



Levels of some heavy metals in cassava and plantain from farmlands in Kaani and Kpean in Khana Local Government Area of Rivers State.

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ABSTRACT: The concentrations of heavy metals (Ni, Zn, Cu, Pb and Fe) were determined in cassava and plantain from farmlands in kaani and Kpean Communities in Khana Local Government Area of Rivers State, Nigeria. Samples were collected, prepared, digested and analyzed using AAS. The levels of heavy metals obtained for cassava samples from Kaani were Ni (5.71 mg/kg), Cu (2.45 mg/kg), Fe (92.4 mg/ kg), Pb (6.57 mg/kg), Zn (9.64 mg/kg) and for plantain samples; Ni (4.31 mg/kg), Fe (59.8 mg/kg), Cu (1.89 mg/ kg), Pb (3.69 mg/kg), Zn (7.04 mg/kg) were recorded. The levels of heavy metals obtained for samples from Kpean were Ni (4.09 mg/kg), Cu (9.64 mg/kg), Fe (6.34 mg/ kg), Pb (13.44 mg/kg), Zn (0.22 mg/kg) for cassava and Ni (10.23 mg/kg), Cu (18.53 mg/ kg), Fe (30.50 mg/kg), Pb (39.18 mg/kg), Zn (9.25 mg/kg) for plantain. Results showed that the levels of these heavy metals Ni, Cr, Cu, Pb and Fe in these food crops were found to be relatively high when compared with FAO/WHO recommended values with crops from Kpean farms having higher values. The most essential element Zn was found to have values below the acceptable limits for cassava and plantain from both farmlands. © JASEM

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Introduction: The petroleum industry is by far the largest industrial sub sector in Niger Delta, at least six of the eight most polluting industrial sub-sectors in Nigeria namely steel works, metal fabrication, food processing, textiles, refineries and paint manufacturing operate in the Niger Delta. According to studies by Hart *et al.*, (2005), the concentration of trace metals, Pb, Fe, Cu, and Zn, were estimated in crops (Cassava, Cocoyam, Okro, Pumpkin and Water Leaf) harvested in an oil prospecting location in Rivers State, Nigeria and this study revealed higher concentration of Pb, with corresponding high levels of iron (Fe), copper (Cu) and zinc (Zn) in various food crops harvested at areas of high industrial activities compared to the non-industrialized area. The concentration levels of some heavy metals in tuber crops grown in farmland around Elelebu Oil flow station in Bayelsa state, Nigeria was investigated by Nkwocha *et al.*, (2010). These tuber crops (cassava, plantain and cocoyam) from both sites were analyzed, and the result obtained showed that the concentration of heavy metals analyzed (Fe, Zn, Cr, Cu, and Pb) in these food crops from oil polluted farmland (Site A) were higher than the permissible value by WHO. The samples from Site B (control) recorded concentration levels of these trace metals below detectable limits. The low

concentration value of these trace metals at site B, was an indication that petroleum activities at Site A were responsible for the pollution of the food crops. Similar studies carried out by Idodo – Umeh *et al.*(2010) revealed that heavy metal concentrations in cassava tubers and plantain fruits grown in petroleum impacted soil were significantly higher than the levels recorded in the same crops grown in non-impacted soils. Several other studies (Ndiokwere *et al.*, 2006, Kalagbor *et al.*2014, Echem, 2010) have shown that crops harvested from oil prospecting regions have higher levels of most heavy metals when compared to those from areas of non-oil exploration in the Niger Delta. Dietary intake is the main route of exposure for most people, although inhalation can play an important role in highly contaminated sites (Tripathi *et al.*,1997). Serious systemic health problems can develop as a result of excessive dietary accumulation of heavy metals such as Cd and Pb in the human body (Oliver 1997). Lacatusu *et al.*, (1996) reported that soil and vegetables polluted with Pb and Cd significantly contributed to decreased human life expectancy within the affected areas of Cospa Mica and Baia Mare in Romania reducing average age at death by 9 – 10 years. It has also been reported (Zhuang *et al.*, 2009) that the contaminated soil and food crops in the

