

Comparative Study of the Vitamin Composition of Some Common Nigerian Medicinal Plants.

Catherine Chidinma Ikwuchi, M.Sc. and Jude Chigozie Ikwuchi, M.Sc.

Department of Biochemistry, Faculty of Science, University of Port Harcourt,
PMB 5323, Port Harcourt, Nigeria.

E-mail: ecoli240733@yahoo.com
okaraonye@yahoo.com

Phone: +2348033715662

ABSTRACT

The vitamin 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 vitamins than the other two plants, with very high biotin, ascorbic acid, and vitamin K content. Only biotin and ascorbic acid were found in high concentrations in *Acalypha wilkesiana*, while all the eleven vitamins analyzed, were found only in low concentrations in *T. procumbens*. However, the relative proportion of the vitamins were greatly improved by dehydration or drying, especially in the case of *T. procumbens*.

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

INTRODUCTION

Vitamins are organic molecules that function in a wide variety of capacities within the body. The most prominent, are cofactors for enzyme-catalyzed reactions. They generally cannot be synthesized by mammalian cells and, therefore, must be supplied in the diet [FC&A, 1997; Crook, 2006; King, 2003, 2007]. The vitamins are of two distinct types:

- Water soluble: Thiamin (B₁), Riboflavin (B₂), Niacin (B₃), Pantothenic acid (B₅), Pyridoxal (B₆), Biotin, Cobalamin (B₁₂), Folic acid, and Ascorbic acid (C).
- Lipid soluble: vitamin A, vitamin D, vitamin E, and vitamin K [FC&A, 1997; Crook, 2006; King, 2003, 2007].

Inadequate intake/absorption, excess loss, or enhanced utilization, results in vitamin deficiencies, which sometimes may manifest as disease conditions [Crook, 2006]. Amongst the various sources of vitamins are plant leaves, some of which are very rich sources of some vitamins.

In Nigeria, *Acalypha wilkesiana*, *Chromolaena odorata*, and *Tridax procumbens* are commonly used in traditional medicine. *Acalypha wilkesiana* Muell Arg belongs to the family Euphorbiaceae (spurge family). It 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 (formerly *Eupatorium odoratum* (L)) belongs to the family Asteraceae (alt. Compositae). It is commonly called "Akintola", "Awolowo", independence weed, siam weed, trifid 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 ahiiha eliza".

Tridax procumbens Linn belongs to the family Asteraceae (alt. Compositae). Its common names are 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 "mbūli" by the Ibo people of South Eastern Nigeria.

All three plants have established antimicrobial and antihypertensive properties [Akinde, 1986; Alade and Irobi, 1993; Iwu, 1993; Adesina *et al.*, 2000; Phan *et al.*, 2001; Salahdeen *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]. Thus as a result of 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 vitamin 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

Samples of fresh *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 ridding them of dirt, the leaves were removed and stored for subsequent use in the analysis. These dirt free samples were weighed and pulverized into fine powder, using Janke and Kunkel (IKA-LABORTECHNIC) grinder. The pulverized samples were then extracted by refluxing with methanol, for 6 hours at very low temperature. The process was repeated twice, using fresh solvents, to ensure that most of the vitamins in the pulverized samples were removed. The extract was then esterified to remove traces of fatty acids, after which it was poured into a rotary evaporator to dry. Water was then removed by adding anhydrous sodium sulphate, after which it was subjected to gas chromatography analysis, using pulse flame photometric detector, for the determination of the component vitamins

RESULTS, DISCUSSION, AND CONCLUSION

The vitamin composition of *Acalypha wilkesiana*, *Chromolaena odorata*, and *Tridax procumbens* is shown in Table 1. As in the table, drying or dehydration produced the highest effect of improving the relative proportion of the vitamins, in *T. procumbens*, while having the least effect on *A. wilkesiana*. *A. wilkesiana* has the highest content of thiamine per 100g wet weight, while *T. procumbens* has the highest content per dry weight. Their thiamine content is less than those reported for *A. hybridus*, *G. africanum*, *T.*

