

Proximate and Mineral Composition of Nigerian Leafy Vegetables

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Abstract

Proximate analysis and mineral composition of some Nigerian leafy vegetables: bitter leaf (*Veronia amygdalina* L), India spinach (*Basella alba* L), bush buck (*Gongronema latifolium*), scent leaf (*Ocimum gratissimum*), Smooth amaranth (*Amaranthus hybridus*), Roselle plant (*Hibiscus sabdariffa*) and fluted pumpkin (*Telfaria occidentalis*) were carried out using standard analytical procedures. The moisture content of the samples ranged between 10.0-12.08 %, crude protein, crude fibre, crude fat, ash contents and carbohydrate ranged between: 46.56 and 66.60, 4.02 and 12.08, 3.51 and 14.02, 5.02 and 15.55, 1.16 and 15.79 % dry matter (DM). Mineral element analysis showed that the leafy vegetables contained high levels of calcium (63.36-110.16), magnesium (27.51-288.65), sodium (15.01-88.00) and potassium (16.85-168.96) and low levels of copper (nd-3.14), nickel (2.32-18.16) and manganese (2.54-10.06) mg/100g respectively. The study showed that the leafy vegetables examined contained high levels of crude protein with low fat content and crude fibres.

Keywords: minerals, proximate, composition, leafy vegetable, analysis

1. Introduction

Vegetables are the edible parts of plant that are consumed wholly or in parts, raw or cooked as part of main dish or salad. A vegetable includes leaves, stems, roots, flowers, seed, fruits, bulbs, tubers and fungi (Uzo, 1989; Uwaegbute, 1989). Vegetables are good sources of oil, carbohydrates, minerals and vitamins depending on the vegetable consumed (Ihekoronye & Ngoddy, 1985). Ononugbu (2002) reported that vegetable fats and oil lower blood lipids thereby reducing the occurrence of disease associated with damage of coronary artery.

Leafy vegetables are important items of diet in many Nigerian homes. Apart from the variety which they add to the menu (Mepha & Eboh, 2007; Subukola et al., 2007), they are valuable sources of nutrients especially in rural areas where they contributes substantially to protein, minerals, vitamins, fibers and other nutrients which are usually in short supply in daily diets (Mohammed & Sharif, 2011). It is worthwhile to note that consumption of numerous types of edible plants as sources of food could be beneficial to nutritionally marginal population especially in developing countries where poverty and climate is causing havoc to the rural populace. In many developing countries the supply of minerals is inadequate to meet the mineral requirements of farm animals and rapidly growing population. Minerals cannot be synthesized by animals and must be provided from plants or mineral-rich water (Anjorin et al., 2010)

Amaranthus hybridus belongs to the family amaranthaceae, it tolerates varying soil and climate conditions but altitude of over 1500ft are unstable. *Amaranthus hybridus* is an annual plant, it is spinless and up to 800m high with grooves. The leaves are green, variable in shape and size (Iheanacho & Udebuani, 2009).

Hibiscus sabdariffa L is commonly called zobo in Nigeria. It is an annual or perennial herb or woody based sub shrub, growing to 2-12.5m (7-8ft) tall. The leaves are deeply three or five lobed i.e 8-15cm (3-6in) long arranged alternatively on the stems, the flower are 8-10cm (3-4in) in diameter, white to pale yellow with dark red spot at the base of each petal. Rselle is a folk remedy for abscesses, billon condition, cancer, cough, heart illness. Philippines use the bitter root as appetitive and tonic (Perry, 1980)

Telfaria occidentalis (Fluted pumpkin) belong to the family of plants called cucurbitaceae. In Nigeria it is known as pumpkins and it is grown in South-Eastern, Nigeria. The crop which is originated from West-Africa is a perennial climber, it leaves and seeds are very nutritive. In the recent times fluted pumpkin has gained

medicinal recognition, it has been discovered to be blood purifiers (Aletor et al., 2000) and could therefore be useful in maintenance of good health most especially in developing countries.

Vernonia amygdalina L (Bitter leaf) is a shrub or small tree that can reach 23m in height when fully grown. Bitter leaf has a grey or brown coloured bark, the bark has a rough texture and flanked. The plant bears fruits which has slightly hairy small nut inside. The bitter leaf is believed to help restore the stermina when consumed in form of a tonic food called indole.

Basella alba L (Indian spinach) belongs to the family basellaceae and order caryophyllales. It has its origin in Asia and it is distributed in most tropical regions. Indian spinach is a soft-stemmed vine. It can be combined in many different vegetable dishes and is sometimes eaten raw in salads.

