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Vitamin and mineral composition of four non-conventional leafy vegetables

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Abstract
Four Non-conventional vegetables frequently consumed among some rural communities in Adamawa State, Nigeria were analysed for vitamins and minerals composition. The vegetables are *Hibiscus cannabinus*, *Haematostaphis barteri*, *Balanites aegyptiaca* and *Sesamum indicum*. Mineral content varied appreciably among the samples; *B. aegyptiaca* and *H. cannabinus* contain high levels of calcium (3.80g/100g and 3.14g/100g respectively). Potassium content was high in all the vegetables analysed, the values ranged from 1.25mg/g in *H. cannabinus* to 1.49g/100g in *S. indicum*. Concentrations of Fe, K, Mn, P and Zn were highest in *S. indicum*. The Vitamins determined namely vitamins C, B1, E and K were found in varying amounts in all the samples. Vitamin C ranged from 0.7 – 1.72mg/g, vitamin B1 (0.08 – 0.12mg/g), vitamins E (0.06- 0.10mg/g) and vitamin K (2.40 -2.96mg/g)**.** Vitamin K content was notably high in all the vegetables. The results indicate that the vegetables could serve as supplementary sources of essential nutrient to their consumers.

Key words: Concentrations, consumers, high levels, essential nutrient, Nigeria

Introduction

Vegetable is a culinary term referring to all parts of herbaceous plants eaten as food by both humans and animals in whole or in part. It includes leaves, stems, roots, flowers, seeds, fruits, bulb and tubers (Uwaegbute, 1989; Uzo, 1989). Green leafy vegetables occupy an important place among the food crops as they provide adequate amounts of many vitamins and minerals. They are rich sources of oil, carbohydrates, carotene, ascorbic acid, retinol, riboflavin, folic acid and minerals like calcium, iron, zinc, magnesium, manganese and selenium (Ihekoronye and Ngoddy, 1985). Vegetables constitute an indispensable constituent of human diet in Africa generally and West Africa in particular. Leafy vegetables are important items in the diets of many Nigerian homes. Apart from the variety which they add to the menu, the vegetables are valuable sources of nutrients especially in rural areas where they contribute substantially to protein, minerals, vitamins, fibres and other nutrients which are usually in

short supply in daily diets (Mohammed and Sharif, 2011).

The search for lesser known crops many of which are potentially valuable as human and animal feeds have been intensified to maintain a balance between population growth and agricultural productivity in the tropical and sub-tropical areas of the world (Oyebiodun *et al.*,1983). As a result, considerable interest is being generated by studies on the chemical composition and nutritional value of non-conventional (lesser known) plants in Nigeria (Oyebiodun *et al.*, 1983). In some parts of Nigeria, conventional vegetables such as cabbage or spinach are not grown at all, therefore the leaves of other crops such as sweet potatoes, cassava, melons, cowpea and wild vegetables are used to provide ample leafy content to the diet. In addition, there is seasonal variation in the availability of some conventional vegetables, they grow abundantly during the rainy season and are scarce during the dry season. As a result wild and semi wild vegetables are often eaten as substitutes in every day cooking especially in rural communities. There are immense numbers of these non-conventional vegetables utilized by people in both urban and rural communities. FAO reports that, at least one billion people are thought to use wild foods in their diet (Burlingame, 2000). Many of such plants have been identified but lack of data on their nutritive value and chemical composition has limited their utilization (Baumer, 1993).

Hibiscus cannabinus, Haematostaphis barteri, Sesamum indicum and *Balanites aegyptiaca* are among such vegetables which are unpopular but frequently consumed by certain communities in Adamawa state, Nigeria. *H. cannabinus* also known as kenaf is an annual herbaceous plant belonging to the *Malvaceae* family. It is widely grown in tropical and sub-tropical climates. Its leaves are eaten by both humans and animals. *H. barteri* commonly known as blood plum belongs to the *Ancardiaceae* family. The fresh tender leaves and the red-purple fruit which has oily seed are edible (Bokhari and Ahmed, 1979). *S. indicum* is an annual flowering plant belonging to *Pediliaceae* family. It is cultivated and used in over fifteen states of Nigeria (Falusi, 1999). Its oil, seeds and leaves are used for several medicinal and other desirable properties, the young tender shoots are used as vegetables in soups (Bokhari and Ahmed, 1979). *S. indicum* is locally grown as vegetable in home gardens thereby contributing to household food security. *B. aegyptiaca* is a tree which belongs to the *Zygophyllaceae* family. The tree is tolerant to drought and the green leaves and fruits are eaten by both humans and animal. The plant is found wild in Adamawa and Borno States of Nigeria (Bokhari and Ahmed, 1979).

This research was undertaken to investigate the vitamin and mineral composition of these non-conventional leafy vegetables so as to assess their importance in the nutritional wellbeing of the communities that consume them and also expose them for better utilization.

