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Contamination Status Of Heavy Metals In *Teiferaoccidentalis*(Fluted Pumpkin) Grown In Uzere Oil-Bearing Community Niger Delta

ChukwudiOGWU &Juliana Ego AZONUCHE
Department of Vocational Education,
Delta State University, Abraka – Nigeria

Abstract
The study investigated the heavy metals content of T. occidentalisgrown in Uzere oil bearing community. The Research station Uzere was mapped out into research stations corresponding to the quarters that make up the community. From each of the research stations, T occidentalis samples were collected from five (5) sampling spots, bulked, a composite drawn, wrapped in absorbent paper, properly labelled and taken to the laboratory. The analytical standards adopted were APHA and USEPA and the analytical instruments deployed was Agilent atomic absorption spectrophotometer 240A. The results obtained were: V: 1.63±0.20mg/kg, Fe: 13.39±0.13 mg/kg, Ni: 2.45±0.03 mg/kg, Pb: 0.86±0.03 mg/kg and Cd: 0.55±0.01 mg/kg. The results of the heavy metals concentration were subjected to test of significance with numerator 4 and denominator 20 at 0.05 level of significance. The F ratio calculated value is 3.53 while F ratio critical value is 2.87, thus rejecting H_o*. The study recommends that oil production in Uzere should be done within the dictates of set down rules and standards. Gas flaring should be discontinued and T. occidentalisvegetables production and consumption in Uzere should be stopped henceforth until remediation is accomplished.*

Keywords*: Oil production; heavy metals; Teiferaoccidentlis; bioaccumulation*

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I. Introduction

Vegetables are rich sources of vitamins, minerals, fibre and also have beneficial antioxidant effects (Mohammed, Ali, Al-Qantani, 2012; Lattimer, Haub 2010; Harbairit, Micentkovic, Morand 2013; News 2013; Shen, Berger's, Chyu 2012). They have been recognised as the key component of a healthy diet because of their high levels of health promoting nutrients and bioactive compounds including vitamins, minerals, fibre and phytochemical (Liu 2013; Calahan 2012; Chibuike, Okaka, Okoli 2012; Clark, 2014; Conner, Brookie, Carr, Mamvil, Visser, 2017). Consumption of adequate vegetables have been associated with prevention and cure of some chronic diseases such as cardiovascular disorder, cancer, osteoporosis, blood pressure, memory loss and obesity (Alimia, Hel, Tetens 2009; Tohill, Seymor, Sendula 2004; Castejoa, Cassado 2011, VioaplonaBaenas, Vilano 2014). Globally, vegetables production and their qualities have suffered some setbacks due to contamination by industrial effluent discharges and emissions (Kaur, Chaudhary, Kaur, 2014; Hazrat, Khan, 2018, Muranto, Radaelli, Cerami, Tureta, Toscano, Capadagho, 2017). The environmental contaminants include VOCs, BCBs, polyaromatic and polycyclic hydrocarbons, pesticides residues and heavy metals (Feng, Fu, Zhao, Gao 2011; Du, Wang, Fu, Xia 2010; Cupr, Barrow, Sanka, Klanova, Mike's, Holoub3k 2010; Camago, Toledo 2003). Intake of heavy metals contaminated vegetables and fruits are detrimental to human health and may cause health complications such as damage to the DNA which will result in change in genetic code and reduction in energy levels in human body, autoimmune disorder such as rheumatoid, arthritis, kidney disease, liver problems, problem of the lungs, cancer and so on (Allabe, Lange, Lalond, Pelletier, Cambouris, Dutilleul, 2012; Wilkowska, Biziuk 2011; Zhao, Huang, Han, Zou, Gu 2014).

Nigeria is an oil and gas producing country. Oil and gas account for 80 percent of the country's gross domestic product and 90 percent of her foreign exchange earning (Adosun 2017; Ogbonaya 2019; Sanusi 2017). The oil-bearing belt of Nigeria is the Niger Delta as over 90% of the Nigeria oil production quota is mined in the region (Kachukwu 2018; Wike 2018; Tam, 2016; Princewill, 2016).

