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TRACE METAL PROFILE OF SOME FRUITS IN KOKORI AND ABRAKA MARKET, DELTA STATE, NIGERIA

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ABSTRACT

An investigation was carried out in Abraka and Kokori Delta state, Nigeria in 2013 to evaluate the trace metal concentration in some fruits: pawpaw, banana, orange and African garden egg commonly grown and sold in their market of Delta State, Nigeria with a view to establishing baseline information on their trace metal elements. The fruit tissues were ashed, wet-digested and analyzed using atomic absorption spectrophotometer following the additive method. The results indicated the presence of elevated trace elements including lead, chromium, cadmium, zinc, manganese, nickel cobalt and copper in the test fruit when compared with values obtained from the same fruits obtained from Abraka (a non oil producing community) in the same local government). The results also showed a highly significant ($P<0.05$) difference relative to the control (Abraka) values. Though the values of the trace metals obtained fell below the critical permissible level following FAO and FEPA and WHO standards, their persistence in soil due to their non-biodegradability raises environmental concern because of the inter dependence between plants and animals including man in the ecosystem. The need for metal monitoring in food materials including fruits–most available, affordable and sustainable sources of micronutrients in diets should be encouraged. Finding from this study have practical application in environmental science, health management and crop improvement.

Keywords*: Trace metals, local fruits, bio magnification and health risk.*

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INTRODUCTION

Vegetables (leafy and fruits) are widely grown in most parts of Sub-Saharan Africa especially in the urban areas and they constitute the most affordable and sustainable sources of micronutrients (Nwajei, 2009; Ismail *et al.*, 2011). Sabo and Dia (2009) reported that vegetables provide between 30 and 50 % of iron and vitamins in resource poor diets. In their fresh forms, they contain large percentage of water. As living biota, they also carry out physiological function of respiration thereby helping in carbon sequestration (Idah*et al.*, 2007). Fruits are generally taken for the treatment of diseases and ailments. They aid digestion and prevent constipation (Asaolu and Asaolu, 2010). Different recipes prepared from fruits are used in the treatment of various ailments (Oyeniran, 1988; Remison, 2005). Idah*et al.* (2007) stated that enormous quantities of fruits are produced in Nigeria; 3.8 million tones of onion, 15 million tones of plantain/banana and 35 million tones of citrus have been quoted as annual production levels of fruits and vegetables. Among the locally available fruits in Delta State are pawpaws, orange, banana and garden egg. Pawpaw (*Carica papaya* L.) also called papaya belongs to the family Caricaceae. It is an important fruit of the tropics and sub-tropics that has high nutritive value and production potentiality. It is native to tropical America but now widely cultivated in nearly all tropical regions of the world (Adeoye*et al.*, 2010). Pawpaw can be used as food, a cooking aid in traditional medicine. The stem and bark can be used in rope production. The rich tree latex (papain) helps in tenderizing meat hence included as a component in powdered meat tenderizers (Salihu*et al.*, 2012). It is rich in nutrients, phytochemicals and used in culinary practices (Bratsch, 2009). Orange (*Citurssinensis*L.) could have originated from China but now, widely cultivated in nearly all tropical regions of the world. They are rich in vitamin C hence helps to prevent scurvy. The vitamin C in citrus fruit strongly enhances the absorption of iron (Umeh, 1998; Erum*et al.*, 2009).

Banana (*Musa sapietum*L.) and Plantain (*Musa paradisica*L) belongs to the family Musacaceae. There are important food in the humid forest and mid-attitude zones of sub-Saharan Africa. They have become a key source of revenue as they are traded both within and exported to other countries including Europe (Adejoni*et al.*, 2010). They also have the potential of contributing significantly to national food security hence reducing rural poverty. Banana can be baked, fried, boiled and roasted. It is the largest herbaceous flowering plant and the fruit is called leathery berry. It is very rich in vitamins and minerals hence rated as an invaluable tree crop in Nigeria. It is needed by both children and adults, pregnant, non-pregnant and non-lactating women (Sinennen and Vuyleleke, 1991; Adejoro, 2007).

African egg plant / Garden egg (*Solanummelongena*L.) as a member of the family solanaceae is a native to India. It is next too okra in terms of production. It acts as a source of income to rural women and their households (Danquah and Ofori, 2012). It is very rich in iron. It is also very important in traditional folklore and

medicine. *S. melongena*induces lactation in fleshly delivered women, prevents heart diseases and high blood pressure. It also has phytochemicals like tannins and other essential bioactive compounds (Umeh, 1998; Nwaiwu*et al.,* 2012a). African eggplants play central role of tradition and culture of people of sub-saharan Africa. They are offered as gift in traditional ceremonies such as marriage, child naming and other social occasions as a sign of blessing and fruitfulness (Ubakudam*et al.*, 2010; Nwaiwu*et al.*, 2012b).

