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Trace Metal Distribution in Nigerian Leafy Vegetables

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Abstract: Trace metal distribution in some selected Nigeria leafy vegetables were determined. All the minerals investigated were found present in all the components of the selected vegetables. On the average, zinc was the most abundant metal with averages of 2.82, 1.97 and 2.08 (mg/g) in roots, stem and leaf of the vegetables, while lead was the leafy with averages of 0.07, 0.06 and 0.07 (mg/g), in roots, stems and leaves respectively. Trace metal distribution number (TMDN) indicates that the roots concentrate most of the metals than the stems and leaves.

Key words: Leafy vegetables, trace metal, human health

INTRODUCTION

Environmental impact of some trace metals cannot be over emphasized. While some of these metals (Pb, Cd, Hg e.t.c) have been reported to be extremely dangerous to human health without any known useful biochemical functions even at low concentration, some (Fe, Zn, Cu, e.t.c) are essential nutrient that are required in enzymatic biochemical activities in the body (Silvia *et al*., 2007; Asaolu *et al*., 1997; Shannon *et al*., 2009).

Apart from the fact that some of these metals could be naturally present in a greater amount (through weathering of the rocks and soils) in the area where the vegetables are grown, some of the metals have been reported to be introduced into our environment through municipal and industrial discharges, urban run off and atmospheric precipitation and deposition (Yuan Gao *et al*., 2007; Ipinmoroti *et al*., 1997).

Knowing the toxicity effect and the essentialities of some of the trace metals in the environment on human health, it is of paramount importance for food hygienist and health authorities to be familiar with available information on some of the trace metal content of our foods like the leafy vegetables. Also information on the distribution of some of these metals in the various components of the vegetables could be a useful guide as to what part of the leafy vegetables contains the highest level of the minerals and in accessing the nutritional value of the various components for appropriate application. Equally, any component could serve as pollution indicator for some metals. To this end, the concentration of iron, zinc, nickel, cadmium and lead have been determined in the various components of five Nigeria leafy vegetables.

MATERIALS AND METHODS

Sampling: Five commonly and widely consumed Nigeria leafy vegetables were selected for analysis. The varieties are: *Corchorus oliterius, Grassocephilum crepodes Ammaranathus caudatus, Talium tragulare and Senecio biofrae*. The vegetables were purchased from local farmers at Ago/ibira located close to University of Ado-Ekiti.

Sample preparation: The roots, stems, and leaves were separated in each case and the components were cuts into pieces, washed, air dried and then dried in the oven at 80°C for six hours. About 10g of the dried materials of each component were powdered in a hammer mill. 1.0g of each powdered component were weighed and digested as reported by Asaolu (1995). The digest were analyzed for the mineral content by atomic absorption spectroscopy (Buck scientific model-210).

RESULTS AND DISCUSSION

Table 1 presents trace metal distribution vegetables (TMD); while Table 2 presents the trace metal distribution number (TMDN) for the components of the vegetables.

All the minerals examined were found present in the various components of the selected vegetable. On the average, zinc is the most abundant metal with averages of 2.82, 1.97 and 2.08 (mg/g) in root, stem and leaves respectively, while lead is the least in the vegetables with averages of 0.01,0.06 and 0.07 (mg/g) in root, stem and leaf respectively. Also *Talium triangulase* seems to concentrate some of the metals better than the other vegetables (Table 1). The difference in the mineral content of the vegetable plant products might be due to the soil compositions and the rate of uptake of minerals by individual plant (Asaolu, 1995; Tanner and Beevers, 2001). In most cases, TMDN indicates that the root concentrates most of the metals than the stem and leaf respectively, while clear distinction could not be made in mineral distribution between the stem and the leaf.

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Table 1: Trace metal Distribution in Vegetable (TMD) (mg/g) dry matter

	Fe			Zn			Ni			Cd			Pb		
	Root	Stem	Leaf	Root	Stem	Leaf	Root	Stem	Leaf	Root	Stem	Leaf	Root	Stem	Leaf
V_1	1.87	1.69	1.57	3.10	1.79	1.85	1.04	1.01	0.94	0.12	0.21	0.14	0.08	0.07	0.05
V_2	2.20	1.81	0.84	1.67	2.14	2.30	1.12	1.20	1.12	0.20	0.19	0.19	0.06	0.07	0.07
V_3	1.19	1.64	1.53	2.90	1.49	1.17	1.03	1.07	1.03	0.11	0.16	0.18	0.07	0.04	0.09
V_4	2.00	1.86	1.10	3.50	2.60	3.12	1.01	0.78	1.05	0.20	0.17	0.10	0.07	0.05	0.07
V_5	1.90	1.70	1.72	2.93	1.81	1.98	1.10	1.11	0.97	0.21	0.16	0.12	0.06	0.06	0.05
M	1.98	1.74	1.75	2.82	1.97	2.08	1.07	1.03	1.02	0.17	0.18	0.15	0.07	0.06	0.07
SD	0.13	0.19	0.23	0.69	0.42	0.71	0.04	0.16	0.07	0.05	0.02	0.04	0.01	0.01	0.02
CV%	6.8	5.3	13.0	24.0	21.0	34.0	4.0	5.0	6.9	27.0	12.0	26.0	12.0	22.0	24.0

V_1 = Corchorus olitorius V_2 = Grassocephilium crepodes V_3 = Ammaranthus caudus V_4 = Talium triangulase
M = Mean SD = Standard deviation CV = Coefficient of variation V_5 = Senecio biodrae

Table 2: Trace Metal Distribution number (TMDN) n vegetable parts

	Fe			Zn			Ni			Cd			Pb		
	Root	Stem	Leaf	Root	Stem	Leaf	Root	Stem	Leaf	Root	Stem	Leaf	Root	Stem	Leaf
V_1	1.00	0.90	0.84	1.00	0.58	0.60	1.00	0.97	0.90	0.57	0.21	0.67	1.00	0.88	0.65
V_2	1.00	0.82	0.84	0.73	0.93	1.00	0.93	1.00	0.93	1.00	0.95	0.95	0.86	1.00	1.00
V_3	1.00	0.86	0.80	1.00	0.51	0.40	1.00	0.99	0.95	0.61	0.89	1.00	0.78	0.44	1.00
V_4	0.95	0.89	1.00	1.00	0.74	0.89	0.96	0.74	1.00	1.00	0.85	0.50	1.00	0.74	1.00
V_5	1.00	0.89	0.91	1.00	0.62	0.68	0.99	1.00	0.87	1.00	1.00	0.83	1.00	1.00	0.83

V_1 = Corchorus olitorius V_2 = Grassocephilium crepodes V_3 = Ammaranthus caudus
V_4 = Talium triangulase V_5 = Senecio biodrae

However, from this observation, the root might be acting as storage or these minerals after up take from the surrounding soil before translocation occurs.

Situation where there is high concentration of the metals in the roots, and the lower part of the stem might be an advantage for the consumers most importantly in the case of toxic metals since in processing vegetables plant for human consumption, the root and the lower part of the stem are usually discarded. However, in this study TMDN indicates that the leaf of *Grassocephilium crepodes Ammaranthus caudatus and Senecio biofrae* have the highest lead storage and the leaf of *Ammaranthus caudatus* has the highest cadmium storage (Table 2). Although, in this case, the lead and cadmium concentration in the leafy part of some of the vegetables seems not to be alarming except in a case of excessive consumption. The high storage of iron and zinc as indicated by TMDN in the leafy part of some of the vegetables might be advantageous for their useful biochemical functions in human system.

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