PROXIMATE AND QUANTITATIVE MINERALS COMPOSITION OF SOME NIGERIAN INDEGENOUS VEGETABLES

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Abstract

Some selected vegetables from southern Nigeria were analyzed for their nutritional potential. Proximate analysis and concentration of minerals (iron, calcium, potassium, magnesium, and sodium) were determined. Chemical composition of Gongronema latifolium, Pterocarpus soyauxii and Piper guineanses leaves was determined using standard methods. Aqueous extracts of G. latifolium, P. soyauxii and P. guineanse extracts contain minerals (iron, calcium, potassium, magnesium, and sodium). The values for proximate chemical composition range are as follows: Crude protein, 22.44% - 27.56%; ash, 5.50% - 9.00%; crude fibre, 10.30% - 12.80%; moisture content, 42.60% - 48.00%; fats content, 3.71% - 4.40%; carbohydrate, 4.59% - 10.85%. The values of minerals ranges are: Potassium, 2.59mg/100g - 6.21mg/100g; sodium, 4.36mg/100g - 5.56mg/100g; calcium, 0.98mg/100g - 4.09mg/100g; magnesium, 1.09mg/100g - 4.61mg/100g; and iron, 0.91mg/100g - 1.18mg/100g. From this study, it can be conclude that P. guineanse G. latifolium and P. soyauxii possess some potent nutrient which can ameliorate nutrients deficiency diseases.

Key words: Gongronema latifolium, Pterocarpus soyauxii, Piper guineanses, Chemical composition, Nutritive values, Indigenous Vegetables, Minerals concentrations and Bioavailability.

INTRODUCTION

Vegetables are important in rational nutrition; take to it rich content of nutrients for energy. Vegetables are also considered as a favorable influence on the functions of the physiologic human organism. The science of nutrition, studies processes by which the body uses food for energy maintenance, development of a strong body and promotes good health (Valeria 1970). There is a current shift towards evaluating the chemical composition and nutritive value of tropical plants, many of which are medicinal. Alelor and Adeogun, (1995) reported on the nutrient components of 17 leafy vegetables in Nigeria. Aporiet al, (2000) reported on the chemical composition and nutritive value of Chromolaenaodora leaves. In Nigeria different regions have their common vegetables which were based on their availability, regional traditions, and cultural food and beliefs of individual community. For instance, these three vegetables (Pterocarpus soyauxii, Piper guineanses, and Gongromena
vegetables are more commonly found in south-south and south-eastern Nigeria. These three leafy vegetables are respectively known in Igbo as; Utazi for *P. guineense*, Uziza for *G. latifolium*, and Oha for *P. soyauxii*.

*Gongromena latifolium* (African salad) is a rain forest plant belongs to the family *Asclepiadaceae* it is a berry that grows wild in the evergreen forest of Africa. The plant is commonly called *Amaranthglove*. Almost every part of the plants has economic importance. But the most important part is the leaf which is embedded for the management of some diseases ethnomedically apart from its uses as spices (Afolabi, 2007). The aqueous and ethanolic extracts of *G. latifolium* had hypoglycemic, hypolipidemic and antioxidative properties (Ugochukwu and Babady, 2003), Ugochukwu et al., (2003) and Ogundipe et al., (2003) that it has showed to have anti-inflammatory properties (Morebise et al., 2002) These reports were focused mainly on the medicinal properties of the plant with little attempts at investigating their nutritive potential and food processing/preservation values.

*Piper guineense* is a West African species of *Piper*; the spice derived from its dried fruit is known as West African pepper, as Ashanti pepper, Benin pepper, false cubeb, Guinea cubeb, uziza pepper or (ambiguously) "Guinea pepper", and called locally *kale, kukauabe, masoro, sasema* and *sorowisa*. *Piper guineenses* leaf and seeds are used for different varieties of food, including pepper soup, yam porridge, as spices for preparing soup for post-partum women. Aletor and Adeogun, (1995).
Pterocarpussoyauxii (African Padauk or African Coralwood) is a species of Pterocarpus in the family Fabaceae, native to central and tropical West Africa, from Nigeria East to CongoKinshasa and South to Angola. The leaf is eaten as a vegetable in the south eastern Nigeria. Bark extracts are used in cordings animal skin in ethno ternary practice. The pulverized bark is mixed with palm oil in making pomade as cosmetic (Dule, 1981).

Vegetables generally contain great varieties of phytochemicals; some of which have been demonstrated to have anti-oxidant, antibacterial, antifungal, and carcinogenic suppressant properties Nijveldt et al, 2001). Some vegetables contain fibre which is important for healthy hairs, and skin as well. Diets containing recommended amount of vegetables may help to lower the risk of heart disease REFF. Such diet may also help protect against incidence of cancer and decrease bone loss (H, 2002.)

