International Digital Organization for Scientific Research ISSN: 2579-0811

IDOSR JOURNAL OF BIOCHEMISTRY, BIOTECHNOLOGY AND ALLIED FIELDS 2(1): 48-60, 2017.

Evaluation of Some Mineral Constituents of *Sphenocentrum jollyanum* Root

Aja P. M[1]., Ugwu Okechukwu P. C[1]., Nwobasi C. S[2] and Orinya O.F[3]

[1]**Department of Biochemistry Faculty of Science, Ebonyi State University, P. M. B 053 Abakaliki, Ebonyi State, Nigeria.**

[2]**Department of Chemistry, Ebonyi State College of Education, Ikwo. Ebonyi State, Nigeria.**

[3]**Department of Biochemistry Faculty of Science, Ebonyi State University, P. M. B 053 Abakaliki, Ebonyi State, Nigeria.**

ABSTRACT

This study evaluates some mineral constituents of Sphenocentrum jollyanum root a common medicinal plant used in the management of infertility in Abakaliki, Ebonyi State. The mineral constituents were carried out using standard procedure outlined by Association of Official Analytical Chemists (A.O.A.C). The result of the mineral analysis showed that iron has the highest concentration of 3.04 ± 0.04 mg/100g, followed by zinc with value of 2.06 ± 0.09 mg/100g and Mg, Ca, P, Cu, Na and K were also detected in lower concentration in the sample. This indicates that Sphenocentrum jollyanum root is a good source of these minerals especially iron and zinc.

Key Words: *Sphenocentrum jollyanum* root, mineral constituents, Evaluation and A.O.A. C.

INTRODUCTION

Sphenocentrum jollyanum is an erect shrub that belongs to the family *Mensipermacea* (Nia *et al.*, 2004)[1]. It is called "Ezeogwu" in Igbo, "Aduro kokoo" or "Okramankote" in the Akan language in Ghana (Woode *et al.*, 2009)[2]. *Sphenocentrum jollyanum* has been shown to have antihypertensive, antioxidant, antinociceptive, antiviral and anti-angiogenic effects in animals (Owiredu *et al.*, 2007; Woode *et al.*, 2009)[2],[3]. The plant is also documented for its use against chronic coughs, worms and other inflammatory conditions as well as tumors

(Mbaka *et al*., 2010; Alese *et al*., 2014)[4],[5]. The plant is traditionally used as remedy for feverish conditions as well and as an aphrodisiac (Akintobi *et al*., 2013; Alese *et al*., 2014)[6],[5]. Studies have shown that the leaves posses significant antipyretic and analgesic activities (Muko *et al*., 1998)[7]. The roots and leaves have been reported to be active against polio[4].

It is also believed to be emetic and purgative agents especially when poisoning is suspected; the sap is believed to relieve stomach ache and constipation and also boost appetite and sexual desire (Owiredu *et al*., 2007)[3]. In Cote d' Ivoire, pounded roots are taken against high blood pressure, while the boiled roots are given against epileptic fits (Amidu *et al*., 2008)[8]. In Ghana the pulped root is used to treat breast tumors (Akintobi *et al*., 2013). Different parts of the plant have been used extensively for the treatment of various ailments in West African sub- regions (Owiredu *et al*., 2007)[3]. Extracts from the root have been used for the relief of constipation, as stomachic, for sickle cell disease, rheumatism and other inflammatory conditions (Iwu, 1993)[9]. The fruits are used as an antifatigue snack (Amidu *et al*., 2008)[8]. It has been also reported by Amidu *et al*. (2008)[8] that the methanolic extract of the root of *Sphenocetrum jollyanum* increased the testosterone levels in a dose-dependent manner and also reduced the count, motility and viability of spermatozoa in albino rats.