Heavy metals are vital components of the natural ecosystem / environment (Hart *et al.*, 2005; Ekeanyanwu*et al.*, 2010). They are required in minute quantities and very useful in the metabolic processes of biota. They however, result in problems when present at elevated amount (Agbogidi and Enujeke, 2012). Metals may also be found in the ecosystem due to numerous anthropogenic activities of man (Jones, 1991). Examples of metals include iron, manganese, copper, cadmium, chromium, zinc, lead, nickel and others. Reports abound on the effects of heavy metals on man, his animals, agricultural soils and crop plants (Erum*et al.*, 2009; Strachan, 2010; Salihu*et al.*, 2012; Agbogidi, 2013; Agbogidi*et al.*, 2013). Their effects ranged from growth stunting, yield reduction, various anatomical, morphological, physiological aberrations to death and outright abandoning of aerable land for food production (Hall, 2002; Namik and Yavuz, 2006; Agbogidi and Eruotor, 2012). Oladele and Smith (2007) noted that Pb exposure account for 7–25% of the disease burden among exposure to Pb and other metals is widely recognized as a major risk for several human diseases and the structure of industrial ecological systems have made exposure to trace metals especially Pb unavoidable for most people alive today (WHO, 2000). It is on this premise that a study as this has been embarked upon. The present study has been conducted to provide baseline information on the trace metal profile of some fruits in Kokori and Abraka markets in Delta State, Nigeria with a view to determining the metal content of these fruits (pawpaw, banana, orange and African eggplant) growing in oil producing area of Kokori as they differ from those in Abraka, a non oil producing community of Delta State. This study will help to provide baseline information on the level of risks faced by the indigenous population where these fruits are grown, sold and widely consumed. The study could also be useful to determine the safety of consuming the fruits around oil producing areas.

MATERIALS AND METHODS

Study areas

The study was carried out in Kokori and Abraka in Ethiope-East Local Government of Nigeria. Kokori is an oil producing community. It has many oil wells, flow stations; oil pipe lines the carry oil to other places and gas flare sites (Agbogidi*et al*., 2005). Abraka lies within the tropical rain forest zone at approximately latitude $6^{0}{}_{30}$'N and longitude $5^{0}{}_{00}$'E of the equator and it is characterized by annual rainfall of 3,097mm, pressure is between 1010 and 1014mb with an annual mean temperature

of 30.6^{0}C. The mean monthly soil temperature at 100cm depth is 29.7$^{0\ C}$ and monthly sunshine of 4.9 bars with an annual relative humidity of 83%, Abraka raining season is between March and October (Abraka Meteorological Station, 2012).

Source of fruits and procedure

Five fresh samples of four fruits (pawpaw, banana, orange and African eggplant) were purchased from Abraka and Kokori markets; they were thoroughly washed and were cut into pieces, air-dried for seven days and then oven dried at 45^{0}C to constant weights. They were ground with porcelain mortar and piston to five particle size and stored in plastic containers for Atomic Absorption Spectrophotometer analysis for trace metal elements by wet digestion following the standard additive method (AOAC, 2005).

Data analysis

Data collected were subjected to analysis of variance and the significant means were separated with the Duncan's multiple range tests using SAS (2005).

RESULTS AND DISCUSSION

Trace metals uptake in the fruits absorbed from the soil of the studied areas are presented in Table 1. Higher amounts of trace metals including Fe, Zn, Cd, Mn, Pb, Cr, Ni, Hg, Co, Cu and Sn were recorded for the four fruits (*C. papaya, M. sapietum, C. sinensis*and *S. melongena*) grown and sold in Kokori, when compared with values obtained for the same fruits grown and sold in Abraka (Table 1).

