TRACE METAL PROFILE OF SOME FOODSTUFFS SOLD IN OZORO MARKETS, DELTA STATE, NIGERIA

Agbogidi, O.M. *, Egboduku, W.O., Arinze, A.N. and Akpomovine, M.O.
Department of Botany, Faculty of Science, Delta State University, Abraka, Delta State, Nigeria.
*Corresponding author. E-mail: omagbogidi@yahoo.com. Tel: 07038679939.

ABSTRACT
An assessment was carried out in 2014 in two markets at Ozoro in Delta State, Nigeria on the trace metal profile of some foodstuffs: cassava (*Manihot esculentus* Crantz.), maize (*Zea mays* L.), okra (*Abelmoschus esculentus* L.) and sweet potatoes (*Ipomoea batatas* L.) with a view to establishing baseline information on their metal index. The results showed that lead, copper, arsenic, zinc and cadmium were present in the foodstuffs. Arsenic was the lowest while cadmium was the highest especially in okra, and copper in sweet potato. Based on the recommendation given by standard bodies like FAO and WHO, the amounts observed were below the tolerable limits recommended, which suggests sub-lethal toxicity in humans. With a gradual and steady bioaccumulation of these non-biodegradable elements, a risk of their rise to lethal levels with their inherent health risk could be envisaged; hence there is a need for monitoring metals in foodstuff. The study has great implication in food safety and environmental management.

Key words: Trace metals, foodstuffs, health risk, Ozoro, Delta State.

INTRODUCTION
Human life is dependent on food and hence the protection of food supply is very essential (Gupta and Gupta, 1998; FAO, 1988). From planting, harvesting and processing of food before consumption, food is exposed to various aspects and components of the environment (Mbong et al., 2013). The environment is constantly exploited and rendered unsafe for human consumption stemming from various activities of man and his animals (FEPA, 2002). Heavy metals are seen as subset of elements that exhibit metallic properties which include transition elements, some metalloids, lanthanides and activities (Nowan and Salam, 2006; Agbogidi et al., 2007). Heavy metal pollution arises from many sources including purification of metals e.g. smelting of or/ and preparation of nuclear fuels, oil exploration and exploitation activities etc. These metals are food nutrients needed in minute amounts for the general metabolism of the body systems but become injurious to the system at higher quantities (Ghosh and Singh, 2005; Abdul, 2010). They include Zn, Fe, Se, Cu, Mn, Cr; Mo, Co and Ni, ultra trace elements. Ultra trace elements, non- essential metals include Al, As, Ba, Cd, Ha, Pb, Sn and Br (Hall, 2002). The health risk of trace metals following the consumption of metal contaminated food items including fruits and vegetables has been reported (Dilek and Almet, 2006); Ghani, 2010; Ismail et al., 2011; Iwegbue et al, 2011, Nkwocha et al, 2011.

There is however, scarcity of documented information on the trace metal profile of food stuff sold in local markets of Ozoro in Delta State. The present study has been embarked upon to provide baseline information on the trace metal status of some food stuffs sold in Ozoro markets, a community commonly known for oil exploration activity in Delta State, Nigeria (Agbogidi, and Erhenhi, 2013; Agbogidi, and Eruotor, 2012: Agbogidi, and Enujeke, 2012: Agbogidi, and Egbuchua, 2010), with a view to comparing their values to that of standard bodies like FAO and FEPA. Besides, findings from this research will have practical applications in environmental science, health risk assessment and plant improvement.

MATERIALS AND METHODS
Study area: The study was conducted at two

markets of Ozoro, Delta State, Nigeria. Ozoro is located in the Isoko North Local Government Area, in the Delta South Senatorial District of Delta State. It is the headquarters of Isoko North. The population is between 2,000 and 5,000. Ozoro lies between latitude 6^0 30 'N and longitude 5'45'6 of the equator. The area experiences double peak periods of rainfall between June/July and September/October. The annual mean rainfall is 2800 mm and the annual mean temperature is 33^{o}C (College of Agriculture, Meteorological Station, Ozoro, 2013).

Source of foodstuffs

The food stuffs: cassava (*Manihot esculentus* Crantz.), maize (*Zea mays* L.), okra (*Abelmoschus esculentus* L.) and sweet potatoes (*Ipomoea batatas* L.) were purchased from the two main markets (Erhovie and Ototie) of Ozoro. The four fresh samples of the foodstuffs were thoroughly washed and cut into small pieces. They were air-dried for three weights following the procedure prescribed by days and then oven-dried at 80% to constant AOAC (2005).

Metal analyses

They were ground and packed separately. The powdered samples were packed into small bottles and stored in a refrigerator. A known amount (2.0 g) was washed and digested using the standard addictive method (AOAC, 2005). The digests were then analysed for metal concentrations using the Atomic absorption spectrophotometer following the standard additive method (AOAC, 2005). The analysis was carried out at the Institute of Agricultural Research and Training (IART), Ibadan, Oyo State, Nigeria. Data collected were exposed to analysis of variance and the significant means were separated with the Duncan's multiple range tests using SAS (2005).