The Niger Delta lies within the geographic positioning system (GPS) coordinates of latitude 5°544230 and longitude 5°760269 to Nigeria Cameroon border, linked together by complicated network of mangrove creeks rich in biodiversity wetlands, biodiversity oil and gas and human resources (Onosode 2014; Aworawo, 2006; Okecha 2003; Ogunleye 2010; Anyaegbunam 2006).

Niger Delta has experience several cases of oil spill since the commencement of oil production (Friends of the Earth 2014; Anyegbunam 2006; Nigerian National Petroleum Corporation 2015; Okecha 2003; Ekwe 2014). The sources of petroleum in the environment include oil spills, equipment failure, tank wash, ballast water, floods, gas flaring (Oboko&Udeme 2018; Okecha 2003; Susu, Abowei&Onyeme 2006, Le, Xu&Zhe 2014, Kaladumo 2015).

The compositions of petroleum include hydrogen, oxygen, sulphur and heavy metals (Susu, Abowei&Onyeme 2006, Piko, Jane & Zen 2014, Abos&Ugbo 2013).

Teiferaoccidentalis is the perennial vine, its leaves are consumed as vegetables and its fruits are eaten as snacks. It is the most popular vegetable in the south east Nigeria and the Niger Delta as it is found grown in every farm and garden and sold in every market (Ojo&Odi 2013; Ezei 2015; Okpako 2014; Ejechi and Deyinfa 2012, Obi and Okelie 2013). *T. occidentalis*being a perennial vegetable is predisposed to bioaccumulation and biomagnification of toxicants in the soil through the roots and particulate toxicant from gas flaring through the leaves (Ugbe&Ugbe 2015; Ufot&Usen 2011; Okafor&Ndili 2014; Ogochukwu 2015).

Uzere is an oil bearing community, so many research reports have been documented on the impacts of oil production activities in the Niger Delta (Major &Idogho 2014; Hosfall and Ojei 2012, Omeje and Ubeku 2015). However research publications on the impact of oil activities on Uzere oil rich community remains barely available, it is against this backdrop that this study on the heavy metals content of *T occidentalis grown in Uzere oil bearing community* became imperative. The heavy metals investigated were V, Fe, Ni, Pb and Cd.

The study was guided by research questions as below:

1. What are the concentrations of V, Fe, Ni, Pb and Cd in *T. occidentalis*grown in Uzere?
2. Are the concentrations of the heavy metals in the *T. occidentalis*grown in Uzere within the maximum permissible concentration of heavy metals in leafy vegetables as specified by WHO?
3. Can cultivation of *T. occidentalis* be continued or discontinued?

The hypotheses that guided the study was as below:

Ho: there is no significant difference between the concentrations of the heavy metals in *T. occidentalis* grown in Uere and World Health Organization maximum allowable concentration for heavy metals in leafy vegetables.

STUDY AREA

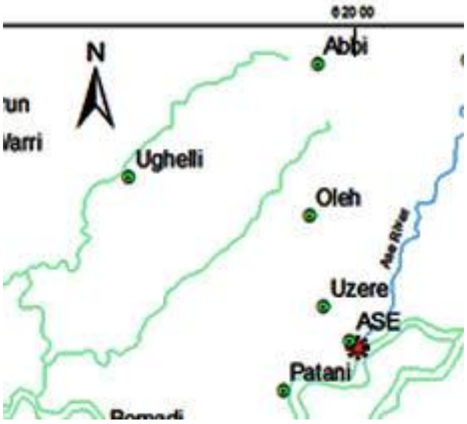

Fig. 1: Map showing Uzere

Source: M. S. O. Aisien, A. P. Ugbomeh, A. O. Awharitoma (2017)

Uzere formerly known as Uzei as in Figure 1 is an Isoko community located within the GPS coordinates of 6 °5'12"N and 5°200'E. It is a community of nine quarters plays host to two oil fields Uzere East and Uzere West with 43 oil wells (Orise 2013; Evroro 2016; Ahon, 2011; Utoware 2013). They are mainly agrarians, cultivating cassava and groundnut as monocrops. They are also fishermen (Elozino 2013; Okoro 2012; Opia 2015). They also engage in petty businesses (Ekoko 2014; Akiri 2013; Enishera 2012).