triangulare, *T. occidentalis*, and *V. amygdalina* [Oguntona, 1998], groundnut [Elegbede, 2008] and cashew nut [Nandi, 1998; NutritionData, 2008], and comparable to that of *S. Mombin* Leaves [Njoku and Akumefula, 2007]. *A. wilkesiana* and *C. odorata* both have approximately equal contents of riboflavin, which is higher than that of *T. procumbens*. Their riboflavin content is less than those of *A. hybridus*, *T. triangulare*, *T. occidentalis*, *P. guineense*, *V. amygdalina* [Oguntona, 1998], and cashew nut [Nandi, 1998; NutritionData, 2008], but comparable to those of *G. africanum* [Oguntona, 1998], groundnut [Elegbede, 1998] and *S. Mombin* Leaves [Njoku and Akumefula, 2007]. A 100g serving of *A. wilkesiana* can provide about 4.77-11.25% of the RDA, while those of *C. odorata* and *T. procumbens* are 4.66-11.50 and 2.54-25.52% respectively (Table 1).

C. odorata has the highest niacin content, while *T. procumbens* is the least. All three plants have lower niacin content than cashew nut [Nandi, 1998; NutritionData, 2008], while dry *C. odorata* and *T. procumbens* have higher niacin content than groundnut [Elegbede, 1998], with a %DV of about 4.87-6.24 per 100g serving. *C. odorata* has the highest pyridoxine content per 100g wet weight, while *T. procumbens* has the least. All three plants have lower pyridoxine content than *Amarantus hybridus*, *Piper guineense*, *Talinum triangulare*, *Telferia occidentalis*, *Vernonia amygdalina* [Oguntona, 1998], groundnut [Elegbede, 1998], and cashew nut [NutritionData, 2008]. A 100g serving of all of them, whether dry or wet can provide less than 1.00% of the RDA (except dry *T. procumbens*, with a %DV of 2.04, Table 1).

C. odorata has the highest vitamin C content per 100g wet weight, while *A. wilkesiana* is the least. All three plants have lower vitamin C content than *A. hybridus*, *T. triangulare*, *T. occidentalis*, *P. guineense*, and *V. amygdalina* [Oguntona, 1998; Ejoh *et al.*, 2007], but greater than those of groundnut [Elegbede, 1998], cashew nut [NutritionData, 2008] and *Spondias Mombin* Leaves [Njoku and Akumefula, 2007]. *C. odorata* and *T. procumbens* has a comparable ascorbic acid content to *Gnetum africanum*, while that of *A. wilkesiana* is lower [Oguntona, 1998]. A 100g serving of these leaves can provide about 36.67-136.21% of the RDA (Table 1). This means that 100g of fresh/dry *C. odorata* can meet the RDA (60mcg) [FC&A, 1997] for vitamin C, while only the dry samples of the other two can.

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

| Element | Composition | | | | | | | | | | | |
|-------------------------|----------------------------|-------|----------------|--------|----------------------------|-------|----------------|--------|--------------------------|-------|----------------|--------|
| | <i>Acalypha wilkesiana</i> | | | | <i>Chromolaena odorata</i> | | | | <i>Tridax procumbens</i> | | | |
| | 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. Water Soluble | | | | | | | | | | | | |
| Vitamin B1 (thiamine) | 0.0206 | 1.28 | 0.0487 | 3.02 | 0.0053 | 0.33 | 0.0131 | 0.81 | 0.0053 | 0.33 | 0.0535 | 3.32 |
| Vitamin B2 (riboflavin) | 0.0842 | 4.77 | 0.1986 | 11.25 | 0.0822 | 4.66 | 0.2030 | 11.50 | 0.0448 | 2.54 | 0.4503 | 25.52 |
| Vitamin B3 (Niacin) | 0.1673 | 0.84 | 0.3946 | 1.97 | 0.3945 | 1.97 | 0.9741 | 4.87 | 0.1241 | 0.62 | 1.2472 | 6.24 |
| Vitamin B6 (pyridoxine) | 0.0073 | 0.38 | 0.0172 | 0.90 | 0.0060 | 0.32 | 0.0148 | 0.78 | 0.0039 | 0.20 | 0.0389 | 2.04 |
| Vitamin C | 33.0061 | 36.67 | 77.8445 | 86.49 | 49.6490 | 55.17 | 122.5901 | 136.21 | 10.6247 | 11.81 | 106.7807 | 118.65 |
| Biotin | 0.0241 | 80.33 | 0.0568 | 189.33 | 0.0299 | 99.67 | 0.0738 | 246.00 | 0.0042 | 14.00 | 0.0426 | 142.00 |
| Folic acid | 0.0053 | 1.30 | 0.0125 | 3.10 | 0.0125 | 3.10 | 0.0309 | 7.70 | 0.0014 | 0.30 | 0.0137 | 3.40 |
| b. Fat Soluble | | | | | | | | | | | | |
| Vitamin A | 0.0002 | 0.03 | 0.0004 | 0.05 | 0.0104 | 1.30 | 0.0257 | 3.21 | 0.0051 | 0.64 | 0.0513 | 6.41 |
| Vitamin D | 0.0000 | 0.00 | 0.0000 | 0.00 | 0.0000 | 0.00 | 0.0000 | 0.00 | 0.0000 | 0.00 | 0.0000 | 0.00 |
| Vitamin E | 0.0071 | 0.04 | 0.0168 | 0.08 | 0.0163 | 0.08 | 0.0402 | 0.201 | 0.0019 | 0.01 | 0.0191 | 0.10 |
| Vitamin K | 0.0001 | 0.13 | 0.0003 | 0.38 | 0.0436 | 54.50 | 0.1077 | 134.63 | 0.0058 | 7.25 | 0.0581 | 72.63 |

