PROXIMATE, MINERAL AND ANTI-NUTRIENT COMPOSITION OF THE LEAVES OF SWEET POTATO (*IPOMOEA BATATAS L*)

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ABSTRACT
Green leafy vegetables have been recognized generally as source of microminerals hence leaves of sweet potatoes (*Ipomoea batatas L*) were subjected to chemical analysis using standard methods of food to determine the proximate composition, nutritional elements and anti-nutritional contents. The leaves were found on dry weight basis to have high moisture content (71.60%), crude proteins (18.74%), crude fat (12.75%), carbohydrate (56.43%) and energy value (395 kcal/100g). The mineral analysis of the leaves revealed the following in mg/100g: N (3.0), P (0.40), Ca (3.12), Mg (0.41), K (3.26), Na (2.62), Fe (12.19), Mn (9.14), Cu (0.47), and Zn (4.84) while anti-nutritive content gave phytate (2.02), tannin (0.05) and oxalate (1.00). When these results are compared with the compositions of most leafy vegetables, it can be seen that leaves of sweet potatoes could be used as sources of energy and nutrients to supplement the recommended dietary intake (RDI) of some elements for different categories of the population.

Keywords: Sweet potatoes, Proximate composition, Mineral elements, Anti-nutritive content.

INTRODUCTION
Declining food production and low socio-economic capability of people has led to the campaign for increase production, utilization and consumption of traditional foods (FAO, 1986). Vegetables have been described as fresh and edible portions of herbaceous plants which can be eaten raw or cooked (Fayemi, 199; Dhillot et al., 2006). The utilization of leafy vegetables is reported to be part of Africa's cultural heritage and as a matter of fact play important roles in the customs, traditions and food cultures of the African household (Mensah et al., 2008). The nutrient content of different types of vegetables differed greatly and they are not major sources of carbohydrates compared to the starchy foods which form the bulk of food eaten but contain vitamins, essential amino acids, as well as mineral elements and antioxidants (Mnzava, 1997; Fasuyi, 2006). Wild leafy vegetables like Roselle (*Hibiscus sabdariffa*) and Anza or Dilo (*Boscia senegalensis*) were the messiah that saved the people of Niger Republic during the famous famine of 2005 (Umar et al., 2007). Thus wild leafy vegetables had attracted a lot of scientific research geared towards assessing their nutrients content (Lockeett et al., 2000; Ogle et al., 2001; Faruq et al., 2002; Gupta et al., 2005).

Sweet potato (*Ipomoea batatas*) is a dicotyledonous herbaceous perennial plant that belong to the family convolvulaceae whose young leaves are sometimes eaten as greens. The leaves are alternate, heart-shaped or palmately lobed (Wikipedia, 2011). Previous studies have revealed that the tubers are good source of energy because of their carbohydrate content (Scott and Maldonado, 1999; O’Hair, 1984). Also, the leaves have been reported to contain protein and crude fibre that are important in addressing protein deficiency related diseases and colon diseases (Ifon and Bassir, 1979; Hiroshi et al., 2000). Despite the reported usage of the leaves of sweet potato as green in some places its use is not yet popular among the people hence, the need for this study with the following objectives.

i. to determine the proximate composition,

ii. to determine the mineral elements content; and

iii. to also determine the presence and concentration of anti-nutrients.

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**MATERIALS AND METHODS**

Sample collection and treatment: samples of *Ipomoea batatas* leaves used in this study were collected from a farm in Ede, Osun state. Before analysis, the leaves were destalked and washed and residual moisture allowed to evaporate at room temperature. Subsequently, the leaves were enveloped and oven dried at 60°C until constant weight was attained (Fasakin, 2004). The dried leaves were then ground into fine powder, sieved through 20 mesh sieves and stored in plastic containers for analysis.