RESULTS AND DISCUSSION

The results obtained from the metal analysis of the four foodstuffs are presented in Table 1. Significant ($P \leq 0.05$) higher amounts of trace metals including Pb, Cu, As, Zn, Cd were observed in the foodstuffs studied. Cd was higher in all the foodstuffs especially in okra, followed by Cu (Table 1). The amount of As followed by Cu (Table 1). The amount of As was insignificant in the foodstuffs examined when compared with standard bodies like FAO (2002) and WHO (2002). The amounts are below the tolerable limits recommended. This is suggestive of sub-lethal toxicity in humans (USEPA, 1986). This study recommends monitoring of the level of metal contamination of foodstuffs since these metals are stable in the environment and their inherent health risk cannot be envisaged. The study has an important implication in food safety and environmental management.

Table 1. Heavy metal (mg/kg) profile of foodstuffs sold in Ozoro Markets of Delta State, Nigeria.

Foodstuff	Pd	Cu	As	Zn	Cd
Cassava	1.2a	2.09c	0.002a	0.76c	3.59b
Maize	0.03d	1.56b	0.002a	0.20d	3.26c
Okra	0.97b	2.16b	0.002a	2.5a	7.82a
Sweet potato	0.34c	2.67a	0.002a	1.52b	2.55d
FAO/WHO	5.0	40.0	1.4	60.5	10.0

Means with different letters in the same column are significantly different at $P \leq 0.05$ using the Duncan's Multiple Range Tests (DMRT).

REFERENCES

Abdul, G. (2010). Toxic effects of heavy Metals on plant growth and metal accumulation In maize (*Zea mays L.*) *Iranian Journal of Txicology* 3 (3): 60-68.

Agbogidi, O.M and Egbuchua, C.O (2010). Heavy metal concentrations of soil contaminated with spent engine oil in Asaba, Delta State. *Acta Agronomica Nigeriana* 10(1): 65-69.

Agbogidi, O.M. and Enujeke, E.C. (2012). Effects of spent motor oil on soil physico-chemical properties and growth of *Arachis*

hypogae L. *Glob. J. Biosci. Biotechnol.* **1(1)**: 71-74.

Agbogidi, O.M. and Eruotor, P.G. (2012). Morphological Changes due to spent engine oil contamination and its heavy metal components of *Jatropha curcas* Linn. *In:* Baby, S. and Sandhu, P.S. (eds.). Proceedings of the International Conference on Bioscience, Biotechnology and Health Sciences (ICBBHs' 2012) organized by Planetary Science Centre Research December 14 and 15, 2012 in Singapore. pp. 88-93.

Agbogidi, O. M. and Erhenhi, H.A. (2013). Metal concentrations of four leafy vegetables sold in markets of Abraka, Delta State, Nigeria. *Journal of Biological and Chemical Research* 30 (2):813-822.

Dilek, D. and Ahmet, A. (2006). Heavy metals levels in vegetables in Turkey are within Safe limits for Cu, Zn, Ni and exceeded Cd and Pb. *Journal of Food Quality* 29:256-265.

FAO (1988). Traditional food plants. A resource book for promoting exploitation and consumption of food plants in Arid, Semi Eastern and Sub-humid lands of Eastern Africa. Rome, Italy.

FAO (2002). World Agriculture: towards 2015/2030. Summary report, Rome.

Federal Environmental Protection Agency (FEPA) (2002). Review of environmental guidelines and standards for the petroleum industries in Nigeria (EGASP1N) issued the Department of Petroleum Resources, Lagos. p.44

Ghani, A. (2010). Toxic effects of heavy metals on plant growth and metal accumulation in maize (*Zea mays* L.). *Iranian J. Toxicol.* **3(3)**: 325-334.

Ghosh, and Singh, S.P. (2005). A review on phytoremediation of heavy metals and utilization in its products. *Applied Ecol. Environ. Resour.* 3(1):1-18.

Hall, J.L. (2002). Cellular mechanisms for heavy metal detoxification and tolerance. *J. Exp. Botany* **53 (366)**: 1-11.

Iwegbue, C.M.A., Overah, C.I., Ebigwe, J.K. Nwozo, S.O., Nwajei, E.E. and Eguavoen, O. (2011). Heavy metal contamination of some vegetables and spices in Nigeria. *International Journal of Biological and Chemical Sciences* **5(2)**: 766-773.

Ismail, F., Anjum, M.R., Mammon, A.N. and Kazi, T.G. (2011). Trace metal contents of vegetables and fruits of Hyderabad retail market. *Pak. J. Nutr*. 10(4): 365-372.

Mbong, E.O., Ogbemudia, F.O., Okon, J.E. and Umoren, U.B. (2013). Evaluation of concentration of heavy metals in leaf tissues of three improved varieties of *Manihot esculenta* Crantz. *E3 J. Environ. Res. Manage.* 4(3): 214-218.

Nkwocha, E.E., Pat-Mbano, E.C. and Tony-Njoku, N.F. (2011). Assessment of heavy metal concentration in food crops grown around Etelebou oil flow station in Bayelsa State, Nigeria. *Int. J. Sci. Nature* **2(3)**:665-670.

Nowan, M.A., and Salama, A.K. (2006). Market basket survey for some heavy metals in Egyptian fruits and vegetables. *Food Chem. Toxicol.* 4: 1273-1278.