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Full Length Research Paper

Assessment of nutritional values of three underutilized indigenous leafy vegetables of Ebonyi State, Nigeria

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The nutritional values of three underutilized indigenous leafy vegetables of Izzi land in Ebonyi State of Nigeria; *Zanthoxylum zanthoyloides* Herms, *Vitex doniana* Sweet and *Adenia cissamploides* Zepernick, were investigated. Their proximate and mineral values (Ca, P, Na, Mg, Zn, K, Fe, Cu, Pb) were determined. Results of the proximate analysis showed their moisture contents to be 10.8, 10.2 and 9.6% for *V. doniana*, *A. cissamploides* and *Z. zanthoxyloides,* respectively. Their protein contents were 8.74, 8.5 and 6.12%, respectively, while their carbohydrate values were 58.94, 59.5, and 66.2% respectively. Fat and ash contents were highest in *Z. zanthoxyloides* (8.1 and 3.5%, respectively), while crude fiber content was highest in *A. cissampeloides* (14.6%). Macro and micro nutrients of these vegetables showed high levels of Ca 90.1 > 72.08 > 54.06 mg/100 g for *Z. zanthoyloide, V. doniana* and *A. cissamploides,* respectively. High values of Cu and Mg were recorded for *Z. zanthoxyloides* and *V. doniana.* The result also indicated the values for Na and K, while the complete absence of Zn and Pd in the three vegetables was of significant interest. The mineral values of the three vegetables exceeded 1% of their dry weights. There was a significant difference (P < 0.05) between their nutritional values and those of the conventional leafy vegetables.

Key words: Underutilized, indigenous, leafy vegetables, nutritional value, Ebonyi State.

INTRODUCTION

Vegetables are important sources of protective foods, which are highly beneficial for the maintenance of good health and prevention of diseases (Sheele et al., 2004; Nnamani et al., 2007). Indigenous leafy vegetables are vegetables of a locality which originated from an area and may or may not be confined to that particular region (Guarino, 1997). They account for about 10% of the world higher plants often regarded as weeds. Some indigenous leafy vegetables grow in the wild and are readily available in the field as they do not require any formal cultivation. Many of them are resilient, adaptive, and tolerate adverse climatic conditions more than the exotic species (Raghuvanshi, 2001). Although they can be raised comparatively at lower management cost and on poor marginal soil, they have remained underutilized, due to lack of awareness of their nutritional values in favour of the exotic ones (Chweya and Eyzaguirre, 1999; Odhav, 2007).

The World Health Organization (1992) reported that chronic under nutrition affects over 200 million people or 42% of the population in Sub-Sahara Africa. Indigenous leafy vegetables represent inexpensive but high quality nutritional sources, for the poor segment of the population especially where malnutrition is wide spread as in Nigeria and Ebonyi State in particular. Leafy vegetables are rich sources of carotene, ascorbic acid, riboflavin, folic acid and minerals like calcium, iron and phosphorous (Nnamani et al., 2007). George (2003) stated that even though the bulk of their weight is water, leafy vegetables represent a veritable natural pharmacy of minerals, vitamins and phytochemicals. He concluded that the potassium content of leafy vegetables is good in the control of diuretic and hypertensive complications, because it lowers arterial blood pressure. The fiber content of vegetables contribute to the feeling of satisfaction and prevents constipation (Noonan, 1999), while the proteins in vegetables are superior to those found in

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fruits, although inferior to those found in grains and legumes (George, 2003).

In Izzi land, Ebonyi State, Nigeria, due to her rich biodiversity, many underutilized indigenous leafy vegetables of promising nutritional values which can nourish the ever increasing human population exist. Ebonyi State lies within the Cross River plain, approximately between 7^{o} 30^{1} N and 8^{o} 30^{1} N latitude and 5^{o} 40^{1} E and 6^{o} 45^{1} E longitude, located in the mosaic of lowland rainforest and secondary grassland vegetation zone found in some parts of Southeastern Nigeria (Ofomata, 1975; White, 1983).

The purpose of this study was to identify and conduct preliminary assessment of the nutritional values of three underutilized indigenous leafy vegetables of Izzi land in Ebonyi State, Nigeria. The ultimate goal of the research would be to enhance better food selection and consequently improve the nutritional statuses of both the rural and urban dwellers.

