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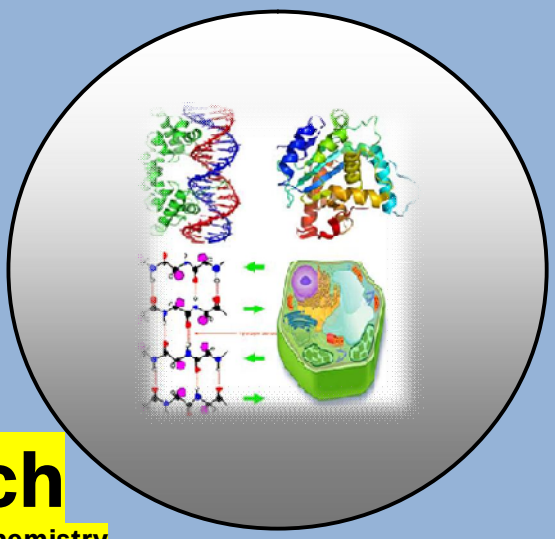
ISSN 0970-4973 Print
ISSN 2319-3077 Online/Electronic

Global Impact factor of Journal: 0.756
Scientific Journals Impact Factor: 2.597
Index Copernicus International Value
IC Value of Journal 4.21 Poland, Europe

J. Biol. Chem. Research
Volume 32 (1) 2015 Pages No. 77-83



Journal of Biological and Chemical Research

An International Journal of Life Sciences and Chemistry

Indexed, Abstracted and Cited in Various National and International Scientific Databases of the World

Published by Society for Advancement of Sciences®

J. Biol. Chem. Research. Vol. 32, No. 1: 77-83, 2015
(An International Journal of Life Sciences and Chemistry)

ISSN 0970-4973 (Print)
ISSN 2319-3077 (Online/Electronic)

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RESEARCH PAPER
Received: 23/10/2014 Revised: 19/12/2014 Accepted: 01/01/2015

Proximate and Mineral Compositions of *Whitfieldia lateria* Leaves from Ishiagu-Ivo, Ebonyi State, Nigeria

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ABSTRACT

The proximate and mineral compositions of Whitfieldia lateritia leaves were evaluated using standard analytical protocols. The results showed that Whitfieldia lateritia leave have appreciable amount of moisture, crude protein, crude fiber, ash content and available carbohydrate with low crude fat. The estimated gross energy (calorific value) is 243.79 Kcal/100g). The results also showed that the leaves are rich sources of minerals and indicated that K was highest with Pb least. The order of the mineral contents were K > Na > Mg > Ca > P > Fe > Mn > Zn > Se > Cu > Co > Mo > Pb. The ratio of Na/K is 0.69 and Ca/P is 1.08. The results indicate that Whitfieldia lateritia are nutritionally potent with appreciable level of minerals.

Key words: Whitfieldia lateritia, Nutrient, Minerals, Calorific Value and Ishiagu.

INTRODUCTION

In most developing countries like Nigeria that is threatened by hidden hunger (micronutrient malnutrition), vegetables and plant leaves are the cheapest and most readily available sources of nutrients (Akubugwo *et al*., 2007a:b). Many plants are consumed as vegetable and these plants have various nutritional and medical values. Some of these plants are wild or semi-wild and are more medically valid for some people while others may only know more of their nutritional values. Although conventional food plants supply of most of the nutrients needed for energy, body building, maintenance and regulation of processes, the need to explore those underutilized are imperative owing to the serious threat to growth, development and survival posed by increasing population, food insecurity and economic crisis in most developing nations (Hassan *et al*., 2007).

Minerals cannot be synthesized by animals and must be provided from plants or mineral-rich water (Anjorin *et al*., 2010). Reports abound that confirms plant leaves as feed supplements or medicines in animal subjects (Guo *et al.,* 2003; Ogbe *et al.,* 2011). Leafy vegetables are necessary ingredients of diet in many Nigerian homes. They add variety to the menu (Mepha and Eboh, 2007; Subukola *et al*., 2007). They are valuable sources of nutrients especially in rural areas where they contribute substantially to the protein, minerals, vitamins, fibers and other nutrients which are usually in short supply in daily diets (Mohammed and Sharif, 2011).

The nutritional and medicinal potentials of many plants especially the under exploited are now being extensively studied. *Whitfieldia lateritia* despite its numerous traditional applications is one of the numerous plants that are under studied. It belongs to the family of *Acanthaceae* which contains ten 10 species (Hutchusion and Dalziel, 1973). It is an evergreen plant having well developed leaves arranged alternately along the stem, and is of Senegalese origin (Hooker, 1845). The numerous traditional uses of this plant for dietetic and medicinal purposes without a scientific knowledge are misleading. Therefore, this study is aimed to bridge the gap by evaluating the proximate and mineral compositions of *whitfieldia lateritia* leaves.

