

Ethnobotanical Survey of Underutilized Crops and Spices of Some Local Communities in Nigeria: Potentials for Improved Nutrition, Food Security and Poverty Reduction

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Abstract: Traditional leafy vegetables (TLVs) represent inexpensive but high quality nutritional sources, for the poor segment of the population especially where malnutrition is wide spread. The objectives of this research were i. to identify and document the traditional leafy vegetables and spices of Ebonyi State, and ii. to assess their nutritional values with a view of enhancing their selection as components of cooked food. Market and field surveys were carried out for traditional leafy vegetables and spices in three major clans in Ebonyi North senatorial zone, Ebonyi State: Izzi, Izhia and Ngbo clans. Informal interviews were also conducted on where, when and how they are obtained for sale. Finally, proximate and physiochemical analysis on some of these TLVs were done. Result recorded twenty-seven TLVs and five spices from 23 plant families. Out of this 46.7 % of the plant collections were collected from the wild, while 40 % were cultivated, 33.3 % of the TLVs were tree species, 30 % were herbaceous plants, and 23 % were climbers, while 13.3 % were shrubs. 60 % of the species were propagated by seed, while 36.7 % were propagated by vegetative means. The parts consumed were mainly the leaves (76.7 %), the stem, flower and the seeds. 40 % of the materials collected were major income earners for the rural populace, 36.7 % earned some income, although small, while 23.3 % had the potential of being transformed into large scale income earner. Results also indicated that three of the TLVs were good sources of micro-nutrients. Their calcium content ranged between 54.06 - 90.10 mg/100 g. The ash content ranged from 8.10 - 6.30 % while protein ranged from 5 - 10 % of fresh weight or 13 - 30% for dry weight. Their fibre (roughage) content was high and will promote digestion and prevent constipation when consumed.

Key Words: Diversity, Traditional leafy vegetable, food security, poverty reduction, South-eastern Nigeria.

I. INTRODUCTION

Vegetables are important protective foods, which are highly beneficial for the maintenance of good health and prevention of diseases. They contain valuable food nutrients, which can be successfully utilized to build up and repair the body. They are rich sources of carotene, ascorbic acid, riboflavin, folic acid and minerals like calcium, iron and phosphorus. In nature there are many underutilized traditional leafy vegetables of promising nutritive values, which can nourish the ever-increasing human population. Traditional 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 of them grow in the wild and are readily available in the field as they do not require any formal cultivation strategy (Nnamani *et al*, 2009) . Many of them are resilient, adaptive, and tolerate adverse climates (Raghuvanshi, 2001). Although, they can be raised comparatively at lower management cost even on poor marginal lands, they have remained underutilized due to lack of awareness and popularization of technologies for their proper utilization (Chweya and Eyzaguirre, 2002, Odhav, 2007). Agriculture is a heritage occupation of the people of Ebonyi State, especially those of the Izzi, Ngbo and Izhia clans. Notwithstanding, stunting growth and deficiency of some micronutrient (vitamin A, iron, iodine and zinc) are prevalent in this part of the country. The World Health Organization (1992) reported that chronic under nutrition affects over 200 million people or 42% of the population in Sub-Sahara Africa. The long-term malnutrition problem of the poor nations cannot be solved by food aid or food trade with the affluent countries but rather by the adequate utilization of indigenous plant foods (Ihekoronye and Ngoddy, 1985). This is because traditional food resources can make substantial contribution in meeting the nutritional needs of the population, especially the low income group and particularly in times of seasonal scarcity (Okeke *et al.*, 1993, 2008). Traditional leafy vegetables represent inexpensive but high quality nutritional sources, for the poor segment of the population.. Even though the bulk of their weight is water, leafy vegetables represent a veritable natural pharmacy of minerals, vitamins and phytochemicals (George, 2003). For example, 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 fruits, although inferior to those found in grains and legumes (George, 2003). Characterization of the species is the first and most important step in understanding the entire food system of indigenous peoples (Okeke *et al.*, 2008). Increasing pressure caused by human activities is continually disrupting the existence, balance and natural regeneration of bioresources, with the result that some of these traditional leafy vegetables are already endangered. This gradual loss of genetic diversity may deprive future generations with useful resources for the enhancement of their health (Ayodele, 1996). Documentation of the wild and cultivated fruits and vegetables in some parts of Nigeria has been made (Okafor, 1975; Dania-Ogbe, 2001), but none has been done for Ebonyi State, Nigeria. The aims of this research were i. to identify and document the traditional leafy vegetables and spices of Ebonyi State, and ii. to assess their nutritional values with a view of enhancing their selection as components of cooked food, thereby improving the nutritional statuses of both rural and urban dwellers.