Materials and Methods

Sampling

Young tender leaves of *Hibiscus cannabinus, Haematostaphis barteri, Sesamum indicum* and *Balanites aegyptiaca* were collected from farm lands/wild in Yola, Adamawa State Nigeria in the month of September. The plants were identified by a taxonomist. They were de-stalked as practiced locally, washed with distilled water and air dried in a room for two weeks. They were then ground into powder using stainless steel mortar and pestle and sealed in air tight containers for the various analysis.

Analysis of Minerals

The for the determination of the mineral elements, the following digestion procedure was employed: Each sample (0.5g) was weighed in triplicate into Kjeldahl flasks and 10 ml of conc. HNO_3 was added and allowed to stand overnight. The samples were heated until a clear solution was obtained. The solution was allowed to cool and then filtered into a 50ml volumetric flask and made up to mark. The elements calcium, cobalt, copper, iron, magnesium, manganese and zinc were determined using atomic absorption spectrophotometer (AA-6800 Shimadzu, Japan). Sodium and potassium were estimated using flame photometer (Corning Flame Photometer 410). Phosphorus was

determined by UV visible spectrophotometric method (AOAC, 2000).

Vitamin Analysis
Vitamin C (Ascorbic acid) was estimated by visual titration method of reduction of 2,6-dicholorophenol-indophenol dye, vitamins B1 (thiamine), C (Ascorbic acid), E (-tocopherol) and vitamin K (Naphthoquinone) were determined using standard methods of the Association of Official Analytical Chemists (AOAC, 1997 & AOAC 1990).

Results and Discussion
The mineral element compositions of the four vegetables studied are presented in Table 1. Results of the analysis showed that *B. aegyptiaca* had the highest calcium concentration (3.8g/100g), while *H. barteri* had the lowest calcium concentration (1.65g/100g). Calcium helps in regulation of muscle contractions, transmission of nerve impulses and in bone formation. The daily requirement for calcium in humans is from 1.2g to 1.5g per day (Donalelle *et al.,* 2005) depending upon the stage of life. A meal containing a modest serving of *B. aegyptiaca* (100g per day) therefore may be enough to supply an adult's daily calcium need. The other vegetables would also provide reasonable calcium content to the diet.

The magnesium content of the vegetables ranged from 0.39g/100g in *S. indicum* to 0.96g/100g in *H. cannabinus.* With the exception of *S. indicum*, magnesium content in all the three vegetables are higher than those of some common leafy vegetables; *Telferia occidentalis* (0.65g/100g) and *Cochorus olitoris* (0.50g/100g) but lower than *Amaranthus hybridus* which is 2.5g/100g (Ifon and Bassir, 1979). Recommended daily allowance (RDA) of Mg is 0.4g/day for men and 0.31g/day for women (FNB, 1997). The vegetables would contribute significantly to the dietary requirements for Mg.

Cobalt, copper, iron, Manganese and Zinc are all mineral elements which are required in trace amounts for a wide range of functions in the body. The concentration of cobalt ranged from 0.01-0.02g/100g, copper was 0.01-0.04g/100g and zinc, 0.03-0.05g/100g. These values are low. However, they could still supplement other sources of these minerals and regular consumption may help in preventing adverse effects associated with their dietary deficiency. The level of iron in *S. indicum* was 0.76g/100g. This value is much higher than that of *Amaranthus hybridus* (0.11g/100g) as reported by Aletor and Adeogun (1995). *A. hybridus* is one of the most common vegetables consumed in Nigeria. Iron is important in the diet of both expectant and lactating mothers as well as infants and the elderly (Awoyinka *et al.,* 1995). Its dietary deficiency is associated with low blood level called anaemia characterized by weakness and dizziness (Ihekoronye and Ngoddy, 1988). This could be prevented by regular consumption of these vegetables in diet. Upper intake level of iron for adults is 0.04g/day (Durupts, and Nove, 2000). Manganese content was highest in *S. indicum* (0.25g/100g) followed closely by *H. cannabinus* (0.23g/100g). The concentrations in *H. bateri* and *B. aegyptiaca* were rather low. The Recommended Dietary Allowance (RDA) for manganese varies between 2mg/kg to 8mg/kg (Jones *et al.,* 1985).

Phosphorus is an important macroelement. Its health benefits include healthy bone formation, improved digestion, regulated excretion, protein formation, hormonal balance, improved energy extraction, cellular repair, optimized chemical reactions, and proper nutrient utilization. All the vegetables analysed contained substantial amounts of phosphorus, ranging from 0.13g/100g in *H. barteri* to 0.38g/100g in *S. indicum*. Consumption of these vegetables will help prevent some of the problems associated with phosphorus deficiency.

