

Full Length Research Paper

Nutritional and antinutritional levels of some local vegetables from Delta State, Nigeria

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Accepted 23 December, 2011

Levels of nutritional and antinutritional factors of five leafy edible green vegetables from Delta State, Nigeria were studied. These vegetables are consumed generally in this area and recently, *Jatropha Curcus* was added to the list of common vegetables. Analyses were done using standard analytical methods. Crude protein, crude lipid, carbohydrate, moisture, ash, crude fiber and colorific values, had values of 6.16 ± 0.22 - 6.72 ± 0.15 , 4.20 ± 0.15 - 4.80 ± 0.18 , 2.96 ± 0.16 - 3.96 ± 0.22 , 78.78 ± 1.42 - 81.77 ± 1.45 , 1.52 ± 0.04 - 2.00 ± 0.03 , 1.60 ± 0.02 - $4.50\pm 0.14\%$ and 78.92 ± 1.55 to 83.84 ± 1.87 Kcal/100 g, respectively. The mineral contents were; sodium 4.44 ± 0.22 - 5.24 ± 0.21 ug/g, calcium 1.07 ± 0.22 - 4.82 ± 0.14 , potassium 0.97 ± 0.06 - 0.98 ± 0.05 , magnesium 1.45 ± 0.15 , -1.95 ± 0.16 ug/g, iron 0.09 ± 0.01 - 0.61 ± 0.02 ug/g, zinc ND- 0.09 ± 0.002 ug/g, phosphorus 0.89 ± 0.05 - 2.82 ± 0.07 ug/g and copper ND- 0.24 ± 0.01 ug/g. The antinutrient compositions were oxalate 0.88 ± 0.12 - 2.20 ± 0.25 ug/g, phytate 6.89 ± 0.25 - 13.00 ± 0.45 ug/g and hydrocyanide 0.13 ± 0.04 - 0.23 ± 0.01 ug/g. These results showed that these vegetables contained an appreciable amount of nutrients, mineral elements and low levels of anti-nutrients and could be included in diets to supplement our daily allowance needed by the body.

Key words: Local vegetables, minerals, nutrients, antinutritional.

INTRODUCTION

Vegetables are known to be important sources of protective foods (Nnamami et al., 2009; Sheela et al., 2004). Vegetables have also been reported to be good sources of oil, carbohydrates, minerals as well as vitamins (Adenipenkun and Oyetunji 2010). The potassium content of leafy vegetable is good in the control of diuretic and hypertensive complications (George, 2003). George (2003) ascertained that the proteins in vegetables are superior to those in fruits but inferior to those in grains. Vegetable fats and oils are known to lower blood lipids thereby reducing the occurrences of diseases associated with the damage of the coronary artery (Adenipenkun and Oyetunji, 2010). These vegetables however contain antinutritional factors that can affect the availability of the nutrients.

Antinutritional factor is known to interfere with metabolic processes such that growth and bioavailability of nutrients are negatively influenced (Abara, 2003; Binta and Khetarpau, 1997). Phytate and oxalates have the ability to form chelates with di- and tri-valent metallic ions such as Cd, Mg, Zn and Fe to form poorly soluble compounds that are not readily absorbed from the gastrointestinal tract thus decreasing their bioavailability (Ademoroti, 1996). He further stated phytate inhibits the functions of some digestive enzymes. Ladeji et al. (2004) reported that oxalates causes irritation and swelling in the mouth and throat. High level of hydrogen cyanide has been implicated for cerebral damage and lethargy in man and animals (Ekop, 2007). The purpose of this study therefore is to evaluate the levels of nutritional and antinutritional factors of some common edible leafy vegetables in Delta State, Nigeria. These vegetables were selected because they are generally consumed in this part of the country and *Jatropha curcus* is becoming

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increasingly popular as edible vegetable in most homes.