Composition and nutritional quality of vegetables contains nonvolatile acids, mineral salts, surplus volatile compounds which impart flavor in diet. The vegetable color also depend on the pigments they contain e.g. anthocyanin impart blue, purple and red. Chlorophyll is a coloringagent for green vegetables leafy once and green bears, while carotenoids are responsible for yellow colors ones (Ebang and Johnson, 1995).

Searching for high quality but cheap sources of energy, proteins, minerals and vitamins continues to be a major concerned to responsible individuals. Nutrition also plays an important role in both preventive and curative medicine. The effectiveness of its role depends upon continued investigation into the metabolism of nutrients (Oyenuga, 1968).

MATERIALS AND METHODS
Materials and reagents
The major raw material used in this work is freshly harvested (P. soyauxii, G. latifolium, and P. guineanese) leaves were obtained from local farm in Enugu, Enugu State Nigeria. The three samples were taken to Botany Department University of NigeriaNsukka (UNN) for identification and packed in clean sterile sample bags. All reagents used were analar grade.

Sample preparation
Leafy parts of freshly harvested G. latifolium, P. soyauxii and P. guineanese) leaves were cut, rinsed, shade-dried, milled, packaged in sterile 1 mm thick high-density polyethylene sachet, labeled and stored in a refrigerator [(3±1) °C] until used.

Preparation of the extract
Ten grams (10g) of dry-milled (G. latifolium P. soyauxii and P. guineanese) leaves respectively were extracted with 200 ml of distilled water with continuous heating and stirring (30 min) on a mechanical shaker. The resulting slurry was centrifuged (10000 r/min, 15 min), filtered under
vacuum (using the Buchner funnel) and concentrated to solid over water bath at 50°C to obtain aqueous extract (AqEx)

Proximate and mineral analysis
Dry-solid extracts of vegetables (P. soyauxii, G. latifolium, and P. guineanses) respective leaves were analyzed for fat (method No. 930.09), crude fiber (method No. 930.10) and total ash (method No. 930.05) as described by AOAC (1990). Crude protein was determined by (N×6.25) using the Leco-N nitrogen determinator (Model FP-428, Leco Corporations, MI, USA). The nitrogen free extractive (NFE) was obtained by difference. The moisture content was determined by drying the sample to a constant weight in an air circulating oven at 70~80 °C. The mineral contents, namely: Na, K, Ca, Mg and Fe contents were determined as described by Whiteside and Milner (1984) using a PyeUnicam SP9 atomic absorption spectrophotometer (PyeUnicam Ltd., York Street, Britain). Regression equations were used to calculate the amount of metals in each sample (using their absorbance and dilutions).

Extract preparation
Each sample of extract was divided into three (3) labeled for; G. lanfolium (A1, A2 & A3), P. soyauxii (B1, B2 & B3) and P. guineanses (C1, C2 & C3). Studies were carried out for proximate analysis and respective concentrations of sodium, potassium, calcium, magnesium, and iron was determined in triplicates.

Standard preparation
Four (4g) of sodium hydroxide in 100ml volumetric flask and made to mark with deionized water, likewise 2g of boric acid in 100ml volumetric flask and made to mark with deionized water.

Statistical Analysis
Means of triplicate measurements was determined for each sample using standard statistical procedures.

RESULTS
Table 1: Result of the proximate composition of the three selected indigenous vegetables in percentage (%).

<table>
<thead>
<tr>
<th>vegetables</th>
<th>Moisture Content (%)</th>
<th>Crude Protein (%)</th>
<th>Crude Fibre (%)</th>
<th>Fat content (%)</th>
<th>Ash Content (%)</th>
<th>Carbohydrate Content (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>G. latifolium</td>
<td>48.00</td>
<td>27.56</td>
<td>10.30</td>
<td>6.05</td>
<td>5.50</td>
<td>4.59</td>
</tr>
<tr>
<td>P. soyauxii</td>
<td>43.20</td>
<td>22.44</td>
<td>12.80</td>
<td>7.00</td>
<td>10.85</td>
<td>6.05</td>
</tr>
<tr>
<td>P. guineanses</td>
<td>42.60</td>
<td>25.35</td>
<td>12.35</td>
<td>4.40</td>
<td>9.00</td>
<td>6.05</td>
</tr>
</tbody>
</table>

Table shows the percentage proximate composition of respective indigenous vegetables. Moisture content recorded the highest proximate component ranges from (42.30, 43.20 and 48.00%), followed by crude protein (22.44, 25.35 and 27.56%) crude fibre. (10.30, 12.35 and 12.80 %), carbohydrate (4.59, 6.05 and 10.85%), ash (5.50, 7.00 and 9.00%), and fat (3.71, 4.05 and 4.40%) was the lowest.