II. Materials And Methods

2.1 Plant Collection and Identification

Market surveys were carried out for traditional leafy vegetables and spices in two major clans in Ebonyi North senatorial zone, Ebonyi State: Izzi and Ngbo/Izhia clans. Major markets in these clans were targeted: Nwakpu, Iboko, Iziogo, Nwaida and Nkwagu in Izzi clan and Eke Izhia, Okwor and Affia Opfu (Odeatang Akpaka) in Ngbo/Izhia clan. The traditional leafy vegetables and spices on sale in these markets were recorded. Informal interviews were conducted with some of the marketers about the variety of vegetables, where, when and how they are obtained for sale in the markets. The field surveys were also carried out in at least three villages each in the two clans under study. The researchers went into the farms and forests with at least two villagers for observations on the habits and forms of the plants. Identification of plants was done in the fields and markets. Plants that could not be readily identified were carried to the curator in the herbarium at the Department of Botany, University of Nigeria, Nsukka and authenticated with (Keay, 1989 and Inyang, 2003). Voucher specimens were deposited in Ebonyi State herbarium.

2.2 Proximate analysis

Freshly harvested leaves of *Zanthoxylum zanthoyloides* Herms (Hercules club, 'Nka'), *Vitex doniana* Sweet (Black plum, 'Uchakuru') and *Adenia cissamploides* Zepernick, (Planch, 'Isororo') were collected from Izzi area of Ebonyi State and washed, cut and oven dried at 90°C for 6 hrs. The dried leaves were pulverized, packaged in airtight sterile bottles, labelled and stored in a refrigerator until used. The chemical analysis of percentage crude protein, crude fiber, moisture content, 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 were estimated by igniting the weighed sample in the weighed crucible at a temperature of 500°C for about 3 hrs 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 H₂SO₄ and 0.223 ml of KOH and Soxhlet extraction method, respectively. The carbohydrate content was determined by their difference.

2.3 Physiochemical analysis

The mineral contents of the plant leaves, namely, Ca, Mg, Cu, Mn, Pb, P, Zn, were determined by using dry ashing procedure as described by Association of Agricultural Chemists (AOAC, 1984). About 2 g of the sample was pre-ashed in a crucible for 1 - 2 hrs until the sample was 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 hrs or until the ash was 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.

III. Results And Discussion

3.1 Traditional Leafy Vegetables and spices of Ebonyi State of Nigeria

Twenty-seven traditional leafy vegetables and five spices were identified and documented from the two clans studied (Fig 1). The botanical names, families, local and english names of the varieties, and their source localities were recorded (Table 1). The vegetables and spices belongs to 23 plant families including Fabaceae, Cucurbitaceae, Tiliaceae, Moraceae etc. 83.3 % of the plant collections were used in the form of leafy vegetables, 10 % were spices, while 6.7 % could be used both as a vegetable or as spice. Out of these, 46.7 % of plants were collected from the wild, while 40 % of plants were cultivated and the remaining 13.3% were

collected from home gardens and the wild (Table 2). Among the cultivated species, 43.3 % are cultivated in compound farms (backyard gardens), 20 % in outlying farms, 6.6 % still seen in the wild, while 30.1% can be obtained from the entire habitats. 33.3 % of the leafy vegetables are tree species, 30 % are herbaceous plants, 23 % are climbers, while 13.3 % are shrubs. 26 % of the plant genetic materials identified are threatened, including *Newbouldia leavis* (P.Beauv) Seemann Bureau (Bignoniaceae), *Ipomoea aquatica* Forsk (Convolvulaceae), *Lecaniodiscus cupanioides* (Sapindaceae), *Zanthoxylum zanthoxyloides* Lam (Rutaceae), *Occimum gratissimum* L. (Lamiaceae), *Piper guinensis* Schum &Thonn (Piperaceae), *Gongronema latifolia* Benth (Apocynaceae) and *Monodora myristica* (Annonaceae).About 60 % of the plant species were propagated by seeds, 36.7 % was propagated by vegetative means, while the remaining 3.25 % can be propagated by both methods. The parts consumed were mainly the leaves (76.7 %). The minor (23.3%) consumable like the stem, flower and seeds. Majority of the plants collections have potential for generating income for the smallholder farmers, especially women.

