Concentrations of Heavy Metals in Vegetable (*Telfairaoccidentalis*) from Farmlands Close to Rumuagholu Dumpsite, Rivers State, Niger Delta, Nigeria

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***Abstract*: - The proliferation of dumpsites in urban settlement the world over is becoming worrisome. The concentrations of some heavy metals were examined in vegetables (*Telfairaoccidentalis*) planted in farmland close to Rumuagholu Dumpsite. Vegetables samples were collected from three station around the dumpsite within a period of three months (April, May and June). They were transported to the laboratory and oven dried at 60 ^{o}C to constant weight. The samples were powdered and digested. The content filtered and the filtrate examined with atomic absorption spectrophotometer. The results obtained showed that the mean station values of the individual metals were; lead (Pb), 0.797±0.112, 0.417±0.081 and 0.300±0.049 mg/Kg in stations 1, 2 and 3, cadmium (Cd), undetected in stations 1and 3 and 0.004±0.001mg/Kg in station 2, copper (Cu), 0.364±0.095, 1.113±0.134 and 0.247±0.049 mg/Kg in station 1, 2 and 3, chromium (Cr), 1.234±0.168, 0.721±0.051 and 0.096±0.020 mg/Kg and nickel (Ni), 0.876±0.458, 0.568±0.350 and 0.166±0.015 mg/Kg in station 1, 2 and 3 respectively. The concentrations of the various heavy metals in the dumpsite vegetables were higher than those of the control farmlands. The concentrations of all the examined metals were lower than the FAO/WHO value for consumable food except that of Pb. Although the concentrations of the heavy metals examined were low, yet caution should be taken when planting vegetables on dumpsite soils. This is because of the danger that might ensure from heavy metals toxicity in consumers.**

***Keywords:* Heavy metals, *telfairaoccidetalis*, dumpsite, accumulation, consumption**

I. INTRODUCTION

The pollution of the environment by the heavy metals and the safety of food has become an important issue of international discourse presently**.** The presence of metals especially at higher than required concentrations in any medium has severe on sequence on the well-being of biological organisms generally and human beings specifically Gupta and Gupta (1998)**.**The quest for the usage of vegetables in human diet is ever increasing all over the world. This is necessitated on the basis of the numerous health and nutritional implications that can be achieved as a result of their consumption.

Vegetables are part of rudimentary consumption routine that every group or class of society and nations all over the globe are involved. They are sources of fountains of essential immune enhancements, antioxidants and metabolites. They have the capacity to act as **b**uffer to different body reactions which may involve acids, more especially during digestion (Bahemuka and Mubofu, 1999). Nevertheless, they contain both indispensable and poisonous chemicals at variable concentrations. One of these categories of chemical constituents are heavy metals which are taken up from the soil (Shakya and Khwaounjoo, 2013).Metals are soil pollutants and in the presence of other soil components, they form different mixtures, which when in solution are taken up by plants and thereafter are accumulated at elevation concentrations in the palatable parts of vegetables (Zhou *et al*., 2016).

The need for food safety is a foremost unrestricted apprehension all over the world. Over the few past decades, there is an ever growing call for food safety. This has encouraged different scientific investigations about the hazard connected with the intake of crops contaminated by heavy metals and other poisons (D'Mello, 2003). Vegetables contains vital constituents of diet such as protein, vitamins, iron, calcium and other nutrients which are not easily assessable (Thompson and Kelly, 1990).

Vegetables Contamination by heavy metals can be through different sources which are irrigation with wastewater, application of fertilizers and pesticides containing metals, discharges from industries, passage from one point to another, method of harvest, source of the vegetable, place where they were stored, type of storage facility and the places they were sold. The need for vegetable consumption by humans has been encouraged because of the expected value of different nutrient that it can offer human and their health benefits. Despite this valuable and positive impact on the human body, yet they also contain important and lethal metals at variable concentrations. It is a common knowledge that plants absorb heavy metals through their root from soils which has been contaminated and they are deposited on different (Chojnacka et al, 2005).

The practice of planting crops near waste site with the mindset that the nearby soils are rich in nutrients without regard to the fact that toxic chemical may also be part of that environment is on the increase in many parts of Port Harcourt in Rivers State. Virtually, close to all the approved dumpsites are farms of different types of vegetables cultivated. These vegetables farms are in most cases owned by ignorant farmers who chose such places because of the expected high yield within a short period of time, without considering the negative part of their actions. Therefore, this study was undertaken to examine the concentrations of some heavy metals in vegetable (*Telfairaoccidentalis*) planted in soils close to a dumpsite at Rumuagholu community, Obio/Akpor, Port Harcourt, Rivers State.