Table 2: Results of minerals content of the three selected indigenous vegetables in mg/100g

<table>
<thead>
<tr>
<th>vegetables</th>
<th>Sodium mg/100g</th>
<th>Potassium mg/100g</th>
<th>Calcium mg/100g</th>
<th>Magnesium mg/100g</th>
<th>Iron mg/100g</th>
</tr>
</thead>
<tbody>
<tr>
<td>G. latifolium</td>
<td>4.36</td>
<td>6.21</td>
<td>2.52</td>
<td>4.61</td>
<td>1.18</td>
</tr>
<tr>
<td>P. soyauxii</td>
<td>5.13</td>
<td>4.55</td>
<td>0.98</td>
<td>4.61</td>
<td>1.08</td>
</tr>
<tr>
<td>P. guineanses</td>
<td>5.56</td>
<td>2.54</td>
<td>4.09</td>
<td>1.08</td>
<td>1.09</td>
</tr>
</tbody>
</table>

Table shows the elements concentration. Averagely the element with highest recorded concentration was sodium with (4.36, 5.13 and 5.56mg/100g), followed by potassium; (2.59, 4.55 and 2.54mg/100g), calcium; (0.98, 0.98 and 4.09mg/100g), magnesium; (4.61, 4.61 and 1.08mg/100g), and iron; (1.18, 1.08 and 1.09mg/100g).
4.55 and 6.21mg/100g), calcium; (0.98, 2.52 and 4.09mg/100g), magnesium; (1.09, 1.52 and 4.61mg/100g) and iron; (0.91, 0.98 and 1.18mg/100g).

DISCUSSION

Vegetables are low in energy generation, contribute moderate quantities of proteins, and are rich sources of vitamins and minerals. They also contribute roughage to diet when the solid matter is considered since vitamin (A, E and C) present in vegetables are soluble. Vegetables are likely to influence cellular protein with enzymatic activity. Vegetable extracted enzyme influenced maker for myocardial infraction which is most often established by the measurement of marker enzymes (Adam and Bitrus, 1993).

*P. soyauxii, P. guineanses* and *G. latifolium* are good source of protein. Their respective protein contents (22.44, 25.35 and 27.56%) are quite high except for *P. soyauxii* when compares favorably with percentdaily mean(DM) values reported for chickpea (24.0%), cowpea (24.7%), lentil (26.1%), greenpea (24.9%), fluted pumpkin leaves (22.4%), *Tamarindus indica* (24.3%), *Mucuna flagellipes* (24.9%), *Hibiscus esculentus* (23%) and *Parkia biglobosa* (20.9%) (Glew et al., 1997; Akwaowo et al., 2000; Ajayi et al., 2006; Iqbal et al., 2006). Consumption of 100 g (DM) of *P. soyauxii, P. guineanses* and *G. latifolium* may be capable of providing 22, 25, and 27 g of protein which satisfies recommended daily allowance of protein for children. These vegetables are good source of proteins more than (3.3%) recorded by USA nutrient Database for standard reference. Their protein content makes it beneficial for the maintenance of good health by providing essential amino acids found in the proteins. For instance, glutamine was known to have anti-inflammatory properties Morebise et al., (2002).

The crude fat content of *P. soyauxii, P. guineanses* and *G. latifolium* (3.71, 4.05 and 4.40%) are significant compare favorably with percent DM values reported for leafy vegetables like *Brachystegiaeurycoma* (5.87%) and *Tamarindus indica* (7.20%) (Ajayi et al., 2006). A child consuming 100 g of *P. soyauxii, P. guineanses* and *G. latifolium* would be ingesting approximately 3.7, 4.0 and 4.4 g of fatty acid which translates into 33.7, 38.4 and 40.6 kcal of energy or about 2%~3% of their daily total energy requirement. Apart from providing energy, the lipid fraction of *G. latifolium* as an example, contains modest but useful amounts of the essential fatty acid, linoleic acid (31.1%) (Afolabi, 2007). Linoleic acid is an important component of membrane phospholipids, a precursor to another critical fatty acid one finds in virtually all tissue membranes of humans, namely arachidonic acid (Glew et al., 2004). Arachidonic acid is important because, it is metabolized to various prostaglandins which regulate many normal processes, including blood pressure and gastric acid secretion (Lauritzen et al., 2001). These fatty acids are important from the nutritional and stability point of view. Nutritionally, edible triglycerides, such as those in olive oil (which are rich in oleic acid), have cardio-protective effects, as opposed to dietary fats that are rich in saturated fatty acids and which are associated with increased risk of macro-vascular diseases e.g., stroke and heart attack (Glew et al., 2004).

