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Distribution of Heavy Metals in Leaves, Stems and Roots of Fluted Pumpkin (*Telfeiria occidentalis)*

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Abstract: The distribution of heavy metals in leaves, stems and roots of fluted pumpkin *(Telfeiria ocidentalis)* was evaluated using chemical analysis. The results show the following sequence Fe (3.14 µg/g) > Cu (0.88 µg/g) > Mn (0.40µg/g) > Pb (0.13µg/g) > Cr (0.08 µg/g) > Zn (0.04µg/g) in the leaves and Cu (1.52 µg/g) > Fe (1.12 µg/g) > Mn (0.20 µg/g) > Zn (0.08 µg/g) > Pb (0.04 µg/g) in the stem with Fe (1.67 µg/g) > Cu (0.53µg/g) > Mn (0.25 µg/g) > Zn (0.09 µg/g) > Pb (0.03µg/g) in the roots. The results also showed that the concentrations of Fe, Mn, Pb and Cr were highest in the leaves, Cu concentration was highest in the stems while that of Zn was highest in the roots. It was also revealed that Fe concentrations was the highest at all the locations in the leaves and roots. While Cu had the highest concentration in the stems.

Key words: Heavy metal, vegetable, telfeiria occidentalis

Introduction

Telfeiria occidentalis is a creeping vegetable that spread low across the ground with lobed leaves and long twisting tendrils. It is a warm weather crop which grows well in low lands and tolerate elevation of some few meters above the ground. It thrives best in soils rich in organic matter. Fluted pumpkin as it is commonly known in southern Nigeria plays important role in human and livestock nutritions. It is a source of protein, oil, fats, minerals and vitamins (Oyenuga, 1968; Ifon, 1977, Okoli *et al*., 1988; Aletor and Adeogun, 1995). The leaves of this vegetable are used in the preparation of several delicacies in southern Nigeria, one of which is "Edikang Ikong Soup" (a popular delicacy of the Efiks/Ibibios in Cross River and Akwa Ibom States in Nigeria). It thrives better in the early part of the rainy season. It can also be planted between August and October which are the latter months of the rainy season. *T. occidentalis* can be grown in garden and farmed as a vegetable. It can survive for 3-4 years if there is moisture in the soil (Achinewu, 1987). The roots of *T. occidentalis* is believed to be toxic to man if consumed, but there is no reported research work on the heavy metal content of this vegetable, though Latunde-Dada (1990) and Akpanunam (1984) reported on the effect of processing and temperature on its ascorbic acid and total carotenoids contents. Archibong (2002) reported on its biochemical composition.

Achinewu (1987) also reported on the thiamine, riboflavin and niacin content of the fermented *T. occidentalis*, while Akpanabiatu *et al*. 1998) evaluated its minerals and toxicant content. Ajayi *et al*. (1980) also reported on the loss of vitamin C content in cooked *T. occidentalis*. This study is aimed at determining the distribution of heavy metals in the leaves, stems and roots of this highly nutritions vegetable which is an extremely important vegetable predominantly grown by small-scale farmers and commonly consumed by majority of the people in southern part of Nigeria.

Materials and Methods

Sample collection: The fluted pumpkin plants used in this study were obtained from three private farm lands located along three streets in Calabar south local government area. The fluted pumpkin from these farmlandsare supplied to all the major markets in Calabar metropolis and beyond. The farmlands are located long the following streets Afokang, Anantigha and Eneobong. 300 fluted pumpkin plants (100 plants per farmland) were uprooted when young and leaves were tender and edible.

The plants were placed under running tap to wash away the sand from the leaves, stems and roots. The plants were put into three separate polyethene bags and labeled. They were then taken immediately to the laboratory.

Sample preparation: The plants were cut using stainless steel knife into leaves, stems and roots separately. The plants samples were dried to constant weight in an oven maintained at 105°C. They were then pulverized to fine powder using a laboratory grinder. They were put in labeled polyethene bags and placed in a desiccator. 3.0g of each sample was accurately weighed into clean platinum crucible and ashed at 450-500°C then cooled to room temperature in a desiccator. The ash was dissolved in 5ml of 20% hydrochloric acid and the solution was carefully transferred into a 100ml volumetric flask. The crucible was well rinsed with distilled water and transferred to the flask and made up to the mark with distilled water and shaken to mix well

Table 1: Heavy metal content of fluted pumpkin (mg/g) dry weight at Afokang Street

