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HEAVY METAL CONCENTRATION OF PLANTS (Zea mays, Potato, Green leaf, Water leaf) GROWN AROUND WASTE DUMPSITES IN OZORO, DELTA STATE, NIGERIA

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ABSTRACT
This study was conducted to determine the heavy metal concentration of plant/food crops grown around waste dumpsites in Ozoro, Delta State, Nigeria. Four different plants (Zea may, Potato, Green leaf and Water leaf) were used for this study. The plant samples were air dried for three days and there after ashed in an electric furnace at 450°C. 2g of the ashed plant was weighed and put in a beaker. 10ml of nitric/perchloric acid, ratio 2:1 was added to the sample and digested at 105°C for 1hour. Atomic Absorption Spectrophotometer (AAS) (Varian spectra 200 AA model) was used to determine the total metal concentration in the various plant samples. Iron was the predominant metal in all the samples and its concentration though low ranged from 1.84 – 4.24mg/kg. The concentration of Manganese and Zinc was equally low and ranged from 0.83 – 1.67mg/kg and 0.01 – 2.12mg/kg respectively. Similarly copper, cadmium and lead concentrations were also relatively low. The mean concentration of all the metals in the four plants is in the order of Fe>Mn>Zn>Cu>Cd>Pb. There was significant variation in metals from plant to plant ($P<0.05$). The results obtained were still within the permissible level set by FAO/WHO. This situation is a threat to our life, therefore planting of vegetables within or around dumpsites should be discontinued with.

Keywords: Plants, Heavy metal, Concentration

INTRODUCTION
Heavy metals refers to metals with density greater than $5g/cm^3$ and atomic number greater than 20 (Raut, et al., 2012). Heavy metals are found naturally in undisturbed soils and in fact, small amounts of many metals are required to remain healthy (Ideriah *et al*., 2010). In Southern Nigeria, most dumpsites have been extensively used for cultivating varieties of edible vegetables and plant

based foodstuffs not minding available data on the heavy metals phyto-accumulation potentials of plants in contaminated and polluted soils (Cobb *et al*., 2000; Benson and Ebong, 2015; Obasi *et al*., 2013). They do this for their own consumption and profit making without regards to the absorption of toxic metals by fruits and other crops grown around these dumpsites (Leah and Johnny, 2014). This practice constitutes a major health and environmental concern because of the phtotoxicity effect of these metals to plants, animals and man feeding on such vegetables and plant based foodstufsf (Ellis and Salt, 2003; Jarup, 2003 and Obasi *et al*., 2013). Consumption of contaminated food through consumption of plants cultivated on contaminated soil or indirectly through milk or meat from a grazing animal that have injected contaminated plant or soil can transfer the contaminant to man (Musa *et al*., 2013). Some hazards associated with the use of polluted water, soil and plant include; diarrhea, cholera, intestinal worms and typhoid fever.

MATERIALS AND METHODS

Description of the study area

The study was conducted in Ozoro, Delta State. Ozoro is a semi-urban town that is fast developing probably because of the state Polytechnic. Ozoro is the administrative headquarters of Isoko North Local government Area and lies between longitude 6°12′58″E and latitude 5°32′18″N (www.wikipedia.org).

Sampling and Analysis

Plant samples were collected from a dumpsite located within the town. The plants were air dried for three days and thereafter ashed in an electric furnace at 450°C. 2g of the ashed plant was weighed and put in a beaker. 10ml of nitric/perchloric acid, ratio 2:1 was added to the sample and digested at 105°C for 1hour. HCl and water in the ratio 1:1 was added to the digested sample and the mixture heated for 30 minutes. The digestate was allowed to cool to room temperature and filtered into a 100ml volumetric flask using Whatman (No. 1) filter paper and made up to mark with distilled water. The samples were then analysed for heavy metals (Cu, Pb, Cd, Zn, Fe and Mn) using Atomic Absorption Spectrophotometer (Varian Spectra AA 200).