3.2 Usage, income generation prospects and seasonality of the leafy vegetables and spices of Ebonyi State Nigeria

The usage of the traditional leafy vegetables and spices, including their medicinal values were shown in Table 3. In all the cases, it is women that either cultivates or collect the vegetables from the wild as an income generating commodity or to supplement family's meal. At every season of the year, there are always some vegetables and spices for sale. However, most of them are abundant during the rainy season.

3.3 Proximate analysis of three traditional leafy vegetables

The result of the proximate analysis of three traditional leafy vegetables are presented in Fig. 1 as culled from Nnamani *et al* (2009). Their moisture contents were 9.6, 10.2 and 10.8 % in *Zanthoxylum zanthoxyloides*, *Vitex doniana* and *Adenia cissampeloides*, respectively. This was low, but was attributed to the fact that the leaves were oven dried before analysis. Higher percentage moisture content is expected in freshly harvested leaves. The ash content of the three plants, a measure of the mineral content of food ranged from 8.10 - 6.30% (Figure 1) with *Zanthoxylum zanthoxyloides* having the highest and *Vitex doniana* having the least value. These results differed 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 values ranging from 8.74 - 5.12 % (Figure 1) with *Vitex doniana* having the lowest and *Zanthoxylum zanthoxyloides* having the highest value. The amount of protein which is about 75 % (when converted) of the total nitrogen in the leafy vegetables was variable for the three plants, ranging from 5 – 10 % in fresh weight or 13 - 30% in dry weight. These percentages were higher than the 3 – 8% and 11 – 28% results reported by Oyenuga and Fetuga (1975), but lower than values reported for *Telfairia occidentalis* leaves (22.4%), *Tamarindus indicus* (24.3%), *Hibiscus esculentus* (23%) and *Parkia biglobosa* (20.9%) reported for dry milled samples (Glew *et al.* 1997;25 Akwawowo *et al.* 2000 26and Igbal *et al.* 2006). So consumption of 100 g of *Vitex doniana*, *Zanthoxylum zanthoxyloides* and *Adenia cissampeloides* 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 *Adenia cissampeloides*, *Vitex doniana* and *Zanthoxylum zanthoxyloides* ranged from 3.50 to 2.10% (Figure 1) may not compare favourably with dry milled percentage values reported for *Brachystegia eurycoma* (5.78%) and *Tamarindus indicus* 4.2% (Ajayi *et al.*, 2006). However, it is higher than the dry milled percentage values for other vegetables like *Celosia argentea* (0.7%), fluted pumpkin (1.8%), *Gnetum Africanum* (1.2%) (Okafor, 1995).²⁹ A child consuming 100 g of *Vitex doinana*, *Adenia cissampeloides*, *Zanthoxylum 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 *Talinum triangulare* (2.0%) and *Telfairia occidentalis* (1.7%) (Akachukwu and Fawusi,1995). This indicates that the fiber (roughage) content of these plants was high and will promote digestion and prevent constipation when consumed. The carbohydrate level of the underutilized indigenous vegetable (Figure 1) ranged from 58.94 % in *Zanthoxylum zanthoxyloides* to 66.20 % in *Adenia cissampeloides*. These values were high compared to the carbohydrate level of 8.0 g in *Telfairia occidentalis* (FAO, 1988). This indicates that the indigenous vegetables can act as better food supplement in providing carbohydrate.

3.4 Physiochemical analysis

. Results indicated that calcium content ranged between 54.06 - 90.100 mg/100 g (Figure 2). The highest value was obtained from *Zanthoxylum zanthoxyloides*, followed by *Vitex doniana* and *Adenia cissampeloides*. Including these calcium rich vegetables in daily diet would ensure 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 which are antioxidants. This is of significant interest because it potentially indicates that the plants are endowed with essential nutrients good for human consumption.

