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DETERMINATION OF HEAVY METALS IN ROASTED PLANTAIN SOLD ALONG MAJOR ROADS IN LAGOS, SOUTH-WEST, NIGERIA

BY

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**ABSTRACT**

Determination of heavy metals in roasted plantain sold along major roads in Lagos, South west, Nigeria was investigated using Atomic Absorption Spectrophotometry method. Roasted plantains were randomly purchased without specific order from five vendors by the road sides from Agege, Iyana-ipaja , Oshodi, Ojodu-Berger and Ogba. All the samples were analyzed for levels of heavy contaminants such as Lead, Copper, Zinc, Arsenic, Cadmium, Iron, Chromium, Manganese, Aluminum and Potassium. The results showed that Lead ranged from 0.08-0.26mg/kg, Copper ranged from 3.27-7.57mg/kg while Zinc varied from 1.72-4.90mg/kg in all the samples. Iron ranged from 6.47-11.73mg/kg, Chromium ranged from 0.05-0.14mg/kg while Manganese varied between 0.09-0.35mg/kg. The level of Aluminum as revealed by the analyses ranged from 7.57-11.26mg/kg while Potassium varied between 5.72-8.63mg/kg. Food and Agricultural Organization/World Health Organization (FAO/WHO) for example had recommended an optimum levels of 0.2mg/kg (Lead), 0.02-0.38mg/kg (Copper), 0.04mg/kg (Manganese) and 0.05mg/kg (Cadmium) for foods. Therefore, this study has shown that most of the roasted plantains were contaminated with some of these heavy metals, indicating that consumers of this snack without being mindful of the health implication from the environment where it is obtained may be exposed to health risks associated with presence of metals.

Keyword: Plantain, roasted, major roads, heavy metals,

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**INTRODUCTION**

Plantain belongs to the genus *musa* of the family musaceae. Nearly all edible plantain cultivars are derived from two wild species, *Musa acuminate* and *Musa balbisiona* (*Robinson, 1996*). Plantain is a staple crop and important dietary source of carbohydrate in Nigeria and in humid tropical zones of Africa, Asia and South America (*Robinson, 1996*). Plantain is rich in vitamins A, C and B groups as well as minerals such as calcium and iron. Plantain provides between 9% and 35% of the total calories in the diet of more than 14 million people in Sub-Sahara Africa (*Robinson 1996; Marriot and Lancaster, 1983).*

Heavy metal is metallic element which is toxic and has high density, specific gravity or atomic weight. Examples of heavy metal includes lead, mercury, arsenic, zinc, cadmium e.t.c Less commonly, any metal with a potential negative health effect or environmental impact may be termed a heavy metal (*Anne,2014*). Foods like roasted plantain are generally consumed for several purposes aimed at growth, development and maintenance of good health. The contamination of foods by metals such as cadmium, manganese, copper, lead, chromium, mercury, zinc and nickel in areas with high anthropogenic pressure is widespread and is a major determinant of food quality (*Ejazul Islam et al., 2007*). Some of these contaminants especially the heavy metals, are cumulative poison that poses potential hazards and toxicity (*Jarup, 2003; Ellen et al., 1990*). The demand and supply of street foods is continually on the increase due to higher mobility status of people in the course of work. Therefore, this present work is aimed at determining concentration of heavy metals in roasted plantain sold along major road in Lagos State, south west, Nigeria and relating them to the permissible level as stipulated by Food and Agricultural Origination/ World Health Organization (FAO/WHO).

**MATERIALS AND METHODS**

Source of material;

Roasted plantain were purchased from five vendors each by the road sides from oko-oba,(Agege), Iyana-ipaja, oshodi, mushin and ogba in Lagos state. Samples were randomly purchased from different vendors five without specific order. The samples were stored at ambient temperature in sterile high density polyethylene bags, adequately labeled and transported to the Food Technology Department Laboratories, Federal Polytechnic, Ilaro, for analyses within two to three hours of purchase.

