VARIATION IN SOME MINERALS PRESENT IN PARTS OF JATROPHA CURCAS USED IN TRADITIONAL MEDICINE PRACTICE IN OKPARI TOWN, DELTA STATE

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ABSTRACT
The study was on evaluation of the variations in some minerals in the leaf, stem bark and root of *Jatropha curcas*. Standard analytical procedures were used in the study. Results from the analysis revealed that magnesium was present in the highest amount in the leaf (389 ± 0.33 mg/kg) followed by root (307.03 ± 0.79 mg/kg) and stem bark (203.75 ± 0.04 mg/kg). This was followed by calcium which was present in highest amount in the root (99.23 ± 0.56 mg/kg) followed by stem bark (82.57 ± 0.76 mg/kg) and leaf (80 ± 0.82 mg/kg). The concentration of iron was highest in the leaf (13.13 ± 0.26 mg/kg) followed by the root with a mean value of 12.47 ± 0.45 mg/kg, and lastly the stem bark (10.33 ± 0.69 mg/kg). The contents of phosphorus in leaf and stem bark were 10.46 ± 0.12 mg/kg and 10. 14 ± 0.22 mg/kg respectively, while the root content was low with a value of 4.49 ± 0.03 mg/kg. There was however, no significant difference in the mean mineral composition of the various parts of *J. curcas*. The findings from this study justifies the use of this plant in traditional medicine practice and reveals its potential use as a nutritional supplement to combat various mineral deficiency related diseases. Increased domestication of this plant is recommended to ensure conservation for future use.

Key words: Mineral composition, Traditional medicine, Okpari town, Medicinal plant.

1.0 INTRODUCTION

Throughout the history of mankind, many infectious diseases have been treated with plant extracts. The indigenous use of plants has been an effective source of traditional and modern medicine. The World Health Organization (WHO) estimates that 4 billion people, about 80% of the world's population use herbal medicine for some aspects of primary health care (Farnsworth *et al.*, 1985). In Africa, traditional medicine still forms the backbone of rural medical practices. The rural population is more disposed to traditional ways of treatment because of its availability and cheaper cost (Banquar, 1993). The practice of ethnomedicine is a complex multi-disciplinary system constituting the use of plant, spirituality and the natural environment and has been the source of healing for people for millennia. The negative side effects, high cost, unavailability and inaccessibility of synthetic medicines to a larger percentage of persons, have left man with no choice than to go back to green medicines in order to remedy his life-threatening afflictions (Paul *et al.*, 2018). Ethnomedicine is the study of traditional medical practice which is concerned with the cultural interpretation of health, diseases and illness and also addresses the healthcare seeking and healing practices. Traditional medicines are potential sources of new drugs, a source of cheap starting product for the synthesis of known drugs. They are mostly compounded from natural products. Traditional medicines are cheaper than orthodox medicine which serves as therapeutic agent as well as important raw material for manufacture of traditional modern medicines. Studying medicinal plants helps to understand plants toxicity and protect human and animal from natural poisons (Olaitan *et al.,* 2017). In traditional medicine, various plant parts are used such as the leaves, stem bark, latex, fruits, seeds and roots. Some of these plant parts can either be used in their fresh state while others may be stored in their dry state (Oduola *et al.,* 2005; Onyije *et al.,* 2012; Fowotade *et al.,* 2017). Different methods are applied in the preparation of various traditional medicine, some of these methods are boiling, soaking, heating, roasting, amongst others. In some rural areas, the use of a particular method may be prevalent. Plants contain valuable sources of nutrients as they contribute substantially to protein, minerals, vitamins, fibers and other nutrients which are usually in short supply in daily diets (Mohammed and Shariff, 2011). Plants also possess phytochemicals which make them nutritionally important (Tukan *et al.,* 1998). However, many of these plants are underutilized today because of the inadequate scientific knowledge of their nutritional potentials.Over 5,000 plants are known to be used for medicinal purposes in Africa, but only a few have been studied (Taylor *et al.,* 2001). Some of these medicinal plants investigated for their nutritional components have been found to contain different micronutrients (Adediran *et al.,* 2017). Humans and other animals require several vitamins and minerals. One of such plant is *Jatropha curcas*. Medicinal plants like *Jatropha curcas* have played a major role in the treatment of various diseases including its use as an anticoagulant and as a heamostatic agent (Oduola *et al.,* 2005; Oduola *et al.,* 2007). It is a multipurpose plant which belongs to the spurge family, Euphorbiaceae which is native to the American tropics. *J. curcas* is a small tree or shrub with smooth grey back, which exudes whitish colored watery latex when cut. It grows 3-5m in height, but can attain a height of 8-10m under favorable conditions. It is a quick yielding plant that survives in degraded, barren, forest land and drought-prone areas and is cultivated as a hedge on the farm boundaries. The leaves have narrow lobes and are alternately arranged. Stem and branches with green to pale green color. The seed contains 27-40% oil that can be processed to produce a high-quality biodiesel fuel, usable in a standard diesel engine (Achten *et al.,* 2008). The growing interest in *Jatropha curcas* as a biodiesel to help alleviate the energy crisis and generate income in rural areas of developing countries make people call it "miracle tree" (Magu *et al.*, 2018). Jatropha has several agronomic morphological traits that make it a useful crop for producing biofuel and feeds for animals, such as drought tolerance, rapid growth, easypropagation, the fact that it can be grown at almost all altitudes, and because the plants canproduce for more than 50 years. In addition, Jatropha oil has good oxidation stability, low viscosity, and a low pour point, making its oil better than soybean oil and palm oil (Azevedo *et al.*, 2017). A good potential for biogas feedstock is *Jatropha* seed cake due to it having a 60% higher biogas production (Primandari *et al.,* 2018). *Jatropha* seed cake does not require densification for the generation of heat and can be pyrolyzed in order to produce biodiesel. (Ramirez *et al.,* 2019). The oil produced from the seed of Jatropha is golden yellow in color. All parts (the seeds, leaves, stem bark, root, etc.) of the Jatropha plant have been used in traditional medicine (Reddy *et al.*, 2012) for treatment of a wide spectrum of ailments related to skin, cancer, digestive, respiratory and infectious diseases.