The basic functions performed by the minerals includes, structural components of body tissues; are involved in the maintenance of acid-base balance and in the regulation of body fluids, in transport of gases and in muscle contractions (Malhotra, 1998; Murray *et al*., 2000)[10]. Knowledge of the biochemistry and functions of the mineral elements in humans, animals and plants will assist plant physiologists and breeders/geneticists, to give priority to mineral elements of importance in health and disease of humans and animals when selecting desirable traits in diets and this will also assist food industries, dieticians, human and animal nutritionists, and veterinarians to be aware of the effects of different

processing methods/techniques on these important mineral elements . For example, high dietary sodium is implicated in cardiovascular and renal disorders, high dietary sodium is often discouraged in patients/subjects who suffer from or are prone to hypertension (Sacks *et al*., 2001)[11]. Also, knowledge of the importance of the mineral elements in plants is essential as the global trend in nutrition and medicine is shifting towards the consumption of plant foods (fruits and vegetables) and medicinal plants (phyto-medicines) respectively, because the plant kingdom is reported by Soetan and Oyeiwole (2009)[12] to be full of large numbers of beneficial substances to both human and animal health (Igile, 1995; Nwadiaro and Nwachukwu, 2007; Ogbonna *et al.,* 2007; Soetan, 2008)[13],[14],[15],[12]. This study was designed to evaluate mineral compositions of *Sphenocetrum jollyanum* root

MATERIALS AND METHODS

MATERIALS

The chemicals, reagents and equipment used were of analytical quality.

COLLECTION OF PLANT SAMPLE

The roots of *Sphenocetrum jollyanum* were collected from Iboko in Abakaliki Local Government Area of Ebonyi State. The sample was authenticated by a taxonomist, Professor S. S. Onyekwelu of Applied biology Department, Ebonyi State University Abakaliki, and Nigeria. It was dried under room temperature in Biochemistry laboratory Ebonyi State University Abakaliki, Ebonyi State. Some parts of the plants were also deposited in the herbarium for reference purpose.

Figure 1: Seeds and Leaves of *Sphenocentrum jollyanum* (Muko *et al.,* 1998)[7].

SAMPLE PREPARATION

The dried roots of *Sphenocetrum jollyanum* were pulverized with electric grinding machine. The sample was then kept in an airtight container in the refrigerator until required used for the analysis.

METHODS

MINERAL CONTENT ANALYSIS

The mineral analysis was carried out according to the procedure of Association of Official Analytical Chemist[16].

DETERMINATION OF MINERALS

The method involves the separation of minerals from the food matrix by destruction of the organic matter of the sample through dry ashing or wet digestion.

DETERMINATION OF CALCIUM

The amount of calcium was determined by the method of [16].

Procedure: Exactly 10ml of the sample filtrate was pipetted into 250ml conical flask and 25ml of 10% potassium hydroxide was added into the same flask and a pinch of calcein indicator was also added. 0.1N EDTA was used to titrate the solution till colour changed from pinkish-green to full pinkish colour.

DETERMINATION OF PHOSPHORUS

The amount of phosphorous was determined by the method of [16].

Procedure: Exactly 5ml of the sample was pipetted into a test tube, 1ml of ascorbic acid solution and 1ml of 2.5% ammonium molybdate reagent was added to the sample and mixed well. The well mixed sample was boiled in a water bath for about 5minute for the blue colour to develop. The absorbance was read at 620nm.

DETERMINATION OF MAGNESIUM

The amount of Magnesium was determined by the method of[16].

Procedure: Exactly 10ml of the sample filtrate was pipetted into 250ml conical flask after which 25ml of ammonia buffer solution was added into the conical flask and was properly mixed. Then a pinch of Erichrome black T indicator was added and titrated with 0.02N of EDTA until the colour of the solution changed from wine-red to blue colour.

DETERMINATION OF IRON

The amount was determined Iron was determined by the method of [16].

Procedure: Exactly 5ml of the sample was pipette into a test tube and 1ml of 2.5% hydroquinol and 1.5ml of acetate buffer was added to the sample, after which 1ml of 0.1% pyridine was also added and stirred properly to mix. The volume of solution was made up with dilute water and was properly mixed. The colour was allowed a maximum of 24hoursfor it to develop and the absorbance was read at 530nm using spectrophotometer.

DETERMINATION OF ZINC

The amount of Zinc was determined by the method of [16].