IV. Conclusion

The projection of Sub Saharan Africa for the next two decades, particularly as regards life expectancy and food security is rather bleak and challenging. Practical intervention in health and nutrition are needed. Identifying some of these underutilized crops and their inculcation into our diet could potentially address some of these challenges. The income generating potentials of the identified traditional vegetables is essential in alleviating the poverty level of rural farm families especially women on whose shoulders the responsibilities of caring for the family rests. Several traditional leafy vegetables and spices of Ebonyi State have been identified with potentials for income generation, poverty reduction and could help in reducing macronutrient deficiency for the smallholders farmers especially women, children and the elderly. The plants are endowed with essential nutrients required for maintenance of good health. The presence of various phytochemicals in these plants can helped to meet the nutritional needs of the rural farm families, thereby assisting in primary Health Care Delivery, since most of them cannot assess the general health care services. It therefor recommends that sustainable utilization of these genetic resources could also aid carbon sequestration in the ecosystem

Table1. Traditional Leafy Vegetables and spices of Ebonyi State of Nigeria

S/N	Botanical Name	Family	English Name	Source
1	<i>Abelmoschus esculentus</i> (L.) Monench	Malvaceae	Ladies finger	Izzi, Ngbo/Izhia
2	<i>Adenia cissampelioides</i> Zepernick,	Passifloraceae	Planch,	Izzi
3	<i>Amaranthus spinosus</i> L.	Amaranthaceae	Spiny amaranth	Izzi, Ngbo/Izhia
4	<i>Bombax buonopozense</i> L. Gaertn.	Bombacaceae	White silk cotton	Izzi
5	<i>Capiscum frutescens</i> L.	Solanaceae	African pepper	Izzi, Ngbo/Izhia
6	<i>Citrullus vulgaris</i> Schrad (Lin) O. Ktze	Cucurbitaceae	Wild ground Melon	Izzi, Ngbo/Izhia
7	<i>Colocasia exculentus</i> L.	Araceae	Cocoa yam	Izzi, Ngbo/Izhia
8	<i>Corchorus olitorius</i> L.	Tiliaceae	Bush Okra	Izzi
9	<i>Cucurbita pepo</i> L.	Cucurbitaceae	Pumpkin	Izzi, Ngbo/Izhia
10	<i>Ficus capensis</i> Thunb.	Moraceae	Fig	Izzi, Ngbo/Izhia
11	<i>Ficus ottoniifolia</i> L	Moraceae	Hedge fig	Izzi, Ngbo/Izhia
12	<i>Gongronema latifolium</i> Benth	Apocynaceae	Sodom apple	Izzi
13	<i>Ipomoea aquatica</i> Forsk	Convolvulaceae	Swamp mor. glory	Izzi
14	<i>Ipomoea batatas</i> (L.) Lam.	Convolvulaceae	Sweet Potato	Izzi
16	<i>Lecaniodiscus cupanioides</i> Lin	Sapindaceae	-	Izzi, Ngbo/Izhia
17	<i>Monodora myristica</i> Gaertn Dunal	Annonaceae	Calabash Nutmeg	Izzi, Ngbo/Izhia
18	<i>Moringa oleifera</i> Lam	Moringaceae	Drum stick plant	Izzi, Ngbo/Izhia
19	<i>Newbualdia leavis</i> (P.Beauw) Seemann Bureau	Bignoniaceae	Boundary tree	Izzi
20	<i>Nauclea diderrichii</i> (DeWild &Th. Due.) Merrill	Rubiaceae	Opepe	Izzi
21	<i>Occimum gratissimum</i> L.	Tiliaceae	Tea bush	Izzi, Ngbo/Izhia
22	<i>Piper guinensis</i> Schum &Thonn	Piperaceae	Guinea black pepper	Izzi, Ngbo/Izhia
24	<i>Pterocarpus santalinoides</i> L, Herit ex D C	Fabiaceae	White Africa padauk	Izzi, Ngbo/Izhia
25	<i>Pterocarpus soyauxii</i> Taub.	Fabiaceae	African padauk	Izzi
26	<i>Senna occidentalis</i> Linn	Fabiaceae	Negro Coffee	Ngbo/Izhia
27	<i>Solanum nigrum</i> Linn	Solanaceae	Black nightshade	Izzi, Ngbo/Izhia
28	<i>Talinum triangulare</i> Willd	Portulacaceae	Water leaf	Izzi, Ngbo/Izhia
29	<i>Telfairia occidentalis</i> Hook	Cucurbitaceae	Fluted pumpkin	Izzi, Ngbo/Izhia
30	<i>Vernonia amygdalina</i> Del.	Asteraceae	Bitter leaf	Izzi, Ngbo/Izhia
31	<i>Vitex doniana</i> Sweet	Verbenaceae	Black plum	Izzi, Ngbo/Izhia
32	<i>Zanthoxylum zanthoxyloides</i> Lam	Rutaceae	Hercules club	Izzi, Ngbo/Izhia