Figure 1: *Jatropha curcas (*Physic nut)

2.0 MATERIALS AND METHODS

2.1 Description of Study Area

The study was carried out in Okpari town in Ughelli South Local Government Area in Delta State, Nigeria, at latitude 5.3435° N and Longitude 5.9511°E. Okpari town in Delta State has basically two (2) major climates normally referred to as wet and dry seasons which are characteristics of the sub-equatorial climate of the Niger Delta. The wet season is characterized by heavy precipitation. This season with its heavy down pours and long-lasting drizzles, begins in the month of March and frizzles out in the month of November (SPDC, 2002). Although, occasional sunshine could be experienced in some days during this season, the weather is generally dull and wet. The dry season is characterized by abundant sunshine and could be very hot especially towards the mid-day.

Okpari community is traditionally inhabited by the urhobo people. One important aspect of the culture of the Okpari people is traditional medicine practices which involves the use of herbs in the treatment and management of various diseases. The plant *J. curcas* locally known as Eshakpa in the urhobo language is used traditionally in the treatment of different ailments such as fever, wound, malaria, toothache, eczema, rheumatism, jaundice, baby's inflamed tongue, ringworm and other skin diseases, diarrhea amongst others. Much value is placed by the Okpari people on the plant hence the choice of sampling from Okpari community. The young leaves of the plant are also used in the preparation of different local meals. In addition to these uses, the plant is also used in fencing compounds for security purposes in the area.

Figure 2: Map of Ughelli South showing sampling area

2.2. Sample collection and identification

The plant leaves, stem bark and root were obtained from a farm at Okpari community, Ughelli South Local Government Area in Delta State, Nigeria. The leaves, stem and root of *J. curcas* plant were identified, confirmed and authenticated by comparison with an authentic specimen at the Biological Garden at the Department of Biology, College of Education, Warri.

2.3 Preparation of the sample

The leaves, stem and root of *J. curcas* were washed with tap water then rinsed with distilled water. The residual moisture was evaporated at room temperature for 72 hours thereafter the fresh leaves were allowed to dry completely for two weeks at a room temperature before using them for this study. The dry leaves, stem and roots were then ground in porcelain mortar, sieved through 2 mm mesh sieve and stored in plastic container. The powdered sample was used for mineral analysis.