II. Materials And Methods

Sampling: The research area Uzere is made up of nine quarters 5 quarters were chosen through random sampling to make the research stations. These are Urhoko, Uhei, Iboro, Ezede and Uweye. From each of the research stations edible portions of *T. occidentalis* were collected from (5) sampling spots, bulked, a composite drawn, wrapped in absorbent paper, coded and taken to laboratory for analysis (Abdulfatai, 2015).

Sample preparation: plant samples were oven dried at 40° C to constant weights. After cooling 5mg was weighed out and 25 ml aqua regia (3HCl:1HNO_3 was added, digested on a hot plate until sample volume was 1 ml. The solution was then cooled and filtered into 50 ml standard flask and made up to Mark with distilled water (Uyimadu, 2015).

Instrumentation: Quantitative determination of heavy metals was carried out using an Agilent atomic absorption spectrophotometer model 240A equipped with an air/acetylene burner after digestion of plant samples. Hollow cathode lamps of metals of interest were used and background correction was done using the deuterium lamp. Working standards for instrument calibration were prepared from stock solution of 1000ppm for each metal by serial dilatant using double-distilled water. Blank samples were also run to check for background contamination (Osborn and Tedd, 2012).

III. Results

The results of the concentrations of the heavy metals investigated are given in Table 1.

Table 1: Results of the heavy metals concentration and World Health Organisation maximum permissible concentration in mg/kg.

Element	A	B	C	D	E	Mean	Std. Deviation	WHO MPC mg/kg	ANOVA
Cr	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.10	F ratio P
Fe	47.65	48.00	0.75	0.65	0.61	19.53	25.83	0.30	value =
Ni	0.84	0.75	0.69	0.72	0.75	0.75	0.06	0.70	3.53
Pb	0.62	0.65	0.60	0.67	0.66	0.64	0.03	0.03	F ratio
Cd	0.58	0.61	0.55	0.54	0.60	0.58	0.03	0.01	Crit = 2.87

The mean results of the parameters investigated were presented graphically with bar charts as in Figure 1.

