Amino Acid, Mineral, and Vitamin Composition of *Sanseviera liberica* Gérôme and Labroy.

Catherine Chidinma Ikewuchi, M.Sc. and Jude Chigozie Ikewuchi, 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 amino acid, mineral, and vitamin composition of *Sanseviera liberica* was investigated. The analysis revealed that this plant is rich in the essential amino acids (with histidine, valine, and phenylalanine being very high) and it has a protein score of 61.90% with lysine as the limiting amino acid. It is also rich in sodium (278.62mg/100g WW and 634.67mg/100g DW), potassium (9.44mg/100g WW and 21.50mg/100g DW), calcium (130.03mg/100g WW and 296.16mg/100g DW), magnesium (30.82mg/100g WW and 70.20mg/100g DW), vitamin C (38.357mg/100g WW and 87.373mg/100g DW), biotin (0.018mg/100g WW and 0.040mg/100g DW), and riboflavin (0.092mg/100g WW and 0.210mg/100g DW). These results indicate the nutritional and nutraceutical potential of the plant.

(Keywords: Amino acid, mineral and vitamin profile, *Sanseviera liberica*)

INTRODUCTION

Sansevieria liberica (family Agavaceae, Ruscaceae or Dracaenaceae), is one of the bowstring hemp species with concave, short petioled leaves containing over 2% fiber. It has long rhizomes with long fibrous roots and a rapid rate of growth. A number of species of bowstring hemp, such as *Sansevieria cylindrica*, *Sansevieria ehrenbergii, Sansevieria guineensis*, *Sansevieria longiflora*, *Sansevieria roxburghiana*, *Sansevieria trifasciata,* and *Sansevieria zeylanica* are grown as ornamental plants [USDA, 2008]. They are widely distributed throughout the tropics. In Nigeria, the leaves and roots of *Sanseviera liberica* are used in traditional medicine for the treatment of asthma, abdominal pains, colic, diarrhea, eczema, gonorrhea, hemorrhoids, hypertension, monorrhagia, piles, sexual weakness, snake bites, and wounds of the foot [Gill, 1992; Osabohien and Egboh, 2008]. In this study, we investigated the amino acid, mineral, and vitamin composition of *Sanseviera liberica*.

MATERIALS AND METHODS

Collection of plant samples: Samples of fresh *Sanseviera liberica* plants were bought from a horticulturist by Air Force Base Gate, Aba Road, Port Harcourt, Nigeria. After due identification at the University of Port Harcourt Herbarium, Port Harcourt, Nigeria, they were cleaned of dirt and stored for subsequent use in the analysis.

Determination of Amino Acid Composition: The amino acid profile of the sample was determined using methods described by Spackman *et al.* [1985]. The sample was dried to a constant weight, defatted, hydrolyzed, evaporated in a rotary evaporator, and loaded into a Technicon Sequential Multi-sample Amino Acid Analyzer (TSM). Then the chemical score of the protein was determined by comparison with WHO reference protein pattern [FAO/WHO/UNU, 1991].

Determination of Vitamin Composition: The dirt free samples were weighed and pulverized into a fine powder, using Janke and Kunkel (IKA-LABORTECHNIC) grinder. The pulverized samples were then extracted by refluxing with methanol, for 6h 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 a pulse flame photometric detector, for the determination of the component vitamins.

Determination of Mineral Composition: The dirt free samples were dried and milled into fine powder, using a stainless steel miller. Samples (1g) of the resultant powder was weighed into 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 HCI. 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 a 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 amino acid profile and chemical scores of the protein are given in Tables 1 and 2, respectively. It is rich in the essential amino acids, especially histidine, valine, and phenylalanine, and may well meet the minimum daily requirements [FAO/WHO/UNU, 1991; McGilvery and Goldstein, 1983].

Table 1: Amino Acid Profile of Protein from *Sanseviera liberica*.