II. MATERIALS AND METHODS

The study was carried out in solid waste dumpsites in Rumuaogholu community in Obio-akpor LGA, Rivers State, Nigeria. It is in the metropolis of Port Harcourt, one of the major centers of economic activities in Nigeria, and one of the major cities in the Niger Delta region. The original indigenous occupants of the area are the Ikwerre people. Obio-Akpor is bounded by Port Harcourt (local government area) to the south, Oyigbo to the east, Ikwerre to the north, and Emohua to the west. It is located between latitudes 4°45'N and 4°60'N and longitudes 6°50'E and 8°00'E. The local government area covers 260 $Km^2$and has a population of 464,789 as at the 2006 population census. It generates large volume of waste which are deposited at designated dumpsites. Vegetable plants are also grown by local farmers at close proximity to such dumpsites.

Vegetable (Telfairiaoccidentalis) Sample Collection

The leaf samples of the *Telfairiaoccidentalis* were collected from four different spots in each farm at a distance of 20m each to make a composite sample. This collection process was carried out in three different farmlands within the dumpsite and from a control site (farmland) 2 kilometer away from the dumpsite. The plant (leaves) were carefully harvested with hands and then bagged in labelled polythene bags and then taken to the laboratory.

Sample Treatment

The Vegetable leaf samples collected were properly rinsed with tap water and then with distilled water to remove any attached soil particles. They were then cut into smaller portions and placed in flat plate and sundried for about a week and thereafter oven dried at 60 ^oC to constant weight. The dried vegetable samples were then homogenized to fine powder using mortar and pestle. Powdered leaf samples were then collected in labelled polythene bags and were placed in a desiccator awaiting laboratory analysis (Okodeye *et al.*, 2013).

Digestion of Vegetable Sample

A weight mass of 2grams each of the pre-treated vegetable samples were weighed and transferred into Kjeldahl flasks for digestion. A. volume of 1ml per-chloric acid ($HCIO_4$) and 3ml of nitric acid (HNO_3) were added to each flask. The vegetable samples were then placed in a heating mantle inside a fume cupboard. They were swilled gently and digested slowly with moderate heating and allowed to cool.

Thereafter, 100 ml of distilled water was put into 100 ml volumetric flask and was transferred into each of the flasks of the dried vegetable samples. They were shaken and filtered (using Watchman filter paper of 15cm diameter). The filtrates were collected, labelled and stored in 50 ml bottles and taken to the laboratory for trace metal analysis using Atomic Absorption Spectrophotometer (AAS).

III. RESULTS AND DISCUSSION

The results of the heavy metals from the Rumagholu refuse dumpsite are given in Tables 1-3, while the mean values are shown in Table 4.The concentrations of Pb in the vegetables within the experimental period was observed to fall within the range of 0.257-0.952 mg/Kg and undetected at the control site within the period. The mean values of Pb in the stations were 0.797±0.112, 0.417±0.081 and 0.300±0.049 mg/Kg for stations 1, 2 and 3 respectively. The result showed that Pb values were higher than the FAO/WHO (2011) value of 0.3 mg/Kg for vegetables. The observations on the concentrations of Pb in this work were lower than the values observed in water leaf planted by dumpsites from Ota, Ogun State, Nigeria (Babayemi *et al*., 2017) and also those of Ukpong *etal.* (2013), in plants within dumpsites within Uyo metropolis, AkwaIbom State, Nigeria. however, the observed concentrations of Pb in the present work fall within the range of values observed in vegetation around Kaduna/Afam Street dumpsite, Port Harcourt, Rivers State, Nigeria (Ideriah *et al*., 2010). The observed concentrations of Pb in the vegetable showed that the vegetable may not be fit for consumption since Pb is not an essential metal.

Cadmium (Cd) concentrations in the vegetable varied from ND – 0.06 mg/Kg in the stations. The mean stations values indicated ND, 0.004±0.001 mg/Kg and ND for stations 1, 2 and 3 respectively. In the control station, Pb was not detected (ND) in any of the months. The observed values of Cd in the vegetables from the different dumpsite locations were lower than the FAO/WHO (2011) value of 0.2 mg/Kg. This implies that the vegetables were not contaminated with Cd to the extent that it cannot be consumed. The experimental values of Cd in the present work is lower than those of Nanvel *et al*. (2015),in spinach, cabbage and radish, but within the same range in tomatoes and pepper in a solid waste treated farm in Kuru Jantar, Nigeria. The ND values of Cd n stations 1 and 3 and very low values in station 2 within the period, in the dumpsite vegetable, were in consonance with the observation of Olakunle *et al*. (2018), in vegetables from dumpsites within Ilesha town settlement, Nigeria.

The concentrations of Cu in the vegetable from the dumpsite varied from 0.209-1.302 mg/Kg in the stations. The mean stations concentrations were 0.364±0.095, 1.113±0.134 and 0.247±0.049 mg/Kg in stations 1, 2 and 3 respectively. The value observed from the control dumpsite was ranged from 0.158 – 0.182 mg/Kg, which were lower than the values observed from the dumpsite stations. The observed values of Cu from the stations were all lower than the 10 mg/Kg limit given by FAO/WHO (2011). The concentrations of Cu observed in the present work is lower than those of Okorosaye-Orubite and Igwe (2017), in vegetables (bitter leaf, pumpkin, green vegetable, okra plant and green amaranths) from different dumpsites within the city of Port Harcourt, Rivers State, Nigeria and also those of Nanven *et al*. (2015),in vegetables planted in solid waste polluted farmland in Kuru Jantar, Nigeria. However, the values of Cu in the vegetables in the present work fall within the range of values observed in vegetation along East-West Road and Afam/Kaduna Street in Port Harcourt Rivers State, Nigeria (Ideriah *et al*., 2010).

