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Research Paper

Heavy Metals Content Of *Teifera occidentalis* (FLUTED PUMPKIN; Order: Violales, Family: Cucurbitaceae) Grown In Ebedei (An Oil and Gas Bearing Community) Niger Delta, Nigeria

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ABSTRACT
This study investigated the heavy metals content of T. occidentalis grown in Ebedei oil-bearing community. The research area Ebedei was mapped out into research stations corresponding to the subsettlements of the community. These are: Adonishaka, Ukuole, Obiogene, Umuosele and Obi Onyeonicha. From each of these research stations, Teifera occidentalisi samples were collected from ten (10) sample spots, bulked, coded and wrapped in absorbent paper and taken to the laboratory for analysis. The analytical standards deployed were APHA and USEPA and the analytical instrument used was Agilent techniques spectrophotometer model 240FSAA. The mean results obtained for the parameters investigated were: Cu 0.62±0.37 mg/kg, Zn 1.22±0.88mg/kg, Mn 15.72±0.21mg/g, Co concentration was 1.68±0.08 g/kg while V was 0.58±0.05mg/kg. The mean results of the parameter were subjected to test of significance with ANOVA with a numerator of 4 and denominator 20 at 0.05 level of significance. The F-calculated is 6.32 while F ratio table value is 3.51 thus Ho is rejected and Ha accepted that there is significant difference in the concentrations of the heavy metals investigated and WHO/FAO maximum permissible (allowable) concentrations for the metals determined. It is therefore recommended that consumption of T. occidentalis grown in Ebedei should be discontinued and remediation should be carried out while gas should be gathered rather than flared.

KEYWORDS: *oil exploitation, Heavy metals, vegetable production, bioaccumulation, human health*

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I. INTRODUCTION

Vegetables are important components of human diet. They have high nutrient content and are loaded with vitamins, minerals and contribute to the maintenance of good health (Osada, 2019; Shanon, 2019; FAO/WHO, 2004, Li, Becheng and Xiaoking, 2013). Vegetables contain antioxidants which fight cellular damage and help prevent heart disease and certain cancers (Linus 2019; La, Veciu, Altieri & Tavani, 2001; Link & Porter, 2004, WHO, 2003). The growth in vegetable production and consumption have suffered setbacks due to contamination from Environmental pollutants, POP, PCBs and heavy metals (Ogwu, 2012, Bu,, Le, Xu, 2012; Pearl, 2014, Jen, 2017). Nigeria is an oil and gas producing country, oil and gas are the mainstay of its economy accounting for 90 percent of its gross domestic product and its export earnings (Ogbonaya 2019; Kachukwu, 2018; Osibanjo, 2016; Emefiele, 2018; Osuntokun, 1999; Adeosun, 2018).

Nigeria has recorded several cases of oil spillage since 1970 (Adedipe, 1999, Niger Delta Environment Survey, 2003, UNDP 2006, Okecha, 2000, Haruna, 2000, NDES, 2018, Friends of the Earth, 2019). The country's daily gas production is 800 million standard cubic feet, over 70 percent of this production is flared (NDES, 2017, Nigeria Society for Environmental Management, 2018, Okecha, 2004, Awerawo, 2006).

The oil production belt in Nigeria is the Niger Delta. The Niger Delta is located at the Gulf of Guinea on the Atlantic Ocean at the GPS coordinates 5.5325°N and 5.8987°E. Ebedei is an oil producing communities in the Niger Delta.

Heavy metals are chemical components of petroleum (Azuzu 2014; Albert, 2016; Samson 2012; Obed, 2015). There are always increase concentration of heavy metals in vegetables and other crops grown in oil-

producing areas with cases of spills or through flash flood due to the presence of oil in the soil and consequence of gas flaring through absorption of particulate droplets through the leaves giving rise to bioaccumulation and biomagnification (Lin, Tu, Zhu, 2005; Li, Xie, Xu and Sun, 2016; Qin, Laung, Leung, Zheng, Wong, 2011; Obade, 2018; Soku, 2019). Heavy metal poisoning results in health disorder such as cancer, gastrointestinal disorder, skin disease, epileptic seizures, organ failure and so on (Nwajei, 2018; Asagba, 2019; Olsson, 2002; An, Xu, Chen, Zhang, Wang & Teng, 2008; Robert, 2014). *Teifera occidentals* as a perennial vegetable has propensities for bioaccumulation and biomagnification through the folia and root parts (Oko, 2012; Bosco 2010, Plan, 2017). However, research investigation on the oil exploitation on the heavy metal content of vegetables grown in Ebedei remains scanty and this underscores the need for this investigations on the heavy metals concentration in *Teifera occidentalis* grown in a Ebedei. The heavy metals investigated in this study are Cu, Zn, Mn, Co and V.