2.4 Method of digestion (Wet digestion)

Two (2) grammes of the samples were weighed in 100 ml conical flask, and 25 ml of digestion solution or aquaregia mixture (70% high purity HNO_3 and HCl ratio 3:1) and 5 ml 30% H_2O_2 were added as described by Rodrigues- Flores & Rodriguez – Castellon, (1982). The mixture was heated at 80 ºC for 3 hours (Ashing). Thereafter, the ash was dissolved using 20 ml of de-ionized water. The mixture was filtered using Whatman N0. 42 filter paper 9 cm to complete the digestion of the organic matter. The solution was stored in a clean bottle for analysis.

2.5 Determination of Mineral Composition by Atomic Absorption spectrophotometer

The mixture was transferred to a 50 ml volumetric flash, filled to the mark, and let to settle for at least 2 hours. The supernatant was analyzed for phosphorus, calcium, magnesium and iron contents (Model Buck 210 GVP).

2.6 Method of Statistical Analysis

Data was analyzed using descriptive statistics and ANOVA according to Idris *et al.*, (2011). Data presented as mean ± Standard Deviation (mg/kg) of three determinations.

3.0 RESULTS

The results of the mineral composition of the leaves, stem bark and root of *J. curcas* showed the presence of Fe, Ca, Mg and P in various concentrations. The mineral compositions of the plant samples are presented in Table 1.

Table 1: Mineral composition (mg/kg) of the leaves, stem bark and root of *J.curcas*

	Parameters(mg/kg)			
	Calcium (Ca)	Magnesium (Mg)	Iron (fe)	Phosphorus (P)
Leaf	80 ± 0.82	389 ± 0.33	13.13 ± 0.26	10.46 ± 0.12
Stem bark	82.57 ±0.76	203.75 ±0.04	10.33 ±0.6	10. 14 ± 0.22
Root	99.23 ± 0.56	307.03 ± 0.79	12.47 ±0.45	4.49 ± 0.03
FAO/ WHO	0.24-0.28	0.62-2.64	0.00012-0.46	

Values are expressed as Mean ± Standard Deviation (mg/kg) of three determinations.

The concentration of calcium in the leaves, stem bark and root are 80 ± 0.82, 82.57 ± 0.76 and 99.23 ± 0.56 respectively. The concentration of magnesium in the leaves, stem bark and root are 389 ± 0.33,203.75 ± 0.04 and 307.03 ± 0.79 respectively while the concentration of iron in the leaves, stem bark and root are 13.13 ± 0.26, 10.33 ± 0.69 and 12.47 ± 0.45 respectively. The concentration of phosphorus in the leaves, stem bark and root are 10.46 ± 0.12, 10. 14 ± 0.22 and 4.49 ± 0.03 respectively. However, leaf has the highest concentration of magnesium, followed by the root and stem bark. The mineral contents were higher than the FAO/WHO standard for minerals in leafy vegetables.

Table 2. Summary of ANOVA

Sources of variation	SS	Df	MS	F-value	F-critical
Treatment (Group)	4,437.84	2	2,218.92	0.11	4.26
Error	181,858.83	9	20206.58		
Total	186,296.67	11			

$F_{0.05}(2,9) = 4.26$

Table 2 shows that there was no significant difference in the mean mineral composition of the various parts of *J. curcas* analyzed since the p- value of 4.26 is higher than 0.05.