The concentrations of Cr observed in the vegetable from the different stations varied from 0.077-1.398 mg/Kg within the period, but undetected at the control stations. The mean stations concentrations observed in stations 1, 2 and 3 were 1.234±0.168, 0.721±0.051 and 0.096±0.020 mg/Kg respectively. The observed values of Cr in the stations were lower than 1.3 mg/Kg limit in edible plants recommended by FAO/WHO (2011). The observed concentrations of Cr in the present work were lower than the values observed in waterleaf from farmlands in a dumpsite in Ota, Nigeria (Babayemi *et al.,* 2017), those of Okorosaye-Orubite and Igwe (2017), indifferent leafy vegetables sampled from selected dumpsites within Port Harcourt, Nigeria, but are higher than the values observed in cocoyam samples collected from waste dumpsite in Uyo, Nigeria (Ukpong *et al*., 2013).

The concentrations of Ni in the farmland vegetables planted by the dumpsite ranged from 0.149 - 1.263 mg/Kg in the stations within the period of investigation. Values from the control station varied from 0.097 – 0.210 mg/Kg. the observed mean values from the stations within the period were 0.876±0.458, 0.568±0.350 and 0.166±0.015 mg/Kg for stations 1, 2 and 3 respectively. The observed values were lower than the FAO/WHO (2011) value for nickel and edible plants. The observed concentrations of Ni in the present work were lower than the findings of Okorosaye-Orubite and Igwe (2017), in vegetable plants from dumpsites in Port Harcourt, those of Babayemi *et al.*(2017), in Ota dumpsites and those of Nanven *et al*. (2015), in spinach vegetables in contaminated with dumpsite soil in Kuru Jantar, Nigeria. However, the values of the present work were higher than those of Ukpong *et al*., (2013), in cocoyam planted within a dumpsite in Uyo, Nigeria and also those of Nanven *et al*. (2015), in cabbage, radish, tomatoes and pepper where Ni was not detected in any of the samples.

Table 1: Mean level of heavy metals (mg/kg) in vegetable samples from solid waste dumpsite in Rumagholu in April

Heavy Metals (mg/Kg	Sample Location			
	Control	1	2	3
Pb	ND	0.695	0.348	0.274
Cd	ND	ND	0.003	ND
Cu	0.169	0.294	1.032	0.217
Cr	ND	1.004	0.697	0.077
Ni	0.097	0.232	1.048	0.185

Table 2: Mean level of heavy metals (mg/kg) in vegetable samples from solid waste dumpsite in Rumagholu in May

Heavy Metals (mg/Kg	Sample Location			
	Control	1	2	3
Pb	ND	0.743	0.372	0.257
Cd	ND	ND	0.004	ND
Cu	0.182	0.301	1.005	0.209
Cr	ND	1.301	0.675	0.086
Ni	0.131	1.132	0.224	0.149

Table 3: Mean level of heavy metals (mg/kg) in vegetable samples from solid waste dumpsite in Rumagholu in June

Heavy Metals (mg/Kg	Sample Location			
	Control	1	2	3
Pb	ND	0.952	0.531	0.369
Cd	ND	ND	0.006	ND
Cu	0.158	0.498	1.302	0.316
Cr	ND	1.398	0.792	0.124
Ni	0.210	1.263	0.432	0.163

Table 4: Mean concentrations of heavy metals in vegetable from the stations

Heavy Metals (mg/Kg	Sample Location		
	1	2	3
Pb	0.797±0.112	0.417±0.081	0.300±0.049
Cd	ND	0.004±0.001	ND
Cu	0.364±0.095	1.113±0.134	0.247±0.049
Cr	1.234±0.168	0.721±0.051	0.096±0.020
Ni	0.876±0.458	0.568±0.350	0.166±0.015

IV. CONCLUSION

The concentrations of heavy metals (Pb, Cd, Cu, Cr and Ni) in vegetable (*Telfairaoccidentalis*) showed varied level of contamination of the vegetable. However, all the metals except Pb fall within the safe limit for consumption set by FAO/WHO. The concentrations of heavy metals in the vegetables planted at the dumpsite areas were higher than the ones that were planted at the control farmlands. Although the concentrations of heavy metal in the vegetable are still within levels that are yet alarming, yet continuous consumption of vegetable from this dumpsite can result in accumulated levels that can be harmful to the human system. Therefore, continuous planting of edible plants in dumpsite soils be discouraged except were proper decontamination procedures has adequately been followed. To forestall negative health implications on consumers, relevant governmental agencies should adequately monitor dumpsite environments so as to prevent the cultivation of plants for possible consumption.

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