Comparatively, *C. odorata* has the highest biotin content, while *T. procumbens* has the least. Their biotin content is comparable to that of groundnut [Elegbede, 1998]. A 100g serving of *A. wilkesiana* can provide about 80.33-189.33% of the RDA, while those of *C. odorata* and *T. procumbens* are 99.67-246% and 14.00-142.00% respectively (Table 1).

C. odorata has the highest folic acid content, followed by *A. wilkesiana* and then *T. procumbens*. They all have lower folic acid content than groundnut [Elegbede, 2008]. The folic acid content of *A. wilkesiana* and *T. procumbens* are lower than that of cashew nut [NutritionData, 2008], while that of *C. odorata* is comparable to it. A 100g serving of *A. wilkesiana* can provide about 1.30-3.10% of the RDA, while those of *C. odorata* and *T. procumbens* are 3.10-7.70 and 0.30-3.40% respectively (Table 1).

C. odorata has the highest content of vitamin A per 100g wet weight, while *T. procumbens* has the highest content per dry weight. *C. odorata* has the highest vitamin E content per 100g wet weight, while *T. procumbens* has the least. Their vitamin E content is lower than those of groundnut [Elegbede, 1998] and cashew nut [NutritionData, 2008]. It means that 100g of

fresh/dry *A. wilkesiana* and *C. odorata* can meet the recommended daily allowance (RDA) for vitamin E (8mcg) [FC&A, 1997], while only the dry samples of *T. procumbens* can.

Comparatively, *C. odorata* has the highest vitamin K content, while *A. wilkesiana* has the least. *C. odorata* has higher vitamin K content than cashew nut [NutritionData, 2008], that of *T. procumbens* is comparable, while that of *A. wilkesiana* is lower. A 100g serving of *A. wilkesiana* can provide about 0.13-0.38% of the RDA, while those of *C. odorata* and *T. procumbens* are 54.50-134.63% and 7.25-72.63% respectively (Table 1). Thus, 100g of dry *Chromolaena odorata* can meet the RDA for vitamin K (80mcg) [FC&A, 1997].

REFERENCES

- Adesina, S.K., O. Idowu, A.O. Ogundaini, H. Oladimeji, T.A. Olugbade, G.O. Onawunmi, and M. Pais. 2000. "Antimicrobial Constituents of the Leaves of *Acalypha wilkesiana* and *Acalypha hispida*". *Phytotherapy Res.* 14:371-374.
- Akinde, B.E. 1986. "Phytochemical and Microbiological Evaluation of the Oils from the Leaves of *Acalypha wilkesiana*". In: *The State of*