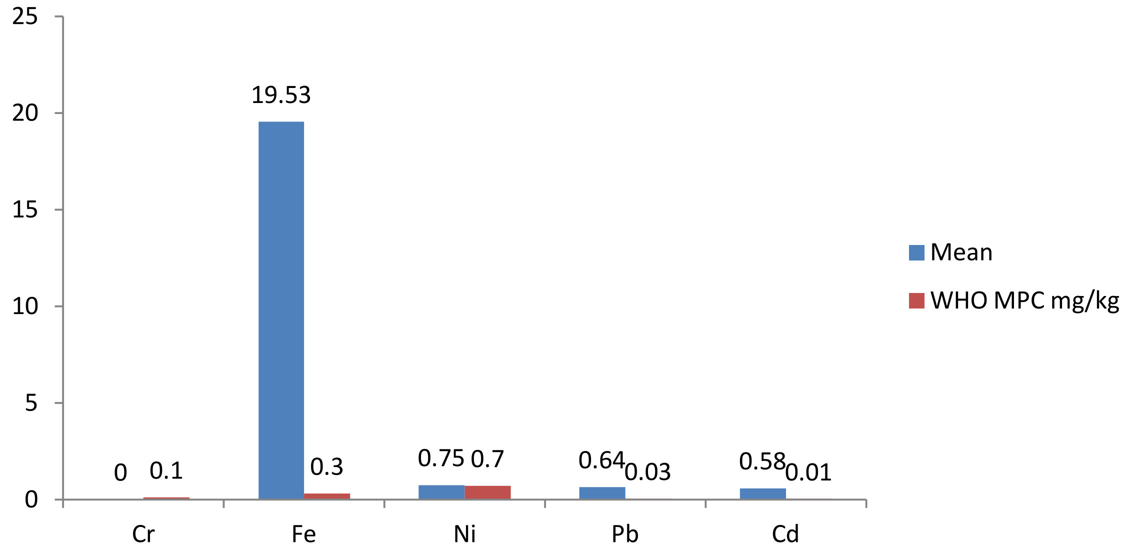

Fig. 1: Mean concentration of the metals investigated and WHO MPC in mg/kg

The concentration of the metals in decreasing order are Fe > Ni >Pb> N 0.55

The results of the heavy metals concentration of *T. occidentalis* were further subjected to a test of significance with analysis of variance (ANOVA) with numerator 4 and denominator 20 at 0.05 level of significance. The F ratio value is 3.53 while F ratio critical value is 2.87. This reveals that there is a significant difference between the concentrations of the heavy metals determined and the World Health Organisation.

IV. Discussion

The results of the heavy metals concentration in *Teiferaoccidentalis* grown in Uzere were treated with statistical tools of mean, standard deviation and variance and the results are as follows: V the mean concentration of 1.63±0.20mg/kg. The WHO maximum allowable concentration for V is 0.05 mg/kg. The concentration of V in the *T. occidentalis* is higher than the acceptable limits. Higher concentration of V in leafy vegetables have been reported (Mandapa, Mangwayana, Nyamangara, Giller 2005; Provot, Douay, Herve and Waterlot 2006). Persistent human exposure to vanadium causes severe irritation of the eye, skin, upper respiratory tract and pulmonary odema (Zull, 2019, Sul, 2018). The mean concentration of Fe is 13.39±0.13 mg/kg. The WHO maximum permissible concentration for Fe in leafy vegetables is 0.30mg/kg. This concentration is higher than WHO allowable concentration of Fe for leafy vegetables. Elevated levels of Fe in leafy vegetables have been recorded (Ge, Murray, Sauve, Hendershot 2002; Ge, Murray, Hendershot 2000). Human exposure to high dose of Fe leads to health complications such as depression, rapid and low respiration, cardiac arrest and so on (Bell, 2016, Mutab, 2019). The mean concentration Ni in the *T. occidentalis*vegetables determined is 2.45±0.03 mg/kg. The WHO maximum allowable concentration of Ni in leafy vegetables is 0.70g/kg. The Ni concentration is higher than the recommended limit. Increased concentration of Ni in leafy vegetables has been documented (Kachenko, Singh, 2006; Khan, Caoa, Zhenga, Huagoga, Zhu 2008; Langney, Kull, Enducher 2011). Health effects of nickel include reduction in lung functioning, cancer of the lungs, chronic bronchitis, nasal sinus and so on (Togwan, 2018; Bruwal, 2019). Mean concentration of Pb in the *T. occidentalis* in Uzere is 0.86±0.03mg/kg. The WHO maximum permissible concentration for Pb in leafy vegetables is 0.03mg/kg. The Pb concentration is higher than acceptable limit for Pb for leafy vegetables. Higher Pbconcentration in leafy vegetables have been reported (Hough, Brewerd, Young, Crout, Tye, Moir, Thornton 2004; Qadir, GhaforMwrtaza 2000). Human health complications arising from lead exposure include kidney failure, damage, to babies nervous system brain damage, weakness, death and so on (Johnson, 2018, Thompson, 2020). Cd mean concentration in *T. occidentalis* grown in Uzere is 0.55±0.01mg/kg. while the WHO maximum allowable concentration of Cd in leafy vegetables is 0.1 mg/kg. Cd mean concentration is higher than the set limit. High Cd content in leafy vegetables have been recorded (Demiquel, Iribarren, Chacon, Ordeneez, Charlesworth 2007; Sipter, Rozsa, Gruiz, Tatrai, Movai 2008). Human exposure to high dose of cadmium results in cancer kidney failure, weakness of the skeletal system and cardiovascular diseases (Samson, 2016, Kuz, 2019).