Table 2. Characteristics of traditional leafy vegetables and spices of Ebonyi State Nigeria

S/N	Scientific Name	CG	SD	LUL	LF	MP	S/S	P/C	F	CI
1	<i>Abelmoschus esculentus</i>	V	C	CF	S	SD	NT	L	F	M
2	<i>Adenia cissampeliodes</i>	V	W	W	C	VG	NT	L	O	P
3	<i>Amaranthus spinosus</i> L.	V	C	CF	H	SD	NT	L/ST	O	P
4	<i>Bombax buonopozense</i> L. Gaertn.	V	W	CF/W	T	SD	NT	L	O	S
5	<i>Capiscum frutescens</i> L.	V/SP	C	CF	H	SD	NT	L	F	M
6	<i>Citrullus vulgaris</i>	v	C	OF	H	SD	NT	L	O	P
7	<i>Colocasia exculenta</i> L.	V	C	CF	H	VG	NT	L	F	S
8	<i>Corchorus olitorius</i> L.	V	SW/C	OF	H	SD	NT	L	O	S
9	<i>Cucurbita pepo</i> L.	V	C	OF	C	SD	NT	L	F	S
10	<i>Ficus sur</i> Thunb.	V	W	W	T	SD	NT	L	O	S
11	<i>Ficus ottoniifolia</i>	V	W	W	T	SD	NT	L	F	S
12	<i>Gongronema latifolia</i>	SP	C/W	OF	C	VG	T	L/ST	F	P
13	<i>Ipomoea aquatica</i>	V	W	W	C/H	VG	T	L	O	S
14	<i>Ipomoea batatas</i>	V	C	CF	C/H	VG	NT	L	F	M
15	<i>Lecaniodiscus cupanioides</i>	V	W	W	T	SD	T	L	O	S
16	<i>Monodora myristica</i>	SP	SW	W	T	SD	T	SD	F	M
17	<i>Moringa oleifera</i>	V	C/SW	CF	T	SD/VG	NT	L/ST/FL/SD	O	P
18	<i>Newbouldia leavis</i>	V	W	CF/W	T	VG	T	L	O	S
19	<i>Nauclea diderrichii</i>	V	W	W	T	SD	NT	L	O	S
20	<i>Occimum gratissimum</i> L.	V/SP	C	CF	H	SD	T	L	O	M
21	<i>Piper guinensis</i>	SP	W	CF	C	SD	T	SD/L	F	M
22	<i>Pterocarpus santalinoides</i>	V	W	CF	T	VG	NT	L	F	P
23	<i>Pterocarpus soyeaxii</i>	V	W	CF	H	VG	NT	L	F	M
24	<i>Senna occidentalis</i>	V	W	W	S	SD	NT	L	O	S
25	<i>Solanum nigrum</i>	V	C	CF	H	SD	NT	L/FT/SD	F	M
26	<i>Talinum triangulare</i>	V	C	CF	H	SD	NT	L	O	M
27	<i>Telferia occidentalis</i>	V	C	OF	C/H	SD	NT	L/SD	F	M
28	<i>Vernonia amygdalina</i>	V	C	CF	S	VG	NT	L	F	M
29	<i>Vitex doniana</i> Sweet	V	W	OF	T	VG	NT	L	O	P
30	<i>Zanthoxylum zanthoxyloides</i>	V	W	W	S	VG	T	L	O	S