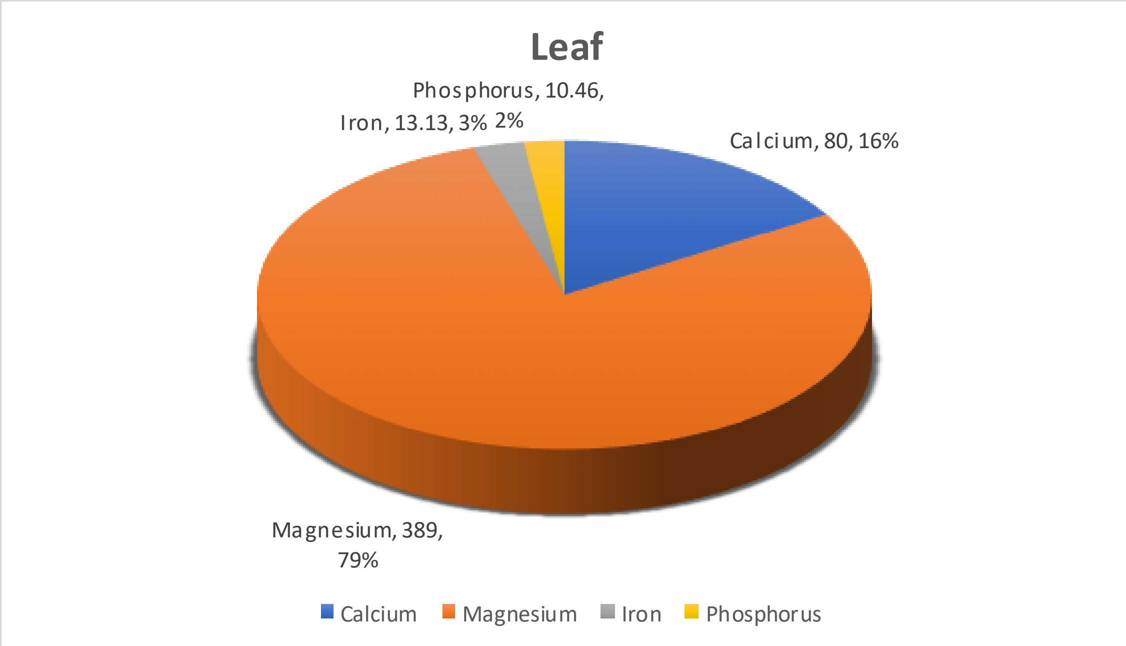

Figure 3: Percentage distribution of minerals in leaf of *J. curcas*.

*M*inerals in leaf showed that magnesium was highest with 79% followed by calcium (16%), iron (3%) and phosphorus (2%).

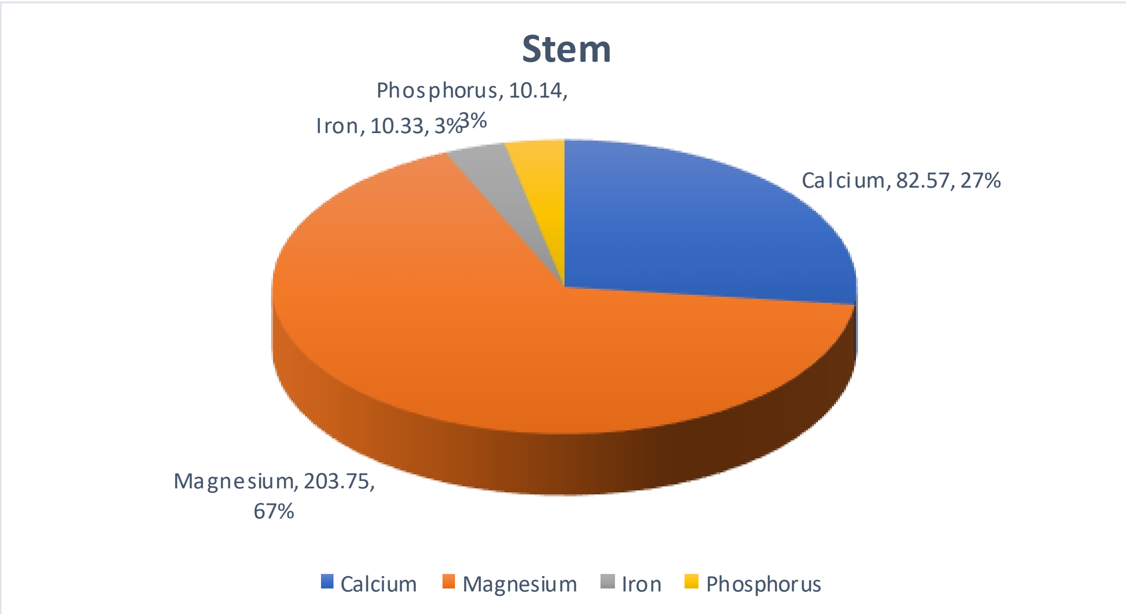

Figure 4: Percentage distribution of minerals in stem bark of *J. curcas*.

Magnesium (67%) was highest in stem bark, followed by calcium (27%). Iron and phosphorus have equal percentage of 3%.