MATERIAL AND METHODS

Sample collection

The leaves of *Whitfieldia lateritia* were harvested in the school premises of Akanu Ibiam Federal Polytechnic Unwana, Ebonyi State. The plant leaves were identified by a plant taxonomist, Prof B.C. Ndukwe of the Department of Plant Science and Biotechnology, University of Port Harcourt, River State, Nigeria. The voucher specimen was deposited in the university Herbarium. The healthy leaves were washed with tap water, air dried in the laboratory, milled into fine powder using milling grinder (Thomas Wiley Model 4). Ground plant samples collected in labeled pre-cleaned polythene bags were placed in glass desiccators (Baroda Scientific Glass Works) prior to analysis.

Methods

Proximate analysis

The sample crude crude protein, crude fat, crude fiber, moisture and ash contents were determined using the method described by the Association of Official and Analytical Chemists (AOAC, 1990). Carbohydrate was calculated by differences (Tapan, 2011).

Estimation of Energy Value

The sample calorific value was estimated (in Kcal) by multiplying the percentage crude protein, crude lipid and carbohydrate by the recommended factor (2.44, 8.37 and 3.57 respectively) used in vegetable analysis (Asibey-Berko and Tayie, 1999).

Mineral Analysis

The mineral content of the samples were determined according to the methods outlined in Armand *et al*. (2012) with some modifications. The processed samples were ashed by weighing 2.0g of each of the processed samples into a well cleaned porcelain crucible and subjecting it to a temperature of 550^{o}C in a muffle furnace for 12 hours. The resultant ash was dissolved in 0.5ml of HNO_3/HCL/H_2O (1:2:3) and heated gently on a hot plate until the brown fumes disappeared. To the remaining material in each crucible, 0.5ml of de-ionized water was added and heated until a colourless solution was obtained. The resultant solution in each crucible was transferred into 10ml volumetric flask by filtration through Whatman No. 42 filter paper and the volume was made to the mark with de-ionized water. This solution was used for elemental analyses by atomic absorption spectrophotometer (Hitachi 26100, Japan). A 10cm long cell was used and concentration of each element in the sample was recorded in parts per million (ppm).

Statistical Analysis

The descriptive statistic was computed using SPSS (Statistical products and Service Solutions) version 17 for windows and results expressed as mean ± standard deviation.

RESULTS

The results of proximate composition of *Whitfieldia lateritia* is shown in Table 1. The results showed that the plant leaves have appreciable amount of moisture (81.17 ± 0.35), crude protein (24.64 ± 2.00), crude fat (2.11 ± 0.33), crude fiber (12.54 ± 0.50), ash content (14.21 ± 0.23%) and available carbohydrate (46.50 ± 0.15) and the Gross energy (calorific value) is 243.79 Kcal/100g).

The results of mineral composition of *Whitfieldia lateritia* is shown in Table 2. The results showed that the leaves are rich sources of minerals and indicated that K was highest with Pb least. The order of the mineral contents were K > Na > Mg > Ca > P > Fe > Mn > Zn > Se > Cu > Co > Mo > Pb. The results (Table 2) also showed that the ratio of Na/K is 0.69 and Ca/P is 1.08.

DISCUSSION

The proximate composition showed that *W. lateritia* leaves have appreciable high nutritional content (Table 1). The moisture content is relatively low when compared with other leafy vegetables.

This is an indication that the plant leaf will be relatively stable with a longer shelf life once it is dried. The crude protein content is high relative to other leafy vegetables since it is able to contribute 24.66% of its calorific value as protein as compared 12% minimum standard (Pearson, 1976). Therefore *W. lateritia* leaves is a good source of protein although its bioavailability may be affected by other factors (Davidson *et al*., 1975). Furthermore, the daily requirements of protein in children, adults, pregnant and lactating mothers are 34 - 56, 13 – 19, 17 and 71g respectively (FND, 2002). Assuming complete protein absorption is met, 100 g DW of leaves of *W. lateritia* would contribute about 44 - 72, 130 -190, 145 and 35% of their daily protein requirement respectively. The resulted indicated that *W. lateritia* is a poor source of lipid and as such, it would be preferable in the control of fat related diseases (Gordon, 2012). The fibre content of *W. lateritia* is appreciably high relative to common utilized leafy vegetables. Adequate intake of fibres in diet facilitate digestion, aid absorption of trace elements in the gut, reduce absorption of cholesterol and facilitate efficient elimination of wastes (Lakshmi and Bindu , 2013). The RDA of fibre for children, adults, pregnant and lactating mothers are 19 – 25, 21-38, 28 and 29 g respectively (FND, 2002). This shows that the plant is capable of contributing 50 - 66, 33 - 60, 45 and 43% of their respective daily requirement when 100 g dried leaves are consumed, Thus, *W. lateritia* is a valuable source of dietary fibre in human nutrition. The observed ash content was relatively high and since the ash content is an index of the mineral in biota, it means that *W. lateritia* leaves could be considered a good source of mineral. The observed carbohydrate content of *W. lateritia* is comparable adequate when compared with most Nigeria and Ghanaian leafy vegetables (Akubugwo *et al*., 2007a:b; Asibey–Berko and Tayie, 1999). The FND (2002) recommended dietary allowance (RDA) values for carbohydrate in children, adults, pregnant and lactating mothers are 130 g, 130, 175 and 210 g respectively. This implies that 36, 36, 27 and 22% of their respective daily requirement can be met when 100 g dried *W. lateritia* leaves are consumed and completely absorbed. The low calorific value estimated from the plant's leaves is comparable to most leafy vegetables and generally indicate that leaves are not good sources of energy (FND, 2002).