Study Area

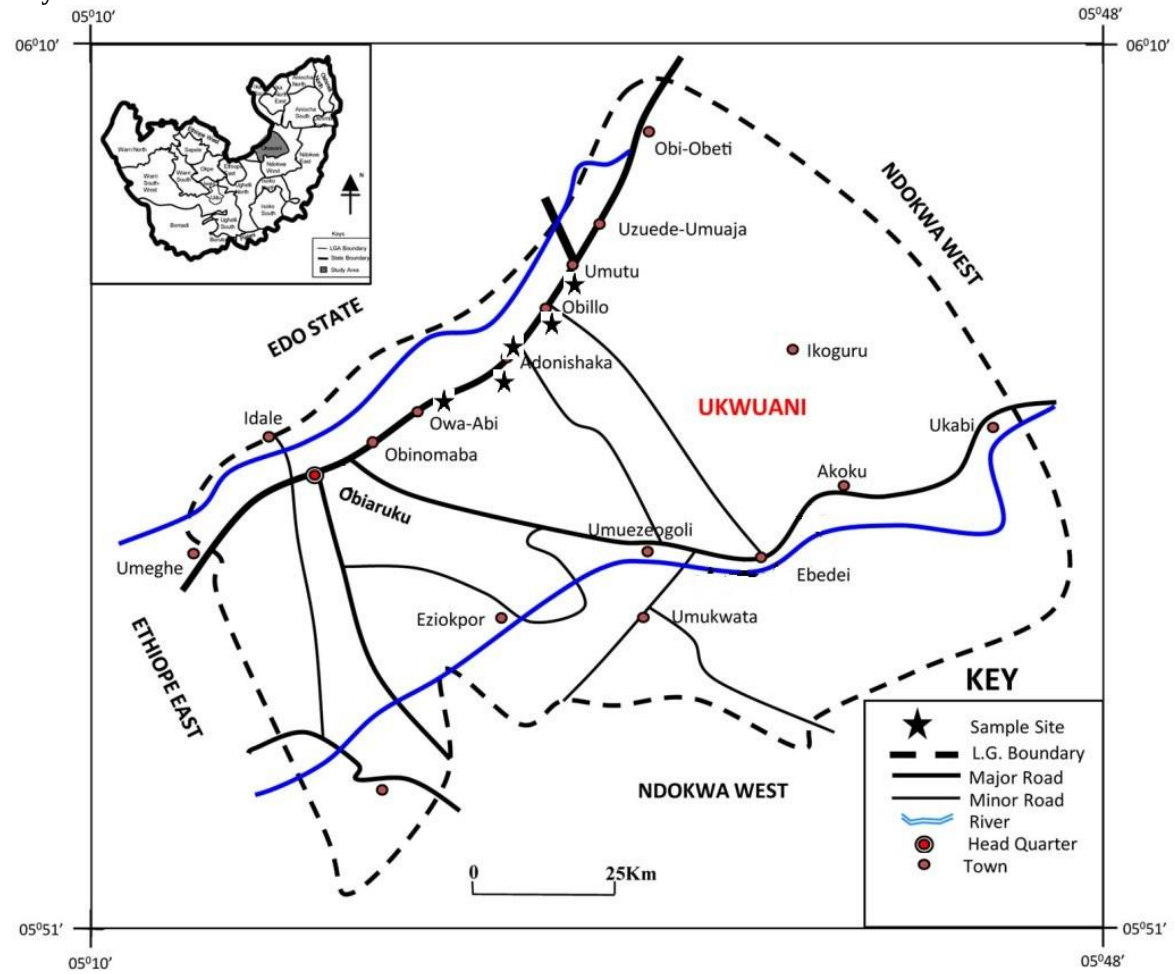

Fig 1: Map of Ebedei

Ebedei in Ukwani local government area delta State Nigeria lies within latitude 5.8024° N and 6.2482°E. It is a linear settlement along the bank of River Ethiope. The people are mainly agrarian with petty businesses. The population is 40056 (National Population Census, 2003). however with oil exploration and exploitation activities, the population may be well over the value hitherto stated.