The presence of poly-unsaturated fatty acid (PUFA) is very important in human feeding and physiology, the most important ones being n-3 fatty acid which are predominant in cold water and deep sea fishes. With the current emphasis on increasing polyunsaturated and monounsaturated fats intake, the use of *G. latifolium* leaf oil in food processing/formulations may be acceptable. The chemical composition of *G. latifolium* suggests that its use in food/feed formulation/supplementation operations is vital. This would be particularly so where protein content is of prime importance.

The results of the biochemical analysis of the three vegetables for moisture, fibre, ash, protein, fat and carbohydrate contents showed that moisture value for all the vegetables are: 42.60 - 48.00%. The turgidity of vegetable depends on the water content which may sometime be between 75%-95% (Smith, 1982). The leafy vegetables are rich in fibre value 12.8% in *Pterocarpussoyauxii*, 12.35% in *P. guineasenes* and 10.3% in *Gongromenalatifolia*. However, the proportion of the fibre in the vegetables depends on the stage of maturity. Fibre generally is useful for maintaining bulk, motility and increasing anti-inflammatory properties. The dietary fibre in these vegetables increases bulk and reduces food transit time in the gastrointestinal tract and reduces the incidence of constipation and other related diseases. These vegetables are
valuable in maintaining alkaline reserve in the body and have tendency to provide high amount of carotene, ascorbic acids, and micro minerals which plays important roles in nutrient metabolism (Szeto, al. 2002). Fibre also cleanses the digestive tract with potential removal of carcinogens from the body by binding to the cancer causing chemicals keeping them away from the cells (Ensminger and Ensminger, 1996). Fibre also prevents the absorption of excess cholesterol which is also a beneficial effect in lowering blood cholesterol levels. The carbohydrates in vegetables consist mainly of indigestible fibre material such as cellulose, hemicellulose and lignin; these are in addition to small quantities of sugars such as glucose, fructose and sucrose.

Ash of the substance is the inorganic residue remaining after the organic matter has been burnt away. The ash content is an index of minerals content (Osua, 2008). The presence of iron, calcium, potassium sodium and magnesium are important in maintaining the electrolyte balance in the body. The high moisture content facilitates bacterial action resulting into spoilage which is common with all fresh vegetables. These vegetables has lower moisture contents which signifies slow bacterial action and less or extended spoilage time.

Calcium presence can serve as a major factor sustaining strong bones and plays part in muscle contraction and relaxation, blood clotting, synaptic transmission and absorption of vitamin B (Ebang and John, 1995). Especially the higher calcium contents of P. guineanse (4.09%) and G. latifolia (2.52%) will be more advantageous to the body in the function associated with the mineral and deficiency of calcium that lead to malformation of bones especially in young animals and formation of shell-less eggs.

Iron normally serves as an essential trace mineral that plays numerous biochemical roles in the body, including oxygen binding in hemoglobin and existing enzymes activities. It also plays a role in the production of DNA, phospholipids, ATP and protein metabolism. Iron also helps to convert tyrosine into pigment that colors the skin and hairs. It plays a role in providing healthy nervous system and formation of collagen. Iron is an element component of heme pigments. Consumption of these fresh vegetables may prevent deficiency disease (hypothombinea) and increase lost susceptibility to infectious diseases.

Sodium and potassium play a role in chemical reaction within the cells, and regulate the transfer of nutrients to the cell. Sodium works in conjunction with potassium for extra cellular fluid balance (Okoka and Oke, 2001). These vegetables known to have high content of both sodium and potassium may help to prevent the formation of kidney stones.

Magnesium plays a role in any biochemical process in an organism, by promoting balance of minerals and for normal activity of the muscle, nervous system and hormones (Okoka and Oke, 2001). It presence also provides energy maintenance/manufacture, effective immune system and regulation of an arterial pressure together with calcium.

Consumption of fresh vegetables is well represented in the composition of numerous minerals such as those of calcium, iron, potassium, phosphate, magnesium, zinc, phosphorus, sodium among others that are commonly found in vegetables. These Leafy greens were found to be a rich source of iron, calcium, potassium, magnesium and sodium, which are generally important in sustaining the electrolyte balance in our body. These concentrations were much higher than recommended values. Though, not all the nutrients present were liable to be assimilated due to bioavailability factors.

In conclusion, the proximate and elemental analysis of these indigenous vegetables has revealed their respective nutritional values. These three vegetables are all good for consumption if possible on dailybases for maintenance of healthy body and also prevent nutritional/mineral deficiency diseases. The nutrient information reported in this study would enhance efforts to promote wider use of the plant as part of a broader program aimed at educating local populations on the nutritional benefits of the many wild plants existing in their environment.
REFERENCES