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vicinity of Dabaoshan mine in Southern China has put the estimated dietary intakes of Pb and Cd from rice grains and food crops to exceed the tolerable daily intake limits in China, thus exposing the consumers to dangerous levels of Pb and Cd. When heavy metals are absorbed by plants which may serve as food and medicine to man and as forage to animals, they find their ways into the body system causing cancer and even heart disease (Corey et al, 1996). The high concentration of heavy metals in the soil is reflected by higher concentration of metal in plants and consequently in animals and human bodies. The crops which were under study (cassava and plantain) from Kaani and Kpean communities of Rivers State, are major staple food for the people of the Niger Delta in particular and for Nigerians at large hence, they are eaten in various forms. Contamination of the soil by some heavy metals through air, water and other sources whether natural or through human activities has found their way into the food chain. This study is therefore aimed at determining the levels of Ni, Zn, Cu, Pb and Fe in cassava and plantain crops harvested from these communities.

MATERIALS AND METHODS

Sample collection: All samples of cassava were harvested by uprooting the tubers from the farms.

The plantain samples were obtained by cutting down the mature bunches and random selections of the fruits for this study were made.

Sample Preparations: The cassava tubers after collection were peeled, sun dried, ground to fine flour and thereafter stored in clean white covered transparent containers. The same process was carried out for plantain,

Wet Digestion Procedure: 2g of each sample dried cassava and plantain were separately weighed out into separate beakers then, a mixture of trioxonitrate (V) acid and tetraoxochlorate (VII) acid in the ratio 4:1 was added to each sample and heated on a hot plate in a fume chamber until all the fumes were given off. The beaker was then allowed to cool.10ml deionized water was added and the contents of the beaker stirred and filtered using Whatman filter paper. The filtrate was transferred into a 50ml volumetric flask and made up to mark with more deionized water. The digested samples were analyzed using AAS.

RESULTS AND DISCUSSION

The result of the analysis of the levels of the heavy metals and their levels found in the samples of Cassava and Plantain are presented in Table 1.

Table I: Mean Concentration of heavy metals (mg/kg)

Metals	Kaani		Kpean	
	Cassava	plantain	Cassava	plantain
Ni	2.45	4.31	4.08	10.23
Zn	6.57	7.04	0.22	9.25
Cu	0.53	1.89	9.64	18.53
Pb	3.19	3.99	13.44	39.18
Fe	92.40	59.80	6.34	30.50

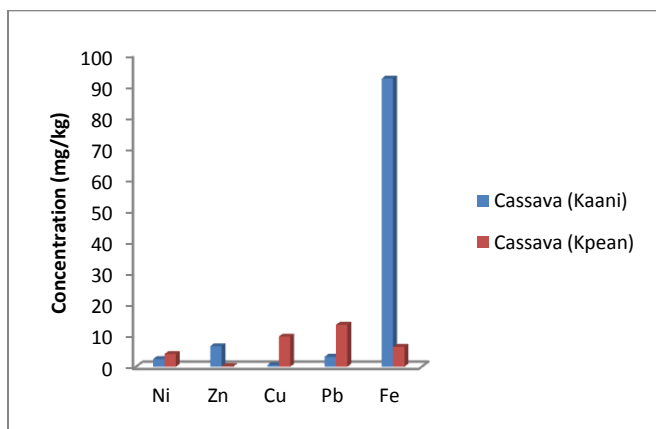


Fig. 1: The metal concentrations for cassava from Kaani and Kpean farms.