II. MATERIALS AND METHODS

This research area Ebedei was mapped out into five (5) research stations corresponding to the sub settlements that make up the community. They are Adonisha, Ukuole, Obiogene, Umuosele, and Obionye Onicha. From each of these research units, ten (10) samples of edible portion of *Teifera occidentals* were collected, bulked, coded and wrapped in absorbent paper after being thoroughly washed with distilled water. At the laboratory, the samples were oven dried at 70 degrees Celsius to expel the moisture contents and then crushed with pestle and mortar. They were digested using 0.5 g of the dried vegetables samples using tri-acid mixture HNO_3,:H_2SO_4,:$HClO_4$ = 5:1:1, this was done until transparent fumes were obtained. The samples were

then cooled and filtered employing whatman paper no 1. The final volume of 50ml was made using double distilled water and the determination of the heavy metals were done with atomic absorption spectrophotometer agilent technologies models 240FSAA.

III. RESULTS

The results of the heavy metal content of the *Teifera incidentals* grown in a Ebedei are as follows in table 1.

Table 1: Showing results of the parameters investigated in mg/kg

Parameters	A	B	C	D	E	$\bar{x}$	Std Dev.	Variance	WHO/MPC mg/kg
Cu	0.64	0.61	0.65	0.66	0.58	0.62	0.37	0.001	0.020
Zn	1.13	1.24	1.08	1.22	1.32	1.22	0.88	0.008	20.00
Mn	15.98	15.56	15.72	15.86	15.48	15.72	0.21	0.04	0.5
Co	1.78	1.69	1.57	1.71	1.67	1.68	0.08	0.00	0.05
V	0.56	0.62	0.48	0.57	0.58	0.56	0.05	0.00	0.05

The mean results of the parameters investigated where further presented graphically in bar charts as follows in Fig 1.

Fig 1 showing the mean results of the heavy metals investigated in bar chart.

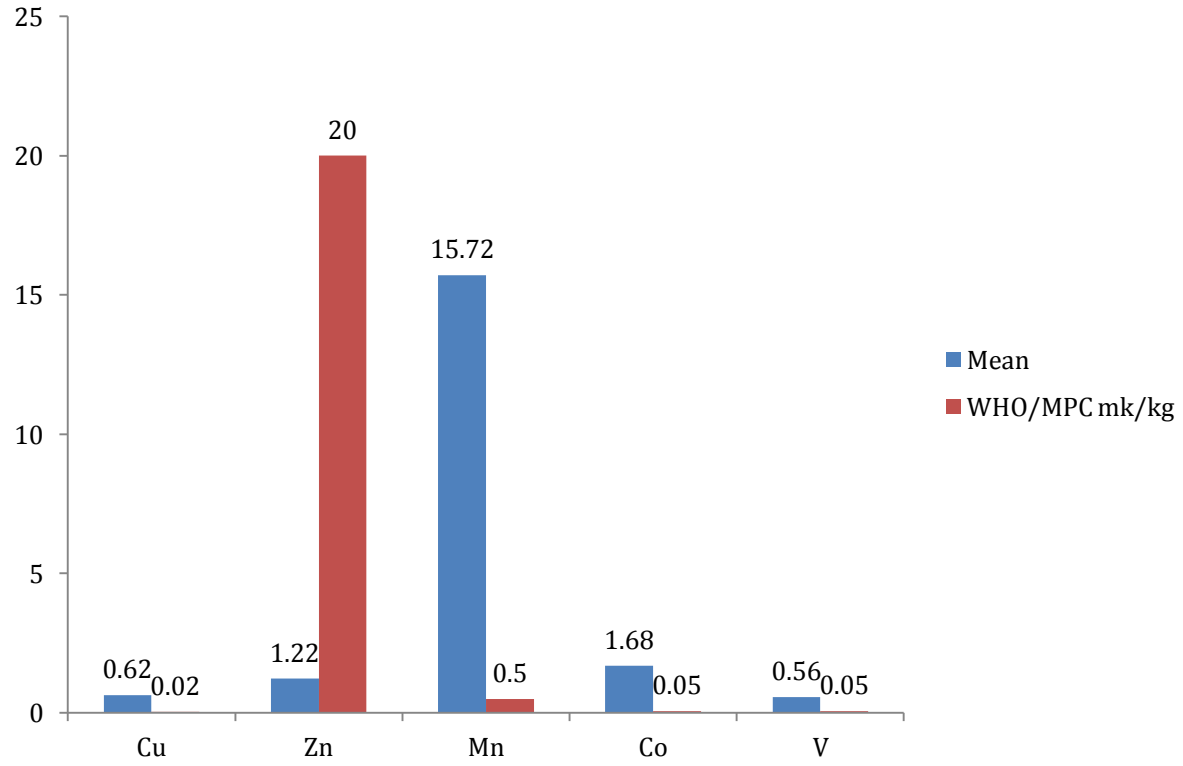

Figure 1: Showing the mean concentrations of the parameters investigated and WHO/FAO maximum permissible concentration