Amino acid	Composition		
	g/100g protein	g/100g food	
		Fresh	Dry matter
Lysine*	3.20	0.70	1.59
Histidine*	2.13	0.47	1.06
Arginine	4.68	1.02	2.33
Aspartate	8.79	1.92	4.38
Threonine*	2.25	0.49	1.12
Serine	3.20	0.70	1.59
Glutamate	13.60	2.98	6.78
Proline	2.55	0.56	1.27
Glycine	4.04	0.88	2.01
Alanine	3.53	0.77	1.76
Cystine	1.45	0.32	0.72
Valine*	5.02	1.10	2.50
Methionine*	1.30	0.28	0.65
Isoleucine*	4.30	0.94	2.14
Leucine*	6.20	1.36	3.09
Tyrosine	3.54	0.77	1.76
Phenylalanine*	4.00	0.88	1.99
TEAA	28.40	6.21	14.15
TNEAA	45.38	9.93	22.62
TSCAA	2.75	0.60	1.37
TAAA	7.54	1.65	3.76

**Essential amino acids. TEAA= Total Essential Amino Acid. TNAA= Total Nonessential Amino Acid. TSCAA= Total*

Sulphur-Containing Amino Acid. TAAA= Total Aromatic Amino Acid.

Table 2: Comparison of Protein from *Sanseviera liberica*, with WHO reference protein pattern (FAO, 1981; McGilvery and Goldstein, 1983)

Amino acid	Reference Pattern, g/100g protein	Chemical score (%)
Lysine	5.17	61.90
Histidine	1.77	120.34
Threonine	3.47	64.84
Valine	4.81	104.37
Methionine	1.53	84.97
Isoleucine	4.19	102.63
Leucine	7.03	68.19
Phenylalanine	3.01	132.89

In comparison to the WHO reference protein pattern [McGilvery and Goldstein, 1983; FAO/WHO/UNU, 1991], the limiting amino acid of the protein lysine, giving it a protein score of 61.90%. This proteins chemical score is higher than that of maize and whole wheat, but lower than those of soy bean, peanuts, polished rice, human milk, egg, cow milk, and beef [FAO, 1981; McGilvery and Goldstein, 1983]. Every 100g of this protein contains 28.40g of essential amino acids, 2.75g of sulphur-containing amino acids and 7.54g of aromatic amino acids (Table 1).

The mineral composition of *S. liberica* is shown in Table 3. The calcium content of *Sanseviera liberica* is comparable to those of *Boerhavia diffusa*, *Commelina nudiflora* [Ujowundu *et al*., 2008] and soybeans [Elegbede, 1998], but greater than that of cashew nut [Nandi, 1998; NutritionData, 2008]. A 100g serving can provide about 14-32% of the recommended dietary allowance (RDA) or recommended nutrient intake (RNI) (Table 3). It contains more sodium than those reported for *B. diffusa* and *C. nudiflora* [Ujowundu et al., 2008], soyabeans [Elegbede, 1998], cashew nut [Nandi, 1998; NutritionData, 2008]. A 100g serving can provide about 16-38% of RDA (Table 3). It contains more potassium than *B. diffusa* and *C. nudiflora* [Ujowundu *et al*., 2008], but however, a lower one than soyabeans [Elegbede, 1998] and cashew nut [Nandi, 1998; NutritionData, 2008]. The level of magnesium recorded here is higher than that of *B. diffusa* and *C. nudiflora* [Ujowundu *et al.*, 2008] but less than those of soyabeans [Elegbede, 1998] and cashew nut [Nandi, 1998; NutritionData, 2008]. A 100g serving of *S. liberica* can provide about 7-18% of the RDA (Table 3). The manganese level is less than those of *B. diffusa* [Ujowundu *et al*., 2008], soyabeans [Elegbede, 1998] and cashew nut [Nandi, 1998; NutritionData, 2008], and comparable to that of *C. nudiflora* [Ujowundu *et al*., 2008]. A 100g serving of *S. liberica* can provide about 5-12% of the RDA (Table 3). Its iron content is higher than those of *B. diffusa* and *C. nudiflora* [Ujowundu *et al*., 2008], comparable to that of soyabeans [Elegbede, 1998], but lower than those of *Amarantus hybridus*, *Talinum triangulare*, *Telferia occidentalis* [Oguntona, 1998] and cashew nut [Nandi, 1998; NutritionData, 2008]. A 100g serving of *S. liberica* can provide about 4-10% of the RDA (Table 3). It has a lower copper content than soybeans [Elegbede, 1998] and cashew nut [Nandi, 1998; NutritionData, 2008]. A 100g serving of *S. liberica* can provide about 1-3% of the RDA (Table 3). The zinc content is less than that of cashew nut [Nandi, 1998; NutritionData, 2008], *A. hybridus*, *T. triangulare* and *T. occidentalis* [Oguntona, 1998]. 100g serving can provide less than 1% of the RDA (Table 3).