Gongronema latifolium (Bushbuck) is commonly called utazi or arokeke in the South-East and South-Western parts of Nigeria. Buchbuck is a tropical rainforest plant primarily

used as spice and vegetable in traditional folk medicine (Ugochukwu & Babady, 2002). It contains essential oil, saponins and pregnaries (Schneider et al., 1993).

Ocimum gratissimum L (Scent leaf) belongs to the family Lamiaceae, it belong to the group of plants known as spices. The plant is an erect small plumb with many barnacles usually not more than 1m high. In South East Asia, it is cultivated as a home garden crop but it is grown on a commercial scale in Vietnam. In traditional medicine, the leaves have been used as a general tonic and anti- diarrhea agent and for the treatment of conjunctivitis by instilling directly into the eyes. The dried leaves are snuffed to alleviate headaches and fever.

This study was carried out to evaluate the chemical constituents of seven varieties of the leafy vegetables. Proximate analysis was carried out to determine the nutrient content of these leafy vegetables under investigation.

2. Materials and Methods

2.1 Plant Materials

Seven different leafy vegetables were purchased from two different locations; Saki market in Oyo-State and Iworoko market in Ekiti-State.

The leafy vegetables were thoroughly washed differently with distilled water and sundried. The dried leaves were ground into powder using pestle and mortar. The ground portion was kept in a plastic bottle in a freezer prior analysis.

2.2 Proximate Analysis

Moisture, ash, crude fat, crude fat and crude fibre were determined in accordance with the official methods of the association of official analytical chemists (AOAC, 1999), while nitrogen was determined by the micro-kjeldahl method (Pearson, 1976) and the percentage of nitrogen was converted to crude protein by multiplying by 6.25. Carbohydrate was determined by difference.

2.3 Mineral Analysis

The minerals in the leafy vegetables were analysed from solution obtained when 2.0g of the samples were digested with concentrated nitric acid and concentrated perchloric acid in ratios 5:3, the mixtures were placed on a water bath for three hours at 80°C. The resultant solution was cooled and filtered into 100ml standard flask and made to mark with distilled water (Asaolu, 1995). Atomic absorption spectrophotometer (Buck scientific model 200A) was used.

3. Results and Discussion

Proximate analysis: The proximate analysis (%) of the selected leafy vegetable are shown in Table 1. The percentage moisture content varies from 10.00% DW in *Amaranthus hybridus* to 12.08% DW in *Hibiscus sabdariffa*. The high moisture content provides for greater activity of water soluble enzymes and co-enzymes needed for metabolic activities of these leafy vegetables (Iheanacho and Udebuani, 2009). *Amaranthus hybridus* had (15.55% DW) of ash content when compare with Indian spinach with (5.02% DW) which is the least of the leafy vegetable investigated. This confirm that there are more minerals in *Amaranthus hybridus* and scent leaf than Indian spinach, the values of ash content obtained are comparable to those reported for some leafy vegetable such as *A. hybridus*, *C. peps* and *G. Africana* (Iheanacho & Udebuani, 2009). The percentage of fat content ranged from 3.51% DW- 14.02% DW in Bushbuck and *Amaranthus hybridus* respectively. These values were fairly high when compared with values reported in some other leafy vegetable such as *Ocimum bassillium*, *Ocimum viride* and *Piper guineens* (Udosen, 1995).

Table 1. Proximate (%) analysis of some selected vegetable leaves

	Bitter leaf	Indian spinach	Bush-buck	Scent leaf	Amaranthus hybridus	Hibiscus sabdariffa	Telfaira occidental
Moisture content	10.02	11.57	11.05	12.00	10.00	12.08	12.05
Ash content	9.56	5.02	9.01	13.01	15.55	7.50	8.54
Fat content	9.05	11.04	3.51	4.02	14.02	6.30	5.50
Crude protein	50.64	58.80	66.60	62.71	49.02	46.56	61.70
Crude fibre	12.08	6.05	4.02	7.04	8.05	12.04	11.05
Carbohydrate	8.65	7.52	5.81	1.22	3.36	15.79	1.16

The crude protein content ranged between 66.60% DW to 46.56% DW. The crude protein was more than what was reported for some other leafy vegetables such as *Momordica balsamina* (11.29%), *Moringa oleifra* (20.72%), *Lesianthera africana* leaves (13.10%- 14.90%) and *Leptadenia hastate* (19.10%).