**Proximate analysis (moisture, crude protein, ash content, crude fat, crude fibre and calorific value):**

The moisture content of the sample was determined by oven drying to a constant weight at 105°C in a GallenKamp oven (AOAC, 1990). Ash content was determined using dry ashing in Lenton Muffle Furnace at 525°C for 24hrs. The fat content was extracted with petroleum ether using a soxhlet apparatus and n-hexane as a solvent (AOAC, 1990). Crude protein content was calculated by multiplying the value obtained from Kjeldahl's nitrogen by a protein factor of 5.3, a factor recommended for vegetable analysis (Bernice and Merril, 1975). Crude fibre was estimated by acid-base digestion with 1.25% H2SO4 (w/v) and 1.25% NaOH (w/v) solutions (AOAC, 1999). The sample calorific value was estimated (in kcal) according to the formula:

\[
\text{Energy} = (g\text{ protein x 2.44}) + (g\text{ lipid x 8.37}) + (g\text{ available carbohydrate x 3.57}) \text{ as reported by Asibey-Berko and Tayie (1999).}
\]

**Determination of mineral contents:**

Mixed acid digestion was carried out on 2 g each of the ground leave sample until a clear solution was obtained. The digest was allowed to cool and then transferred into a 20 ml standard flask and made up to mark with distilled water. Iron, zinc, Copper and manganese were determined using Atomic Absorption Spectrophotometer (AAS) Model 200, Germany (AOAC, 2005).

**Determination of anti-nutrient content:** Tannin was determined spectrophotometrically by the acidified vanillin method as described by Chang *et al.*, (1994). Total oxalate was determined using the method described by (AOAC, 2005). Phytate was quantified using the method described by Ola and Oboh (2000).

**RESULTS AND DISCUSSION**

The result of proximate composition is presented in Table 1. The moisture content was high and found to be 71.60% and this was similar to 70.54% reported in *Ipomoea batatas* leaves (Olayiwola *et al.*, 2009 ) and 72.83% in *Ipomoea aquatica* leaves (Umar *et al.*, 2007). The implication of this is that the leaves can not be kept for longer time (Temple *et al.*, 1996).

**Table 1: Proximate composition of *Ipomoea batatas* leaves**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Concentration (% Dry weight)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Moisture content</td>
<td>71.60</td>
</tr>
<tr>
<td>Crude protein</td>
<td>18.74</td>
</tr>
<tr>
<td>Crude lipid</td>
<td>8.21</td>
</tr>
<tr>
<td>Crude fibre</td>
<td>15.86</td>
</tr>
<tr>
<td>Total ash</td>
<td>12.75</td>
</tr>
<tr>
<td>Carbohydrate content</td>
<td>56.43</td>
</tr>
<tr>
<td>Caloric value (Kcal /100g)</td>
<td>395</td>
</tr>
</tbody>
</table>

The crude protein content is 18.74% in the leaves and this was higher than 6.30% reported in *Ipomoea aquatica* leaves (Ogle *et al.*, 2001; Umar *et al.*, 2007) and also higher than 8.0% in *Ipomoea batatas* reported by Asibey-Berko and Tayie (1999), 11.67% (Ishida *et al.*, 2000) but lower than 24.37% reported by (Monamodi *et al.*, 2003). The protein content of this plant can therefore be of great assistance to man in realizing their daily dietary intake most especially during pre-harvest period when prices of food normally soars.

The high ash content of 12.75% is a good reflection of the presence of nutritionally important elements. The concentration recorded in this study is higher compared to 10.83% reported in *Ipomoea aquatica* (Umar *et al.*, 2007), 1.8% i
Ipomoea batatas (Asibey-Berko and Tayie, 1999) and 8.83% also in Ipomoea batatas leaves (Olayiwola et al., 2009).

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The crude lipid content was found to be 8.21% in the samples and this was higher than the value of 0.74% and 2.56-6.82% reported in Ipomoea batatas leaves by Asibey-Berko and Tayie 1999 and Ishida et al., 2000. Again, this value was higher than 3.88% reported in Ipomoea batatas by Olayiwola et al., 2009. However, it was lower than 11.00% reported in Ipomoea aquatica leaves (Umar et al., 2007).