Values of potassium in the vegetables ranged from 1.25g/100g to 1.49g/100g with *S. indicum* having the highest value. These values are much lower than obtainable in some common Nigerian vegetables e.g *Basella tubra (*3.80g/100g) and *Amaranthus hybridus* (4.29g/100g) (Ifon and Bassir, 1979). The RDA for potassium in adults is 900mg, teenagers and pregnant women however, require higher (1200 and1250 mg/day) respectively. 100g of any of these will be enough to satisfy the RDA for potassium in adults.

Table 1: Mineral element composition of vegetables investigated (g/100g) dry weight

Mineral element	*Hibiscus cannabinus*	*Haematostaphis barteri*	*Sesamum indicum*	*Balanites aeqyptiaca*
Ca	3.14 ± 0.41	1.65 ± 0.02	2.90 ± 0.44	3.80 ± 0.90
Mg	0.96 ± 0.04	0.70 ± 0.04	0.39 ± 0.12	0.86 ± 0.04
Co	0.02 ± 0.00	0.01 ± 0.00	0.02 ± 0.00	0.03 ± 0.00
Cu	0.04 ± 0.02	0.01 ± 0.00	0.01 ± 0.00	0.04 ± 0.02
Fe	0.46 ±0.03	0.24 ± 0.20	0.76 ± 0.20	0.25 ± 0.11
Mn	0.23 ± 0.03	0.11 ± 0.00	0.25 ± 0.02	0.12 ± 0.00
Zn	0.03 ± 0.01	0.03 ± 0.04	0.05 ± 0.02	0.03 ± 0.02
K	1.25 ± 0.01	1.34 ± 0.01	1.49 ± 0.05	1.30 ± 0.19
Na	0.14 ± 0.01	0.23 ± 0.02	0.10 ± 0.00	0.22 ± 0.00
P	0.25 ± 0.02	0.13 ± 0.12	0.38 ± 0.24	0.19 ± 0.02

Values are mean ± SD for three determinations

Table 2: **Vitamin Content of vegetables investigated (mg/g)**

Vitamin	*Hibiscus cannabinus*	*Haematostaphis barteri*	*Sesamum indicum*	*Balanites aegyptiaca*
B1	0.12 ±0.002	0.04 ± 0.00	0.08±0.002	0.08 ± 0.002
C	0.7 ±0.00	1.17 ± 0.01	0.64 ± 0.00	1.72 ± 0.01
E	0.08 ± 0.002	0.08 ± 0.002	0.10 ±0.00	0.06 ± 0.00
K	2.94 ± 0.45	2.96 ±0.33	2.50 ±0.50	2.40 ± 0.45

Values are mean ± SD for three determinations

The vitamin contents of the four vegetables samples in are shown in table 2. The results of the analysis showed very high amounts of vitamin K in all the vegetables, the values ranged from 2.40mg/g to 2.96mg/g with *H. barteri* having the highest value. Vitamin k is found mostly in green leafy vegetables among other sources. It is required for blood coagulation and bone metabolism. Regular consumption of any of these vegetables therefore may help in preventing adverse effects of its deficiency which results in slow blood clotting (Ihekoronye, and Ngoddy, 1988). *B. aegyptiaca* has the highest vitamin C value (1.72mg/g) followed by *H. barteri (*1.17mg/g), then *H. cannabinus* and *S. indicum* with values 0.78mg/g and 0.64mg/g respectively. These values are low in comparison to those of *Amaranthus hybridus* (4.05mg/g), *Telferia accidentalis* (3.41mg/g and *Cochorus olitoris* (1.65mg/g), (Ifon and Bassir, 1979). Vitamin C aids wound healing and also help in resisting infection. Its deficiency can cause scurvy, bleeding gums, poor healing of wound and low resistance to infection. The recommended dietary allowance of vitamin C is 45mg per day (WHO, 1991). These vegetables although low in Vitamin c, can still supplement other sources of the vitamin. Vitamin E, a fat soluble vitamin which is a powerful anti-oxidant (*West et al., 1988*) was present in appreciable amounts in all the four vegetable samples analysed, with *S. indicum* having the highest value (0.10mg/g). Values of vitamin B_1 in the vegetables ranged from 0.04mg/g in *H. barteri* to 0.12mg/g in *H. cannabinus*. These values are relatively high in comparison to the values for some common vegetables reported by previous workers (Oguntona and Oguntona, 1985; Oguntona and Oguntona, 1986)

Conclusion

The results from this research indicates that the leaves of *H. cannabinus, H. barteri, S. indicum* and *B. aegyptiaca* could serve as rich sources of vitamins and minerals especially calcium, magnesium, iron and vitamin K for humans. Comparison of their nutrient contents with those of some popular leafy vegetables revealed that the vegetables are not inferior to the conventional ones. Significant contribution regarding the recommended daily allowance (RDA) of the nutrients can be made by these vegetables. Earlier studies on the vegetables by Kubmarawa *et al.* (2009), established their proximate composition and anti-nutritional factors. The study revealed that their anti-nutritional contents are low. This implies that the overall nutritional value of the vegetables will not be affected. We recommend further research on the presence of other vitamins and minerals in the vegetables and the effects of preservation and cooking methods on the nutrients availability. This is necessary in order to establish their complete nutritional contribution to humans.

