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DETERMINATION OF ESSENTIAL ELEMENTS IN *LEPTADENIA LANCEFOLIA* (DECNE) USING ENERGY DISPERSIVE X-RAY FLOURESCENE ANALYSIS (EDXRF)

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ABSTRACT

Essential elements concentration in the flowers, leaves, stems and roots of Leptadenia lancefolia decne from unutilized and abandoned farmlands were determined using Energy Dispersive X-ray Fluorescence (EDXRF) instrumentation. The elements determined were Ca, Cu, Fe, K, Mn, Rb, Sr and Zn. Ca, Fe and K were found in higher concentrations while Cu, Mn, Rb, Sr and Zn were in trace levels. Nutritional, medicinal and distribution pattern of the elements in the plant are discussed.

Keywords: *Leptadenia lancefolia Decne*, Essential elements and Dispersive X-ray Fluorescence analysis (EDXRF) instrumentation.

INTRODUCTION

The roles played by the conventional and non-conventional leafy vegetables in the diet of the poor inhabitants of the developing nations. This is because the nutritional needs of these people still remain unsatisfied. This has spurred various researchers to study the nutrient composition of these items (Abdullahi, 2000). The nutritional insufficiency is attributed to lack of balanced diet since people in these parts of the world are in acute poverty, illiteracy, experiences draught/famine and could not afford the food items that contain all the components that make up a balanced diet. Reports on the micronutrient deficiencies worldwide have been reviewed and described (Tomori and Obijole, 2000) and found to afflict over 2 billion people with most, living in the poorer countries. Some 40 million pre-school children worldwide are suffering from at least mild Vitamin A and 0.7 million new cases are added every year (Omidiji, 1977).

Vegetables are consumed as food especially in soup, stews, and salad preparations whereby the leaves, young roots, stems and flowers are boiled and consumed. Nutritionally, these vegetables are good source of vitamins, proteins, minerals and fibers (Omidiji, 1977). Apart from the macro elements such as calcium, potassium, phosphorus and sulphur, green leafy vegetables are good sources of micro elements such as iodine, copper, manganese, cobalt, nickel, chromium, vitamins A and C and carbohydrates(Omidiji , 1977; Tomori and Obijole, 2000).

Conventional and non-conventional leafy vegetables are excellent sources of nutrients. Consumption of such substances in conjunctions with other sources of food classes ensures good health of individuals. Although present in small amounts, the mineral elements are indispensable to the body. They enter in the body structure and tissue of plants to a greater or lesser extent as their component (Abbio, 1990). Usually, the mineral elements present in biological tissues and are available can be essential since it is impossible for rare metals to be acquired. The humans acquire their supply of minerals from plants, and it has been postulated that any element not present in plants are probably not essential (Dim *et al.,* 2004). The mineral elements are either present in plants as components of enzymes, pigments, cell sap or cell wall. Their amount depends on many factors such as species, variety, stage of maturity and soil type (Gwarzo *et al.,* 2006; Clarkson and Hansen, 1980). Among the non-conventional green leafy vegetables is *Leptadenia lancefolia* decne.

Leptadenia lancefolia decne belongs to the plant *Asclepidaceae*. It has the vernacular names such yadiya (Hausa) and iran-aji (Igbo) (Dalziel, 1955). The young shoots, roots and flowers are used as food in soups or added to beans and in the western Sahel of Africa (Dalziel, 1955; Cook *et al.*, 2000). Also in many parts of the Savanna interior, the leaves of this plant and the greenish sap of stems are regarded as a remedy for gonorrhea (Dalziel, 1955). In northern Nigeria, the leaves are taken dry along with the leaves of smilax for treatment of tertiary syphilis. The plant is found in several prescriptions for veneral diseases. In eastern Sudan the roots are given to horse and cattle to relieve flatulence. Some Fulani women prepare a comestible of the buds, flowers and fruits. In French Sudan, *Leptadenia lancefolia* decne harbors an aphis and therefore the plant is grown in Guinea corn fields to attract sphides for pest control (Dalziel, 1955). The fiber obtained from this plant provides properties that compares favorably with other natural sources like cotton, jute, sum hemp and pineapple. It has a high cellulose content (75.26%) as well as low lignin (4.93%) and pentosan (5.15%) levels (Kundu et al., 2005).

Phytochemical studies of this plant have indicated the presence of several triterpenes with both anti-inflammatory activity and effect on keratinocyte proliferation in its latex (Nkiema *et al.,* 2001). Literature on mineral composition of *Leptadenia lancefolia* decne is scarce but significant amount of selenium and phosphorus are found in the leaves and as well as fatty acids, amino acids, lutein and beta-carotene (Aquino *et al.,* 1996; Frienberger *et al.,* 1998; Sena *et al.*, 1998).

MATERIALS AND METHODS

Sample Collection

Twenty five (25) samples of Leptadenia *lacefolia* decne consisting of the leaves, stems, fruits and roots were collected from two sites: at Karkari village, Gwarzo local government of Kano state, Nigeria and Koraye village around Ahmadu Bello University (ABU) dam banks all located in the southern part of ABU, Zaria, Kaduna state, Nigeria.