The vitamin content of *S. liberica* is shown in Table 4. The thiamine content observed here for *S. liberica* is less than those reported for *A. hybridus*, *Gnetum africanum*, *T. occidentalis*, *T. triangulare*, V*ernonia amygdalina* [Oguntona, 1998], groundnut [Elegbede, 2008], and cashew nut [Nandi, 1998; NutritionData, 2008]. A 100g serving can provide about 1-4% of the RDA (Table 4). Its riboflavin content is less than those of *A. hybridus*, *T. occidentalis*, *T. triangulare*, *Piper guineense*, *V. amygdalina*, *G. africanum* [Oguntona, 1998], and cashew nut [Nandi, 1998; NutritionData, 2008], but greater than that of groundnut [Elegbede, 1998]. A 100g serving can provide about 5-12% of the RDA (Table 4). Its ascorbic acid content is less than those of *A. hybridus*, *T. occidentalis*, *T. triangulare*, *P. guineense*, and *V. amygdalina*, *G. africanum*

[Oguntona, 1998], but greater than that of groundnut [Elegbede, 1998], and cashew nut [NutritionData, 2008]. A 100g serving of *S. liberica* can supply about 43-98% of the RDA (Table 4). Its pyridoxine content is less than those of *A. hybridus*, *T. occidentalis*, *T. triangulare*, *P. guineense*, *V. amygdalina* [Oguntona, 1998], groundnut [Elegbede, 1998] and cashew nut [NutritionData, 2008]. A 100g serving can provide about 0.5-1.2% of the RDA (Table 4). Its folic acid content is lower than those of groundnut [Elegbede, 2008], but equal to that of cashew nut [NutritionData, 2008]. A 100g serving can provide about 3-7% of the RDA (Table 4). Its vitamin K content is less than that of cashew nut [NutritionData, 2008]. A 100g serving can provide less than 1% of the RDA (Table 4). Its vitamin E content is lower than those of groundnut [Elegbede, 1998] and cashew nut [NutritionData, 2008]. A 100g serving can provide less than 1% of the RDA (Table 4). The niacin content is comparable to that of groundnut [Elegbede, 1998], but less than that of cashew nut [Nandi, 1998; NutritionData, 2008]. A 100g serving can provide about 2-5% of the RDA. The biotin content is comparable to that of groundnut [Elegbede, 1998]. A 100g serving can provide about 59-134% of the RDA (Table 4). The vitamin A content is higher than that of cashew nut [NutritionData, 2008]. A 100g serving can provide about 3-7% of the RDA (Table 4).

Table 3: Mineral Element Composition of *Sanseviera liberica.*

Mineral	Mineral element /100g Dry weight Amount (mg)	% DV	Composition/100g Wet weight Amount (mg)	% DV
Calcium	296.19±1.72	32.02	130.03±0.75	14.06
Copper	0.06±0.00	3.05	0.03±0.00	1.52
Iron	1.79±0.01	9.87	0.79±0.01	4.36
Magnesium	70.20±0.45	17.55	30.82±0.20	7.71
Manganese	0.25±0.01	12.27	0.11±0.00	5.40
Potassium	21.50±0.13	0.61	9.44±0.06	0.27
Sodium	634.67±4.01	37.78	278.62±1.76	16.59
Zinc	0.10±0.00	0.67	0.04±0.00	0.27

Values are means ± SD of two determinations. Percent Daily Values (%DV) are for adults or children aged 4 or older, and are based on a 2,000 calorie reference diet. The daily values may be higher or lower based on individual needs [FAO, 2004; NutritionData, 2008].

