ABSTRACT

Proximate analysis on *Ipomea aquatica* (green kangkong) was carried out using standard methods. The results revealed 51.36% moisture, 42.18% carbohydrate, 1.70% protein, 2.75% ash, 1.20% fiber and 0.81% fat. The investigation of mineral content in µg/ml showed that the vegetable was relatively high in iron, magnesium and calcium. Other minerals that were present include phosphate, manganese, sulphate and nitrates. The vitamin content was investigated using spectrophotometric methods and it revealed high contents in mg/100g of vitamins A, B₁, C and K. Relatively water-soluble vitamins were predominant over fat-soluble vitamins. Phytochemical screening of green kangkong revealed high concentrations of alkaloids, reducing sugar, soluble carbohydrate, flavonoids, while it contained lower concentrations of steroids, phenols, glycosides, β-carotene, saponins and tannins. The high carbohydrate, vitamin and mineral contents showed that the plant material can be a good source of nutrient for man and animal food. The natural endowments of phytochemicals showed that the plant has serious pharmacological and therapeutic effects apart from its nutritional essence.
KEYWORDS

*Ipomea aquatica*, green kangkong, mineral, vitamin , Phytochemicals

INTRODUCTION

Traditional societies have always exploited edible wild plants, including fruits and vegetables, to provide for themselves adequate food security and income generation (Edmonds and Cheweya, 1997). Fruits and vegetables generally form indispensable constituents of human diets supplying the body with minerals, vitamins and certain hormone precursors, in addition to small amounts of protein and energy (Akindahunsi and Salawu, 2005). However, many of these fruits and vegetables are yet to be adequately studied and utilized. An example is the green kangkong.

Consequently, it becomes imperative to investigate the proximate composition, mineral contents, vitamin compositions and phytochemical analysis, to evaluate the nutritional essence and other possible and useful application as well as provide a nutritional database that will include information on mineral nutrients. This has become necessary as only few vegetables are both nutritionally essential and medicinally important.

Industrial uses of plant products have mounted pressure on the food uses of some plants. Desert encroachment in some parts of the world where the land gets drier further from the oceans, has also wiped away some varieties of food crops and vegetables. These contribute to the global food crisis and have increased the search for safe plants that can provide most of the essential nutrients for human and animal feed. These nutrients include carbohydrates, proteins, lipids, minerals and vitamins. Most vitamins needed by animals cannot be produced in the body and therefore must be supplied in the diet (Gaby et al., 2000). Some of the vitamins produced in the body are not synthesized in amounts adequate for its daily needs (Carr and Frei, 2006). Plants synthesize most of the vitamins and serve as primary sources of these dietary essentials (Brody, 1999).

The plant *Ipomea aquatica* belongs to the plant family Convolvulacea, a moving glory family. It is a semi-aquatic tropical plant grown as a leaf vegetable (Oomem and Grubben, 1978). *Ipomea aquatica* is commonly called water convolvulus or water spinach and is highly invasive, forming dense mats over the surface of water bodies such as lakes, ponds, canals and ditches.

The green kangkong has green/white stem, green leaves with green/white petioles and white flowers (Siemonsma and Kasem, 1994). It is prolific in growth and can invade most cultivated areas such as rice and sugarcane fields and other areas with varying water levels (Schartd and Schmidt, 1990). The young shoot (tender) and/or the whole plant (stem and leaves) are cooked or lightly fried in oil and eaten in a variety of dishes. The vines are used as fodder for cattle and pigs. In the south-eastern part of Nigeria, it is eaten, cooked with oil and spices are added to enhance the relatively bland flavor. It is also used as a sauce for tuber crops such as yam and potatoes or as leaf vegetable component of farm food. It is claimed to be a potent agent in the treatment of gastro-intestinal disorders as well anemia.

MATERIALS AND METHODS

Fresh leaves of *Ipomea aquatica* were harvested from a rice farm at the Democracy Estate, behind PRESCO Annex of Ebonyi State University, Abakaliki, Ebonyi State, Nigeria. The leaves were thoroughly washed...
with distilled water, ground to reduce particle size and to increase the surface area. All the reagents used were of analytical grade from May and Baker Ltd, England and BDH Chem. Ltd., England.

METHODS

PROXIMATE ANALYSIS: The method of Pearson (1976) was employed for the determination of the proximate composition. The soxhlet method was also employed in the determination of the crude fat/oil in the sample using petroleum ether (40-60°C). The Kjedhal method was used for protein estimation while the crude fiber and ash contents were also determined (AOAC, 1980).

MINERAL ANALYSIS: The method of Andrew and Fett (1941), which depends on the measurement of color developed in the reaction of α1-dipyrirydyl and ferrous ion at 520nm was employed in evaluation of iron content. The official methods (A.O.A.C., 1980) were used in the determination of copper and manganese concentrations. The calcium concentration of the sample was determined by precipitation as the oxalate (Pearson, 1976). Vanadomolybdophosphoric acid method as described by Rand et al., (1976) was used for phosphate determination while nitrate was estimated using the method of Hoather and Rackham, (1959).

VITAMIN CONTENT: Spectrophotometric methods as described by Pearson (1976) were employed in the determination of vitamins A, C, E, and K concentrations while the methods of Ball (1994) were used for the determination of vitamins B₁, B₂, B₆ and B₁₂.