Statistical Analysis

The data obtained were processed statistically and presented as mean ± standard error of mean. Statistical significance of comparison of data was analysed using one way analysis of variance (ANOVA), followed by LSD's multiple range tests, using the software, statistical package for social science (SPSS) version 21 windows software and significance level at p values < 0.05 was considered significant.

RESULT AND DISCUSSION

The result of the analysis of some heavy metals in plants grown around dumpsites in Ozoro is presented in table 1 and Figures 1 - 7.

Table 1: Analytical Result Showing Metal Concentration in Some Plants

	Concentration of metals (mg/kg dry weight)					
Samles	Cu	Pb	Cd	Zn	Fe	Mn
Zea mays	0.001±0.000[a]	0.001±0.000[a]	0.010±0.000[a]	0.04±0.000[a]	1.84±0.009[a]	0.83±0.006[a]
Potato	0.470±0.002[b]	0.001±0.000[a]	0.010±0.000[a]	2.12±0.000[b]	3.74±0.000[b]	1.41±0.005[b]
Green leaf	0.001±0.001[a]	0.001±0.000[a]	0.040±0.000[b]	0.01±0.000[a]	3.26±0.042[b]	1.33±0.006[b]
Water leaf	0.020±0.006[c]	0.002±0.000[b]	0.001±0.000[c]	1.09±0.003[c]	4.42±0.003[c]	1.67±0.005[c]
Sum	0.492	0.005	0.061	3.26	13.36	5.24

Values are expressed as mean ± SEM. ANOVA followed by LSD,s multiple range tests. Values not sharing a common superscript differ significantly at P<0.05

Table 2: FAO/WHO safe limit (2001) in mg/kg

Metal	**Safe limit**
Cu	73.00
Pb	0.30
Cd	0.20
Zn	99.40
Fe	425.00
Mn	-

The result of the concentration of the metals determined in the plants in (mg/kg) show low concentration of the metals.The mean concentration of all the metals in the four plants are in the order: Fe>Mn>Zn>Cu>Cd>Pb.

Iron was the highest occurring metal in all the sampled plants. It ranged from 1.84 – 4.24mg/kg. Zea mays had the lowest concentration of Iron (1.84±0.009mg/kg), while water leaf had the highest concentration of Iron (4.42±0.003mg/kg). The concentrations of Iron in all the sampled plants were below the 425.00mg/kg permitted by WHO/FAO, (2001). The concentration of Iron in this present study must have been caused by the corrosion, rusting and tear and wears of metallic substances in the dumpsites when compared to other metals. Similarly, previous works have suggested that Iron is abound richly in Nigeria indicating the Iron enrichment of the plants from both anthropogenic and crustial origin (Garba *et al*., 2014). Iron in plants is desirous as it is essential to human biochemical processes (Eze and Hillary, 2008).

Manganese is the next most dominant metal in the studied plants. It had varying concentrations in the plants and ranged from 0.83 – 1.67mg/kg. Water leaf had the highest manganese concentration (1.67±0.005mg/kg) while zea mays had the lowest concentration (0.83±0.006mg/kg) compared to other vegetables. Manganese is very essential in carbohydrate metabolism as well as serves as an anti oxidant in superoxide dimutases enzymes (Ishmail *et al*., 2011). Zinc concentration was also very high with range of 0.01mg/kg – 2.12mg/kg. The highest concentration of zinc was recorded for potato while the least concentration was observed for green leaf. The concentrations of zinc in all the sampled plants were below the 99.40mg/kg permitted by WHO/FAO, (2001). Zinc plays an important role in many enzymatic reactions (Erum,Zahir et al., 2009). The deficiency of zinc in the body can cause the disturbance of human body zinc maintenance (Dilek and Ahmed, 2006; Erum, Zahir et al., 2009). Copper concentrations ranged from 0.001mg/kg – 0.470mg/kg. Potato had the highest concentration of copper. This was closely followed by water leaf. Zea mays and green leaf showed very low concentration of copper (0.001±.000) as compared with potato and water leaf significantly at $p<0.05$. The concentrations were lower than the 73.00mg/kg permissible level recommended by WHO/FAO, (2001). Copper in conjunction with Iron is needed for neurovascular system, maintenance of the pigmentation of the body and is crucial in anaemia (Erum, Zahir et al., 2009; Ishmail et al., 2011).