Procedure: Exactly 5 ml of the sample was pipetted into a test tube and 2 ml of citric acid solution was added and neutralize with ammonia. Exactly 5 ml of dithizone solution was added and the lower layer was discarded. Then, 2 ml of carbon tetrachloride was added and stirred vigorously and the lower layer discarded. The upper layer was allowed for 30 minutes and 5 ml of dilute dithizone was added and stirred. The absorbance of dithizone layer was taken at 532 nm.

DETERMINATION OF MANGANESE

This was carried out by the procedure of[16].

Procedure: Exactly 5 ml of the ashed sample was pipetted into a test tube. Then, 0.5 ml of concentrated H_2SO_4 was added and boiled for 1 hour. Exactly 0.1 g of sodium m- periodate was added into the test tube and boiled for 10 minutes and allowed to cool and made up to 10 ml with water. The absorbance was measured at 570nm.

DETERMINATION OF SODIUM AND POTASSIUM

These were determined using flame photometric method by[16].

DETERMINATION OF COPPER

This was carried out by the procedure of [16].

Procedure: Exactly 5 ml of the ashed sample was pipetted into a test tube and 1 ml of vasanate citrate solution was added. The mixture was made alkaline with ammonia and 0.1 ml of 1% sodium diethyldithiocarbamate was added with 5 ml of carbon tetrachloride and stirred properly. Then, the mixture was allowed to separate and the absorbance of the lower layer taken at 440 nm.

RESULTS

The result of mineral composition of *Sphenocetrum jollyanum* root showed that iron has the highest concentration of 3.04±0.04 mg/100g, followed by zinc with value of 2.06±0.09 mg/100g and Mg, Ca, P, Cu , Na and K were detected as shown in Figure 2.