PHYTOCHEMICAL ANALYSIS: Investigation of the secondary metabolites accumulated in the plant was carried out. The concentration of alkaloids was determined using the method of Haslam (1966). The methods of Harborne (1973) were employed in the determination of flavonoids, glycosides, phenol, tannin, β-carotene, cyanogenic glycosides, steroids, saponins, reducing sugars and soluble carbohydrate.

RESULTS

Table 1
Proximate composition of fresh leaves of Ipomea aquatica

<table>
<thead>
<tr>
<th>COMPONENT</th>
<th>% COMPOSITION</th>
</tr>
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<tbody>
<tr>
<td>Moisture</td>
<td>51.36±0.02</td>
</tr>
<tr>
<td>Crude fat/oil</td>
<td>0.81±0.01</td>
</tr>
<tr>
<td>Crude protein</td>
<td>1.70±0.02</td>
</tr>
<tr>
<td>Crude fiber</td>
<td>1.20±0.02</td>
</tr>
<tr>
<td>Ash content</td>
<td>2.75±0.01</td>
</tr>
<tr>
<td>Carbohydrate</td>
<td>42.18±0.02</td>
</tr>
</tbody>
</table>

Table 2
Mineral analysis on Ipomea aquatica.

<table>
<thead>
<tr>
<th>MINERAL</th>
<th>CONCENTRATION (µg/ml)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Iron</td>
<td>6.925 ± 3.12</td>
</tr>
<tr>
<td>Magnesium</td>
<td>12,121 ± 3.21</td>
</tr>
<tr>
<td>Manganese</td>
<td>2,390 ± 6.38</td>
</tr>
<tr>
<td>Phosphate</td>
<td>1,096 ± 6.37</td>
</tr>
<tr>
<td>Sulphate</td>
<td>2,130.130 ± 49.52</td>
</tr>
<tr>
<td>Nitrate</td>
<td>693.30 ± 3.12</td>
</tr>
<tr>
<td>Calcium</td>
<td>18mg/100g</td>
</tr>
</tbody>
</table>
DISCUSSION

The results of the proximate analysis as seen in table 1 revealed that *Ipomea aquatica* (green kangkong) contains 51.36% moisture, 38.18% carbohydrate, 1.70% protein, 2.75% ash, 1.20% fiber and 0.81% fat. It was observed that it is not a good source of vegetable oil. The high carbohydrate content showed that the plant material can be a good source of food.

The investigation of mineral contents in table 2 showed that it contained in µg/ml 6,925±3.12 iron, 12,121±3.21 magnesium, 2,399±6.38 manganese, 1,096±6.37 phosphate, 693.60±3.14 nitrate, 2,130.130±49.52 sulphate and 18.32mg/100g of calcium. These minerals play significant roles in several biological processes. Bone growth and turnover are influenced and regulated by the metabolism of calcium, phosphate and magnesium while iron is important in the formation of haemoglobin (Burtis and Ashwood 2003).

The investigation of the vitamin contents revealed 13.14±0.00 of vitamin A, 6.35±0.33 vitamin B₁, 13.08±0.04 vitamin B₂, 8.87±0.88 vitamin B₆, 0.78±0.02 vitamin B₁₂, 83.57±2.52 vitamin C, 0.07±0.01 vitamin K (the anticoagulant vitamin) and 25.99±0.37 for vitamin E. Vitamin A is essential in vision as the precursor for the visual purple, rhodopsin, as well as plays a role in immunity. Vitamin B₂ (riboflavin) is essential for energy production and in its coenzyme forms (FMN and FAD), it serves as hydrogen transport systems (Mayes 2000); vitamin C an antioxidant, facilitates wound healing, production of collagen, formation of red blood cells and boosts immune system (Monsen, 2000); vitamin E is an antioxidant and plays a role in cellular respiration (Burtis and Ashwood, 2003); niacin (nicotinic acid) is converted to NAD and NADP, which are coenzymes for various oxidoreductases (Burtis and Ashwood, 2003). Thus it contains both fat-soluble and water-
Soluble vitamins which are essential for normal healthy growth.

*Ipomea aquatica* contains some vital phytochemicals as shown in table 4. Phytochemical screening of green kangkong revealed concentrations in mg/100g of 7398.3±118.7 alkaloids, 234.0±32.1 steroids, 21.4±3.6 saponins, 113.7±8.64 phenols, 1239.2±112.2 reducing sugar, 938.2±28.9 flavonoids, 9.46±0.1 tannins, 26.4±0.8 β-carotene, 268.4±12.4 glycosides, 17.2±0.6 cyanogenic glycosides and 1578.9±56.8 soluble carbohydrate.

Phytochemicals are naturally occurring substances found in fruits, vegetables and grains. Unlike vitamins and minerals, they have no nutritional value. They can however influence various body processes. They work together with nutrients and dietary fiber to protect the body against diseases, slow the aging process and reduce the risk of many diseases such as cancer, heart disease, stroke, high blood pressure, cataracts, osteoporosis and urinary tract infection. Alkaloids have analgesic effects (Okwu and Ndu, 2006). Morphine alkaloids are powerful pain relievers and narcotics (induces sleep or drowsiness). Many plant glycosides are used as medications. In animals including humans, poisons are often bound to sugar molecules of glycosides in order to move them from the body. Tannins prevent urinary tract infection by preventing bacteria from adhering to the walls.

REFERENCES