MATERIALS AND METHODS

Collection of plants

Freshly harvested leaves of *Zanthoxylum zanthoxyloides* (Hercules club, 'Nka'), *Vitex doniana* (Black plum, 'Uchakuru') and *Adenia cissampeliodes (*Planch, 'Isororo') were collected from Izzi area of Ebonyi State, Nigeria. The plants were taken to the curator in the herbarium of Botany Department, University of Nigeria, Nsukka for identification.

The leafy parts of these vegetables were washed, cut and oven dried at 90°C for 6 h. The dried leaves were pulverized, package in airtight sterile bottles, labeled and stored in a refrigerator until used.

Proximate analysis

The chemical analysis of percentage crude protein, crude fiber, moisture, ash, fat and carbohydrate were carried out using methods described by Pearson, (1976). The crude protein was obtained by determining the organic nitrogen content of the sample using micro-Kjeldah method and multiplying the nitrogen by a protein conversion which is usually 6.25.

The ash content of the leaves was estimated by igniting the weighed sample in the weighed crucible at a temperature of 500°C for about 3 h in a muffle furnace, while the moisture content was determined using oven method. The crude fiber and fat determination were done by hydrolyzing the sample with 0.128 ml of H_2SO4 and 0.223 ml of KOH and Soxhlet extraction method, respectively. The carbohydrate content was determined by their difference.

Physiochemical analysis

The mineral contents namely, Ca, Mg, Cu, Mn, Pb, P, Zn, were determined using dry ashing procedure as described by Association of Agricultural Chemists (AOAC, 1990). About 2 g of the sample was pre-ashed in a crucible for 1 - 2 h until the sample is completely charred on a hot plate. The pre-ashed sample was then placed on a muffle furnace and ashed at 500°C for about 3 h or until the ash is white. After ashing the sample was cooled and weighed. This was 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 then used for individual mineral determination using Spectrophotometer and flame photometer.

RESULTS AND DISCUSSION

The result of the proximate analysis of the indigenous leafy vegetables is presented Figure 1. It showed that these plants are potentially endowed with essential nutrients required for maintainance of good human health. Their moisture contents are 9.6, 10.2 and 10.8% in *Z. zanthoxyloides*, *V. doinana* and *A. cissampeloides*, respectively. These are however low because the leaves were oven dried before analysis. Since this percentage of moisture was found in the dry milled (DM) sample, it indicates that freshly harvested leaves will contain higher amount of moisture. This result is in line with the work of George (2003), who reported that although moisture content makes an important contribution to the texture of the leaves and help in maintaining the protoplasmic content of the cells, it also makes them perishable and susceptible to spoilage by micro-organism during storage.

The ash content, which is a measure of the mineral content of food, had values ranging from 8.10 - 6.30% (Figure 1) with *Z. zanthoxyloides* having the highest and *V. doinana* having the least ash content. These results are not in agreement with the results of Ajayi et al. (2006) who reported an ash content of some leafy vegetables that ranged from 0.6 – 34%.

Crude protein had values ranging from 8.74 - 5.12% (Figure 1) with *V. doinana* having the lowest and *Z. zanthoxyloides* the highest value. The amount of protein which is about 75% (when converted) of the total nitrogen in the leafy vegetables is variable, ranging from 5 – 10% of fresh weight or 13 - 30% for dry weight basis. These percentages are higher than the 3 – 8% and 11 – 28% results reported by Oyenuga and Fetuga (1975). However the crude protein level in the dry milled samples are lower and cannot be compared favourable with the percentage dry milled values reported for *Telfairia occidentalis* leaves (22.4%), *Tamarindus indica* (24.3%), *Hibiscus esculentus* (23%) and *Parkia biglobosa* (20.9%), as reported by Glew et al. (1997), Akwawowo et al. (2000) and Igbal et al. (2006). So consumption of 100 g of *V. doinana, Z. zanthoxyloides* and *A. cissompeloides* may not be capable of providing 27 g of protein which satisfies the recommended daily allowance of protein for children (FAO, 1986).