Lead concentration was very low for all the sampled plants. Zea mays, potato and green leaf had same value of (0.001±.000mg/kg) for lead compared with water leaf (0.002±.000mg/kg). The values obtained for lead were very much lower than the recommended level of 0.30mg/kg by WHO/FAO, (2001). Lead has no biological role and is potentially toxic to microorganisms (Soboler and Begonia, 2008). Its excessive accumulation in living organisms is always detrimental. Lead is not an essential element. It is toxic and can cause serious injury to the brain, nervous system, red blood cells and kidneys (Baldwin and Marshall, 1999). The concentrations of cadmium for Zea mays and potato were the same (0.01±.000mg/kg) whereas green leaf (0.040±.000mg/kg) and water leaf (0.001±.000mg/kg) were significant at P<0.05. The concentrations of cadmium were lower than the acceptable concentration of 0.2mg/kg by WHO/FAO, (2001) for foods and vegetables. Cadmium is is highly biopersistent but has little toxicological properties and once absorbed by an organism remains resident for many years (Wuana & Okieimen, 2011)

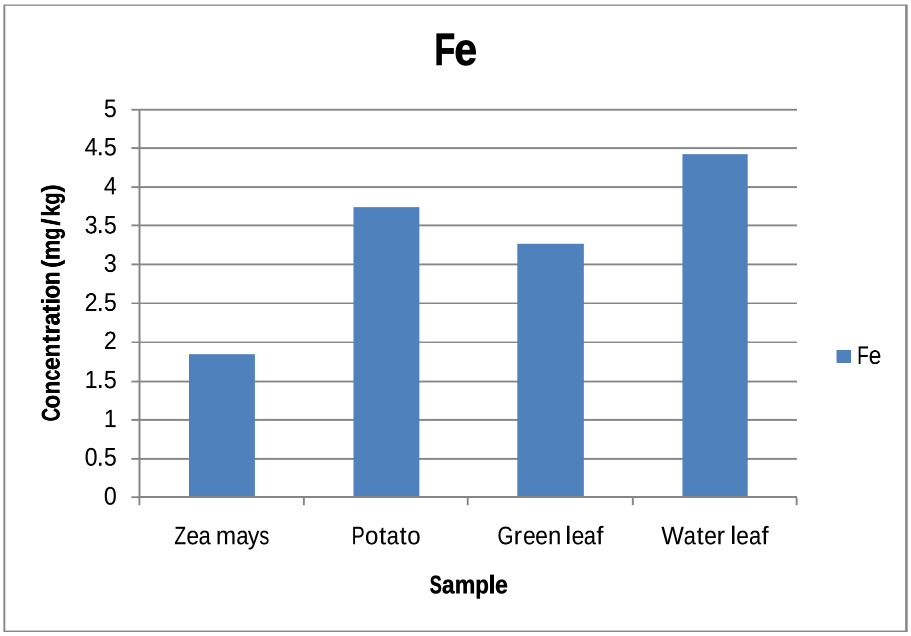

Figure 1: Bar Chart showing the Concentration of Fe in selected plants

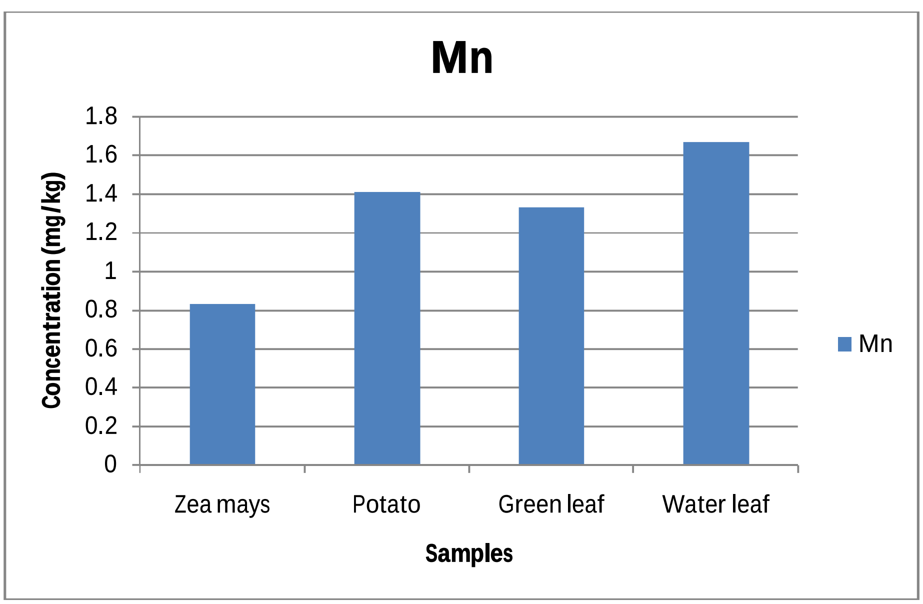

Figure 2: Bar Chart Showing the Concentration of Mn in selected plants

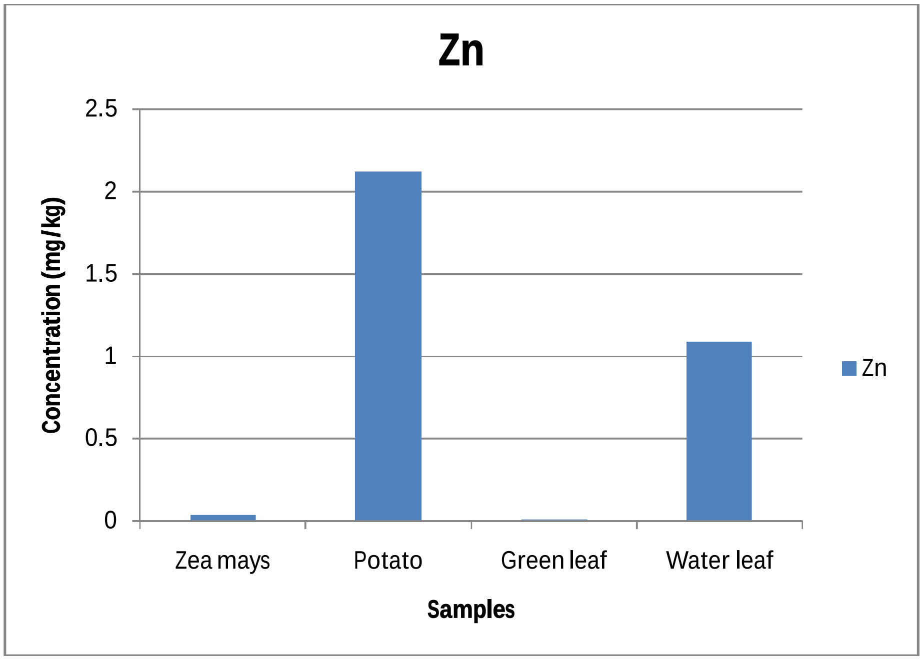

Figure 3: Bar Chart Showing the Concentration of Zn in selected plants.