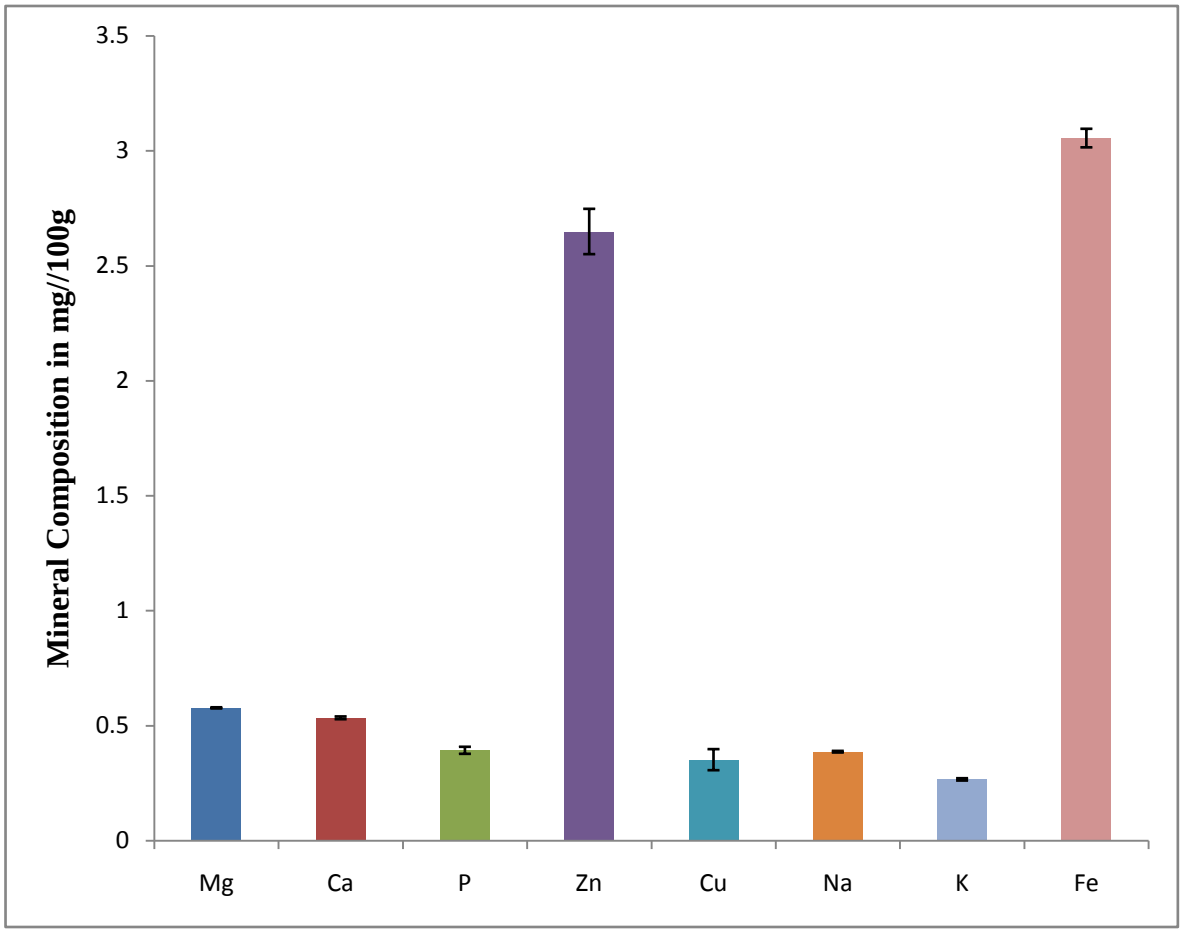

Figure 2: Mean Value of Mineral Constituents of *Sphenocetrum jollyanum* root in mg/100g.

Mean values were in triplets ± standard deviation

DISCUSSION AND CONCLUSION

The result of the mineral analysis in Figure 2 showed that *Sphenocetrum jollyanum* could be a good source of iron (3.04±0.04 mg/100g) and zinc (2.06±0.09 mg/100g) and other mineral detected. This result correlates a bit with the findings reported by Abolaji *et al.* (2007)[17] on *Xylopla aethlopica* and *Parinari polyandra*. The values obtained for zinc were higher than those reported by Hassan *et al.* (2007)[18] in *Cassia occidentalis* leaves (0.05 mg/100g). The result of zinc concentration as reported by Ngaski (2006)[19] in *C. siamea* leaves was higher (6.85 mg/100 g) when compared to the result of this research. This result does not agree with the report of Nwali *et al.* (2014)[20] that revealed high values of potassium (3.49±0.01and 3.74 ±0.04 %) and calcium (4.99±0.01 and 6.82 ± 0.04 %) in *Bryophyllum pinnatum* leaves in wet and dry samples. Whereas, Igwenyi *et al.* (2011)[21] reported relatively high values of iron, magnesium and calcium in μg/ml and low values of phosphate, manganese, sulphate and nitrates in *Ipomea aquatic* leaves. Aja *et al.* (2013)[22] revealed Calcium concentration of 1.475 x 10^2 + 0.15mg/l, Chlorine concentration of 2.482 x 10^2 + 0.01mg/l and Phosphorus concentration of 3.85 + 0.20mg/100g in seed of *Moringa oleifera* whereas the concentration in the leaves recorded calcium (1.151 x 102 + 0.02mg/l), Chlorine (0.319 + 0.07mg/l) and Phosphorus (3.85 + 0.04mg/100g). Zinc is distributed widely in plant and animal tissues and occurs in all living cells. It functions as a cofactor and is a constituent of many enzymes like lactate dehydrogenase, alcohol dehydrogenase, glutamic dehydrogenase, alkaline phosphatase, carbonic anhydrase, carboxypeptidase, superoxide dismutase, retinene reductase, DNA and RNA polymerase. Zn dependent enzymes are involved in macronutrient metabolism and cell replication[23].