Plant foods that provide more than 12% of their calorific value from protein have been shown to be good source of protein (Ali, 2009). This shows that all the leafy vegetables investigated are all good sources of protein. The crude fibre content ranged between 4.02% DW- 12.08% DW. This fell within the ranged from the reported values (8.50- 20.90%) for some Nigerian vegetables (Isong & Idiong, 1997). Dietary fibre helps to prevent constipation, bowel problems and piles. The total carbohydrate content ranged between 1.22% DW- 15.90% DW. The values obtained for all the leafy vegetables under this study fell below amount of carbohydrate for *Momordica balsamina* (39.05%) (15) and similar to grains (Sanni & Olaofe, 1998). Carbohydrate is low in the sample due to high level of protein content.

Table 2 shows the mineral composition of leafy vegetables, nutritional significant of element when compared with the standard recommended dietary allowance. The content of K, Ca, Na and Mg were of comparable values; the values were higher when compared with standard dietary allowance whereas, the levels of Zn, P, Mn, Ni, Cu and Fe were moderately low. Sodium and potassium are important intracellular and extracellular cations respectively. Sodium is involved in the regulation of plasma volume, acid-base balance, nerve and muscle contraction (Akpanyung, 2005). The magnesium content ranges between 120.0mg/100g and 288.65mg/100g. Fluted pumpkin had the highest magnesium content, which is in agreement with the previous work carried out by (Mephba et al., 2007) on fluted pumpkin. However, the levels obtained in this studies is low to meet the recommended daily allowance(RDA) of 400mg/day for men 19-30 years old and 310mg/day for women 19-39 years old (FWB, 1997).

Table 2. Mineral (mg/100g) composition of some selected vegetable leaves

Minerals	Bitter leaf	Indian spinach	Bush-buck	Scent leaf	Amaranthus hybridus	Hibiscus sabdariffa	Telfaria occidentalis
Calcium	71.50	61.19	72.65	64.80	70.40	110.16	63.36
Sodium	52.76	15.01	32.97	84.10	88.00	46.98	42.24
Iron	16.43	34.47	18.41	23.36	39.04	21.84	34.92
Zinc	18.15	3.73	12.49	6.85	21.68	15.43	24.64
Potassium	73.25	16.85	99.01	86.24	168.96	84.11	130.24
Magnesium	61.08	27.51	92.51	88.25	249.92	120.09	288.65
Phosphorus	12.52	15.38	29.42	21.65	32.63	36.91	26.19
Manganese	3.16	2.54	5.46	4.60	10.06	6.14	7.41
Nickel	4.82	7.01	2.32	5.16	12.24	10.35	18.16
Copper	1.06	0.14	ND	5.69	0.08	3.14	0.33

The iron content of all the samples investigated was lower when compared with RDA (mg/day). Iron is an

important trace element in the human body, it plays crucial roles in haemopoiesis, control of infection and cell mediated immunity (Bhaskaran, 2001). The deficiency of iron has been described as the most prevalent nutritional deficiency and iron deficiency anemia is estimated to affect more than one billion people worldwide (Trowbridge & Martorell, 2002). The consequences of iron deficiency include reduced work capacity, impairments in behaviour and intellectual performance and decrease resistance to infection (Dioxin et al., 2004). The level of Zn in all the leafy vegetable samples were moderately high, the value obtained ranged between 3.73 and 24.64mg this value are similar to ones reported by Asaolu and Asaolu (2010) and Ayoola et al. (2010). Zinc is an essential micronutrient for human growth and immune functions (Black, 2003). An estimated 20% of the world population is reported to be at risk of inadequate Zinc intake (Hotz & Brown, 2004). Studies on Nigerian shows that zinc deficiency affects 20% of children less than five years; 28.1% of mothers and 43.9% of pregnant women (Dioxin et al., 2004). The level of phosphorus determined in the leafy vegetables showed moderate concentration. The level ranged between 26.19mg/100g and 36.91mg/100g. A balance proportion of calcium and phosphorus is needed in the body. Phosphorus is essential component of bone mineral. Deficiency of phosphorus- calcium balance result in osteoporosis, arthritis, pyorrhea, rickets and tooth decay.

4. Conclusion

The present study has shown that the leafy vegetables examined have high content of crude protein with low fat content and crude fibre. The ash contents were of moderate values, the vegetables also contained good minerals with abundance of them in calcium, magnesium, sodium, and potassium while they were least in copper, nickel and manganese. The result suggest that the vegetables if consume in sufficient amount would contribute greatly towards meeting human nutritional requirement for normal growth and adequate protection against diseases arising from malnutrition.

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