Sample Treatment

The sample were washed with tap water and then air-dried followed by oven drying at 60^0C. After drying, the samples were ground using mortar and pestle and made to pass through 1.00mm mesh.

Elemental Analysis

Pellets of the pooled and homogenous powdered samples were prepared by taking 0.500g and pressed with about 10 tonnes hydraulic press. Measurements were then taken using annular 25mCi^{109}Cd as the excitation source that emits AgK X-rays (22.2Kev) in which case all elements with lower excitation mode were detected (Funtua, 1999).

The quantitative analysis of the samples was carried out using the Emission Transmission method (Funtua, 1999). It consists of SILENa model 12170 Lithium drifted Se (Li) detector with a resolution of 170Kev line coupled to a computer controlled analog digital converter (ADC) card. The system utilized the MAESTRO software for spectral acquisition, peak location, energy assignment, elemental identification, smoothing background subtraction and normalization as well as the AXIL software for quantification of the acquired spectra.

RESULTS AND DISCUSSION

The average concentration of eight essential elements analyzed in the leaves, stems, roots and flowers *Leptadenia lacefolia* decne from two sites are shown in Tables 1 and 2. These elements are Ca, Cu, Fe, K, Mn, Rb, Sr, and Zn respectively. Among these elements Ca, Fe, K, and Mn are in higher concentrations (≥2704.55µgg-^{1}) while Cu, Rb, Sr, and Zn are in traces≤ϱ1.44ugg -^{1}) and within normal plant element composition and may not play any unusual role in man when the plant is consumed (Gwarzo et al., 2006).

Calcium (Ca) has the highest concentration among the essential elements found in *Leptadenia lacefolia* decne at about 2960-19750µgg-^{1} with the concentration increasing in the order stems> leaves > roots > leaves. The element (Ca) is the major depository in animal bones, essential in the contractibility of cardiac muscles. It helps in growth rate in infants and plays a major role in preventing osteoporosis in animals. It also enhances the ability for the blood to clot, improved nerve function and immune defenses (Dim et al., 2004). Therefore the consumption of this plant by humans may be beneficial. Potassium is present at about 9495.94µgg-^{1} in the plant and together with sodium are essential electrolytes for maintaining normal fluid balance in cells and delicate balance of these two elements are reported to prevent an increase in blood pressure and maintain normal cardiac rhythm.

Iron, manganese and zinc are present averagely at 194.4µgg-^{1}, 156.19µgg-^{1} and 39.913µgg-^{1} concentrations respectively. They are, for example, present in the hormone insulin, protein and immune system. Manganese plays a vital role in the control of diabetes while zinc has an anti-diarrheal activity and regulates fertility (Allen et al., 1974). These are some of the illnesses for which, *Leptadenia lancefolia* decne is traditionally reported as remedy (Dalziel, 1955). The concentrations of copper, rubidium and strontium are 37.82µgg^{-1}, 43.48µgg^{-1} and 244.5µgg-^{1} respectively. Copper is an element that is a remedy for heart diseases, anaemia and osteoporosis (Kiple and Coneeorles, 2000).

The distribution of these elements in *Leptadenia lancefolia* decne from the two sampling sites have shown that their concentrations did not increase from roots, stems, leaves and flowers as observed elsewhere (Funtua, 1999). This may be attributed to the greenish young stems and roots of the plant indicating the presence of large amount of pigments and enzymes performing various functions.

Table 1: Average essential concentration and standard deviation [in µgg^{-1}weight] of the leaves and stem of *Leptadenia lancefolia* decne at site 1 [Koraye village] and site 2 [Karkari village].

Site 1			Site 2	
Elements	**Leaves**	**Stems**	**Leaves**	**Stem**
Ca	15450 ± 1485	87975 ± 967.5	16500 ± 1337.5	19750 ± 1970
Cu	34.5	39.7	32.25	ND
Fe	271.0 ± 45.1	192.775 ± 329	91.725 ± 35.8	360.2 ± 201
K	15500 ± 1755	50225 ± 1212.5	7922.5 ± 1465	7990 ± 2740
Mn	141.0	132.75	136.25	356
Rb	34.5 ± 8.295	24.5	22.25 ±9.08	178.05 ± 48.18
Sr	126.0 ± 6.23	71.5 ± 6.61725	240.5 ±7 .4725	1179.0 ± 41.995
Zn	33.8 ± 5.6	26.9	26.975	129.35

ND = Not detected

Table 2: Average essential element concentration and standard deviation [in μgg^{-1}weight] of the roots and flowers of *Leptadenia lancefolia* decne at site 2 [Koraye village] and site 2 [Karkari village].