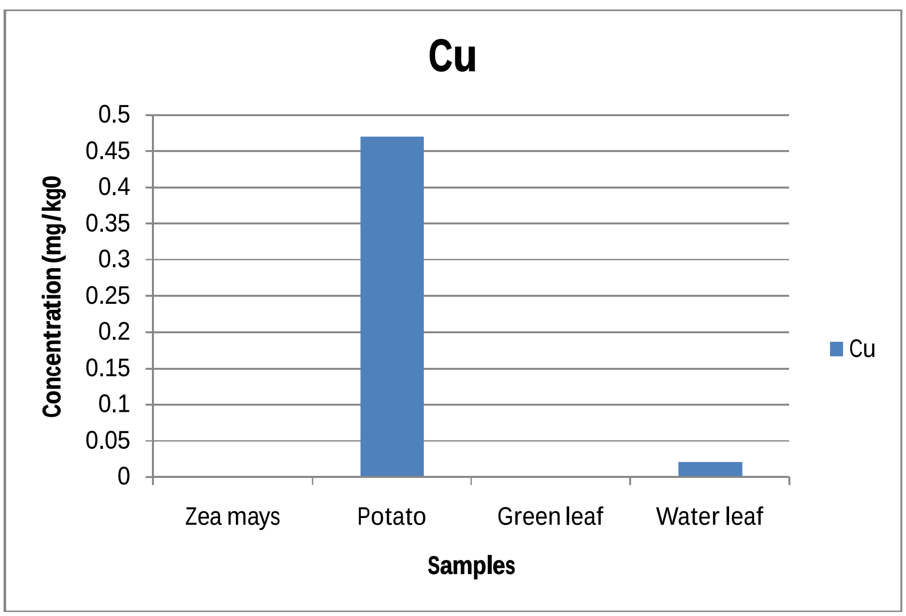

Figure 4: Bar Chart Showing the Concentration of Cu in selected plants.

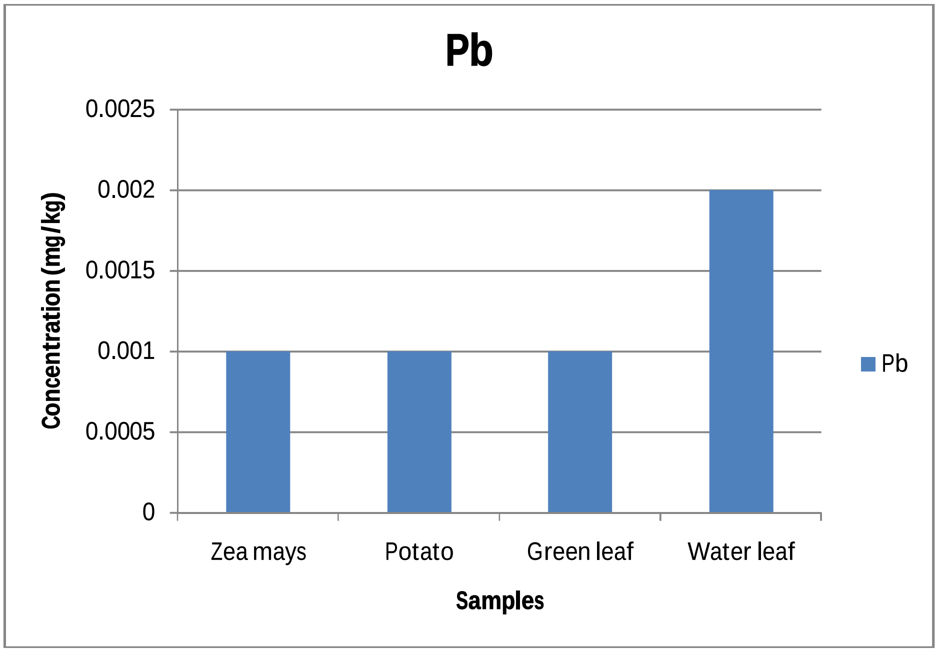

Figure 5: Bar Chart Showing the Concentration of Pb in selected plants.