V. Conclusion

Industrialization in developing countries such as Nigeria leaves in their wake environmental degradation emanating majorly from poor effluents management. Oil exploitation in Uzere has caused the soil to be contaminated with heavy metals which have ultimately resulted in bioaccumulation and biomagnification of heavy metals in *T occidentalis* grown in. It is germane that oil exploration and exploitation companies operating in Uzere adopt world best practices as template for their operation so as not to impugn on the sanctity of the air and soil of the host communities.

Consequent upon the outcome of this study, it is recommended that the oil companies operating in Uzere should be conscious of the environment through proper equipment handling, maintenance and effluents management.

Gas flaring is inimical to the environment and affects the ecosystem, and ecosystem services. Gas flare out should be initiated and gas to liquid program adopted.

*T occidentalis v*egetables should not be grown in Uzere and those grown should not be consumed to avoid health complications associated with heavy metals ingestion.

Remediation and decontamination programme should be commissioned forthwith to return the environment to its original pristine state.

References

[1]. Abas, N. A., Ugbo, G. P. (2013). Are you pollution and the mangrove vegetation in the Niger Delta. *Journal of Environmental Studies* 15 (6) 92 - 97.

[2]. Adeosun, K. (2017). Nigeria economic recession, economic recovery and growth plan and during oil.A ministerial briefing on the state of Nigeria economy, Abuja.

[3]. Ahin, A. (2011). The Uzere people, language and commerce. Warri: OkpakoPublishers .

[4]. Akiri, A. N. O. (2014). Shell petroleum development company and Uzere people. How have we fared. Lagos: Omotosho Publishers.

[5]. Alinia, S., Ifels, O., Telens, I. (2009). The potential association between fruits intake and body weight – a review, International Association for the Study of Obesity. *Obes. Rev* 10, 639-647.

[6]. Anyaegbunam, J. E. (2006). Oil spills in the Niger Delta and the aquatic organisms. *Journal of Environment and Science* 28(6), 182-192.

[7]. Attaire, S. E., Lange, S. F. Ladond, J. A. Pelletier, Camboris, A. N., Duileul, P. (2012). Multiscale spatial variability of Co_2 emission and correlation with physicochemical properties of soil.*Geochem*170, 251-260.

[8]. Aworawo, D. (2014). The impact of environmental degradation on the rural economy of the Niger Delta.*Journal of Environmental Studies* 7(3), 61-68.

[9]. Briggs, N. N. and Ogbora, H. a. (2012). Oil activities the environment of the Niger Delta and Agriculture 8 (4) 72 - 83.

[10]. Callahan, S. T. (2012). Focus on preventive healthcare for young adults. *Archives of Pediatric and AdolescentMedicine*

[11]. Carmago, M. C. K., Toledo, M. C. F. (2008). Polycyclic aromatic hydrocarbons in Brazilian fruits and vegetables.*Food Control* 14, 49-53.

[12]. Castejon, M. G., Casado, A. R. (2011). Dietary phytochemical and their potential effects on obesity.*AReview Pharm Res*. 04, 434-455.

[13]. Chandia, C., Salamanca, M. (2012). Long-term monitoring of heavy metals in Chilean coastal sediments in the eastern south pacific ocean. *Mar. Poll. Bull*. 64, 2245-2260.

[14]. Chibuike, N. E. Okaka, J. C. and Okolie, E. C. (2013). Evaluation of vegetables consumption in south eastern Nigeria. *International Journal of Nutrition and Metabolism* 5(4) 41-60.

[15]. Clarke, J. E. (2014). Taste and flavor; their importance on food choice and acceptance.*Proceedings of Nutrition Society* 57, 639-653.