MATERIALS AND METHODS

Sampling

Five leafy vegetables were obtained from farms within the University. They were then taken to the Botany Department of the Delta State University, Abraka, Nigeria for identification. The vegetables are *Jatropha curcas*, *Myrianthus arboreus*, *Celosia argentea*, *Gnetum africanum* and *Ocimum gratissimum*. The vegetable leaves were harvested, destalked, washed with clean cold tap water. The fresh leaves were used for the study.

Sample preparation

5.00 g of each sample was weighed and mashed. 100 ml of distilled water was added and then filtered. Filtrate was used for further analysis.

Determination of carbohydrate

This was done by the anthrone standard method (David, 1978). A standard curve was obtained using the following concentration of sucrose in (mg/ml). 1.00, 0.50, 0.25, 0.13 and 0.06. 1 ml of each vegetable sample extract was measured into test-tube and 2 ml anthrone solution added. This was shaken for 15 min and boiled for 30 min. It was then allowed to cool. The absorbance was then read off a spectrophotometer (spectrum lab 22) at 625 nm. The sugar concentration was then obtained by extrapolation from the standard curve.

Determination of protein

The biuret method (Okon and Akpanyung, 2005) was adopted. 1 ml of the extracted sample was measured into test-tube and 4 ml of biuret reagent was added. This was allowed to stand for 20 min. The absorbance was then read off at 540 nm in a spectrophotometer. The quantity of protein was obtained by extrapolation from a calibration curve prepared with bovine serum albumin (BSA).

Determination of fat

The oil from the samples was extracted by solvent extraction in petroleum ether. Percentage oil was calculated using the following formula:

$$\% \text{ Oil} = \frac{\text{Weight of oil}}{\text{Weight of dry sample}} \times 100$$

Determination of ash

This was determined using the method of Association of official analytical chemist (1984).

Determination of crude fibre

This was carried out using the standard methods of the Association of Official Analytical Chemist (1984).

Determination of moisture

This was done according to standard method of the Association of Official Analytical Chemist (1984).

Energy value

This was calculated using water factor method as described by Osborne and Voogt (1978). $[(9 \times \text{fat}) \pm (4 \times \text{carbohydrate}) \pm (4 \times \text{protein})]$.

Oxalate determination

The titration method as described by Day and Underwood (1986) was followed. 1g of sample was weighed into 100 ml conical flask. 75 ml 3 M H_2SO_4 was added and stirred for 1 h with a magnetic stirrer. This was filtered using a Whatman No 1 filter paper. 25 ml of the filtrate was then taken and titrated while hot against 0.05 M KMnO_4 solution until a faint pink colour persisted for at least 30 s. The oxalate content was then calculated by taking 1ml of 0.05 m KMnO_4 as equivalent to 2.2 mg oxalate (Chinma and Igyor, 2007; Ihekoronye and Ngoddy, 1985).

Phytate content determination

This was determined by the method of Wheeler and Ferrel (1971). 100 ml of the sample was extracted with 3% trichloroacetic acid. The extract was treated with FeCl_3 solution and the iron content of the precipitate was determined using Atomic Absorption Spectrophotometer (Cye Unicam 2900). A 4:6 Fe/P atomic ratio was used to calculate the phytic acid content. (Okon and Akpanyung, 2005).

Hydrogen cyanide determination

The alkaline titration method of AOAC (1984) used for determination. 100 ml of sample was steam-distilled into a solution of NaOH. The distillate was treated with dilute KI solution. This was then titrated against 0.02 M AgNO_3 solution. The endpoint was obtained when there was a change from clear to a faint but permanent turbid solution. The hydrogen cyanide content was determined by taking 1ml of 0.02 m AgNO_3 as equivalent to 1.08 mg Hydrogen Cyanide (HCN).

Mineral element content

This was determined after wet acid digesting of samples using the Cye Unicam 2900 model of Atomic Absorption Spectrophotometer with appropriate hollow cathode lamps. Phosphorus was determined spectrophotometrically.

Statistical analysis

Results were presented as simple means, ranges, standard deviations and percentages.

RESULTS AND DISCUSSION

The result of proximate composition of the leafy vegetables is as shown in Table 1. The moisture content

Table 1. Proximate composition of samples.