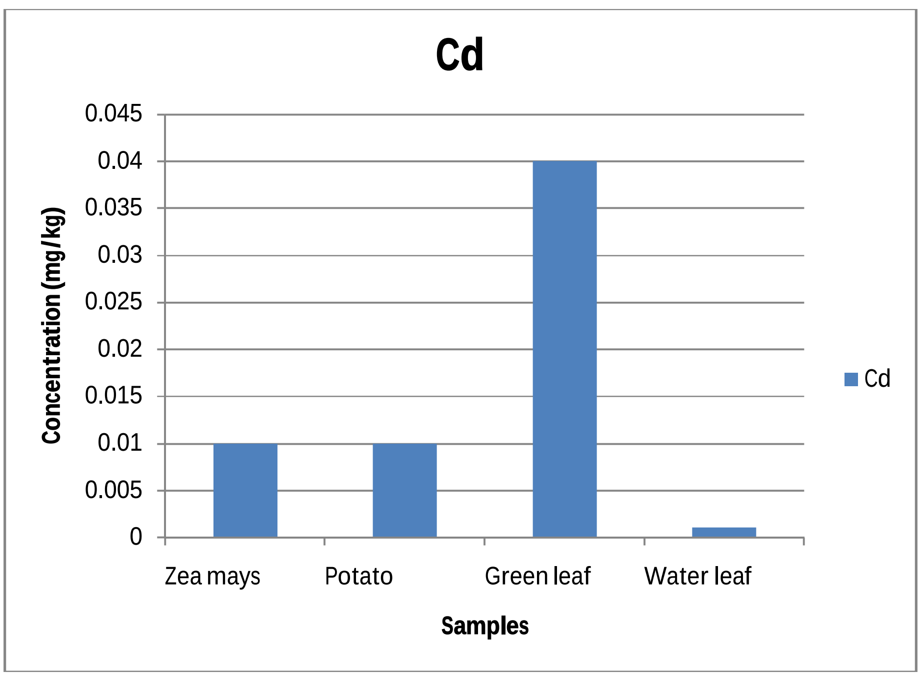

Figure 6: Bar Chart Showing the Concentration of Cd in selected plants.

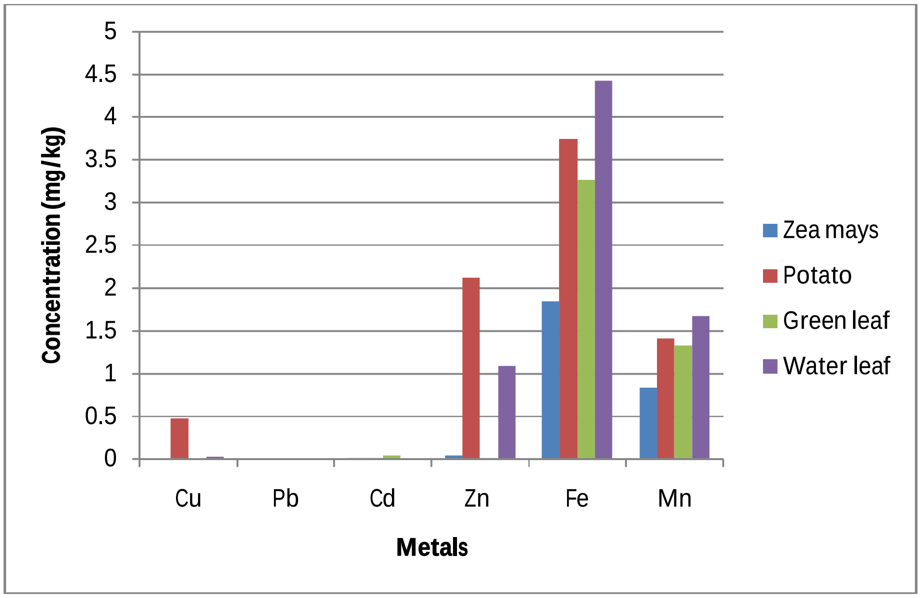

Figure 7: Bar Chart Showing the Distribution of Fe, Mn, Zn, Cu, Pb and Cd in selected plants.

CONCLUSION AND RECOMMENDATION

This study on the heavy metal concentration of plants (Zea mays, Potato, Green leaf, Water leaf) grown around waste dumpsites in Ozoro, Delta State, Nigeria has revealed that dumpsites contribute tremendously to the contamination/pollution of plants grown around them. This situation demands control because the level of utilization of waste dumps to raise vegetables is on the increase. And there is no doubt that these metals will bioaccumulate in the long run causing serious health challenge in the near future. Iron was the highest occurring metal in all the sampled plants while lead was the least occurring metal. Though the results obtained were still within the permissible level set by FAO/WHO (2001). This situation is a threat to our life, therefore planting of vegetables within or around dumpsites should be discontinued with. Similarly Regulatory agencies on the environment and sanitation should be alive to their responsibilities in periodical monitoring so as to arrest this menace by this act of planting vegetables and other crops around dumpsites and the intending consequences.

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