The concentrations of parameters in the decreasing order Zn > Mn > Co > Cu > V

IV. DISCUSSION

Vegetables are cherished and consumed globally because of their dietary importance. *Teifera Occidental's* is the most cherished vegetable in the Niger Delta Nigeria which doubles as the oil belt of the country. Heavy metals contamination of the soil and air of Niger Delta have been widely discussed and reported (Zolan, 2014; Venice, 2015; Zulum, 2018) .

The results of the investigations of the heavy metals contents of *Teifera occidentalis* grown in Ebedei oil producing community reveal thus: Cu 0.62 ± 0.37mg/kg, WHO MPC for Cu is 0.020 mg/kg. This concentration is higher than the maximum allowable limit for copper. High concentration of copper in vegetables has been reported (Obed, 2016: Murray Pinchin, Machie, 2011). The mean concentration of Zn in *T. occidentalis* grown in Ebedei is 1.22 ± 0.88mg/kg. The WHO maximum permissible limit of Zn in heavy leafy vegetables in 20g/kg. The concentration of Zinc is within allowable concentration. A similar concentration of

Zn in leafy vegetable have been reported (Margaret, Matameros, Diez, Canameras, Amas & Bayoria, 2019, Shaheen, Khan, Islam, Islam, Ahmed, 2016). The mean concentration of Mn grown in Ebedei is 15.72±0.21 mg/kg. The WHO allowable concentration of Mn grown in Ebedei leafy vegetables is 0.5 mg/kg. The concentration of Mn in *T occidentalis* in Ebedei is much more higher than WHO recommended concentration. Higher concentration of Mn in leafy vegetables has been recorded (Okojie and Balogun, 2016; Zeng, Zhang, Zhou, Quin and Li, 2018). The concentration of Co in *T. occidentalis* in Ebedei is 1.68±0.08mg/kg. While WHO maximum permissible concentration for Co in leafy vegetable (WHO, 2014) is 0.05mg/kg. The concentration of Co in *T occidentalis* in Ebedei is above the WHO limit. This report is similar to the reports recorded in leafy vegetables in (Biri and Zanni, 2015; Sodje, 2014; Qadirchihafoor, Murtaza, 2004; Peris, Mico, Recake, Sanchez, Sanchez, 2007). The vanadium mean concentration as revealed by the analysis is 0.58 ± 0.05 mg/kg. The WHO maximum permissible concentration for V is 0.05 mg/kg. The mean concentration of V in *T. occidentalis* grown in Ebedei is higher than the acceptable limit. Higher concentration of vanadium in leafy vegetables was reported in (Samuel, Kotsyuk, Holscher, Lenkerent, Weber, Kowarik, (2012; Ojo, Abdul & Muhamed, 2016).

The main results of the parameters investigated where further subjected to test of significance with ANOVA at 0.05 level of significance with denominator 4 and numerator 20. The F ratio calculated is 6.32 while the F ratio table value is 3.51. Thus Ho is rejected and Ha accepted that there is significant difference in the concentrations of the heavy metals investigated and WHO/FAO maximum permissible (allowable) concentrations for the metals determined. This indicates that the *T. occidentalis* grown and consumed by the inhabitants of Ebedei oil producing communities contain higher levels of heavy metals which may be injurious to their health.

V. CONCLUSION

The wealth of any nation is predicated on the health of the citizens. The quest for economic growth has left on its thrill environmental degradation arising from the input of toxicants into the ecosystem, one of such economic quest is oil exploitation in Ebedei communities that has given rise to high concentrations of heavy metals in the vegetables grown and consumed in the settlement. Oil exploitation as national economic ventures in Ebedei should be done within the ambit of the world best practices to reduce the pollution of the fauna and flora, the soil and the air of the Host communities and ameliorate the impact on health of the people.

Consequent upon the results of the investigation, the following are recommended

1. The cultivation and consumption of *T. occidentalis* grown in Ebedei oil yielding community should be stopped forthwith.
2. Remediation of the soil should be carried out
3. The gas flared should be harnessed to reduce contamination of the air and reduce particulate droplets.

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