KEY**LUL=Land Use location.CG=Commodity grouping****SD=Status of domestication**

CF = Compound farm V = Vegetable

Wild A= Abundant

OF = outlying farm SP = Spice

= Semi wild F = Frequent

W = Wild forest S/S= Status of Species

Climber C = Cultivate

MP=Method of Propagation O = Occasional

Cash income (CI) Part Consumed (PC)**SS=Status of the species**

M = Major L = Leaves

Threat Slight

S = Small SD = Seed`

Endangered

P = Potential ST = Stem

2=Substantial

LF=Life**F=Frequency**

T = Trees

SH = Shrub

P/P= Parts Consumed

H= Herbs

Method of Propagation (MP)

SD =Seed

VG=Vegetative

NT=

No

form

W =

SW

C =

T=

E =

Threat

Fl= Flower

3=Greatest

Table 3. Uses, income generation prospects and seasonality of the leafy vegetables and spices of Ebonyi State Nigeria

Ethnobotanical Survey Of Underutilized...

S/N	Scientific Name	Usages	Gender	Unit of Sale	Unit price (N)*	Seasonality	
						R	D
						R	D
1	<i>Abelmoschus esculentus</i>	Used for making soup	Female	bowl/a small heap	20	R	D
2	<i>Adenia cissampeloides</i>	Fresh fruit used in making soup	Female	bowl/a small heap	350/50	+	
3	<i>Amaranthus spinosus</i>	Used for making soup and yam	Female	Bundle	20/50	R	D
4	<i>Bombax buonopozense</i>	Used for the preparation of yam	Female	Bundle	20	R	
5	<i>Capiscum frutescens</i>	Used for the preparation of yam and water yam	Female	Bundle	10	D	+
6	<i>Citrullus vulgaris</i>	Used for spicing food	Female	Milk Cup	50	+	+
7	<i>Colocasia exculentus</i>	Used as a major soup ingredient; moulded into lumps in special soups (a delicacy) during festivals. Egusi soup is highly valued in Ngbo/Izhia and used during major traditional functions and festivals	Female	Milk cup	50	R	
8	<i>Corchorus olitorius</i>	Used for making soup	Female	Bundle	50	R	
9	<i>Cucurbita pepo</i>	Used for soup and cooking yam pottage	Female	Bundle	20	R	
10	<i>Ficus capensis</i>	Leaves used as vegetables in soup. Also used to cook yam or cocoyam. It is soft when Cooked and high in B-carotene	Female	Bundle	20	+	
11	<i>Ficus ottoniifolia</i>	Used for making soup	Female	Bundle			+
12	<i>Gongronema latifolia</i>	Used for making soup	Female	Bundle			+
13	<i>Ipomoea aquatica</i>	Used for pregnant, lactating mothers and for sick people.	Female	Bundle	50	+	
14	<i>Ipomoea batatas</i>	Used as spice for Goat/beef/chicken/fresh fish pepper soup	Female	Bundle	20/50		
16	<i>Lecaniodiscus cupanioides</i>	Used as spice for making soup for new nursing mothers	Female	Bundle	50	+	+
17	<i>Monodora myristica</i>	Tubers are eaten as staple food	Female	Bundle	20/50	+	
18	<i>Moringa oleifera</i>	Used for making soup	Female	Bundle	20/50		
19	<i>Newbouldia leavis</i>	Used in making soup for pregnant and lactating mothers. Mixed with peanut butter and other traditional foods for flavour	Female	1 seed	20		
20	<i>Nauclea diderrichii</i>	Used for making soup and for treating several ailments	Female	Bundle/milk cup		+	+
21	<i>Occimum gratissimum</i>	Used for making soup	Female	Bundle		+	+
22	<i>Piper guinensis</i>	Used as a spice in preparation of soups, pepper soup, yam porridge etc, and as a medicinal plant	Female	Bundle	20		+
23	<i>Pterocarpus mililbraedii</i>	Used as a spice in the preparation of pepper soup etc and as a medicinal plant	Female	Bundle	20	+	+
24	<i>Pterocarpus santalinoides</i>	Used to spice food especially for lactating mothers to clear womb and in pepper soups	Female	bundle	50	+	
25	<i>Pterocarpus soveaxii</i>	Tender leaves used for preparing soups	Female	Bundle	20	+	+
26	<i>Senna occidentalis</i>	Tender leaves used for preparing soups	Female	Bundle	20		+
27	<i>Solanum nigrum</i>	Used for soup.	Female	1 bucket	200		R
28	<i>Talinum triangulare</i>	Leaves used as vegetable in soup. Fruit used for entertaining guest, eaten with spiced peanut butter. Smaller seeds from other species used in preparing yam pottage.	Female	Bundle	50	+	+
29	<i>Telfairia occidentalis</i>	Used for soup preparation.	Female	Bundle	20	+	
30	<i>Vernonia amygdalina</i>	Used for soup preparation. Washed extract is used in treating anaemia and	Female	Bundle	20	+	
31	<i>Vitex doniana</i>	in building up blood for pregnant mothers	Female	bundle	20		
32	<i>Zanthoxylum zanthoxyloides</i>	Used in cooking soups and other dishes. Some varieties can be chewed raw after washing. Used for the treatment of malaria and recommended for diabetics	Female	bundle	50	+	+