- Medicinal Plant Research in Nigeria*. Sofowora A, (ed.) University of Ibadan Press: Nigeria. 362-363.
3. Akinmoladun, A.C., E.O. Ibukun, and I.A. Dan-Ologe. 2007. "Phytochemical Constituents and Antioxidant Properties of Extracts from the Leaves of *Chromolaena odorata*". *Sci. Res. Essays*. 2(6):191-194.
http://www.academicjournals.org/SRE/PDF/PDF/2007/Jun/Akinmoladun_et_al.pdf
 4. Akinyemi, K.O., O.K. Oluwa, and E.O. Omomigbehin. 2006. "Antimicrobial Activity of Crude Extracts of Three Medicinal Plants used in South-Western Nigerian Folk Medicine on Some Food Borne Bacterial Pathogens". *Afr. J. Trad. CAM*. 3(4):13-22.
<http://www.bioline.org.br/abstract?id=tc06048&lang=en> <http://www.africanethnomedicines.net/ojs2/index.php/ajtcam>
 5. Alade, P.I. and O.N. Irobi. 1993. "Antimicrobial Activities of Crude Leaf Extracts of *Acalypha wilkesiana*". *J. Ethnopharmacol*. 39(3):171-174.
 6. Crook, M.A. 2006. *Clinical Chemistry and Metabolic Medicine*. 7th ed. Holder Arnold: London. ISBN-13:978 0 340 90618 7.
 7. Edeoga, H.O., D.E. Okwu, and B.O. Mbaebie. 2005. "Phytochemical Constituents of Some Nigerian Medicinal Plants". *Afr. J. Biotech*. 4(7): 685-688.
http://www.academicjournals.org/AJB/PDF/Pdf2005/Jul/Edeoga_et_al.pdf
 8. Ejoh, R.A., D.V. Nkongha, G. Inocent, and M.C. Moses. 2007. "Nutritional Components of Some Non-Conventional Leafy Vegetables Consumed in Cameroon". *Pak. J. Nutr*. 6(6):712-717.
<http://www.pjbs.org/pjnonline/fin813.pdf>
 9. Elegbede, J.A. 1998. "Legumes". In: *Nutritional Quality of Plant Foods*. Osagie, A.U. and Eka, O.U. (eds). Post Harvest Research Unit, Department of Biochemistry, University of Benin: Benin City, Nigeria. 120-133. ISBN: 978-2120-02-2.
 10. FAO. 2004. *Vitamin and Mineral Requirements in Human Nutrition*. Second edition. Report of a Joint FAO/WHO Expert Consultation: Bangkok, Thailand. 21–30 September 1998. ISBN: 92 4 154612 3.
<http://whqlibdoc.who.int/publications/2004/9241546123.pdf>
 11. FC&A. 1997. *Super LifeSpan, Super Health*. Frank W. Cawood and Associates: Los Angeles, CA. ISBN: 0-915099-92-6.
 12. Ikewuchi, J.C., A. Anyadiegwu, E.Y. Ugono, and S.O. Okungbowa. 2008. "Effect of *Acalypha wilkesiana* Muell. Arg. on Plasma Sodium and Potassium Concentration of Normal Rabbits". *Pak. J. Nutr*. 7(1):130-132.
<http://www.pjbs.org/pjnonline/fin834.pdf>
 13. Iwu, M.M. 1993. *Handbook of African Medicinal Plants*. CRC Press Inc.: Boca Raton, FL. ISBN: 084934266X.
 14. King, M.W. 2003. "Vitamins and Coenzymes".
<http://www.med.unibs.it/~marchesi/vitamins.html>
 15. King, M.W. 2007. "Vitamins and Coenzymes".
<http://web.indstate.edu/thcme/mwking/vitamins.html>
 16. Nandi, B.K. 1998. "Cashew Nut Nutritional Aspects". In: *Integrated Production Practices of Cashew in Asia*. Papademetriou, M.K. and Herath, E.M. (eds.). Food and Agriculture Organization of the United Nations Regional Office for Asia and the Pacific: Bangkok, Thailand (FAO/RAP Publication: 1998/12).
<http://www.fao.org/docrep/005/ac451e/ac451e0b.htm#fn11>
 17. Njoku, P.C. and M.I. Akumefula. 2007. "Phytochemical and Nutrient Evaluation of Spondias Mombin Leaves". *Pak. J. Nutr*. 6(6):613-615.
 18. NutritionData. 2008. Know What You Eat: Nuts, Cashew Nuts, Oil Roasted, Without Salt Added.
<http://www.nutritiondata.com/>
 19. Ogundaini, A.O. 2005. "From Greens Into Medicine: Taking a Lead From Nature". An Inaugural Lecture Delivered at Oduduwa Hall, Obafemi Awolowo University, Ile-Ife, Nigeria. Inaugural Lecture Series 176. OAU Press Limited: Ile-Ife, Nigeria. 12-15.
<http://www.oauife.edu.ng/faculties/pharmacy/aogund.pdf>
 20. Oguntona, T. 1998. "Green Leafy Vegetables". In: *Nutritional Quality of Plant Foods*. Osagie, A.U. and Eka, O.U. (eds). Post Harvest Research Unit, Department of Biochemistry, University of Benin: Benin City, Nigeria. 120-133. ISBN: 978-2120-02-2.
 21. Okon, P.B. and U.C. Amalu. 2003. "Using Weed to Fight Weed". *LEISA Magazine*. December 2003.
<http://www.metafro.be/leisa/2003/194-21.pdf>
 22. Oladunmoye, M.K. 2006. "Comparative Evaluation of Antimicrobial Activities and Phytochemical Screening of Two Varieties of *Acalypha wilkesiana*". *Trends Appl. Sci. Res*. 1:538-541.