References

Aletor, M.V.A and Adeogun, O.A. (1995). Nutrient and Anti-nutrient components of some Tropical leafy vegetables. *Food chem* 53:375-376.

A.O.A.C. (1990). Association of Analytical Chemists Official Methods of Analysis. 15th ed., Washington D. C.USA.

AOAC,(1997) Official Methods of Analysis of AOAC International. 1997, 16th ed., 3rd rev.Association of Vitamin Chemists Inc. 1951 Methods of Vitamin Assay. 2nd ed.. Interscience Publishers, Inc., New York.

AOAC, 2000). Horwitz W (2000) (editor). Official Method of Analysis of AOAC International, 17th Edition. Maryland, USA. Methods 9.1.09 and 50.1.14.

Awoyinka, A.F., Abegunde, V.O. and Adewusi S.R.A. (1995). Nutrient content of young Cassava leaves and assessment of their acceptance as a green vegetable in Nigeria. H*um nutr.* 47: 21-26.

Baumer, M. (1993). Notes on trees and shrubs in arid and Semi-arid regions. FAO/UNEP Programme p.2

Bokhari, M.H. and Ahmed, M.J. (1979). Food plants in Borno State Nigeria. University Press Maiduguri, Nigeria pp 20-21.

Burlingame, B., (2000). Comparison of total lipids, fatty acids, sugars and nonvolatile organic acids in nuts from *Castanea* species. *J. Food Comp. Anal.* 13:99-100.

Donalelle, R.J. (2005). Health: The Basics 6th edition, Pearson Education Publishers San Francisco. P.20.

Durupts, D.T. and Nove, J.R. (2000) Hereditary hemochomatosis *Rev. Med. Interne*22 (11): 961-71.

Falusi, O.A. (1999). Genetic Studies in the genes *Sesamen Pedliaca*. PhD Thesis Federal University of Technology, Minna, Nigeria, p. 92.

FNB (1997). Food and Nutrition Board, Institute of medicine: Dietary refrence intakes for calcium, phosphorus,magnesium. Washington DC, National Academy Press.

Ifon, E.T. and Bassir, O. (1979). The Nutritive value of some Nigerian green vegetables part 1; Vitamin and Mineral content. *Food chem.*, 5: 253-267.

Ihekoronye, A.I. and Ngoddy, P.O. (1988). Integrated food Science and Technology for the tropics. Macmillan Education Limited, London pp 22-25.

Jones, M. M., Johnson, D. O., Netlerville, J. T., Wood, J. I. and Joesten, M. D., (1985). Chemistry and Society. 5th ed., Saunders College Publishers U. S. A., 521- 577.

Kubmarawa, D., Andenyang, I.F.H. and Magomya, A.M., (2009). Proximate composition and amino acid profile of two non-conventional leafy vegetables (*H.cannabinus and H.barteri*). *African J of food Science*, Vol. 3(9) :233-236.

Mohammed, M. I. and Sharif, N. (2011). Mineral composition of some leafy vegetables consumed in Kano,Nigeria. *Nigerian Journal of Basic and Applied Science, 19*(2), 208-211.

Oguntona, T. and Oguntona, C.R. B. (1985). Loss of Thiamin in Some Nigerian Vegetables. Paper presentation at the First international conference on Food and Health. Salsa maggione Parma, Italy.

Oguntona T. and Oguntona, C.R.B. (1986). Proximate composition of three leafy

Vegetables commonly consumed in Northeastern Nigeria, paper presented at the 1st National Workshop of Food composition at Ibadan, Nigeria pp 1-3.

Oyebiodun, G.L., Gabriel, O.F. and Babatunde L.F. (1983). Nutritional value of the fluted pumpkin (*Telferia Accidentalis*) *Agric. Food Chem.* 31: 989-992.

Uwaegbute, A. C (1989). V*egetables: Nutrition and utilization*. In: Food crops production. Dotan publishers Ltd.Ibadan, 39-44.

Uzo, J. O. (1989). *Tropical vegetable production*. In: Food crops productions. Dotan publisher Ltd Ibadan,45-49.

West, C.E., Pepping, F. and Temalilwa, C.R. (1988). The composition of Foods eaten in East Africa. Wageningen Agricultural University. The Netherland.

WHO (1991). Guidelines for the Assessment of Herbal Medicines, World Health Organization, Geneva.