* Threshold prices for a bundle or cup of the item.

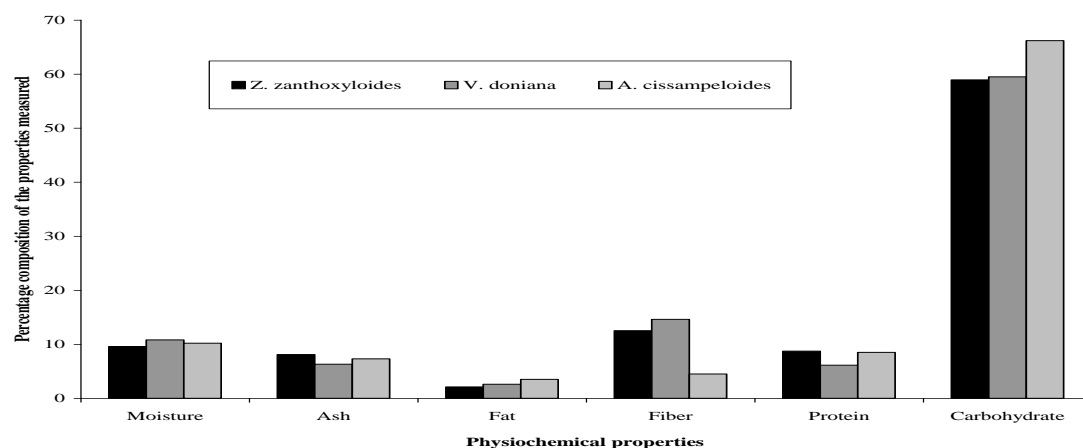
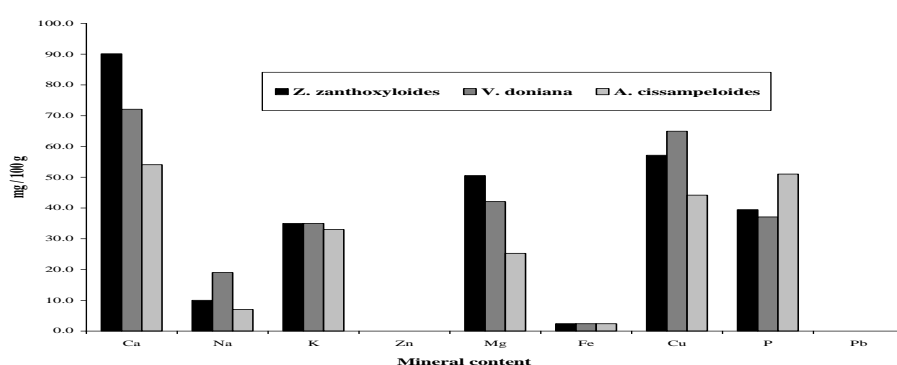


