

## COMPARATIVE EVALUATION OF NUTRITIONAL VALUES OF SOME WILD PLANTS LEAFY VEGETABLES IN SOUTH EASTERN NIGERIA

INIOMBONG E. OKON & UDUAK S. JAMES

Department of Botany and Ecological Studies, University of Uyo, Uyo, Nigeria

### ABSTRACT

In this study the nutritional values of three woody leafy vegetables commonly consumed in the south eastern Nigeria were investigated. Fresh edible leaves of *Heinsia crinata*, *Lasienthera africana* and *Pterocarpus mildbraedii* were collected from the wild stands. Proximate analyses were carried out to evaluate their nutritional values vis-à-vis moisture, ash, fibre, protein, lipid, carbohydrate and caloric value while physicochemical analyses were done to determine their sodium (Na), calcium (Ca), potassium (K), magnesium (Mg), zinc (Zn), phosphorus (P), copper (Cu) and iron (Fe) concentrations. Results revealed that *P. mildbraedii* had the highest moisture content 78.15%; ash, 19.72%; fibre, 13.14% and protein, 29.75% but lowest lipid, 3.13%; carbohydrate, 34.30% and lowest caloric value, 284.37kcal. *Lasienthera africana* had 77.67% moisture, 8.50% ash and 15.40% protein but highest lipid, 7.06% and caloric value 380.82kcal. *H. crinata* had the lowest moisture content, 69.50%; ash, 7.68% and protein, 13.30%. Except for K and Cu, *L. africana* contained the highest amount of minerals while *P. mildbraedii* had the lowest of all the mineral elements except Cu. *Heinsia crinata* however had the highest K content. Our investigations have shown that *P. mildbraedii* with its high fibre and protein contents but low lipid, carbohydrate and caloric values can be an excellent vegetable for checking type 2 diabetes, obesity and heart disease. These studies have shown that *P. mildbraedii* nutritionally compares favourably well with *Telfairia occidentalis* and *Talinum triangulare*, the two most commonly consumed vegetables of the southeastern Nigeria.

**KEYWORDS:** Wild, Woody Leafy Vegetables, Nutritional Values, South-East Nigeria

### INTRODUCTION

Vegetables in the Nigerian context can be described as edible plant parts roots, stems, leaves, fruits or seeds which can be eaten raw as salad or cooked with some other condiments as soup. They are very important because of the significant role they play in the maintenance of good health and resistance to diseases in the human body (Nnamani *et al.*, 2007). Vegetables are known to provide the body with vital nutrients such as dietary fibre, minerals, vitamins, proteins, fats and carbohydrates (Ihekoronye and Ngoddy, 1985). Their low calories place vegetables at a vantage position of lowering overall calorie intake. The fibre content of vegetables are beneficial in reducing the risk of type 2 diabetes (Montonen *et al.*, 2003), obesity (Lairon *et al.*, 2005) and coronary heart disease (Liu *et al.*, 1999). Also some vegetables have been found to contain phytochemicals with antioxidants, antibacterial, antifungal, antiviral anticarcinogenic properties (Steinmetz and Potter, 1996).

The southeastern area of Nigeria located between latitude 4° 15' and 7° 00' N and longitude 5° 50' and 9° 30' E (Chigbu and Onukaogu, 2012) in the tropical climatic zone has many herbaceous and woody plants in the wild whose

leaves are consumed by humans as vegetables. Most of the herbaceous ones have been cultivated but majority of the woody ones are found in the wild where they grow into shrubs and trees. Some of these wild plants leaves have been shown to have anti-bacterial, hepatoprotective and anticarcinogenic properties (Green, 1992; Bianco *et al.*, 1998). Besides, some of them are multipurpose trees which can be used as live poles or fencing sticks, fire wood for domestic fuel and browse for animals. The leaves of these plants have been consumed as vegetables and have served as delicacies in many homes and restaurants.

*Heinsia crinata* DC. called 'atama' in Ibibio is a member of Rubiaceae family. It is a medium size shrub also growing wild in the bush. Apart from the leaves being used as vegetable, its other major usefulness is in the area of drugs for its antiparasitic, hypoglycemic and antidiabetic effects (Okokon *et al.*, 2009b). Dead wood can also serve as firewood.

*Lasianthera africana* P. Beauv., called 'editan' in Ibibio is a perennial shrub belonging to the Icacinaceae family (Hutchinson and Dalziel, 1973). It grows wild in the tropical rainforest of southeastern Nigeria. Apart from being consumed as vegetable, much use has been made of the leaves of this plant as analgesic, antispasmodic, laxative, antipyretic, antiulcerogenic, antidiabetic and antimalarial therapy (Okokon *et al.*, 2009a) while the stems are used as live sticks for boundary demarcation and wood as axe handles in Cameroun (Burkill, 1985).