The crude fat content of *A. cissompeloides*, *V. doinana* and *Z. zanthoxyloides* which ranged from 3.50 to 2.10% (Figure 1) may not compare favourably with dry milled percentage values reported for leafy vegetables like *Brachystegia eurycoma* (5.78%) and *T. indica* 4.2% (Ajayi et al., 2006). However, it is higher than the dry milled percentage values for leafy vegetables like *Celosia argentea* (0.7%), fluted pumpkin (1.8%), *Gnetum africa-*

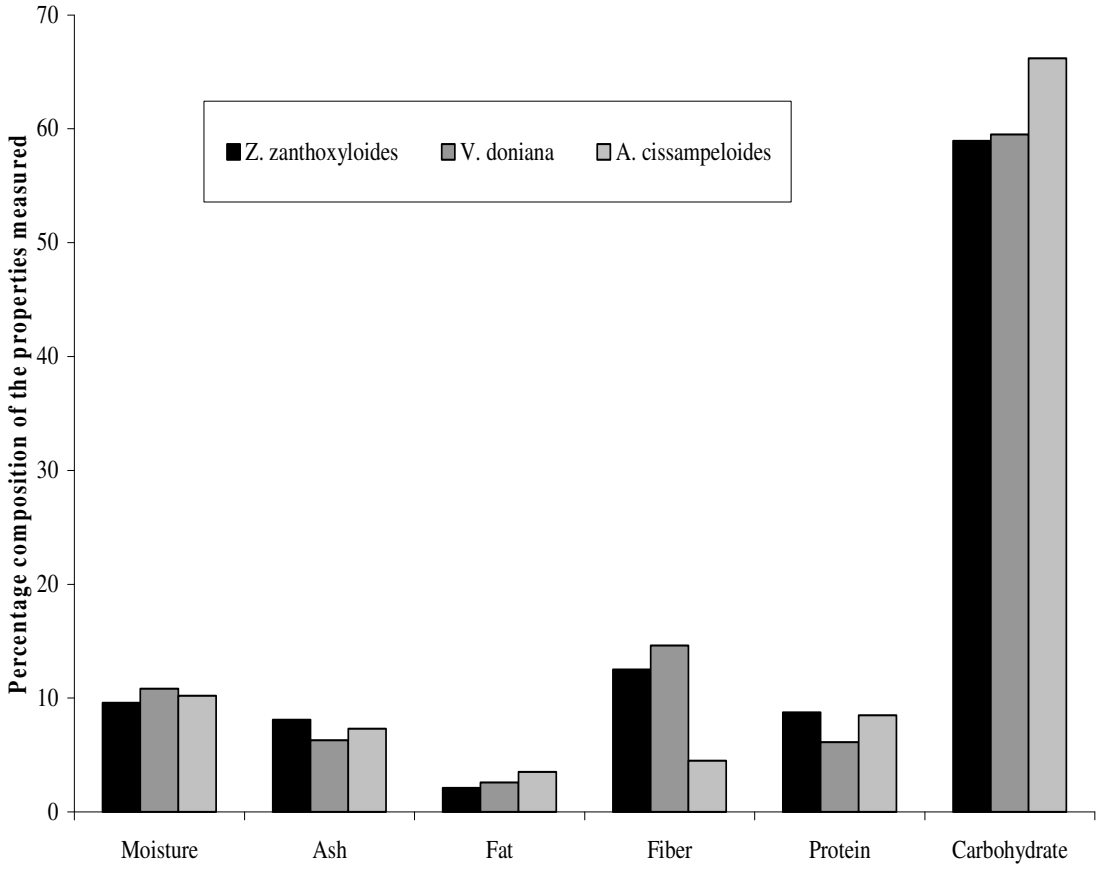

Figure 1. Proximate composition of three indigenous leafy vegetables.

num (1.2%) as reported by Okafor (1995). A child consuming 100 g of *V. doinana*, *A. cissompeloides*, *Z. zanthoxyloides* would be ingesting approximately 2.60, 3.5 and 2.10% of fatty acid which translates to 22.2, 30.4 and 21.3 kcal of energy, and is approximately a high amount. The fiber content of these leafy vegetables (Figure 1) ranged from 12.50 - 4.50%. These exceeded the fiber content of *T. triangulare* (2.0%) *T. occidentalis* (1.7%) and *C. argentea* (1.8%) (Akachukwu and Fawusi, 1995). This indicates that the fiber (roughage) content of these plants are high will promote digestion and prevent constipation when consumed.

