Comparative Study of the Mineral Element Composition of Some Common Nigerian Medicinal Plants.

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ABSTRACT

The mineral composition of three Nigerian medicinal plants (*Acalypha wilkesiana*, *Chromolaena odorata,* and *Tridax procumbens*) was investigated. Our result shows that *C. odorata* is comparatively richer in minerals than the other two plants, with moderately high calcium, iron, and sodium content. Only calcium and sodium were found in moderately high concentrations in *Acalypha wilkesiana*, while all the eight minerals analyzed, were found only in low concentrations in *T. procumbens*. However, the relative proportion of the minerals were greatly improved by dehydration or drying, especially in the case of *T. procumbens*.

(Keywords: *Acalypha wilkesiana*, *Chromolaena odorata*, mineral composition, *Tridax procumbens*)

INTRODUCTION

Minerals are naturally occurring chemical elements the body uses to help perform certain chemical reactions. Minerals form an integral part of functionally important organic compounds such as iron (Fe) in hemoglobin and Cytochrome or zinc (Zn) in insulin [FC&A, 1997; Chaney, 2006]. They are essential for the normal functioning of muscles, heart, nerves, and in the maintenance of body fluid composition among others, as well as for building strong bones [Chaney, 2006]. Mineral deficiencies have manifested in forms of different disease conditions as goiter, rickets, and one form of metabolic dysfunction or the other. Minerals are divided into two groups: major minerals and trace minerals. The body needs larger amounts of major minerals than trace minerals, although trace minerals can be just as important for good health [FC&A, 1997; Chaney, 2006; Crook, 2006].

The major minerals include calcium, chloride, phosphorus, potassium, sodium, sulphur, and magnesium, while the trace minerals include iodine, iron, zinc, selenium, fluoride, chromium, copper, molybdenum, and manganese [FC&A, 1997; Chaney, 2006; Crook, 2006]. Leaves are potential sources of minerals and vitamins, and are reportedly inexpensive and easy to cook [Ejoh *et al*., 2007]. They constitute an indispensable constituent of human diet in Africa generally, and West Africa, in particular. They are often consumed as cooked complements to the major staples like cassava, cocoyam, guinea corn, maize, millet, rice, and plantains [Oguntona, 1997]. They are rich, especially in carotenoids, as well as in iron, calcium, ascorbic acid, riboflavin, and folic acid, and appreciable amounts of other minerals.

In Nigeria, *Acalypha wilkesiana*, *Chromolaena odorata,* and *Tridax procumbens* are among the commonly used medicinal plants. Medicinal plants are plants that contain substances which could be used for therapeutic purposes or which are precursors for the synthesis of useful drugs [Sofowora, 1982]. *Acalypha wilkesiana* Muell Arg (Euphorbiaceae or spurge family), is commonly called copperleaf, Joseph's coat, fire dragon, beef steak plant, and match-me-if-you-can [http://www.floridata.com/ref/A/acal_wil.cfm].

Chromolaena odorata (family Asteraceae or alt. Compositae), formerly *Euphatorium odoratum* (L.), is commonly called "Akintola", "Awolowo", independence weed, siam weed, triffid weed,

bitter bush, or jack-in-the-bush [Okon and Amalu, 2003; [http://www.ehs.cdu.edu.au/chromolaena/pubs/friend.html]. The Ibo people of South Eastern Nigeria call it "obiarakara or ahihia eliza".

Tridax procumbens Linn (family Asteraceae or alt. Compositae), is commonly called coat buttons, wild daisy, erva-de-touro, cadillo chisaca, tridax [http://www.lucidcentral.org/keys/FNW/FNW seeds/html/fact sheets/Tridax procumbens.htm; http://www.ars-grin.gov/cgi-bin/npgs/html/family.pl]. It is called "mbụli" by the Ibo people of South Eastern Nigeria.

All three plants have established antimicrobial, antihypertensive properties, and other medicinal properties [Akinde, 1986; Alade and Irobi, 1993; Iwu, 1993; Adesina *et al*., 2000; Phan *et al*., 2001; Salahdeen *et al.*, 2004; Suksamrarn *et al*., 2004; Edeoga *et al.*, 2005; Ogundaini, 2005; Ravikumar *et al.*, 2005; Saxena and Albert, 2005; Akinyemi *et al.*, 2006; Oladunmoye, 2006; Akinmoladun *et al*., 2007; Ikewuchi *et al*., 2008]. Therefore, due to their widespread occurrence and prevalence (especially in Southern Nigeria) there is need to harness their likely potentials as food source. In line with this, the present study was designed to investigate the mineral composition of three Nigerian medicinal plants (*Acalypha wilkesiana*, *Chromolaena odorata,* and *Tridax procumbens*) with a view of finding any nutritional or nutraceutical potential.