Site 1			Site 2	
Elements	**Leaves**	**Stems**	**Leaves**	**Stems**
Ca	8992.5 ± 1252.5	5570.0±1150	16300.0 ± 645.655	2960.0 ± 603.0
Cu	42.3	ND	ND	ND
Fe	241.25 ± 43.5	81.4	240.0 ± 44.15	77.0 ± 75.0
K	4067.5 ± 790	14900.0±1780	5615.0 ± 1640.0	149950.0± 1465.0
Mn	132.0 ± 1.4425	17.3	127.0	108.5
Rb	21.85	48.1 ± 4.70	22.8± 7.06	26.55 ± 4.175
Sr	71.3 ± 7.2425	22.0	162.0 ± 7.615	57.95 ± 4.85
Z	28.475	116.0	29.25	21.85

ND = Not detected

CONCLUSION

The leaves, stems roots and flowers of *Leptadenia lancefolia* decne contain essential elements like Ca, Cu, Fe, K, Mn, Rb, Sr, and Zn. Ca, Fe, K, and Mn in higher concentration while Cu, Rb, Sr, and Zn are in traces. The levels of all the elements are higher in the root, leaves stems and the flowers. Cu was absent in the flowers of samples from site 1 and in stems, roots and flowers of sample from site 2 .Variations in the concentrations of the elements may be attributed to localized factors such as the parent material that form the soil in the different sites. This implies that consumption of *Leptadenia lancefolia* decne may supplement the nutritional level of he rural populace that reside around the sites of collection.

REFERENCES

Abbio, D. (1990): *Useful plants of Ghana*. Intermediate Technology Publication Ltd. Pp 200 – 201.

Abdullahi, S.A. (2000): Nutrition Composition of Three Species of Mormyrids in the Nigerian Fresh water. *Nig. J. Tech. Edu. 17(1and2): 177-183.*

Allen, S.E.; Grimshaw, H.; Parkinson, T.A. and Quimbly, C. (1974): Chemical analysis of ecological samples. Blackwell publishers, Oxford, London *565.*

Aquino, R.; Peluso, G.; Detommas, N.; Desimone, Fad n Pizza, B. (1996): new polyoxy pregnane ester derivatives from leptadenia hastate. *J. Nat. Prod. 59 (6): 555-564*.

Clarkson, D.T. and Hansen, J.B. (1980): The mineral Nutrition of Plants Annual Review of Plant Physiology. *31: 239-298*.

Cook, J.A.; Vanderjagt, D.J.; Pastuzyn, A,; Mounkaila, G.; Glew, R.S., Millson, M. and Glew, R.H. (2000): Nutrient and chemical composition of 13 wilds plant food of Niger, *J. of food composition and Analysis, 13 (1): 83-92*.

Dalziel, J.M. (1955): *The useful plants of West Africa*. Crown agents for overseas government and administration, London. Pp *127-128*.

Dim, L.A.; Funtua I.I.; Oyewale, A.O.; Grass, F.; Umar, I.M.; Gwozdz, R. and Gwarzo, U.S. (2004): Determination of the Essential Elements in *Ageratum Conyziodes*: a tropical Medicinal plant using instrumental neutron activation analysis. *J. Radianal. Nucl. Chem 261 (1):22-228*.

Frienberger, C.E.; Vanderjagt, D.J.; Pastuszyn, A. and Glew, R.S. (1998): nutrient content of the edible leaves of seven wild plants form Niger. *Plant foods Hum. Nutr. 53 (1).*

Funtua, I.I. (1999): Application of the Transmission – Emission method in EDXRF for the determination of trace metals in biological materials. *J. Trace microprobe Tech.17, (3), 293-297*.

Gwarzo, U.S.; Gimba, C.E. and Dim, L.A. (2006): Mineral Composition of *Hibiscus cannabinus* Linn. *CHEMICLASS JOURNAL*. *3: 51-56*.

Kundu, S.K. Mojumder, P.; Bhadhuri, S.K. and Das, S. (2005): Physical properties of khimp fiber, *Indian J. fiber and textile research.30:148-153.*

Nkeima, J. B.; Vahaelen-Fastre, R.; Vanhaelen. M.; Fontaine, J.; Degraef, C. and Haenen, M. (2001): effect of ati-inflammatory triterpene isolated from *Leptadenia Hastata* latex on keratinocyte proliferation. *Phytother. Res. 15 (2): 131-41*.

Omijidi, M.O. (1977): Yield and Nutritive Quality of Selected Leafy Vegetables from Interspecific *Solanum* L. Crosses. *Nig. J. of Sci. II (1 and 2) 197-208*.

Sena, L.P.; Vanderjagt, D.T.; Rivera, C.; Tsin, A.I. and Muhammad, I. (1998): Analysis of nutritional components of eight famine foods of the republic of Niger. *Plant Foods Hum. Nutr. 52 (1) 17-30*. The Cambridge World History of Food (2000) Vol. 1 Cambridge University Press (eds) Kiple, F.K. and Coneeorles, K. Cambridge University Press. Pp 859 - -860

Tomori, W.B and Obijole, O.A (2000): Mineral Composition of Some less Utilized Vegetables in Nigeria. *Afr. J. Sci. Tech. 1 (2): 153-157*.

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