Sample	Fe	Mn	Cu	Zn	Pb	Cr	Hg	Cd	Co	Ni
Roots	1.67	0.25	0.16	0.08	0.03	ND	ND	ND	ND	ND
Stems	1.12	0.20	0.28	0.05	0.04	ND	ND	ND	ND	ND
Leaves	3.14	0.40	0.16	0.04	0.13	0.08	ND	ND	ND	ND

Table 2: Heavy metal content of fluted pumpkin (mg/g) dry weight at Anantigha street

Sample	Fe	Mn	Cu	Zn	Pb	Cr	Hg	Cd	Co	Ni
Roots	1.41	0.25	0.29	0.09	ND	ND	ND	ND	ND	ND
Stems	0.17	0.16	1.52	0.08	ND	ND	ND	ND	ND	ND
Leaves	1.57	0.35	0.88	0.03	ND	ND	ND	ND	ND	ND

Table 3: Heavy metal content of fluted pumpkin (mg/g) dry weight at Eneobong street

Sample	Fe	Mn	Cu	Zn	Pb	Cr	Hg	Cd	Co	Ni
Roots	1.67	0.23	0.53	0.09	ND	ND	ND	ND	ND	ND
Stems	0.82	0.17	0.93	0.07	ND	ND	ND	ND	ND	ND
Leaves	1.71	0.30	0.62	0.04	ND	ND	ND	ND	ND	ND

(Ademoroti, 1996). The resulting sample solutions were then taken for the determination of the heavy metal concentrations. The samples from each farm were analyzed compositely.

Analysis: The determination of the heavy metal (Fe, Mn, Cu, Zn, Pb, Cr, Cd, Ni, Hg, Co) content of the sample solution was carried out using atomic absorption spectrophotometer (Pye Unicam 2900) according to the procedure of the AOAC (1984) on dry samples.

Results and Discussion

The results (Table 1-3) showed that the concentration of Fe ranged from 3.14 µg/g at Afokang to 1.57 µg/g at Anantigha in the leaves, 1.67µg/g at Afokang to 1.41µg/g at Anantigha in the roots and 1.12 µg/g at Afokong to 0.82 µg/g at Eneobong in the stems. The concentrations of Mn ranged from 0.40µg/g at Afokang to 0.30µg/g at Eneobong in the leaves, 0.25µg/g at Afokang to 0.23 µg/g at Enobong in the roots and 0.20µg/g at Afokang to 0.16 µg/g at Anantigha in the stems.

The concentrations of Cu ranged from 1.52µg/g at Anantigha to 0.28µg/g at Afokang in the stem, 0.88µg/g at Anantigha to 0.16 µg/g at Afokang in the leaves and 0.53µg/g at Eneobong to 0.16 µg/g at Afokang in the roots.

The concentration of Zn ranged from 0.09µg/g at Anantigha to 0.08 µg/g at Afokang in the roots, 0.08µg/g at Anantigha to 0.05 µg/g at Afokang in the stems and 0.04µg/g at Eneobong to 0.03 µg/g at Anantigha in the leaves.

The concentrations of Pb were 0.13µg/g in the leaves, 0.04µg/g in the stems and 0.03µg/g in the roots all at Afokang. Pb was not detected in the plants at Anantigha and Eneobong.

The concentration of 0.08µg/g was recorded for Cr at Afokang only. Cr was not detected in the plants at Anantigha and Eneobong. The concentrations of Hg, Cd, Ni and Co were not detected in any of the plants in all the locations sampled. The results revealed that Fe had the highest concentration of 3.14µg/g followed by Cu (0.88µg/g), Mn (0.40µg/g), Pb (0.13µg/g), Cr (0.08µg/g) and Zn (0.03µg/g) was the least in the leaves Cu had the highest concentration of (1.52 µg/g) followed by Fe (1.12 µg/g), Mn (0.20 µg/g), Zn (0.08µg/g) and Pb (0.04µg/g) was the least in the stems. While Fe had the highest concentration of (1.67µg/g) followed by Cu (0.53µg/g) Mn (0.25µg/g), Zn (0.09µg/g) and Pb (0.03µg/g) was the least in the roots. The concentrations of Fe and Mn were highest in the leaves followed by the roots and least in the stem. Cu was highest in the stem and least in leaves. Zn was highest in the root and least in the leaves, Pb was highest in the leaves and least in the roots while Cr was only detected in the leaves at Afokang. The sequence of each heavy metal is shown to be as follows (Fe) in leaves > roots > stems. (Mn) in leaves > roots > stems, (Cu) in stems > leaves> roots (Pb) in leaves > stems > roots, (Zn) in roots > stems > leaves (Cr) in leaves only. The results further reveals the heavy metals distribution in the fluted pumpkin (*T. Occidentalis*) to be Fe (3.14µg/g) > Cu (0.88µg/g) > Mn (0.40µg/g) > Pb (0.13µg/g) Cr (0.08µg/g) > Zn (0.04µg/g) in the leaves. Cu (1.52µg/g) > Fe(1.12µg/g) > Mn (0.20µg/g) > Zn (0.08µg/g) > Pb (0.04µg/g) in the stems Fe (1.67µg/g) > Cu (0.53µg/g) > Mn (0.25µg/g) > Zn (0.09µg/g) > Pb(0.03µg/g) in the roots.