[16]. Cupr, F. Barihil, T., Sarika, m, Kilanira, J. Mikes, O. Holoubek, I. (2000).Soil burden of persistent organic pollutant – their levels of fate and risks.*Total Environment* 408, 486-494.
[17]. Dem, D., Jeewon, R. (2015). Frits and vegetables intakes: Benefit and progress of nutrition education intervention – narrative review article. Iran, *J. Public Health* 44(10), 1309-1321.
[18]. De-Niiguel, E. Iribarren, I., Chacon, E., Ordene, A., Charlesworth, S. (2007). Risk based evaluation of the exposure of children to trace metals in playground in Madrid Spain. *Chemosphere* 60, 505-533.
[19]. Du, Q., Wang, W., Fu, X., Xia, H. (2010). Diffusion and accumulation in cultivated plants of di(2-ethychexyl) philate from plastic production factory. *Food Additt and Contam.*27, 1186-1192.
[20]. Ejechi, D. N. and Deyinfa, S. A. (2012).The cultivation and consumption of *T. occidentlais*among the calabaris, River State Nigeria.*Journal of Food Science* 7(4), 142-151.
[21]. Ekoko, O. A. (2014). Oil exploitation in Isoko land. A curse or blessing in Izomo, P. (Ed). Isokos of the Niger Delta Lagos: Ibukuola Publishers.
[22]. Elozino, C. A. (2013). The oil companies and the degradation of the environment in the Niger Delta. In: Izomo, P. (Ed.) Isokos of the Niger Delta. Lagos: Ibukuola Publishers.
[23]. Enigheno, A. A. (2012). Oil exploitation and agriculture in Uzere community: a call for review a keynote address Uzere development Union Lagos annual conference.
[24]. Feng, H. Y., Fu, X. Q., Zhao, Q., Gao, Z. E. (2011). Health risk assessment of polycyclic aromatic hydrocarbon in soils of Ningbo area China.*J Agro Environ. Sci.* 30, 1998-2004.
[25]. Friends of the Earth (2015). Oil spills and the people of Niger-Delta. A press conference on World Environment Day 2015, Lagos Nigeria.
[26]. Ge, Y., Murray, P. Hendershot, W. H. (2002). Trace metals speciation biodiversity in urban soil. Environmental *pollution* 21*: 954-961.*
[27]. Ge, Y., Murray, Sauve, S., Hendeshot, H. (2002).Low metal bioavailability in a contaminated urban site.*Environmental Toxicology and Chemistry* 21, 954-961.
[28]. Habauzit, V., Milenkivic, D., Miorand, C. (2013). Vascular protective effects of fruits polyphenols in waston, K. Preedy, V. and Zibadi, S. (eds). Elsevier Inc London pp, 875-893.
[29]. Hazrat, A, Khan, E. (2018).Trophic transfer, bioaccumulation of non-essential hazardous heavy metals and metalloid in food chain/webs-concepts and implication for wildlife and human health risk assessment.*Environ. Sci. Technol.* 76, 346-354.
[30]. Hosfalto, J. N. and Clarke, K. A. (2014).The oil mining activities in the Niger Delta and food production. *Journal of Agriculture* 16 (4) 121-128.
[31]. Hough, E. L., Breward, N., Young, S. D., Grout, N. M. J., Tye, A. M., Moir, A. M., Thornm T. I. (2004). Assessing potential risks of heavy metals exposure from consumption of home produced vegetables by urban population. *Environmental Health Perspective* 112, 215-221.
[32]. Kachenko, A. G. , Singh, B. (2006). Heavy metals in urban and metal smaller contaminated in Australia.*Water, Soil and Air Pollution* 169, 101-123.
[33]. Kachikwu, I. (2018). Oil production in Nigeria and OPEC.A press conference Ministry of Petroleum Abuja Nigeria.
[34]. Kaladumo, A. J. (2015). Gas flaring in the Niger Delta and the environment. *Journal of Environmental Science and Technology* 76, 336-342.