Phosphorus formed part of the constituents of bone tissue and they form compounds needed for energy conversion. Also a high potassium plays a vital role in normal cell function including neurotransmission, muscle contraction, and maintaining acid-base balance. Magnesium is essential for healthy bones and proper functioning of muscle and nerve tissue. The iron content, a component of hemoglobin in red blood cells, determines the balance of oxygen in the blood. When low or deficient, it leads to fatigue, anxiety, nausea and low bone density. Fe is an important constituent of succinate dehydrogenase as well as a part of the haeme of haemoglobin (Hb), myoglobin and the cytochromes (Chandra, 1990)[24]. Iron is required for proper myelination of spinal cord and white matter of cerebellar folds in brain and is a cofactor for a number of enzymes involved in neurotransmitter synthesis (Larkin and Rao, 1990)[25]. Iron is involved in synthesis and

packaging of neurotransmitters, their uptake and degradation into other iron-containing proteins which may directly or indirectly alter brain function (Beard, 2001)[26]. Iron exists in the blood mainly as haemoglobin in the erythrocytes and as transferrin in the plasma. It is transported as transferrin; stored as ferritin or haemosiderin and it is lost in sloughed cells and by bleeding (Murray *et al.*, 2000)[27]. Fe is required for making Hb and it is a pro-oxidant which is also needed by microorganisms for proliferation (Galan *et al.*, 2005)[28]. Biologically important compounds of iron are haemoglobin, myoglobin, cytochromes, catalases and peroxidase[10].

The primary roles of zinc appear to be in cell replication and gene expression and in nucleic acid and amino acid metabolism. Vitamins A and E metabolism and bioavailability are dependent on zinc status (Szabo *et al.*, 1999)[29]. It is necessary for fertility of mice. It is also required for normal testicular development (Arinola, 2008)[30] and for functions of the taste buds. It is needed for tissue repair and wound healing, plays a vital role in protein synthesis and digestion, and is necessary for optimum insulin action as zinc is an integral constituent of insulin. It is an important constituent of plasma (Malhotra, 1998; Murray *et al.*, 2000)[10],[27]. Formation of zinc fingers in nuclear receptors for steroid-thyroid, calcitriol receptors, gene expression, essential in protein synthesis, involves in the storage and release of insulin, growth and repair of tissues, development of sex organs, needed in the enzymes required for the synthesis of DNA and RNA, mobilization of vitamin A from the liver and stabilization of cell membranes. It is present in meat and other protein foodstuffs, but intestinal absorption is affected by other dietary constituents. Absorbed zinc enters the liver where it is incorporated into zinc metalloenzymes and exported to peripheral tissue in plasma, bound to albumin. A high dietary iron intake can decrease zinc absorption. Toxicity disease or symptoms of zinc in humans include gastrointestinal irritation, vomiting, decreased immune function and a reduction in high density lipoprotein (HDL) cholesterol. Higher dietary levels of Zn are required in the presence of phytic acid to prevent parakeratosis and allow for normal growth[31].

The basic functions performed by the minerals includes, structural components of body tissues; are involved in the maintenance of acid-base balance and in the regulation of body fluids, in transport of gases and in muscle contractions (Malhotra, 1998; Murray *et al.*, 2000)[10],[27]. Knowledge of the biochemistry and functions of the mineral elements in humans, animals and plants will assist plant physiologists and breeders/geneticists, to give priority to mineral elements of importance in health and disease of humans and animals

when selecting desirable traits in diets and this will also assist food industries, dieticians, human and animal nutritionists, and veterinarians to be aware of the effects of different processing methods/techniques on these important mineral elements . For example, high dietary sodium is implicated in cardiovascular and renal disorders, high dietary sodium is often discouraged in patients/subjects who suffer from or are prone to hypertension (Sacks *et al.*, 2001)[11]. Also, knowledge of the importance of the mineral elements in plants is essential as the global trend in nutrition and medicine is shifting towards the consumption of plant foods (fruits and vegetables) and medicinal plants (phyto-medicines) respectively, because the plant kingdom is reported by Soetan and Oyeiwole (2009)[12] to be full of large numbers of beneficial substances to both human and animal health [13],[14],[15],[32].

CONCLUSION

The analysis on *Sphenocetrum jollyanum* root showed that the root of is rich in minerals especially iron which is the central metal of transport protein haemoglobin and zinc which is a co-factor in superoxide dismutase. The mineral content of the root suggests that the plant can contribute significantly to the nutrient requirements of man and this informs the use of the plant root in ethno-medicine.