MATERIALS AND METHODS

Fresh samples of *Acalypha wilkesiana*, *Chromolaena odorata,* and *Tridax procumbens* were collected from within the Abuja and Choba Campuses of University of Port Harcourt, Port Harcourt, Nigeria. The collected samples were identified at the University of Port Harcourt Herbarium, Port Harcourt, Nigeria. After removing excess dirt, the leaves were removed and stored for subsequent use in the analysis. A portion of the dirt free samples were dried and milled into a fine powder, using a stainless steel miller. 1g of the resultant powder was weighed into a Pyrex culture tubes after which 1mL of redistilled concentrated nitric acid was added. The tubes were sealed with cling film and left overnight at room temperature in a fume hood. They were transferred to a hot block at 120^0C and heated to dryness. Another 1mL of concentrated HNO_3 was added and the tubes were heated to dryness at 150^0C. This was repeated twice, until the heated samples no longer gave off red brown (ferrous oxide) fumes and the sample was light brown to yellow in color. 1ml of $HNO_3/HClO_4$ (50/50) solution was then added and the block temperature was increased to 180^0C, to allow the samples digest for about 2 hours. As soon as the digests became clear to light yellow in color, the temperature was increased to 240^0C and the samples were heated to dryness. The tubes were then removed from the block and allowed to cool. The resultant ash was dissolved in 0.25 mL of concentrated HCl. 20 mL of 5% HNO_3 was added to the resulting solution, and allowed to stand. Inductively Coupled Plasma Optical Emission Spectrometer (ICPOES), Model TL 6000 Jarrell-Ash, was calibrated with standard reference solution of known concentrations to prepare a standard curve, after which the clear digests were aspired into the machine, to determine their mineral contents.

RESULTS, DISCUSSION, AND CONCLUSION

The mineral profiles of *Acalypha wilkesiana*, *Chromolaena odorata,* and *Tridax procumbens* leaves are shown in Table 1. As shown in the table, the mineral composition of the plants can be improved or enhanced by drying or dehydration, with the impact of being most pronounced in *Tridax procumbens*. Comparatively, *A. wilkesiana* has the highest calcium content, closely followed by *C. odorata*, before *T. procumbens*. All three plants have lower calcium content per wet weight than *Boerhavia diffusa*, *Commelina nudiflora* [Ujowundu *et al*., 2008], and soybeans [Elegbede, 1998]. The calcium contents of *A. wilkesiana* and *C. odorata* are higher than that of cashew nut [Nandi, 1998; NutritionData, 2008], while that of *T. procumbens* is lower. A 100g serving of *A. wilkesiana* can provide about 14.54-34.30% of the RDA, while those of *C. odorata* and *T. procumbens* are 13.16-32.50% and 3.59-36.03%, respectively (Table 1). However, calcium content of *C. odorata* recorded in this study is less than that earlier reported by Dux (2005), for the same plant.

C. odorata has the highest magnesium content, followed by *A. wilkesiana*, before *T. procumbens*. All three plants have higher magnesium content than *B. diffusa* and *C. nudiflora* [Ujowundu *et al.*, 2008] but lesser ones than soyabeans [Elegbede, 1998] and cashew nut [Nandi, 1998; NutritionData, 2008].

Table 1: The Mineral Element Composition of *Acalypha wilkesiana*, *Chromolaena odorata,* and *Tridax procumbens*.