Table 1. Proximate composition of the leaves of *Whitfieldia lateritia.*

PARAMETERS	AMOUNT (% DW)
Moisture content	81.17 ± 0.35
Crude protein	24.64 ± 0.20
Crude Fat	2.11 ± 0.33
Crude Fiber	12.54 ± 0.50
Ash content	14.21 ± 0.23
Available Carbohydrate	46.50 ± 0.15
Calorific value (Kcal/100g)	243.79

Table 2. Mineral concentration of the leaves of *Whitfieldia lateritia.*

MINERAL ELEMENT	AMOUNT(ppm)
Sodium	16418.68 ± 0.68
Potassium	23670.26 ± 5.00
Calcium	2864.12 ± 10.00
Phosphorus	2641.49 ± 5.01
Iron	204.13 ± 4.00
Magnesium	3376.96 ± 6.00
Zinc	61.64 ± 1.64
Manganese	64.36 ± 4.00
Copper	8.52 ± 0.52
Cobalt	4.24 ± 0.24
Selenium	45.19 ± 2.00
Molybdenum	3.05± 0.05
Lead	0.14± 0.02
Na/K	0.69
Ca/P	1.08

The mineral composition (Table 2) showed that *W. lateritia* is a rich source of minerals. The ratio of sodium to potassium (Na/K) and calcium to phosphorus (Ca/P) are also shown in Table 2. Sodium helps in fluid balance and nerve transmission while potassium helps prevent excess fluid retention in the body (Choudhary and Bandyopadhyay, 1999). The Na/K ratio in the body is of great concern for prevention of high blood pressure. Na/K ratio less than one is recommended (FND, 2002). Hence, consumption of *W. lateritia* would probably reduce high blood pressure diseases because its Na/K is less than one. Thus *W. lateritia* is a good source of sodium and potassium. Calcium is required for normal growth, activities of muscles and skeletal development and electrical impulses in brain and preventing osteoporosis (Choudhary and Bandyopadhyay, 1999). Phosphorus aids in the regulation of acid-base balance (Oluyemi *et al*., 2006). Good Ca to P intestinal absorption is achieved only when Ca/P ratio is close to unity (Gull-Guerrero et al., 1998). Ca/P ratio in *W. lateritia* is close to unity (Table 2) and as such predicates good Ca to P intestinal absorption. Fe, Mg, Zn, Mn, Cu, Co, Se, Mo and Pb in *W. lateritia* compared favourably with those reported in many leafy vegetables (Akubugwo *et al*., 2013a:b; Vinita *et al.,*2012). Magnesium aids various chemical reactions in the body, intestinal absorption and also prevents heart diseases and high blood pressure while iron is an important part of haemoglobin and helpful for maintaining a healthy immune system (Oluyemi *et al*., 2006). Manganese plays a role in energy production and immune system (Mohamed *et al.,* 2011). Zinc is useful for protein synthesis, normal growth and reproduction (Lakshmi and Bindu, 2013). Minerals such as lead, copper and Cobalt are in trace amounts and are necessary for the proper functioning of the human body but are toxic at high levels.

Their amounts in *W. lateritia* fall within the tolerable limits (FND, 2002) and as such would not present any toxic effects but beneficial effects. Low concentration of lead in plants makes them suitable for medicinal use (Guo *et al*., 2013). Thus, *W. lateritia* may be suitable for medicinal and therapeutic purposes due to the low level of its lead content.

CONCLUSION

The study revealed that *W. leteritia* is nutritionally potent with appreciable amounts of mineral.

AKNOWLEDGEMENTS

The authors are grateful to management and staff of Federal University,Ndufu-Alike, Nigeria and University of Nigeria Nsukka for using laboratory facilities in their Chemistry and Biochemistry departments respectively.

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