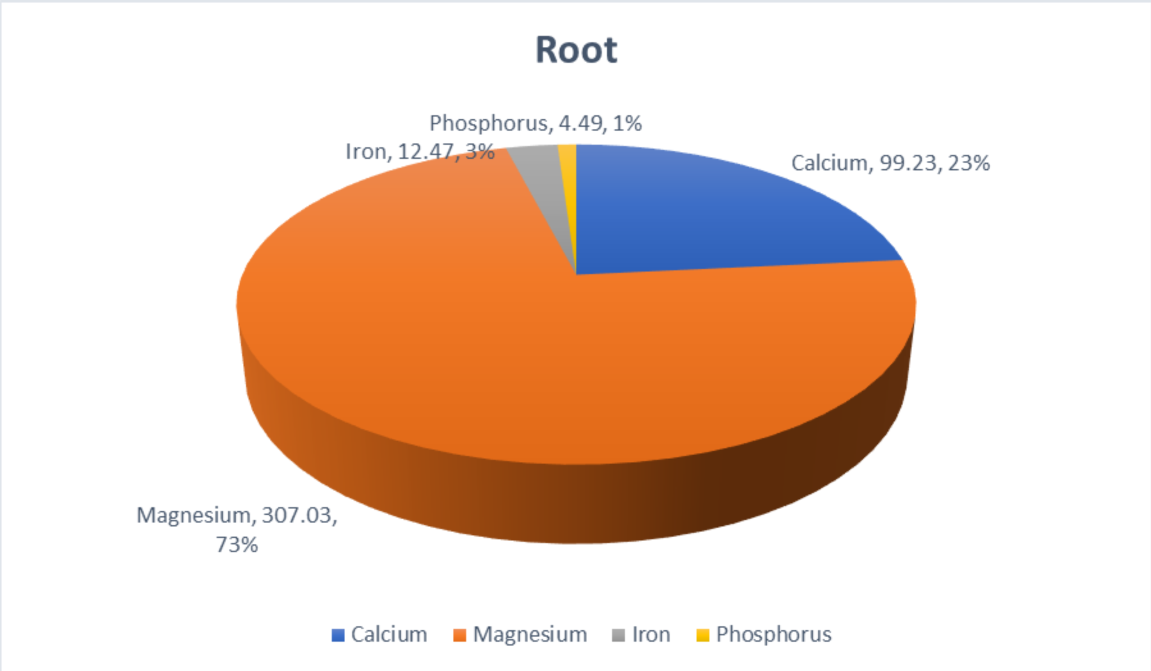

Figure 5: Percentage distribution of minerals in root of *J. curcas*.

Magnesium (73%) was highest followed by calcium (23%), iron (3%) and phosphorus (1%). However, magnesium was highest in leaf with 79% followed root with 73% and lastly stem bark with 67% content.

3.2 Discussion

The mineral composition of the leaf, stem bark and root of *J. curcas* was assessed through quantitative determination of their relative distribution in the various parts. Plants are known to play prominent roles in the treatment of diseases as some species especially the Euphorbia have been reported to possess antitumour and anticancer activities (Monteiro *et al*., 2014; Saedi *et al.*, 2014). The results of the macro and micro minerals taken together showed that the leaf, stem bark and root of *J. curcas* possess strong potentials for medicinal use and would also serve as agents for the treatment of a wide range of diseases and infections (Godswill *et al.*, 2020). There was abundance of calcium, magnesium, iron and phosphorus in the leaf, stem bark and root of *J. curcas*. The results obtained from mineral analysis of leaf, stem bark and root of *J. curcas* established the fact that they can be used as rich calcium and magnesium sources. The mean calcium concentration in the leaves was 80 ± 0.82 mg/kg; while that of stem bark was 82.57 ± 0.76 mg/kg, the mean value of 99.23 ± 0.56 mg/kg was found in the root. However, the calcium contents in all the parts assessed were higher than the value of 50.00 ± 0.47 mg/kg in *J. curcas* reported by Atamgba *et al.*, (2015). Calcium helps in regulating the passage of nutrients through cell walls and the correct contraction of the muscles. Ca along P is required for the formation and maintenance of bones and teeth. It also helps in the clotting of blood and the transfer of the signal by the nerves (Wardlaw *et al.*, 2004). The presence of Ca and Mg are collectively known to reduce hypertension and blood pressure as well as used in the prevention and treatment of high blood pressure (Wardlaw *et al.*, 2004). Therefore, its presence in the leaf, stem bark and root give a positive weight to the nutritional importance of the *J. curcas* plant.