[35]. Kaur, J. Chadhary, A., Kaur, R. (2014). Assessment of mutagenic genotoxic of water samples of Harike wetlands, Aramsar site in India using different ex-vivo biological systems. *Ecotoxicology* 23, 967-977.
[36]. Khan, S., Caoa, Q., Zhenga, Y. M., Huanga, Y. Z., Zhu, Y. G. (2008). Health risk of heavy metals in contaminated soil and food crops irrigated with waste water in Beljing China. *Environmental Pollution* 152, 686-692.
[37]. Langner, M., Kull, M., Endiiche, W. R. (2011).Determination of the PM10 depositoinbvased on antimony that thix to selected urban surface.*EnvironmentalPollution* 159, 2028-2034.
[38]. Lattimer, J. M., Haub, M.D. (2010). Effect of dietary fibre and its consumption on metabolic health. Nutrients 2, 1266-1289.
[39]. Lee, J..Xu, P. N., Zhe, H. E. (2014). Bioremediation of petroleum polluted environment in urban Korea. *Environment Science and Technology* 78,356-403.
[40]. Liu, R. H. (2003). Health benefits of fruits and vegetables are from and synergistic combination of phytochemicals. *Am. J. Clin. Nutr.*78(31), 517-622.
[41]. M. S. O. Aisien, A. P. Ugbomeh, A. O. Awharitoma (2017). Parasitic infections of anurans from a freshwater creek community in Delta State, Niger Delta of Nigeria.Helminthologia, 54, 2: 132 – 144.
[42]. Major, A. K. and Idogbor, J. J. (2014). Oil spills bioremediation and crop cultivation.*Journal of environment* 20 (6) 223-230.
[43]. Mandapa, F. Mangwayana, E. N., Nyamangara, J., Giller, K. E. (2005). The effects of long term irrigation using waste water on heavy metals content of soils under vegetables in Herare, Zimbabwe. *Agriculture Ecosystem and Environment* 107, 151-156.
[44]. Muhamed, H. H. Ali, A. B., Khaira, M., Al. Q. (2001).Assessment of some heavy metals in vegetables, cereals and fruits in Saudi Arabian markets.*Egyptian Journal of Aquatic Research* 38, 31-37.
[45]. New, S. (2001). Fruits and vegetables consumption and skeletal health: is there a positive link. *Nutrition Foundation Nutri Bull.*26, 121-125.
[46]. Nigeria National Petroleum Corporation (NNPC). Catalogue of oil mishaps in Nigeria 1970-2014.A NNPC Bulletin Abuja Lagos.
[47]. Niorabito, E., Radaelli, M., Corami, F. Turetta, C., Toscani, T., Capodigho, G. (2017).Temporal evolution of cadmium, copper and lead concentration in Venice lagoon water in relation with the speciation and dissolved particulate partition.*Mar. Poll. Bull.* 129(2) 884-892.
[48]. Nzei, R. A. (2003). The place of *Teiferaoccidentalis* in the rural economy of South-East. *Journal of Agriculture* 28 (6) 72-78.
[49]. Obi, C. A. and Okolie, T. M. (2013).*Teiferaoccidentalis* and d micro economy of the rural South East.*Journal of social science* 10 (2), 253-262.
[50]. Obiko, C. O. and Udeme, N. N. (2018).Production and pollution of the environment.*Journal of environmental studies* 10 (3) 165-171.
[51]. Ogbonaya, O. (2019). The position of the government on gas flaring.A ministerial conference Federal Ministry of Science Abuja Nigeria.
[52]. Ogechukwu, W.C. (2015). The medicinal values of common vegetables in the South-East.*Journal of pharmaceutical research 58 (7) 1421-1429.*
[53]. Ogunleye, J. N. and Ode, P. B. (2013). Fluted pumpkin production and marketing in the South-East and south-south Nigeria.*Journal of social sciences 8 (6) 198-203.*
[54]. Okafor, E. E. and Ndili, J. C. (2014).Determination of the nutritive and medicinal values of *T occidentalis*.*J. Pharm* 28(3), 145-153.