23. Phan, T.T., L. Wang, P. See, R.J. Grayer, S.Y. Chan, and S.T. Lee. 2001. "Phenolic Compounds of *Chromolaena odorata* Protect Cultured Skin Cells from Oxidative Damage: Implication for Cutaneous Wound Healing". *Biol. Pharm. Bull.* 24(12):1373-1379. doi:10.1248/bpb.24.1373. JOI:JST.JSTAGE/bpb/24.1373. PMID:11767105 http://www.jstage.jst.go.jp/article/bpb/24/12/1373/_pdf
24. Ravikumar, V., K.S. Shivashangari, and T. Devaki, 2005. "Hepatoprotective Activity of *Tridax Procumbens* against D-Galactosamine/Lipopolysaccharide-induced Hepatitis in Rats". *J. Ethnopharmacol.* 101(1-3):55-60. <http://www.sciencedirect.com/science/journal/03788741>
25. Salahdeen, H.M., O.K. Yemitan, and A.R.A. Alada. 2004. "Effect of Aqueous Leaf Extract of *Tridax Procumbens* on Blood Pressure and Heart Rate in Rats". *Afr. J. Biomed. Res.* 7:27 – 29. <http://www.ajbrui.com/files/AJBR712729.pdf>
26. Saxena, V.K. and S. Albert. 2005. "β-Sitosterol-3-O-β-D-xylopyranoside from the Flowers of *Tridax procumbens* Linn". *J. Chem. Sci.* 117(3):263–266. <http://www.ias.ac.in/chemsci/Pdf-May2005/263.pdf>
27. Simon, H. 2007. "Vitamins". <http://adam.about.com/reports/Vitamins.htm>

ABOUT THE AUTHORS

C.C. Ikewuchi, M.Sc. holds a B.Sc. (Hons) degree in Biochemistry as well as an M.Sc. in Nutritional Biochemistry and Toxicology. Presently, she serves as a Lecturer in the Department of Biochemistry, University of Port Harcourt, Nigeria, where she is also concluding a Ph.D. degree in Nutritional Biochemistry and Toxicology. Her research interests are in the area of Nutritional Biochemistry and Toxicology.

J.C. Ikewuchi, M.Sc. holds a B.Sc. (Hons) degree in Biochemistry as well as an M.Sc. in Biochemical Pharmacology and Toxicology. Presently, he serves as a Lecturer in the Department of Biochemistry, University of Port Harcourt, Nigeria, where he is also pursuing a Ph.D. degree in Biochemical Pharmacology. His research interests are in the area of Analytical Biochemistry and Biochemical Pharmacology.

SUGGESTED CITATION

Ikewuchi, J.C. and C.C. Ikewuchi. 2009. "Comparative Study of the mineral Element Composition of Some Common Nigerian Medicinal Plants". *Pacific Journal of Science and Technology.* 10(1):367-371.



[Pacific Journal of Science and Technology](http://www.pacificjournalofscienceandtechnology.com)