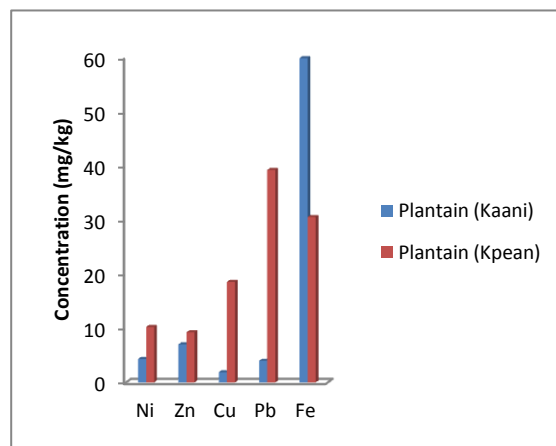


Fig. 2: The metal concentrations for plantain from Kaani and Kpean farms.

From the results obtained for Ni in this study, the cassava sample had lower concentrations of (2.45

mg/kg and 4.08 mg/kg) than the plantain samples (4.31 mg/kg and 10.23 mg/kg) with samples from

Kpean having the higher concentrations as shown in Table 1. Ni activates some enzymes function in the body but its toxicity at higher level has its effect in the blood and kidney. All the samples that were analyzed for Zn were below the acceptable limit of 99.40 mg/kg. Zn levels were from 0.22 mg/kg to 9.25 mg/kg. Zn is an essential trace element for humans; it is vital for many biological functions and plays a crucial role in more than 300 enzymes in the human body. Zn is needed for growth and it plays a vital role in fertility. In males, Zn protects the prostate gland from infection (prostates) and ultimate enlargement (prostatic hypertrophy). Zn deficiency in the body is worse than its toxicity. Concentration levels for Cu are the third highest for samples from Kpean farmlands (9.64 mg/kg and 18.53 mg/kg) for cassava and plantain respectively and the least for samples from Kaani (0.53 mg/kg and 1.89 mg/kg) for cassava and plantain respectively. Copper is essential in the body for good health. It helps prevent inflammation in arthritis and similar diseases but in high doses, it can cause anemia, liver disease and kidney damage. The results show that Pb concentrations for cassava are 3.19 mg/kg and 13.44 mg/kg for Kaani and Kpean samples respectively while the values from plantain are 3.99 mg/kg and 39.18 mg/kg. These values exceed WHO maximum acceptable limit of 0.1mg/kg. Therefore, there is risk of Pb poisoning from cassava and plantain harvested from these farmlands, and it is well established that exposure to high levels of Pb may cause kidney damage leading to renal failure (Laura *et al.*, 2009, Colgan, 2003). Such concentration of Pb in cassava and plantain and other trace heavy metals in general will particularly affect vulnerable populations including children (Wang *et al.*, 2006, Canfield *et al.*, 2003) and all exposed adults (Saraiva *et al.*, 2007). Pb is considered a potential carcinogen and is associated with etiology of a number of diseases especially cardiovascular diseases. All the crop samples analyzed for Fe were found to exceed acceptable limit at very high concentrations for samples from Kaani. Cassava has concentration level of 92.40 mg/kg and the plantain sample a concentration of 59.80 mg/kg. The cassava and plantain samples from Kpean have lower concentrations of 6.34 mg/kg and 30.50 mg/kg respectively. Fe is essential in the body and its benefits include carrying oxygen to human blood cells. About two-thirds of the body iron is found in hemoglobin. The benefit of iron correspond to proper growth of human body and maintaining robust health also to produce red blood cells but in very high amount causes vomiting, abdominal pain and liver enlargement.

Conclusion:The selected food crops (cassava and plantain) are staple food for the inhabitants of the study area and this study has revealed high accumulation of heavy metals by these edible food crops from the area of study which is also experiencing pollution activities. The concentration of heavy metals in cassava tubers and plantain fruits were significantly higher than the WHO maximum acceptable limit for food and this calls for serious health concern as heavy metals are bio accumulative in human organs and tissues and thus causing various diseases and disorders, if they are not properly controlled.

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