REFERENCES

1. Nia, R. , Paper, D. H. , Essien, E. E., Iyadi, K. C., Bassey, A. I. L. and Anti, A. B. and Franz, G. (2004). Evaluation of the anti-oxidant and anti-angiogenic effects of *Sphenocentrum jollyanum* Pierre. *African Journal of Biomedical Research,* **7:**129-132.

2. Woode, E., Amidu, N., William, K. B. A., Ansah, C. and Duwiejva, M. (2009). Anxiogenic-like effects of root extract of *Sphenocentrum jollyanum* Pierre in Murine behavioral models. *Journal of Phamacology and Toxicology*, **4 (3):** 91-106.

3. Owiredu, W. K. B. A., Nafiv, A., Amissah, F. and Woode, E. (2007). The effects of the ethanolic extract of root of *Sphenocentrum jollyanum* Pierre on sexual behaviour and hormonal levels in rodents. *Journal of Science and Technology,* **27(2):**9-20.

4. Mbaka, G. O. and Adeyemi, O. O. (2010). Toxicity study of ethanol root extract of *Sphenocentrum jollyanum (Menispermaceae)* Pierre. *Asian Journal of Experimental Biological Science,* **4:** 869-874.

5. Alese, M. O., Adewole, O. S., Ijomone, O. M., Ajayi, S. A. and Alese, O. O. (2014). Hypoglycemic and hypolipidemic activities of methanolic extract of *Sphenocentrum jollyanum* on streptozotocin-induced diabetic wistar rats. *European Journal of Medical Plants*, **4(3):**353-364.

6. Akintobi, O. A., Adejuwon, A. O., Bamkefa, B. A., Daniels, O. V. C and Ojo, V. O. (2013). Antimicrobial potency of *Sphenocentrum jollyanum* on some human pathogenic bacteria. *Academia Arena*, **5(5):**1 -7

7. Muko, K. N., Ohiri, P. C. and Ezegwu, C. O. (1998). Antipryetic and analgesic activities of *Sphenocentrum jollyanum* Nigeririan *Journal of Natural Product Medicine,* **2:** 52-53.

8. Amidu, N., Woode, E., Owiredu, K. B. A., W. and Asare, A. G. (2008). An evaluation of toxicity and motagenicity of *Sphenocentrum jollyanum*. *International Journal of Pharmacology*, **4:** 67-77.

9. Iwu, M. M. (1993). Handbook of African Medicinal Plants. CRC Press Inc. 239.

10. Malhotra, V. K. (1998). Biochemistry for Students. Tenth Edition. Jaypee Brothers Medical Publishers Ltd, New Delhi, India. **2**: 178-240.

11. Sacks, F. M., Svetkey, L. P., Vollmer, W. M., Appel, L. J., Bray, G. A., Harsha, D., Obarzanek, K., Conlin, P. R., Miller, E. R., Simons-Morton, D. G., Karanja, N and Lin, P. H (2001). Effects on blood pressure of reduced dietary sodium and the Dietary Approaches to Stop Hypertension (DASH) diet, DASH-Sodium Collaborative Research Group, *New England Journal of Medical* 4:344(1)3-10.

12. Soetan, K. O. and Oyewole, O. E. (2009). The need for adequate processing to reduce the Anti-nutritional Factors in Plants used for Human Food and Animal Feeds- A Review. *African Journal Food Science,* **3**(9): 123-132.

13. Igile, G. O. (1995). Phytochemical and Biological Studies on some constituents of *Vernonia amygdalina* (compositae) leaves. Ph.D Thesis, Department of Biochemistry, University of Ibadan, Nigeria.

14. Nwadiaro, P. O. and Nwachukwu, I. (2007). Inhibition of Pathogenic Fungi by Ethnobotanical Extracts of *Cymbopogon citrates*, *Ceiba pentandra* and *Loranthus bengwelensis*. *Nigerian Journal of Biotechnology*, **18**: 61-65.

15. Ogbonna, A. I., Makut, M. D., Gyar, S. D and Adamu, E. U. (2007). Antimicrobial Activity of Ethanolic Extracts of the Seeds of *Ricinus communis* (L). *Nigerian Journal of Biotechnology*, **18**(1-2): 40-43.