The sample crude fibre content was found to be 15.86%. This value was found to be lower than 17.67% reported in Ipomoea aquatica leaves (Umar et al., 2007) and 46.05% reported in Japanese Ipomoea batatas (Ishida et al., 2000) but higher than 3.7% found in Ipomoea batatas leaves (Asibey-Berko and Tayie, 1999). This value falls within the range of 8.5-20% fibre content reported in some Nigerian leafy vegetables (Ifon and Bassir, 1979). Fibre cleanses the digestive tract by removing potential carcinogens from the body and prevents the absorption of excess cholesterol (Mensah et al., 2008). High fibre content in food causes intestinal irritation and lower nutrient bioavailability (Aletor and Adeogun, 1995).

Most vegetables are reported to have low calorific values of between 30-50 Kcal/100g (Delvin, 1982) but the value of 395 Kcal/100g recorded in this sample was higher. It was higher than the value of 300.94 Kcal/100g reported in Ipomoea aquatica leaves (Urnar et al., 2007), 288.3 Kcal/100g in Ipomoea batatas leaves (Asibey-Berko and Tayie, 1999).

The result of mineral elements determination in the samples is presented in Table 2. The concentration of the elements varied. Copper was found to be 0.47 mg/100g. Zinc was 4.84 mg/100g and Manganese was 9.14 mg/100g. With exception of Copper (Cu), these values falls within the range reported in Ipomoea batatas leaves by the previous workers (3.34-3.95 mg/100g for Cu, 3.95 - 6.86 mg/100g for Zinc and 4.83 -10.03 mg/100g for Mn) Asibey-Berko and Tayie (1999), Ishida et al., (2002) and Monamodi et al., (2003). Iron concentration in the sample was found to be 12.19 mg/100mg and this value was lower than 36.69-147.87 mg/100g recorded in Ipomea batatas leaves (Asibey-Berko and Tayie 1999; Ishida et al., 2002).

Table 2: Mineral elements composition of Ipomoea batatas leaves

<table>
<thead>
<tr>
<th>Mineral element</th>
<th>Concentration (mg/100g)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fe</td>
<td>12.19</td>
</tr>
<tr>
<td>Mn</td>
<td>9.14</td>
</tr>
<tr>
<td>Cu</td>
<td>0.47</td>
</tr>
<tr>
<td>Zn</td>
<td>4.84</td>
</tr>
</tbody>
</table>

The result of antinutient concentration is presented in Table 3. The presence of oxalate, tannin, saponin and phytate were established. Their concentration were generally low (oxalate 1.00/100g, tannin 0.05/100g, phytate 2.02/100and saponin 0.34/100g). The presence of these anti-nutrients in food have been reported to be beneficial to the body because they contain anti-oxidants and also have mineral binding effect that prevents colon cancer by reducing oxidative stress in the lumen of intestinal tract (Vucenik and Shamsuddin, 2003). Phytate for example has been reported to be protective against Parkinson's disease in vitro (Xu et al., 2008).

Table 3: Anti-nutrient composition of Ipomoea batatas leaves

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Concentration (% Dry weight)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Saponin</td>
<td>0.34</td>
</tr>
<tr>
<td>Tannin</td>
<td>0.05</td>
</tr>
<tr>
<td>Phytate</td>
<td>2.02</td>
</tr>
<tr>
<td>Oxalate</td>
<td>1.00</td>
</tr>
</tbody>
</table>

CONCLUSION
The results of analyses carried out on Ipomoea batatas leaves have revealed that like other leafy vegetables, it is nutritionally endowed. The results suggests that the plant leaves if consumed in the right quantities could assist in meeting man's nutritional requirements for normal body growth and fight against ravaging disease that could arise from malnutrition most especially now that food supply appears to be inadequate for
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the ever growing population. It can also be concluded that most nutrient present in the *Ipomoea batatas* leaves will be readily available for body use as a result of the presence of anti-nutrients which will not affect the body system negatively. It is hereby recommended that people should consume *Ipomoea batatas* leaves and avail themselves with a lot of nutritional benefits therein.

REFERENCES