Table 4: Vitamin Composition of *Sanseviera liberica.*

Vitamin	Composition/100g Dry weight Amount (mg)	% DV	Composition/100g Wet weight Amount (mg)	% DV
Niacin	0.9891	4.95	0.4342	2.17
Vitamin B6	0.0228	1.20	0.0100	0.53
Vitamin C	87.3734	97.08	38.3569	42.62
Biotin	0.0401	133.67	0.0176	58.67
Vitamin A	0.0548	6.85	0.0241	3.01
Vitamin B1	0.0495	3.06	0.0217	1.35
Vitamin B2	0.2103	11.92	0.0923	5.23
Vitamin E	0.0185	0.09	0.0081	0.04
Folic acid	0.0250	6.20	0.0110	2.70
Vitamin K	0.0005	0.63	0.0002	0.25
Vitamin D	0.0000	0.00	0.0000	0.00

Percent Daily Values (%DV) are for adults or children aged 4 or older, and are based on a 2,000 calorie reference diet. The daily values may be higher or lower based on individual needs [FAO, 2004; Simon, 2007; NutritionData, 2008].

REFERENCES

1. Elegbede, J.A. 1998. “Legumes”. In: Osagie, A.U. and Eka, O.U. (eds). *Nutritional Quality of Plant Foods*. Post Harvest Research Unit, Department of Biochemistry, University of Benin: Benin City, Nigeria. 120-133. ISBN: 978-2120-02-2.

2. FAO. 1981. *Amino Acid Content of Food and Biological Data on Proteins*. A report of FAO/UN Joint Committee: Rome, Italy. 84. ISBN 92-5-001102-4. http://www.fao.org/DOCREP/005/AC854T/AC854T00.htm#TOC

3. FAO. 2004. *Vitamin and Mineral Requirements in Human Nutrition. Second Edition*. A report of a Joint FAO/WHO Expert Consultation: Bangkok, Thailand. ISBN 92 4 154612 3. http://whqlibdoc.who.int/publications/2004/9241546123.pdf

4. FAO/WHO/UNU. 1991. *Energy and Protein Requirements*. Report of a Joint FAO/WHO/UNU Expert Consultation. WHO Technical Report Series 724. ISSN: 0512-3054. http://www.fao.org/docrep/003/aa040e/AA040E01.htm

5. Gill, L.S. 1992. *Ethnomedical Uses of Plants in Nigeria*. Uniben Press: Benin City, Nigeria. p209.

6. McGilvery, R.W. and G.W. Goldstein. 1983. *Biochemistry: A Functional Approach. 3rd edition.* W.B. Saunders: Philadelphia, PA. ISBN: 4-7557-0080-9.

7. Nandi, B.K. 1998. “Cashew Nut Nutritional Aspects”. In: Papademetroiu, M.K. and Herath, EM (eds.). *Integrated Production Practices of Cashew in Asia*. 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

8. NutritionData. 2008. “Know What You Eat: Nuts, Cashew Nuts, Oil Roasted, Without Salt Added”. http://www.nutritiondata.com/

9. Oguntona, T. 1998. “Green Leafy Vegetables”. In: Osagie AU and Eka OU (eds). *Nutritional Quality of Plant Foods*. Post Harvest Research Unit, Department of Biochemistry, University of Benin: Benin City, Nigeria. 120-133. ISBN: 978-2120-02-2.

10. Osabohien, E. and Sho, E. 2008. “Utilization of Bowstring Hemp Fiber as a Filler in Natural Rubber Compounds”. *J. Applied Polymer Sc.*, 107:210–214. DOI:10.1002/app.27012

11. Simon, H. 2007. “Vitamins”. http://adam.about.com/reports/Vitamins.htm

12. Spackman, D.H., E.H. Stein, and S. Moore. 1985. “Automatic Recording Apparatus for use in the Chromatography of Amino Acids”. *Analytical Chemistry*. 30:1191.

13. Ujowundu, C.O., C.U. Igwe, V.H.A. Enemor, L.A. Nwaogu, and O.E. Okafor, 2008. “Nutritional and Anti-Nutritive Properties of *Boerhavia diffusa* and *Commelina nudiflora* Leaves”. *Pak. J. Nutr.* 7(1): 90-92. http://www.pjbs.org/pjnonline/fin689.pdf

14. USDA. 2008. Germplasm Resources Information Network - (GRIN) [Online Database]. , ARS, National Genetic Resources Program. National Germplasm Resources Laboratory, Beltsville, MD. http://www.ars-grin.gov/cgi-bin/npgs/html/taxon.pl?33057

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, C.C. and J.C. Ikewuchi. 2009. "Amino Acid, Mineral, and Vitamin Composition of *Sanseviera liberica* Gérôme and Labroy". *Pacific Journal of Science and Technology.* 10(1):477-482.

Pacific Journal of Science and Technology