[55]. Okecha, S. A. (2003). Pollution and conservation of Nigeria environment.Owerri: T'Afrique.

[56]. Okoro, N. J. (2013). The oil companies, the economy and culture of Uzere people. A press conference Uzere progressive Union.

[57]. Okpako, N. A. (2014). Cultivation and marketing of fluted pumpkin in south-east and south south Nigeria.*Journal of Social Science* 17(4), 142-151.

[58]. Omodode, U. (2014). Environmental management and sustainable development in Osuntokun, A. (ed). *Environmental Problems of the Niger Delta. Lagos:* Fredrick Ebert Foundation.

[59]. Opia, K. K. (2015). Oil exploitation in the Niger Delta and the environment question. *Journal of Environment and Science* 9 (4) 16-22.

[60]. Orije, D. A. (2013).The economy of the Isoko people and oil companies.In Izomo, P. (Ed.).Isokos of the Niger-Delta. Lagos: Ibukuola Publishers.

[61]. Osborn, A. A. and Tedd, C. T. (2012). Heavy metals determination methods. Enugu: Trans Afrique Books.

[62]. Ovreme, N. P. (2013). Oil exploitation and the Isoko environment.In Izom, P. (Ed) Isoko of the Niger-Delta. Lagos: Ibukuwola Publishers.

[63]. Piko, N. Jane, P. C. and Zen, K. (2014). Toxicity of petroleum on Bufo-bufolavae: a case study. *Journal of environment science and technology* 4268-74.

[64]. Princewill, A. (2006). Niger-Delta the "goose that lays the golden eggs" in Okafor, G. (ed). The environmental problems of the Niger Delta, Port Harcourt.Johnson Publishers.

[65]. Sanusi, L. (2017). Nigeria economy in the wood.A press conference.Emir of Kano and former governor of Central Bank Nigeria.

[66]. Shen, G. L., Bersen, V. V., Chyu, M. C. (2012). Fruits and dietary phytochemicals in bone Protection. *Nutr. Res.* 32, 897-910.

[67]. Singh, N., Kaur, M., Kafnaria, J. K. (2017). Spatial and temporal heavy metals distribution and surface water characterisation of Kanjli wetland (a ramsar site) India using different indices. *Bull Environ. Contain Toxicol.,* 99, 735-742.

[68]. Susu, A., Abowei, M. F. N. and Onyeme, O. (2006).The behavior of oil in marine environments.*Journal of Chemical Engineering* 7(4), 252-260.

[69]. Tam, D. (2016). Niger Delta: the oil bill of Nigeria. A keynote address Ikwerr development Union.

[70]. Ufot, P. A. and Usen C. P. (2011).The medical values of *T. occidentalis*.*J. Pharm* 27(6), 253-270.

[71]. Ufoware, C. N. (2013). The people of Isoko in Nigeria polity.A press conference Isoko development Union Oleh.

[72]. Ugbe, R. A. and Ugbe, P. C. (2015).Vegetables and fruits consumption and health of the south east rural population.*Journal of Food Science* 45(6), 79-86.

[73]. Viplema, A. G., Baenas, N. Vilano, D. (2014). Evaluation of Latin American fruits rich in phytochemicals with biological effects. *J. Find Foods* 7, 599-608.

[74]. Wike, O. (2018). Nigeria monocultural economy and the issue of governance.A press conference. River State Government, Port Harcourt.

[75]. Williams, D. J., Edwards, D., Hamernig, I. (2013). Vegetables containing phytochemicals with potential anti-obesity properties: A review. *Food Res Int*52: 323-333.

[76]. Yar-Adu, M. (2007).The Nigeria economy standpoint.Midterm address president federal republic of Nigeria Abuja.

[77]. Zelibe, N. A. and Ojeibe, T. C. (2012).Oil production in the Niger Delta and food production. *Journal of Agricultural Science* 12 (30), 146-154.

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