The carbohydrate level of the underutilized indigenous vegetable (Figure 1) ranged from 58.94% in *Z. zanthoxyloides* to 66.20% in *A. cissampeloides*. The level of carbohydrate in these vegetables is high compared to the carbohydrate level of 8.0 g in *T. occidentalis* (FAO, 1988). This indicates that the indigenous vegetables can act as better food supplement in providing carbohydrate more than *T. occidentalis.*

The three vegetables studied are good sources of micro-nutrients. Results indicated calcium content which ranged between 54.06 - 90.100 mg/100 g (Figure 2). The highest value was obtained from *Z. zanthoxyloides,* followed by *V. doinana* and *A. cissompeloides*. Thus, including these calcium rich vegetables in daily diet ensures the 20 – 25% of the daily requirement for calcium that aid strong bones and healthy teeth (Raghuvanshi et al., 2001).

The result of the mineral analysis (Figure 2) also showed complete absence of zinc and lead. These are antioxidants that are not good for human consumption. This is of significant interest because it potentially indicates that these plants are endowed with essential nutrients good for human consumption.

Conclusion

It should be noted that variations in the chemical compositions of leafy vegetables, including quantity of compounds that are useful and detrimental to humans are influenced by environmental conditions and the age of plants at harvest. Again, the projection of Sub Saharan Africa for the next two decades, particularly as regards life expectancy and food security, are rather bleak and challenging. Therefore, practical intervention in health and nutrition are needed. Identifying some of these underutilized indigenous leafy vegetables and their inculcation into our diet could potentially address some of

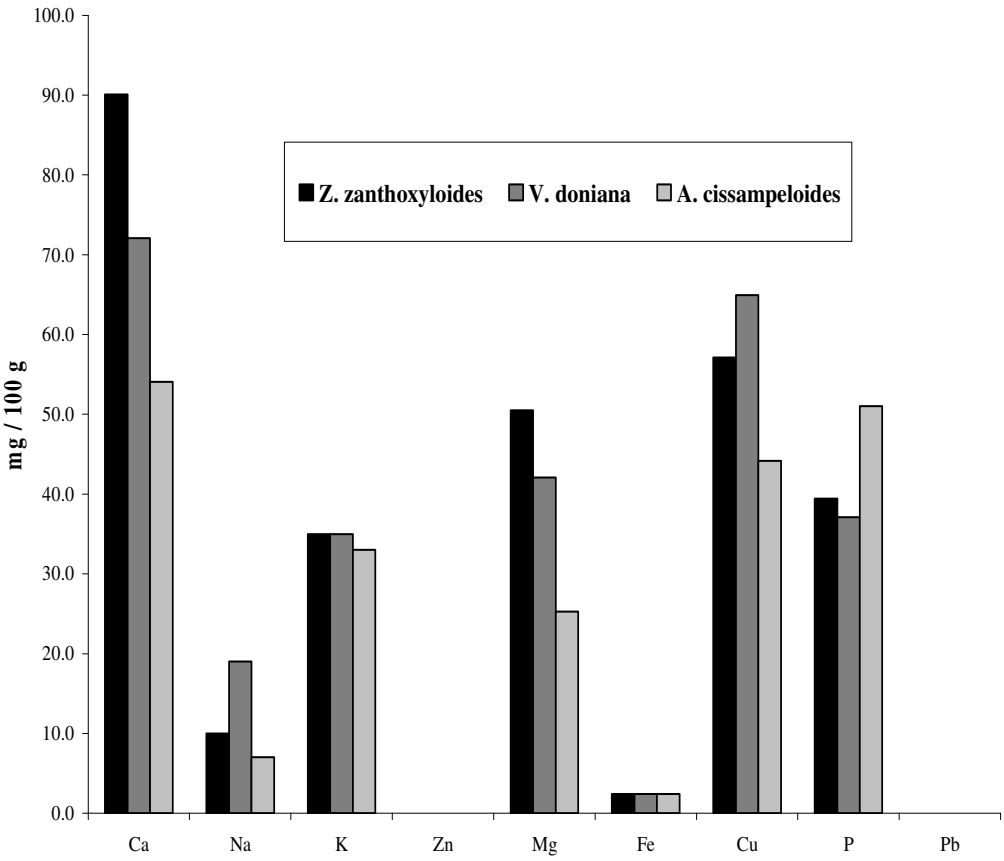

Figure 2. Physiochemical compositions of three indigenous leafy vegetables.

these challenges.

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