The observed amount of trace metals could be attributed to oil exploration and exploitation activities prevalent in Kokori community. Agbogidi and Eshegbeyi (2006) noted that one of the greatest problems associated with oil pollution is the constant exposure to high concentration of heavy metals from oil leading to environmental degradation. In their study on the socio-economic activities of oil on the communities of Edjeba and Kokori in Delta State, Agbogidi*et al.* (2005) reported that oil activities exerted negative significant influence on Kokori community stemming from oil pollution/spillage resulting in environmental degradation that have a significant effect on their farming activities. Agbogidi and Enujeke (2012) had also reported that if a cultivated soil is deficient in certain trace elements, then the cultivated crops would ultimately be deficient for those metals. Similarly, trace metals pollution staining from oil contamination of soil and its inherent health implications have been widely reported both locally and globally (Ernst *et al.*, 1992, 1995; Baize, 1997; Meinz, 1999; Duffus, 2002; Dauda*et al.*, 2011; Osufi and Onojake, 2004; Ross, 2004; He *et al.*, 2005;2005; Vwioko*et al.*, 2006; Agbogidi*et al.*, 2007; Merrill *et al.*, 2009; Agbogidi and Egbuchua, 2010; Chukwu*et al.*, 2010; Nwachukwu*et al.*, 2010; Dauda*et al.*, 2011; Nwokocha*et al.*, 2011; Oluyemi*et al.*, 2008 and Agbogidi*et al.*, 2013). Environmental pollution from heavy metals is a global phenomenon and it has raised a lot of concerns because of the inherent health risks due mainly to the persistence,

stability and non-biodegradability of metal elements in the ecosystem.

Significant and positive relationships existed between the trace metals indicating their presence is from the same sources. The levels of the metals are not above the permissible levels for crop plants recommended by WHO (2000), FAO (2002) and FEPA (2002). Though these metals fell below the critical permissible concentration, their persistence in soils may lead to increase uptake by plants including the test fruits though their transfer ratio differs among plants. It is fearful now because food materials cultivated in contaminated soils and consumed by man is of great interest to the public especially now that environm-ental quality of food production are of major concern. The need to closely monitor the great danger posed by the accumulation of these trace metals on the health of the population of animals and plants in the area cannot be overemphasized. The study is also useful for the determination of safety of consuming the fruits around oil producing areas

CONCLUSION

This study evaluated the trace metal profile of some fruits in Kokori and Abraka markets in Ethiope East local Government Area of Delta State, Nigeria. The results showed high amounts of trace metals in fruits in Kokori community - an active oil producing area when compared with values recorded for same fruits from Abraka, a non-oil producing community. Although the levels of the metals are not significantly higher by FAO (1985), WHO (2000) and FEPA (2002) standards, but with time and gradual bioaccumulation process, a rise to a lethal level is envisaged with their inherent health risks. The need for metal monitoring in food materials including fruits most available, affordable and sustainable sources of micronutrients in diets should be encouraged.

Table 1: *Trace metal profile (mgkg^{-1}) of fruits in Kokori and Abraka markets, Delta State, Nigeria*

Location	Fruits	Trace metal profile (mg/kg)								
		Zn	Cd	Fe	Cu	Mn	Pb	Cr	Ni	Co
Kokori	*C. papaya*	30.61^{c}	7.63^{a}	7.64^{a}	3.40^{a}	0.42^{d}	0.56^{c}	0.84^{d}	0.14^{c}	0.004^{b}
	M. sapietum	32.42^{b}	6.35^{b}	5.22^{b}	2.81^{b}	0.60^{c}	1.38^{b}	4.62^{a}	0.68^{a}	0.006^{a}
	C. sinensis	24.63^{d}	6.04^{c}	4.34^{c}	2.86^{b}	2.42^{b}	1.46^{a}	3.68^{b}	0.56^{a}	0.008^{a}
	S. melongena	34.14^{a}	5.26^{d}	4.01^{d}	2.51^{c}	2.71^{a}	1.23^{b}	2.89^{c}	0.43^{b}	0.08^{a}
Abraka	*C. papaya*	2.46^{a}	0.64^{a}	3.46^{a}	0.62^{a}	0.08^{c}	0.26^{b}	0.21^{d}	0.05^{c}	0.003^{b}
	M. sapietum	2.38^{b}	0.58^{a}	3.12^{b}	0.58^{b}	0.21^{b}	0.48^{a}	2.60^{a}	0.26^{a}	0.004^{b}
	C. sinensis	1.64^{c}	0.63^{a}	2.62^{c}	0.66^{a}	0.44^{a}	0.34^{b}	1.76^{b}	0.13^{b}	0.005^{a}
	S. melongena	1.42^{d}	0.81^{a}	1.36^{d}	0.48^{d}	0.37^{a}	0.12^{c}	0.92^{c}	0.11^{c}	0.006^{a}

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