S/N	Plant specie	Moisture content %	Ash content %	Crude protein %	Crude lipid %	Carbohydrate %	Crude fiber %	Energy value Kcal/100 g
1	<i>Jatropha curcas</i> (Hospital too far)	81.77±1.45	1.52±0.04	6.32±0.23	4.20±0.15	3.96±0.22	2.20±0.05	78.92±1.55
2	<i>Myrianthus arboreus</i> (Esage)	78.78±1.42	1.76±0.07	6.16±0.22	4.80±0.18	3.92±0.22	4.50±0.14	83.52±1.45
3	<i>Celosia argentea</i> (shoko)	81.21±1.22	2.00±0.03	6.72±0.15	4.60±0.06	2.96±0.16	1.60±0.02	80.12±1.67
4	<i>Gnetum africanum</i> (utazi)	79.00±1.23	1.92±0.05	6.40±0.25	4.60±0.11	3.92±0.23	3.80±0.10	82.68±1.77
5	<i>Ocimum gratissimum</i> (scent leaf)	80.19±1.22	1.90±0.05	6.24±0.24	4.80±0.12	3.92±0.18	2.40±0.06	83.84±1.87
	Minimum	78.78±1.42	1.52±0.04	6.16±0.22	4.20±0.15	2.96±0.16	1.60±0.02	78.92±1.55
	Maximum	81.77±1.45	2.00±0.03	6.72±0.15	4.80±0.18	3.96±0.22	4.50±0.14	83.84±1.87

Results are mean± standard deviation of triplicate determinations.

Table 2. Mineral composition of sample.

S/N	Plant specie	Sodium Na (ug/g)	Calcium Ca (ug/g)	Potassium K (ug/g)	Magnesium Mg (ug/g)	Iron Fe (ug/g)	Zinc Zn (ug/g)	Phosphorus P (ug/g)	Copper Cu (ug/g)
1	<i>Jatropha curcas</i> (Hospital too far)	5.24±0.21	1.26±0.25	0.96±0.05	1.45±0.15	0.24±0.01	0.02±0.001	0.95±0.05	ND
2	<i>Myrianthus arboreus</i> (Esage)	4.89±0.24	1.07±0.22	0.97±0.06	1.48±0.11	0.09±0.01	0.02±0.001	0.89±0.03	0.01±0.001
3	<i>Celosia argentea</i> (shoko)	4.70±0.22	1.51±0.15	0.97±0.07	1.59±0.08	0.45±0.02	0.09±0.002	0.97±0.05	0.01±0.001
4	<i>Gnetum africanum</i> (utazi)	4.44±0.22	2.24±0.11	0.97±0.06	1.58±0.22	0.61±0.02	0.04±0.001	1.53±0.05	ND
5	<i>Ocimum gratissimum</i> (scent leaf)	4.89±0.22	4.82±0.14	0.98±0.05	1.95±0.16	0.53±0.03	ND	2.82±0.07	0.24±0.01
	Minimum	4.44±0.22	1.07±0.22	0.97±0.06	1.45±0.15	0.09±0.01	ND	0.89±0.03	ND
	Maximum	5.24±0.21	4.82±0.14	0.98±0.05	1.95±0.16	0.61±0.02	0.09±0.002	2.82±0.07	0.24±0.01

ND: Not detectable; Results are values of mean± standard deviation of triplicate determinations.

with a range of 78.78±1.42-81.77±1.45% is quite high. This high moisture content of these vegetable would encourage microbial growth and so deterioration. This result is however similar to those obtained by other workers (Abidemi et al., 2009; Chimma and Igyor, 2007; FAO, 1990).

