Nutrient and Anti Nutrient Composition of Some Nigerian Leafy Vegetables

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ABSTRACT

Objective: This study was aimed at determining the nutrient and anti nutrient composition of five Nigerian leafy vegetables namely Igbo (*Solarium macrocarpon*), Ishapa (*Hibiscus sabdariffa*), Okro (*Hibiscus esculentus*), Tete (*Amaranthus viridis*) and Ugwu (*Telfaria occidentalis*).
Materials and Methods: The five green leafy vegetables namely Igbo, Ishapa, Okro, Tete and Ugwu were washed under running tap water, cleaned, chopped, sun dried for two day and finely ground to pass a 100 - mesh sieve and analyzed. Nutrient assayed included proximate constituents and minerals while the anti nutritional factors included tannin, hydrogen cyanide and oxalates which were determined by titrimetric and colorimetric methods.
Results: Igbo had the maximum crude protein (CP, 23.18%) while Ugwu had the minimum crude protein (CP, 17.28%). Lipid content varied from 0.07% for Okro to 1.67% for Igbo. Crude fibre and total ash varied from 8.0 to 10.60% and 9.96 to 17.33%, respectively. Igbo had the highest amount of zinc, sodium, and magnesium. Tete had the maximum amount of phosphorus (1210 mg/100g dry matter) while Ugwu had the minimum amount (740 mg/100g dry matter). All the vegetables are good sources of nutrients necessary for human development
Conclusion: They have been shown to be a good source of nutrients and thus will play a significant role in human nutrition. The presence of some anti nutritional factors like tannin, hydrogen cyanide and oxalate will not pose any danger to their consumption since they were found in very low quantities.

Keywords: Leafy vegetables, Nutrients, Anti- nutrients

INTRODUCTION

Leafy vegetables preparations include the raw salad, widely known over the world in partially or completely cooked or fried forms [1]. Nigerian cuisine has a wide range of choice among the leafy vegetables. In most Nigerian households, the inclusion of a leafy vegetable preparation in daily diet is an accepted practice. These green leafy vegetables are inexpensive, easily and quickly cooked and are rich in several nutrients such as vitamins, minerals, proteins of higher biological value than some major staples [2] and [3]. According to Ifon and Bassir [4], Onayemi and Badifu [5] and Badifu [6] green leafy vegetables apart from providing variety in the diet, are good sources of ascorbic acid, dietary fibre, carotene, iron and other minerals in addition to protein. However, relative to other foodstuffs like legumes and cereals, the consumption of leafy vegetables is usually low [7].
Despite their widespread use as condiments and spices in soup and stew, their nutritional composition is not very well understood for a good appraisal of their potential contribution to human dietaries. Moreoso, the presence of anti nutritional and toxic factors makes their nutritional exploitation a problem. Gupta and Wagle [1] have worked on Chicken pea, Clenopodium, Spinach, Mustard and Cauliflower and concluded that green leafy vegetables were good sources of minerals and that the maximum amount of nitrates (5.36%), saponin (2.45%), and oxalate (8.69%) were noted in spinach. It has been reported that green leaves were rich in protein, but their utilization was limited because of the presence of indigestible fibre [8]. This study was undertaken to provide much needed information on the levels of important nutrients in five leafy vegetables commonly used in Nigeria.

MATERIALS AND METHODS

Five green leafy vegetables namely Igbo (*Solarium macrocarpon*), Ishapa (*Hibiscus sabdariffa*), Okro (*Hibiscus esculentus*), Tete (*Amaranthus viridis*) and Ugwu (*Telfaria occidentalis*) were purchased from reputable dealers in Mile 12 market in Lagos. These were washed under running tap water, cleaned, chopped, sun dried for two days and finely ground to pass a 100 - mesh sieve and stored in coloured air tight container until further analysis. The proximate composition analysis was based on the methods of AOAC [9]. Crude protein, Ether extract, Crude fibre and Ash were extracted by standard methods of the AOAC [9]. Calcium, magnesium and phosphorus were estimated by colorimetric methods of [10,11,12] respectively. Sodium and potassium were estimated by flame photometry after the sample was digested with a tri-acid mixture (nitric acid- perchloric acid- sulphuric acid 4: 05: 0.5 v/v). Iron, zinc, copper, and manganese were estimated by atomic absorption spectrophotometric methods in tri-acid hydrolysate.
The tannin was determined by the method of Makker and Goodchild [13] 10ml, 70% aqueous acetone was added to 200mg of finely ground sample in a bottle and properly covered. The bottle was put in an ice bath shaker for 2h at 30°C.The solution was then centrifuged and the