Experimental Procedures:

The determination of heavy metal was carried out using methods of *Oyelola et al., (2013).* All the samples were oven dried at 70 for 24hr, to remove all moisture. Dried samples were milled into a fine powder of 80µm. 1.0g of the dried sample was weighed into a digestion tube and 10 ml of 98% nitric acid was added. This was then placed in a water bath (Model KET-6-T, Toronto, Canada) and allowed to boil for about 72hours. The resulting pale yellow solution was made up to 25ml with de-ionized water for each sample and stored. The solutions were analyzed for heavy metals using a Flame Atomic Absorption Spectrophotometer (*AAS, Perkin Elmer Model 2130*). A certified standard reference material was used to ensure accuracy and the analytical values were within the range of certified value

Statistical Analysis:

Data obtained were analyzed using Analysis of Variance (ANOVA) to determine the difference in sample means and Duncans Multiple Range Test (DMRT) was used to separate means at p0.05 with Statistical Package for Social Science Version 16.0 for Windows (SPSS Inc. illions, USA)

**RESULTS AND DISCUSSION**

RESULT.

TABLE 1: DETERMINATION OF HEAVY METALS IN ROASTED PLANTAINS SOLD ALONG MAJOR ROADS IN LAGOS STATE, SOUTHWEST, NIGERIA.

PARAMETERS SAMPLES

(mg/kg) A B C D E

LEAD 0.08±0.07d 0.26±0.01a 0.20±0.03b 0.09±0.05d 0.14±0.01c

COPPER 4.73±0.03b 7.57±0.01a 7.06±0.11a 4.17±0.21b 3.27±0.01c

ARSENIC 0.32±0.06b 0.33±0.03b 0.42±0.03b 0.33±0.09b 0.29±0.21c

ZINC 3.94±0.71b 4.90±0.02a 2.43±0.02d 1.72±0.05e 2.93±0.06c

IRON 11.73±0.01a 8.70±0.0b 6.90±0.05d 7.37±O.12c 6.47±0.02e

CHROMIUM 0.08±0.09b 0.05±0.11c 0.14±0.03a 0.07±0.01b 0.05±0.01c

CANDMIUM 2.37±0.07a 2.06±0.01b 1.73±0.03c 1.33±0.05d 1.60±0.01c

MANGANESSE 0.22±0.03b 0.35±0.01a 0.18±0.11c 0.18±0.21c 0.09±0.01d

ALLUMINIUM 10.88±0.06b 10.50±0.03b 11.26±0.03a 10.23±0.09c 7.57±0.21d

POTASSIUM 7.88±0.09b 8.63±0.02d 6.52±0.02c 5.27±0.05d 6.23±0.06c

Values are mean± standard deviations of triplicate determinations. Values with different superscript in the same column are significantly different at p<0.05

A= Roasted plantain from Oshodi:

B= Roasted plantain from Ogba:

C= Roasted plantain from Agege;

D=Roasted plantain from Ojodu Berger;

E=roasted plantain from IyanaPaja

**DISCUSSION**

The results of heavy metals in roasted plantains sold along major roads in Lagos State, South West, Nigeria are shown in Table 1. There are several reported cases of heavy metals pollution especially, Lead, Iron, Nickel, Manganese, Arsenic, Chromium and Copper in Nigeria (*Dan Azuni and Bichi, 2010; Garba et al., 2010; Ibeto and Okoye, 2010*). Foods consumed in Nigeria may be a major source of heavy metal toxicity in human, especially the children (*Galadima et al., 2010*). The level of Lead from the Table 1 ranged from 0.08-0.26mg/kg for all the five samples under consideration. The concentration of Lead in all the samples was within the maximum permissible level of 0.2mg/kg recommended by *FAO/WHO (2007).* However, cases of lead poisoning especially among children in Nigeria are widespread. Exposure to Lead can cause mental retardation, coma and eventual death. Also, symptoms associated with Lead poisoning include constant headache, loss of appetite, vomiting, nausea, irritability and or behavioral problem (*Iweala et al., 2014*)