The ash content which is a measure of the mineral content of food ranged from 1.52±0.04 to 2.00±0.03%. This range is similar to that obtained by Abidemi et al. (2007). According to Lucas (1988), this is the acceptable range for edible

vegetables in Nigeria. The crude lipid content is between 4.20±0.15-4.8±0.18%. This is comparable to what was obtained by Ekop (2007). The crude protein ranged from 6.16±0.22 to 6.72±0.15%. This was a bit higher than what was reported by Abidemi et al. (2009) but it falls within the normal range for edible vegetable and are however in agreement with results by Nnamani et al. (2009). Carbohydrate content of these vegetables ranged between 2.96±0.16 to 3.96±0.22%. This is low compared with result

obtained by Abidemi et al. (2009). These vegetables can therefore not be recommended solely to vegetarians. It has to be mixed with other sources of carbohydrate. Crude fiber ranged between 1.60±0.02 to 4.50±0.14%. This is high in comparison with results obtained by both Ekop (2007) and Abidemi et al. (2009). Energy value ranged between 78.92±1.55 to 83.84±1.87 Kcal/100. This is similar to what was obtained by Chinma and Igyor (2007). The result of the mineral analysis is as shown in Table 2.

Table 3. Anti-nutritional factors in sample.

S/N		Oxalates (ug/g)	Phytate (ug/g)	Hydrocyanide (ug/g)
1	<i>Jatropha curcas</i> (Hospital too far)	1.10±0.11	6.89±0.25	0.23±0.01
2	<i>Myrianthus arboreus</i> (Esage)	1.98±0.14	8.39±0.33	0.13±0.05
3	<i>Celosia argebtea</i> (shoko)	2.20±0.25	9.24±0.43	0.15±0.04
4	<i>Gnetum africanum</i> (utazi)	0.88±0.12	8.24±0.33	0.13±0.05
5	<i>Ocimum gratissimum</i> (scent leaf)	1.00±0.06	13.00±0.45	0.13±0.04
	Minimum	0.88±0.12	6.89±0.25	0.13±0.04
	Maximum	2.20±0.25	13.00±0.45	0.23±0.01

Values are mean± standard deviation of triplicate determinations.

Minerals are important in human nutrition. It is well known that enzymatic activities as well as electrolyte balance of the blood fluid are related to adequacy of Na, K, Mg and Zn. Potassium is very important in maintaining the body fluid volume and osmotic equilibrium. Metal deficiency syndrome like rickets and calcification of bones is caused by calcium deficiency. Sodium content ranged between 4.44±0.22-5.24±0.21 ug/g. Potassium ranged from 0.97±0.06-0.98±0.05 ug/g. Zinc was not detected in *Ocimum gratissimum* and ranged between 0.02±0.001 to 0.09±0.002 ug/g for the other vegetables. Calcium ranged from 1.07±0.22-4.82±0.14 ug/g. Magnesium ranged from 1.45±0.15-1.95±0.16 ug/g. The results of the above mineral analysis were generally low as compared with other workers (Ekop, 2007; Yildirim et al., 2001). The value of the iron content between 0.09±0.01-0.61±0.02 ug/g was comparable with those obtained by Okon and Akpanyung (2005). Copper was not detected in two of the five samples. This element is an essential component of many enzymes including the antioxidant enzyme; Superoxide dismutase.

This antioxidant defense protects the body against the harmful effects of free radicals. Again the value for phosphorus with a mean of 0.89±0.03-2.82±0.07 ug/g is lower than that obtained by Yildirim et al. 2001. Table 3 shows the antinutrient composition of these samples. The oxalate value of between 0.88±0.12-2.20±0.25 ug/g is low as compared with similar work by Ekop (2007) and those by Chinma and Igyor (2007). But it is comparable with values obtained by Okon and Akpanyung (2005). Phytate ranged from 6.89±0.25 to 13.00±0.45 ug/g. This value is comparable to what was obtained by Okon and Akpanyung (2005) while that of hydrocyanide of 0.13±0.04 to 0.23±0.01ug/g. was also low. The low value of the antinutritional factors may not pose any serious nutritional problem when these vegetable leaves are consumed. It is known that high content of these antinutrients exert negative effects on the bioavailability of some mineral nutrients. The consumption of these vegetables was therefore encouraged.

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