supernatant stored in ice. From the supernatant, 0.2 ml was pippeted into 0.8ml distilled water. Standard tannic acid solution was prepared. Folin reagent (0.5 ml) was added to both sample and standard followed by 2.5ml 20% Na_2CO_3. The solutions were vortexed and allowed to incubate for 40min at room temperature after which the absorbance was read at 725nm. The concentration of tannin in the sample was estimated from the standard tannic acid curve.

Hydrogen cyanide was determined by the method of Egan *et al.* [14] and Bradbury *et al.* [15] using Baush and Lamb spectronic 20 spectrophotometer to measure absorbance at 510nm. The method involves the immobilization of linamaraze in a small filter paper) also loaded with phosphate buffer at pH 8. The disk was placed in a small flat-bottom plastic bottle. The test sample (100mg ground sample) was added. Distilled water (0.5ml) was added and a yellow picrate paper attached to a plastic strip immediately inserted into the bottle. The bottle was closed immediately with a screw lid and allowed to stand for 16-24 hr at room temp (28-32°C). The picrate paper attached to the plastic strip (HCN reacted picrate paper) was removed and immersed in 5ml – distilled water in a test tube with occasional string for 30mins. The unreacted yellow picrate paper was treated similarly as blank. The absorbance of the solution of HCN reacted picrated paper was measured against the blank at 510nm. The cyanogens content in ppm was calculated by the equation: ppm = 396A where A is the absorbance.

The oxalate was estimated by the titration method described by Day and Underwood [16]. One gram of the sample was weighed into 100ml conical flask where 75ml 3N H_2SO_4 was added and stirred intermittently with a magnetic stirrer for 1hr. It was then filtered using Whatman No 1 filter paper. From the filtrate, 25 ml was taken and titrated while hot (80 – 90°C) against 0.1N $KMnO_4$ solution until a faint pink colour persisted for at least 30secs.

RESULTS

Proximate composition

The result of the proximate chemical compositions of five green leafy vegetables is as shown in Table 1. Crude protein and crude fat in leafy vegetables ranged from 17.28 (Ugwu) to 23.18% (Igbo) and 0.074 (Okro) to 1.67% (Igbo) respectively. Igbo contained the maximum amount of crude fibre (10.6%) whereas Ishapa contained the smallest amount (8.0%). Ishapa contained maximum amount of total ash 17.33% while a minimum value 9.96% was observed in Okro.

Table 1: Proximate compositions of some leafy vegetables (Percent Dry weight Basis)*

Parameters	Vegetable Samples				
	Igbo	Ishapa	Okro	Tete	Ugwu
Ether extract (Fat)	1.67	12.80	0.07	0.43	1.23
Crude Protein	23.20	22.30	17.70	22.0	17.30
Ash	11.67	17.33	9.96	12.67	10.0
Crude Fibre	10.60	8.0	9.20	9.86	8.50
Carbohydrate	13.42	14.83	13.58	12.92	14.0

*Each value is the average of triplicate determinations

Mineral composition

The results of the mineral composition of the green leafy vegetables are shown in Table 2. Calcium and phosphorus contents are maximum in Ishapa and Tete, respectively while these nutrients are minimum in Ugwu and Igbo (Table 2). Igbo contained the highest amounts of iron, zinc, sodium, and magnesium in comparism with other leafy vegetables. However, all values of minerals are highly significant among vegetables except copper content, which does not appear different.

