-eat products as well as health benefits associated with their consumption [10,11]. In Nigeria, and in most other tropical countries of Africa, where the daily diet is dominated by starchy staple foods, vegetables are the cheapest and most readily available source of important proteins, vitamins, minerals and essential amino acid [12]. Leafy vegetables are important items of diet in many Nigerian homes, apart from the variety which they add to the menu [13,14], they are valuable sources of nutrients especially in rural areas where they contributes substantially to protein, minerals, vitamins, fibers and other nutrients

which are usually in short supply in daily diets [15]. The numerous minerals present in vegetables provide alkalizing effects by neutralizing the acidity produced by other foods during the digestion process [16]. The concentrations of these minerals however vary from one location to the other. Hence, a need for comparative investigation of the level of these minerals in leafy vegetables remains crucial. This study thus compares the mineral composition of some leafy vegetables from two different regions in Nigeria.

## 2. MATERIALS AND METHODS

### 2.1 Materials

Fresh green leafy vegetables were sourced from Awka central market in Awka, Anambra State, Nigeria and from Central market in Ado-Ekiti, Ekiti State, Nigeria. The vegetables are water leaf (*Talinum triangulare*), fluted pumpkin (*Telfaria occidentalis*), bitter leaf (*Vernonia amygdalina*) and ukazi (*Gnetum africanum*). The vegetable leaves were harvested, destalked, washed with clean cold tap water and was cut into smaller piece. The young fresh leaves were used for the study.

### 2.2 Mineral Analysis

The mineral content was determined by dry ash extraction method following which for specific mineral element, about 2.0 g of the samples was burnt to ashes in a muffle. The resulting ash was dissolved in 100ml of dilute hydrochloric acid and then diluted to 100l in a volumetric flask using distilled water. The digest obtained was used for the various mineral analyses [17].

## 3. RESULTS AND DISCUSSION

The results of the mineral composition of the leafy vegetables are presented in Table 1. Generally, the results indicate that the vegetables contain different levels of essential minerals with vegetables sourced from Awka generally having higher concentration of the researched minerals. This could be as a result

**Table 1. Mineral composition of some selected green leafy vegetables from Awka and Ado-Ekiti (mg/100 g)**

Mineral	<i>Talinium triangulare</i>	<i>Gnetum africanum</i>	<i>Vernonia amygdalina</i>	<i>Telfairia Occidentalis</i>
<b>Awka</b>				
Zinc	17.85±0.11 <sup>c</sup>	22.60±0.11 <sup>e</sup>	16.99±0.21 <sup>f</sup>	23.21±0.11 <sup>c</sup>
Phosphorous	21.15±0.12 <sup>c</sup>	33.67±0.11 <sup>e</sup>	39.62±0.22 <sup>d</sup>	37.24±0.13 <sup>c</sup>
Iron	22.89±0.23 <sup>c</sup>	35.95±0.14 <sup>e</sup>	24.72±0.11 <sup>e</sup>	35.57±0.22 <sup>c</sup>
Calcium	63.69±0.11 <sup>a</sup>	67.91±0.11 <sup>d</sup>	104.86±0.01 <sup>b</sup>	63.96±0.13 <sup>b</sup>
Sodium	80.25±0.14 <sup>a</sup>	88.21±0.21 <sup>c</sup>	45.97±0.01 <sup>d</sup>	43.83±0.12 <sup>c</sup>
Potassium	84.49±0.02 <sup>a</sup>	149.53±0.13 <sup>b</sup>	80.06±0.11 <sup>c</sup>	125.25±0.11 <sup>b</sup>
Magnesium	85.31±0.12 <sup>a</sup>	245.96±0.33 <sup>a</sup>	125.44±0.11 <sup>a</sup>	323.05±0.12 <sup>a</sup>
<b>Ado-Ekiti</b>				
Zinc	17.90±0.11 <sup>e</sup>	12.90±0.11 <sup>c</sup>	6.96±0.11 <sup>d</sup>	12.44±0.12 <sup>d</sup>
Phosphorous	71.57±0.11 <sup>a</sup>	12.91±0.12 <sup>c</sup>	15.77±0.13 <sup>d</sup>	29.03±0.11 <sup>c</sup>
Iron	16.96±0.12 <sup>e</sup>	28.56±0.11 <sup>c</sup>	32.84±0.11 <sup>b</sup>	23.42±0.11 <sup>c</sup>
Calcium	67.92±0.21 <sup>b</sup>	68.13±0.01 <sup>a</sup>	63.56±0.22 <sup>a</sup>	73.59±0.22 <sup>b</sup>
Sodium	53.20±0.10 <sup>d</sup>	53.87±0.11 <sup>b</sup>	14.84±0.12 <sup>d</sup>	33.97±0.21 <sup>c</sup>
Potassium	52.61±0.11 <sup>d</sup>	68.26±0.12 <sup>a</sup>	17.62±0.21 <sup>d</sup>	91.16±0.11 <sup>a</sup>
Magnesium	61.61±0.11 <sup>c</sup>	61.32±0.21 <sup>ab</sup>	26.85±0.11 <sup>c</sup>	88.23±0.12 <sup>a</sup>

Means along the column with the same superscript are not significantly different by DMRT ( $p < 0.05$ )

of difference in soil composition and varied climatic factors. Green leafy vegetables are rich sources of magnesium because of the presence of chlorophyll in them. *Telfairia occidentalis* sourced from Awka is the only vegetable of all the investigated ones present to meet the recommended daily values for magnesium of 300 mg [18]. The essentiality of magnesium is owing to its interaction with phosphate in stabilizing nucleic acids. In addition, more than 300 enzymes require magnesium ions for their catalytic action. Similarly, the concentration of potassium in *Gnetum africanum* is significantly higher across the row except for *Telfairia occidentalis*. Although the Dietary Reference Intake (DRI) of 4,700 mg of potassium [19] cannot be met by any of the vegetables at 100g per day serving, the vegetables are nevertheless good sources of potassium as supplementation with other food components will make up for the potassium need. Epidemiological studies indicate that diets high in potassium can reduce the risk of hypertension and possibly stroke by a mechanism independent of blood pressure [20].

Although phosphorus is well represented in the vegetables, especially *Gnetum africanum*; its ubiquity in protein rich foods makes its deficiency unlikely in protein sufficient diet [21]. The concentration of sodium in the vegetables is so small that even a serving of 2 kg per day of *Gnetum africanum*, which has the most sodium concentration, will still contribute less than the

upper limit standard of sodium. The upper limited standard of sodium is 2.3 grams per day [22]. Intake exceeding this level has been associated with hypertension [23]. With zinc concentrations ranging from 6.96 mg/100g to 22.60 mg/100g, the investigated leafy vegetables at servings thrice daily will meet the zinc recommended dietary allowance of 8 mg/day for women and 11 mg/day for men [24]. Hence, the vegetables can be regarded as good sources of zinc. This is consistent with the report of Hussain and co workers [25] and Oladejo [26].

#### 4. CONCLUSION

The investigated green leafy vegetables are rich sources of minerals. Generally, vegetables sourced from Awka, South east Nigeria presents the highest content of the investigated minerals with *Telfairia occidentalis* having highest magnesium content. A serving of 100 g per day of the investigated vegetables, complemented by other nutrient sources, will provide the recommended dietary allowance (RDA) of the essential minerals investigated and could be an alternative source of minerals to the consumers in this region, thereby improve general health.

#### COMPETING INTERESTS

Authors have declared that no competing interests exist.

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