Fig1. Proximate composition of three indigenous leafy vegetables

Fig. 2. Physiochemical compositions of three indigenous leafy vegetables (Sheela *et al* 2004; Nnamani *et al.*, 2007)

REFERENCES

- [1] Ajayi, I. A., Oderinde, R.A., Kalogbola, D.O., Ukponi, J.U. 2006. Oil of Underutilized Legumes from Nigeria. *Food Chemistry*. 99(1): 115-120.
- [2] Akachukwu, C.O., Fawusi, M.O.A. 1995. Growth Characteristic, Yield and Nutritive values of waterleaf. *Discovery and Innovation*. 7(2): 163-172.
- [3] Association of Official Analytical Chemist (AOAC) 1990. *Official Methods of Analysis*. 15th Ed. Washington, DC. p.123.
- [4] Akwawowo, E.U., Ndori, B.A., Etuk, E. U 2000. Minerals and Antinutrient in Fluted Pumpkin. *Food Chemistry*. 70(2): 235-240.
- [5] Chweya, J.A., Eyzaguirre, P. B 1999. *The Biodiversity of Traditional Leafy vegetables*. IPGRT Publication. p. 540.
- [6] Eyzaguirre, P.B. 2002. Home Gardens and in Situ Conservation of Plant Genetic Resources in Farming Systems. *Proceedings. 2nd International Home Gardens Workshop*. 17-19 July 2001, Witzenhausen, Federal Republic of Germany, pp. 3-9.
- [7] FAO, 1986. *Compositional Analysis Method*. In: *Manuals of food quality control*. Food 7: 203-232. George, P.M. 2003. *Encyclopedia of foods*. Volume 1. Humane Press; Washington. p. 526.
- [8] Guarino, L. 1997. Traditional Africa vegetables. Promoting the conservation and use of underutilized and neglected crops. In: *Proceedings of the IPGRI International Workshop on Genetic Resources of Traditional Vegetables in Africa*. IPGRI, Rome, Italy.
- [10] Igbal, A., Khalil I.A., Ateeq N., Khan, M.S. 2006. Nutritional Qualities of Important Food Legumes. *Food Chemistry*. 97(2): 331-335.
- [11] Nnamani, C. V., Oselebe, H. O. and Agbatutu, A. 2009. Ethnobotany of Indigenous Leafy Vegetables of Izzi Clan, in Ebonyi State, Nigeria. In: *Proceeding of 20th Annual National Conference of Biotechnology Society of Nigeria*. Abakaliki, November 14th -17th, p. 111-114.
- [12] Noonan, S. C. and Savage, G. P. 1999. Oxalate content of foods and its effect on humans. *Asia Pacific Journal of Clinical Nutrition*. 67: 64-74.
- [13] Ofomata, G. 1975. *Nigeria in Maps*. Ethiopia Publishing House, Eastern States, Benin City Nigeria, p. 186.
- [14] Okafor J.C. 1995. Conservation and Use of Traditional Vegetables from Woody Forest Species in South- Eastern Nigeria. In: *Proceedings of the IPGRI Workshop on Genetic Resources of traditional vegetables in Africa*, Nairobi.
- [15] Oyenuga, V.A., Fetuga, B.C 1975. Dietary importance of fruits and vegetables. A paper presented at the First National Seminar on Fruits and Vegetable at National Horticultural Research Institute. pp. 19-23.
- [16] Pearson, D. 1976. *The Chemical Analysis of Food*. Churchill and Livingstone, London, New York.

- [17] Raghuvanshi, R.S, Singh, R. 2001. Nutritional Composition of uncommon foods and their role in meeting in micronutrient needs. *Int. J. Food Sci. Nutr.* 32: 331-335.
- [19] Sheela, K., Kamal, G.N, Vijayalakshmi, D, Geeta, M.Y, Roopa, B.P. 2004. Proximate Analysis of Underutilized Green Leafy Vegetables in Southern Karnataka. *J. Human Ecol.* 15(3): 227-229.
- [20] World Health Organization, 1992. Energy and Protein requirement. Report of a Joint FAO/WHO Ad Hoc Expert Committee. World Health Organization, Geneva.
- [21] White, F. 1983. *Vegetation of Africa*. Unesco, Paris, p. 356