Anti - nutritional factors

The anti-nutritional factors of tannin, hydro cyanide, and oxalate contents are also reported in Table 3. Tannin and hydro cyanide contents varied from 0.09% (Igbo) to 4.37% (Ugwu) and 0.83% (Igbo) to 0.89% (Okro) respectively. Ugwu had the maximum amounts of tannin followed by Okro and Tete

Table 2: Mineral contents of some Nigerian leafy vegetables

Vegetable	Minerals present (mg/100g dry matter) *							
	Zn	Na	K	Fe	Ca	P	Mg	Cu
Igbo	4.5	680	595	72.50	870	122.84	1198	1.60
Ishapa	3.87	35.60	57.85	35	2050	960	1010	1.87
Okro	2.74	462	310	25	231	890	870	0.95
Tete	2.23	205.80	1170	46	1740	1210	310	1.56
Ugwu	3.25	320.75	2047.50	26.25	158.88	740	760	1.34

*Each value is the average of triplicate determinations

Table 3: Anti - nutritional factors in some leafy vegetables

Vegetable	Anti-nutrients (mg/100g) *		
	Hydro cyanide	Tannin	Oxalate
Igbo	0.83	0.09	0.40
Ishapa	0.84	0.11	ND
Okro	0.89	3.64	ND
Tete	0.88	0.11	0.41
Ugwu	0.84	4.37	0.21

ND = Not Determined

*Each value is the average of triplicate determinations

DISCUSSION

Proximate composition

The result of the proximate chemical compositions of five green leafy vegetables is as shown in Table 1. The results of this investigation (Table1) are in good agreement with the reports of Livingstone [17], Patel and Patel [18] and Rawate and Hill [19]. Green leafy vegetables are rich sources of protein and minerals, but their utilization is limited due to the presence of indigestible fibre Kohler and Bickoff [8]. Crude fibre contents of the vegetables varied from 8.0 to 10.60% with maximum amount accounted for by Igbo while the minimum is obtained in Ishapa. The fat content of vegetable which was maximum in Igbo (1.67%) indicates that vegetables are not such a good source of oil.

The mean protein content of vegetable is 20.5% on dry weight basis and this is comparable to that of a standard protein-casein which has 10% protein content. Thus, these vegetables can be supplemented with other protein sources to develop new food products for man, feed development for livestock, which will indirectly increase food supply to man; also these vegetables are cheap and easily grown. The carbohydrate content amongst the leafy vegetables had a maximum value of 14.83% as found in Ishapa while the lowest value of 12.92% was found in Tete. These vegetables are thus good sources of carbohydrate. The indigestible carbohydrate which is referred to as the crude fibre was determined to be between 8.0% in Ishapa to 10.60% in Igbo. This crude fibre can be used in the development of high fibre food products suitable for consumption especially by the elderly.

Mineral composition

The result of the mineral compositions of the five green leafy vegetables is as shown in Table 2. Calcium and phosphorus contents are highest in Ishapa and Tete, respectively while these nutrients are lowest in Ugwu and Igbo (Table 2). Igbo contained the highest amounts of iron, zinc, sodium, and magnesium in comparism with other leafy vegetables. However, all values of minerals are highly significant among vegetables except copper content, which does not appear different. Total ash is the biological material which was obtained after organic matter has been burnt away. Total ash was highest in Ishapa (17.33%). The ash content gives an idea of amount of mineral element in the sample while the organic matter gives an estimate of protein, lipids (fats), carbohydrates and nucleic acids content of the sample. The minerals which were found in green leafy vegetables include amongst others phosphorus and magnesium which are involved in bone formation, calcium, magnesium and manganese which serve as co-factors to many enzymes involved in the synthesis of haemoglobin, myoglobin and also prevent synerensis. Furthermore, sodium and potassium are involved in membrane transport and transmission of nerves.

Anti - nutritional factors

The anti-nutritional factors namely tannin, hydro cyanide, and oxalate in the dried leafy vegetables is as shown in Table 3. Tannin and hydro cyanide contents varied from 0.09% (Igbo) to 4.37% (Ugwu) and 0.83% (Igbo) to 0.89% (Okro) respectively. Ugwu had the maximum amounts of tannin followed by Okro and Tete. The amount of oxalate in these vegetables is in trace amount when compared to the results of Gupta and Wagle [1] on the work on Chicken pea, Clenopodium, Spinach, Mustard and Cauliflower. The tannin and hydro cyanide values obtained showed their presence in these leafy vegetables that are commonly consumed. The low value obtained is a strong indication of their safety of consumption without hampering bioavailability of nutrients consumed by its consumers. Furthermore, these low values indicate that processing of the vegetables has reduced these anti nutrients.

CONCLUSION

Despite the presence of some anti-nutritional factors as noted in some of these vegetables, their quantities were not in any appreciable level therefore, will not pose any danger to the consumers of such vegetable as food. They have been shown to be a good source of nutrients and thus will play a significant role in human nutrition.

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