*Pterocarpus mildbraedii* L'Hérit. Ex DC (red sandal wood) variously called 'mkpafere' in Ibibio is a nodulating leguminous tree belonging to the fabaceae family. Apart from the leaves being consumed by humans as vegetables, livestock also browse on them. Other uses include timber, gum or resin and dyes production (Keay, 1989) as well as analgesia from the bark (Akinyeye and Oluwadusun, 2010). Beside these, *P. mildbraedii* is extensively used as a multipurpose tree for soil conservation, erosion control, shade and shelter provision, live stakes for yams, live sticks and poles for fencing and boundary demarcation (Keay, 1989) as well as firewood.

Although some studies have been done about the nutritional values of these three plants especially in the areas of medicinal values and agroforestry potentials for sustainable agriculture, information on the nutritional values of *Heinsia crinata*, *Lasianthera africana* and *Pterocarpus mildbraedii* in comparison to the conventionally known cultivated vegetables: *Telfairia occidentalis* and *Talinum triangulare* is scarce. The purpose of this study was therefore to evaluate the nutritional values of these wild woody leafy vegetables in comparison to these popularly accepted ones with a view to recommending and popularizing them as alternatives for improving human nutrition through their consumption especially in the dry seasons when these cultivated species become scarce.

## MATERIALS AND METHODS

### Collection of Plant Samples

Fresh samples of *Heinsia crinata*, *Lasianthera africana* and *Pterocarpus mildbraedii* growing in the wild were collected from the south eastern part of Nigeria. These samples were identified by the curator of the department of Botany and Ecological Studies, University of Uyo herbarium.

### Sample Preparation

The leaves were destalked, washed with tap water and then rinsed with distilled water to remove all dirt. These were air dried and later oven dried to constant dry weight at 70°C. The dried leaf samples were separately pulverized and stored in their respectively labeled sample bottles kept in an air tight desiccator for subsequent proximate and physicochemical analyses.

### Proximate Analysis

Percentage moisture, ash, fibre were determined using the standard method of the AOAC (1990). The percentage crude protein was determined following the biuret method of Okon and Akpanyung (2005). Organic nitrogen content obtained using micro-Kjeldal method was multiplied by a protein conversion coefficient of 6.25 (Frank, 1975). Percentage lipid content was determined by using petroleum ether (B. P. 60°C - 80°C) extraction method as described by AOAC (1990), and the percentage oil calculated as:

$$\% \text{ Oil} = \frac{\text{Weight of oil} \times 100}{\text{Weight of dry sample}}$$

Percentage carbohydrate content was determined using the anthrone standard of David (1978). A standard curve was obtained using sucrose solution of the following concentration (mg ml<sup>-1</sup>): 1.00, 0.50, 0.25, 0.13, and 0.06. 1ml of each vegetable sample extract was added to 2 ml of anthrone solution. The mixture was shaken for 15 minutes and boiled for 30 minutes. It was allowed to cool after which absorbance was read off a spectrophotometer at 625 nm. The sugar concentration was determined by extrapolation from the standard curve earlier plotted. The caloric value was obtained using the Atwater factor method described by Osborne and Voogt (1978) and calculated as:

$$[(9 \times \text{fat}) + (4 \times \text{carbohydrate}) + (4 \times \text{protein})].$$

### Physicochemical Analysis

The mineral elements, sodium (Na), calcium (Ca), potassium (K), magnesium (Mg), zinc (Zn), phosphorus (P), copper (Cu) and iron (Fe), contents were determined using the dry ashing procedure of AOAC (1990). 2 g of the pulverized sample was pre-ashed in a crucible for 1-2 h on a hot plate until it was completely charred. This was then placed in a muffle furnace and ashed at 500 °C for about 3 h by which time the ash turns white. The ashed sample was allowed to cool in a desiccator. It was then transferred into a 50 ml volumetric flask by carefully washing the crucible with 5 ml of 30% HCl. The solution was diluted to volume with iodized water. The solution was subsequently used for the determination of the concentration of Ca, Mg, Cu, P, Zn, Fe using Pye-Unicam Atomic Absorption Spectrophotometer while K and Na were determined using flame photometer.

## RESULTS AND DISCUSSIONS

The proximate analysis results are as presented on table 1. The moisture contents of the three vegetables in consideration were 69.50, 77.67 and 78.15% for *H. crinata*, *L. africana* and *P. mildbraedii* respectively.