16. A.O.A.C. (1997). Official Methods of Analysis, 8th Edition, the Association of Official Analytical Chemists, Washington DC, USA.

17. Abolaji, O. A., Adebayo, A. H. and Odesanmi, O. S. (2007). Nutritional Qualities of Three Medicinal Plant Parts (*Xylopia aethiopica, Blighia sapida* and *Parinari polyandra*). *Indian Journal of Nutrition,* **5**: 144-151.

18. Hassan, L. G., Sani, N. A. and Faruq, C. M. (2002). Nutrient Composition of *Cassia occidentalis* (L) Leaves. *Journal of Agriculture and Environment*, **3**(2): 399-403.

19. Ngaski, M. M. (2006). Phytochemical Screening and Proximate Analysis of *Cassia Siamea* Leaves. M.Sc. Dissertation. Submitted to the Department of Pure and Applied Chemistry, Usmanu Danfodiyo University, Sokoto, Nigeria.

20. Nwali, B. U., Aja P. M., Okaka, A. N. C., Offor, C. E. and Nwachi, U. E. (2014). Proximate and Mineral composition of *Bryophyllum pinnatum*a medical plant used to cure diseases and injuries. *American Journal of Phytomedicine and Clinical Therapeutics in Biochemistry,* **7**: 2321-2748

21. Igwenyi, I. O., Eze, C. A., Azoro, B. N., Offor, C. E. and Nwuke, C. P. (2011). Proximate, mineral and amino acid compositions of *Irvigna gabonesis and Citrullus colocynth* are used as soup thickeners in South Eastern Nigeria. *International Journal of Biotechnology*, **7**(4): 493- 499.

22. Aja, P. M., Ibiam, U. A., Uraku, A. J., Orji, O. U., Offor, C. E. and Nwali, B. U. (2013). Comparative Proximate and Mineral Composition of *Moringa oleifera* Leaf and Seed. *Journal of Global Advanced Research of Agricultural Science,* **2**(5): 137-141

23. Hays, V. W. and Swenson, M. J. (1985). Minerals and Bones. Dukes' Physiology of Domestic Animals. Taylor and Francis, Washington, D.C., U.S.A. Tenth Edition. 449-466.

24. Chandra, R. K. (1990). Micro-nutrients and Immune Functions: An overview. (4th Edition) Annual New York Academy Science. 587: 9-16.

25. Larkin, E. C and Rao, C. A. (1990). Importance of Fetal and Neonatal Iron; adequacy for normal Development of Central Nervous System, Brain behavior and iron in the infant diet (Dobbing, J. Edition), London, UK. 43-63.

26. Beard, J. L. (2001). Iron biology in Immune Function, Muscle Metabolism and Neuronal Functioning. *Journal of Nutrition*, **131**: 5685-5695.

27. Murray, R. K., Granner, D. K, Mayes, P. A. and Rodwell, V. W. (2000). Harper's Biochemistry, 25th Edition, McGraw-Hill, Health Profession Division, USA. **5**: 171-187.

28. Galan, P., Viteri, F., Bertrais, S., Czernichow, S. and Faure, H. (2005). Serum Concentrations of beta carotene, vitamins C and E, zinc and selenium are influenced by Sex, Age, Diet, Smoking Status, Alcohol Consumption and Corpulence in a general French Adult Population. *European Journal of Clinical Nutrition*, **59**: 1181-1190.

29. Szabo, A and Bak, M. (1999) Exercise-induced affect during training and competition in collegiate soccer players. *European Yearbook of Sport Psychology*, 3, 91-104.

30. Arinola, O. G. (2008). Essential Trace Elements and Metal binding Protein in Nigeria consumers of alcoholic beverages. *Journal of Nutrition,* **7**(6): 763-765

31. Sidhu, O, Vishal Kumar, P and Hari, M B (2004). Variability in triterpenoids (Nimbin and Salanin) composition of neem among different provenances of India. Ind. crops products, 19: 69-75.

32. Batra, J. and Seth P. K. (2002). Effect of iron Deficiency on Developing Rat Brain. *Indian Journal of Clinical Biochemistry,* **17**(2): 108-114.