Element	Composition											
	Acalypha wilkesiana				*Chromolaena odorata*				*Tridax procumbens*			
	Fresh		Dry		Fresh		Dry		Fresh		Dry	
	Amount mg/100g	% DV	Amount mg/100g	% DV	Amount mg/100g	% DV	Amount mg/100g	% DV	Amount mg/100g	% DV	Amount mg/100g	% DV
a. Major minerals												
Calcium	134.51	14.54	317.25	34.30	121.76	13.16	300.64	32.50	33.17	3.59	333.32	36.03
Magnesium	29.88	7.47	70.47	17.62	35.37	8.84	87.33	21.83	8.86	2.22	89.02	22.26
Potassium	8.70	0.25	20.53	0.58	5.70	0.16	14.08	0.40	2.33	0.07	23.46	0.66
Sodium	352.72	21.00	831.89	49.52	212.43	12.64	524.53	31.22	110.10	6.55	1106.56	65.87
b. Trace minerals												
Copper	0.06	3.05	0.14	7.11	0.11	5.58	0.27	13.71	0.05	2.54	0.47	23.86
Iron	0.97	5.35	2.28	12.57	2.04	11.25	5.03	27.73	0.36	1.98	3.60	19.85
Manganese	0.07	3.44	0.17	8.35	0.12	5.89	0.30	14.73	0.02	0.98	0.22	10.80
Zinc	0.03	0.20	0.07	0.47	0.04	0.27	0.11	0.73	0.02	0.13	0.17	1.13

A 100g serving of *A. wilkesiana* has a %DV of about 7.47-17.62, while those of *C. odorata* and *T. procumbens* are 8.84-21.83 and 2.22-22.26 respectively (Table 1).

Comparatively, *A. wilkesiana* has the highest potassium content, followed by *C. odorata* and then *T. procumbens*. All three plants have higher potassium content than *B. diffusa* and *C. nudiflora* [Ujowundu *et al*., 2008], which are however, lower than those of soybeans [Elegbede, 1998] and cashew nuts [Nandi, 1998; NutritionData, 2008]. A 100g serving of *A. wilkesiana* can provide about 0.25-0.58% of the RDA, while those of *C. odorata* and *T. procumbens* are 0.16-0.40% and 0.07-0.66% respectively (Table 1).

The sodium content of *A. wilkesiana* is the highest followed by that of *C. odorata*. They all have higher sodium content than *C. nudiflora* [Ujowundu *et al*., 2008], soybeans [Elegbede, 1998], cashew nut [Nandi, 1998; NutritionData, 2008]. While *A. wilkesiana* and *C. odorata* have higher sodium content than *B. diffusa* [Ujowundu *et al*., 2008] that of *T. procumbens* is lower. A 100g serving of *A. wilkesiana* can provide about 21.00-49.52% of the RDA, while those of *C. odorata* and *T. procumbens* are 12.61-31.22% and 6.55-65.87% respectively (Table 1).

The copper content of *C. odorata* is the highest, while that of *T. procumbens* is the least. They all have lower copper content than soyabeans [Elegbede, 1998] and cashew nut [NutritionData, 2008; Nandi, 1998]. A 100g serving of *A. wilkesiana* can provide about 3.05-7.11% of the RDA, while those of *C. odorata* and *T. procumbens* are 5.58-13.71% and 2.54-23.86% respectively (Table 1).

C. odorata has the highest iron content, while *T. procumbens* has the least. All three plants have lower iron content than *Amarantus hybridus*, *Talinum triangulare*, *Telferia occidentalis* [Oguntona, 1998] and cashew nut [Nandi, 1998; NutritionData, 2008], but a higher one than *B. diffusa* and *C. nudiflora* [Ujowundu *et al*., 2008]. The iron content of soybeans [Elegbede, 1998] is comparable to that of *A. wikesiana*, less than that of *C. odorata* and greater than that of *T. procumbens*. A 100g serving of *A. wilkesiana* can provide about 5.35-12.57% of the RDA, while those of *C. odorata* and *T. procumbens* are 11.25-27.73% and 1.98-19.85%, respectively (Table 1).

C. odorata has the highest manganese content, followed by *A. wilkesiana*, before *T. procumbens*. All three plants have lower manganese content per wet weight than *B. diffusa* [Ujowundu *et al*., 2008], soybeans [Elegbede, 1998] and cashew nut [Nandi, 1998; NutritionData, 2008], *C. nudiflora* [Ujowundu *et al*., 2008]. A 100g serving of *A. wilkesiana* has a %DV of about 3.44-8.35, while those of *C. odorata* and *T. procumbens* are 5.89-14.73 and 0.98-10.80 respectively (Table 1).

As shown in the table, *C. odorata* has the highest zinc content while *T. procumbens* has the least. They all have lower zinc content than cashew nuts [Nandi, 1998; NutritionData, 2008], *A. hybridus*, *T. triangulare* and *T. occidentalis* [Oguntona, 1998]. 100g serving of each of these

plant leaves can provide less than 2% of the RDA.

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