The level of Copper are: 4.73mg/kg,7.57mg/kg,7.06mg/kg,4.17mg/kg and3.27mg/kg for the samples. All the samples investigated showed higher level than 0.02-0.38mg/kg Copper tolerable limits exposure as recommended by *FAO/WHO (2007).* Even though, deficiency and toxicity of Copper are rare, chronic ingestion of high amounts of Copper may result in liver dysfunction and other negative adverse effects (*Brewer, 2010; Cockvell et al ., 2008*). Arsenic ranged from 0.29mg/kg-0.42mg/kg for all the samples. Nickel can cause respiratory problem and is a carcinogen (*Nico et al., 2012*). The permissible limit of Nickel in foods according to *FAO/WHO* standard is 0.5mg/kg *(FAO/WHO, 2007)*.

The levels of Zinc in all the samples varied between 1.72 and 4.90mg/kg. The Zinc in all the samples were higher than the tolerable limit recommended by *FAO/WHO(2007).* Zinc enters the air, water and soil as a result of both natural processes and human activities such as metal manufacturing and zinc chemical industries, domestic waste and run off from soil containing Zinc, disposal of Zinc wastes from metal manufacturing industries and coal from electric utilities. However, excessive absorption of Zinc can suppress Copper and Iron absorption (*Iweala et al., 2014*). The knowledge of Zinc toxicity in human is minimal and the most important information reported is its interference with Copper metabolism (*Barone et al.,1998*). The symptoms that an acute Zinc dose may provoke include tachycardia, vascular shock, dyspeptic and nausea, vomiting, diarrhea, pancreatitis and damage of hepatic parenchyma (*Salgueiro et al., 2000*).

Iron is an essential element required by all forms of life. In man, it is required for the synthesis of haem proteins and in many enzyme systems. The concentration of Iron ranged from 6.47 to 11.73mg/kg (*Magomya et al., 2013;Ogundiran et al., 2014)* However, Iron when taken in excess of requirement can be toxic. The least values of all these heavy metals were recorded on Chromium. The values ranged from 0.05 to 0.14mg/kg (*Nkwocha et al., 2011*). The health effect from exposure to Chromium are darmatis skin inflammation, chronic allergic reactant, asthma-like condition in lungs and respiratory tract lung cancer were carcinogenic infection.

Cadmium is one of the heavy metal that is of concern to human health in Nigeria as a result of its ease of contamination of foods (*Galadima and Garba, 2012*). Cadmium pollution is as a result of its use in alloys, pigments metal coating and batteries. (*Ladigbolu and Balogun 2011*). The Cadmium level in this work ranged from 1.33 to 2.37mg/kg. *FAO/WHO(1996)* has stipulated tolerable limits of 0.05mg/kg. High level of exposure to Cadmium are also associated with irritation of the eyes and respiratory passages, damage to brain, liver, bones, kidney, bronchitis, dermatis, emphysema, hypertension, rickets and asthma (*Galadima et al., 2010*). It is also associated with some cancer such as pancreatic cancer (*Luckett et al., 2012*).

The level of Manganese in all the samples under investigation ranged from 0.09 to 0.35mg/kg. All the roasted plantain samples had Manganese levels above 0.04mg/kg of FAO/WHO tolerable limits. Manganese is an essential micro nutrients but with potential for toxicity as very high levels (*Martine-Finley et al., 2013*). Neurological toxicity is usually due to long term exposure and is characterized by behavioral changes including slow movements, tremor, facial muscle spasms, irritability, aggressiveness and hallucinations. Manganese may be considered a new environmental toxic pollutant with potential consequences for public health (*Normandin et al., 2002*)

**CONCLUSION**

This study has shown high concentration of notable heavy metals such as Manganese, Copper, Zinc and Cadmium above tolerable limits stipulated by standard regulatory bodies. Therefore, consumers of roasted plantains displayed mostly on the roadsides in Lagos, South west, Nigeria with high level of metal contamination may be exposed to health risk associated with their presence.

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