The mean magnesium concentration in the leaves was found to be 389 ± 0.33mg/kg, the stem bark with the value of 203.75 ±0.04mg/kg and the root has a mean value of 307.03 ± 0.79mg/kg. However, the magnesium content in all the plant parts analyzed were higher than the value of 43.00± 2.16 mg/kg as reported by Atamgba *et al*., (2015). Mg is vital in strengthening cell membrane structure and modulates glucose transport across cell memebranes. Studies have shown that Mg supplementation improves insulin sensitivity in diabetic patients and can improve insulin sensitivity in obese individuals who are at risk of Diabetes mellitus (Liu *et al.,* 2020). The iron concentration in the leaves have mean value of 13.13 ± 0.26mg/kg which was higher than the value of 2.85 ± 0.04mg/kg as reported by Bello *et al*. (2016). The concentration of Fe in the stem bark and root were 10.33 ± 0.69 mg/kg and 12.47 ± 0.45mg/kg respectively. Fe is important in cognitive development, temperature regulation andenergy metabolism. It is also required for the synthesis of hemoglobin and myoglobin while its deficiency causes anaemia. It is therefore an important diet in pregnant and nursing women, infants and elderly people to prevent anaemia and other related diseases (Geissler & Singh, 2011). The mean phosphorus content in the leaves was 10.46 ± 0.12 mg/kg, the values for stem bark and root were 10. 14 ± 0.22 mg/kg and 4.49 ± 0.03 mg/kg respectively. Phosphorus is a mineral that makes up 1% of a person`s total body weight. It is also needed for synthesis of protein which is required for growth, maintenance and repair of cells and tissues. Phosphorus also helps the body to produce ATP (Schauss, 2015). Phosphorus works with vitamin B and also helps in kidney function, muscle contractions, normal heart beat and nerves signaling.

4.0 CONCLUSION

Plant medicine is considered safer and better for human health than synthetic drugs. This is because humans have co-evolved with plants. We eat plant, drink their juices, ferment and distil libations from them and consume them. The study revealed that *J. curcas* leaves, stem bark and root contribute useful amounts of nutrients to human diet. It contains high levels of calcium, iron, magnesium and phosphorus which are good for human health.

REFERENCES

Achten, W.M.J., Verchot, L., Franken, Y.J., Mathijs, E., Singh, V.P., Aerts, R. and Muys, B. (2008). Jatropha bio-diesel production and use. *Biomass Bioener,* 32:1063–1084.

Adediran OA, Avwioro OG, Ibikunle DE, Funsho-Agu AG (2017). Histochemical Studies of the Efficacy of an Anti-Ulcer Herbal Mixture on the Gastrointestinal Tract of Albino Rats. *European Journal of Medicinal Plants.* 19(1): 1-11

Atamgba, A. A., Margret, A. A., Kayode, D. and Amonor, J. W. (2015). The biomedical significance of the phytochemical, proximate and mineral composition of the leaf, stem bark and roots of *Jatropha curcas*. *Asian Pacific Journal of Tropical Biomedicine,* 5(8):650-657

Azevedo-Peixoto L.D., Laviola, B.G., Alves, A.A., Rosado, T.B., Bhering, L.L. (2017). Breeding *Jatropha curcas* by genomic selection: A pilot assessment of the accuracy of predictive models.

Banquar, S.R., (1993). The *role of traditional medicine in a rural medicine*. In: Sindinga, I., Nyaigatti-chacha, C., Kanunah, M.P. (Eds.), Traditional Medicine in Africa. English Press Ltd, Nairobi

Bello, B.A., A.K. Jalaluddin, A. Rilwan, A.A. Adam, M.M. Sani, S.I. Ibrahim, F.S. Abdullahi, and A.S. Magaji. (2016). Comparative proximate and some micronutrients content of five local varieties of mango pulp (*Mangifera indica*) commonly consumed in wudiltown kano state. *Int.l J. Sci. Eng. Res.* 7(8):840–854.

Geissler, C. and Singh M. (2011). Iron, meat and health. *Nutrients,* 3(3):283-316.

Godswill, A. G., Somtochukwu, I. V., Ikechukwu, A. O. and Kate, E. C. (2020). Health Benefits of Micronutrients (Vitamins and Minerals) and their Associated Deficiency Diseases: A Systematic Review. *International Journal of Food Sciences*, 3(1), 1–32.

Fowotade A.A., Fowotade, A., Enaibe B.U., Avwioro, O.G. (2017). Evaluating Toxicity Profile of Garlic (*Allium sativum*) on the Liver, Kidney and Heart Using Wistar Rat Model. International *Journal of Tropical Disease & Health* 26(2): 1-12

Liu H, Li N., Jin M., Miao X., Zhang X., Zhong W. (2020). Magnesium supplementation enhances insulin sensitivity and decreases insulin resistance in diabetic rays. *Iran Journal of Basic Medical Science* 23(8): 990-998

Magu, T.O., Louis, H., Nzeata-Ibe, N., Sunday E.A., Udowo, V.M, et al. (2018). Proximate Analysis and Mineral Composition of *Jatropha curcas* Seeds Obtained from Pankshin Local Government Area of Plateau State of Nigeria. *J. Phys. Chem. Biophys.* 8: 265.