Afokang street is the only street with heaviest vehicular traffic out of the three locations sampled, therefore the high concentration of Pb found in the leaves of the plants in this location may be due to high levels of emission from vehicles plying the road. And the fact that the concentration decreases from the leaves to roots seems to support this view point. The other sampled locations that are far away from the roods are free from the effect of this vehicular emission of Pb and other toxic metals on them. The high concentration of Fe in this vegetable and the very low concentration of other toxic heavy metals show that *T. occidentalis* from this locations may

increases the nutritional health of the people in the study area (Fiona *et al.*, 2003; Ifon, 1977; Latunde - Dada, 1990).

Conclusion: The results of the study revealed that *T. occidentalis* has highest concentrations of Fe and Mn in the leaves, Cu and Fe in the stems and Fe, Cu, Mn and Zn in the roots. High concentrations of Fe in the leaves of the plant may increases the nutritional health of the people that consumed it.

References

Achinewu, S.C., 1987. Thiamin, Riboflavin and Niacin contents of fermented fluted pumpkin *(Telfeiria occidentalis)* and castor seeds *(Ricinus communis)* Nig. Nutr. Sci., 8: 51-61.

Ademoroti, C.M.A., 1996. Environmental Chemistry and Toxicology Ibadan, Foludex press Ltd.

Akpanunam, M.A., 1984. Effects of wilting, blancing and storage temperatures on ascorbic acid and total carotenoids content of some Nigerian fresh vegetables. Plant foods. Hum. Nutr., 34: 177-180.

Akpanabiatu, M.I., N.B. Bassey, E.O. Udosen and E.U. Eyong, 1998. Evaluation of some minerals and toxicants in some Nigerian soup meals. J. Food Composition and analysis, 11: 292-297.

Aletor, M.V.A. and O.A. Adeogun, 1995. Nutrients and anti-nutrient composition of some tropical leafy vegetables Food Chem., 53: 375-379.

AOAC, 1984. Official methods of analysis 14th Edn. Association of Official Analytical Chemists. Washington DC. USA.

Archibong, E.M., 2002. Biochemical composition and Biotoxicity of fluted pumpkin *(telfeiria occidentalis)* M.Sc Thesis, Dept. Biochemistry, University of Calabar, Nigeria.

Ajayi, S.O., S.F. Oderinde and Osibanjo, 1980. Vitamin C losses in cooked fresh leafy vegetables. Food Chem., 5: 243-247.

Fiona Marshall, Ravi Agarwal, Dolfte Lintelo, D.S. Bhupal, Ranasingh, neela Mukherjee, Chandra sen, Nigel Poole, Madhocuka Agrawal and S.D. Singh, 2003. Executive summary of technical report on heavy metal contamination of vegetables in Delhi. UK. Department of International Development and Indian Agricultural Research Institute.

Ifon, E.T., 1977. The nutrient composition of some Nigerian leafy green vegetables and physiological availability of their iron content. Ph.D. Thesis Dept.of Biochemistry University of Ibadan, Nigeria.

Latunde-Dada, G.O., 1990. Effects of processing on Iron levels in and availability from some Nigerian leafy vegetables J. Sci. Food Agric., 53: 355-361.

Okoli, E.C., O.O. Nmorka and C.M. Mgbegbu, 1988. Blanching and storage of some Nigerian vegetables Int. J. Ed. Sci. Tech., 23: 639-641.

Oyenuga, V.A., 1968. Nigeria's food and feeding stuffs their, chemistry and nutritive value: 3rd Edn. Ibadan University press.