**Table 1: Proximate Analysis Results of Some Wild Woody Leafy Vegetables of Southeastern Nigeria**

|                           | <i>H. crinata</i> | <i>L. africana</i> | <i>P. mildbraedii</i> |
|---------------------------|-------------------|--------------------|-----------------------|
| Moisture (%)              | 69.50b            | 77.67a             | 78.15a                |
| Ash (%)                   | 7.68b             | 8.50b              | 19.72a                |
| Fibre (%)                 | 5.64b             | 5.12b              | 13.14a                |
| Protein (%)               | 13.30bc           | 15.40b             | 29.75a                |
| Lipid (%)                 | 6.19a             | 7.06a              | 3.13b                 |
| Carbohydrate (%)          | 67.19a            | 63.92a             | 34.30b                |
| Caloric value (Kcal/100g) | 377.67a           | 380.82a            | 284.37b               |

\*Means of three replicates. Means in the same row followed by different letters are significantly different at  $P < 0.05$  according to Duncan's multiple range test.

*P. mildbraedii* had the highest ash (19.72%), fibre (13.14%) and protein (29.75%) contents. These values when compared with what has been obtained in the two most popular vegetables of this area: *Telfairia occidentalis* and *Talinum triangulare* by some earlier workers, show that *P. mildbraedii* is the richest in these food substances. Idris (2011), found 17.2, 20.17 and 8.72% of ash, crude fibre and protein contents respectively while Orhuamen *et al.* (2012), found 10.4, 2.2 and 3.43% respectively for *Telfairia occidentalis*. For *Talinum triangulare*, Orhuamen *et al.* (2012), found 8.85, 4.0 and 2.45% for ash, fibre and protein respectively. These three components are very important for human nutrition. Thus *P. mildbraedii* can compare favourably with *T. occidentalis* and *Talinum triangulare* nutritionally and can be considered and accepted as a very rich vegetable which can supply the much needed minerals, fibre and protein to human diet. Fibre is known to decrease the risk of obesity (Maki *et al.*, 2012), cholesterol level and heart disease (Brown *et al.*, 1999). Lipid content of the three vegetables under study ranged from 3.13% in *P. mildbraedii* to 7.06% in *L. africana*. These values are lower than what has been obtained in *T. occidentalis* (14.27%) by some earlier researcher (Idris, 2011). In terms of caloric value, *L. africana* had the highest (380.82kcal/100g), followed by *H. crinata* (377.6kcal/100g) while *P. mildbraedii* had the lowest (284.37kcal/100g).

Physicochemical results as presented on table 2 showed that *P. mildbraedii* had the lowest concentration of all the elements analyzed for except copper whose concentration was highest in this vegetable (0.92mg/100g), followed by *H. crinata* with 0.78mg/100g concentration.

**Table 2: Mineral Concentrations in Some Wild Woody Leafy Vegetables of Southeastern Nigeria (mg/ 100g)**

|    | <i>H. crinata</i> | <i>L. africana</i> | <i>P. mildbraedii</i> |
|----|-------------------|--------------------|-----------------------|
| Na | *69.01b           | 710.86a            | 3.85c                 |
| Ca | 21.20b            | 28.52a             | 0.71c                 |
| K  | 87.04a            | 53.85b             | 8.32c                 |
| Mg | 11.57a            | 12.94a             | 9.35b                 |
| Zn | 0.45b             | 0.59a              | 0.23c                 |
| P  | 7.43a             | 7.65a              | 5.99b                 |
| Cu | 0.78a             | 0.61b              | 0.92a                 |
| Fe | 0.66b             | 1.04a              | 0.21c                 |

\*Means of three replicates. Means in the same row followed by different letters are significantly different at  $P < 0.05$  according to Duncan's multiple range test.

The reason for this condition may be due to the fact that only the very young and tender leaves usually eaten as vegetables were used for the analysis. *L. africana* had the highest concentration of Na (710.86 mg/100g), followed by *H. crinata* (69.01mg/100g). This was the trend for Ca, Mg, Zn, P and Fe concentrations. *H. crinata* however had the highest K concentration (87.04 mg/100g), followed by *L. africana* with 53.85 mg/100g concentration. The presence of all these mineral elements indicates that the intake of these three vegetables at varying quantities can adequately meet the required daily dietary allowances recommended by for human beings (Wardlaw, 1999).

## CONCLUSIONS

Our investigations have revealed that *P. mildbraedii* is the richest in protein among the five vegetables compared. This property in addition to its high fibre and ash content make the leaves of this plant suitable for intake as vegetable.

Being found in the wild with an ability to highly resist drought it can provide cheap a source of vegetable in alternative to *Telfairia occidentalis* and *Talinum triangulare* during the dry season.

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