Mohammed, M.I. and Sharif, N. (2011). Mineral composition of Some leafy vegetables consumed in Kano, Nigeria. *Nigerian Journal of Basic and Applied Science*, 19(2):208-212

Monteiro, S., Bastos K.X., Barbosa-Filho, J.M., Athayde-Filho, P.F., DinizMde, F, Sobral, M.V. (2014). Medicinal plants and other living organisms with antitumor potential against lung cancer. *Evid Based Complement Altern* Med 2014; http://dx.doi.org/10.1155/2014/604152.

Oduola, T., Adeosun, O.G., Oduola, T.A., Avwioro O.G., and Oyeniyi M.A. (2005) Mechanism of action of Jatropha gossypifolia stem latex as a haemostatic agent. *European Journal of General Medicine* 2: 140-143

Oduola T, Avwioro O.G. and Ayanniyi T.B. (2005) Suitability of the leaf extract of Jatropha gossypifolia as an anticoagulant for biochemical and haematological analyses. *African Journal of Biotechnology*. Vol. 4; 679-681

Oduola, T, Popoola G.B, Avwioro, O.G, Oduola T.A, Ademosun A.A, and Lawal M.O (2007) Use of *Jatropha gossypifolia* stem latex as a haemostatic agent: how safe is it? *Journal of Medicinal Plants Research* 1:14-017

Olaitan, A.Q., Yetunde, S.A., and Joy, O.O. (2017). Proximate Composition of *Jatropha curcas* Leaves, Phytochemical and Antibacterial Analysis of Its Ethyl Acetate Fraction. *Asian Journal of Physical and Chemical Sciences*, 4(1): 1-8.

Onyije, F.M., Avwioro, O.G. (2012). Effect of ethanolic extract of Bauhinia monandra leaf on the liver of alloxan induced diabetic rats. *Journal of Physiology and Pharmacology Advances* 2012, 2(1) 59-63.

Paul, S.H., Usman, A.A., Gana, I.N., Manase, A., Adeniyi, O.D., Olutoye, M.A. (2018) Comparative Study of Mineral and Nutritional Composition of a Multifunctional Flora Composite Formulated from Seven Medicinal Plants and their Applications to Human Health. *Eng Technol* 1(5): 555572. DOI

Primandari, S. R. P., Islam, A. A., Yaakob, Z., & Chakrabarty, S. (2018). *Jatropha curcas* L. biomass waste and its utilization. *Advances in biofuels and bioenergy*.

Ramírez, G.A., Garber, A.I., Lecoeuvre, A., D'Angelo, T., Wheat, C.G. and Orcutt, B.N. (2019) Ecology of Subseafloor Crustal Biofilms. *Front.*

Microbiol. 10:1983. doi: 10.3389/fmicb.2019.01983

Reddy, P.D.M., Amirah, I. and Maksudar R.K. (2012).*Jatropha curcas:* Plants of medicinal benefits..*Journal of Medicinal Plants Research*, 6(14): 2691-2699.

Saedi, T.A., MdNoor, S., Ismail, P., and Othman, F. (2014). The effects of herbs and fruits on leukaemia. *Evid Based Complement Altern Med* 2014;http://dx.doi.org/10.1155/2014/494136.

Schauss, A.G. (2015). Minerals and human health: the rationale for optimal and balanced trace element levels. Utah: trace Minerals. 2015. [Online] Available from: http://www.traceminerals.com/research/humanhealth [Accessed on 1st April, 2015]

Taylor, L.H., Latham, S.M. & Woolhouse M.E.J. (2001). Risk factors for human disease emergence. Philosophical Transactions of the Royal Society of London Series Biological Sciences, 356, 983-989.

Tukan, S. K., Takruri, H.R., Al-Eisaw D.M. (1998). The use of wild edible plants in *Jordanian diet. Int. J. Food. Sci. Nutr*. 49:225-235

Wardlaw, G. M., Hampl, J.S., DiSilvestro, R.A. (2004). Perspectives in nutrition. 6th ed. New York: McGraw Hill.