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Full Length Research Paper

Assessment of Heavy Metal Residues in Stock Fish, Cray Fish and Consumable Vegetables Sold in Selected Markets in Enugu-State, South Eastern Part of Nigeria.

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Studies were carried out to determine the levels of selected heavy metals (Cd, Pb, As and Cu) in the consumable vegetables (curry, pumpking, green and scent leaves) and stock fish and Cray fish sold in two markets within Enugu Metropolis using atomic absorption spectroscopy after acid digestion with a mixture of Conc. HNO_3 and $HCL0_4$ in the ratio of 3:2. The general order of decrease of heavy metals in the vegetables samples were, Cu>As>Pb>Cd. Also the general order of decrease of heavy metals in the stock fish and Cray fish samples followed the same trends as in the vegetables. The mean heavy metal levels in the analyzed food items from the two markets were within permissible levels of safety recommended by W.H.O.

Keywords: Bioaccumulation, Heavy metals, Vegetables, Stock fish and Cray fish.

INTRODUCTION

Vegetable form one of the major percentage of human day to day diet today and this is not far from the fact that human beings wants to maintain good shape and proper body weight.

Vegetables as food sources constitute essential diet components by contributing Protein, Vitamins, Iron, Calcium and other nutrients which are usually in short supply [Harri *et al*., 2003]

They also act as buffering agents for acidic substances produced during digestion processes.

Vegetables take up metals by absorbing them from contaminated soils as well as from deposits on the different parts of the vegetables from polluted environments [Elbagermi *et al*., 2012]. It has been reported that nearly half of the mean ingestion of metals through food is plant originated [Hussain *et al*., 1995].

Also fish is a vital source of food for hundreds of millions of people worldwide. Consuming fish provides an important source of protein, poly unsaturated fatty acid, liposoluble vitamins and essential minerals which are associated with health benefits and animal growth [Bender,I 2003]. According to statistics, fish accounted for about 16% of global populations intake of animal protein and 6% of all protein consumed (FAO 2010b).

As fish constitute an important part of human diet, the quality and safety of these fishes from environmental pollutants are of health concern. Over the past decades, the concentrations of heavy metals in fishes have been extensively studied in various places around the world.

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Heavy metals are metal with specific gravity of between 5.0 to 6.0g/cm^3. They are metals with atomic weight between 65 and 129g/mol. Heavy metals have no known metabolic function in the body.

Commonly encountered heavy metals include chromum, cobalt, mercury, copper, lead, cadmium, arsenic, nickel and selenium (Reena *et al*., 2011). Heavy metals can enter into fish through the water they live in and their feeds.(Castro Gonzalez *et al*., 2008). Water which are usually home to fishes are contaminated by industrial wastes, from home, run off and release from storage.

Heavy metals are hazardous to man. The main threat to human health from heavy metals is associated with exposure to lead, cadmium, mercury and arsenic e.t.c (WHO, 2006). Heavy metals are cumulative poisons and causes damage to the Liver, Kidney, Lungs and central nervous system in the body. Some of them are cancerous while acute level of it can cause irritation, abdominal pain, headache and vomiting e.t.c (Chowdbury *et al*., 1987). The need to ascertain the levels of selected heavy metals in regularly consumable items and to assess the risk concern to the people of Enugu state necessitated the use of stock fish, Cray fish, scent, pumpking, green and curry leaves for this study. Copper, lead, cadmium and arsenic were selected for heavy metal assessment in the food items mentioned above.

MATERIALS AND METHODS

Sample collections

Twenty samples of Ugu leaves (*Telfaira accidentallis*), green leaves (*Amaranthus Hybridus*), scent leaves (*Ocimium grat issimum*) and curry leaves (*Murraya enigii*) were purchased from Emene market ,Enugu state. Ten samples of stock fish and cray fish were purchased at different points from Ogbete main market, Enugu state. The samples were placed immediately in poly ethene bags, put in separate containers and brought to the chemistry laboratory of project development institute (PRODA), Enugu for analysis.

Reagents and apparatus were prepared and used in accordance with AOAC standards. (AOAC, 2006).

Preparations of samples

The leaf samples were sun dried for about 72 hours in order to remove moisture. Both the dried leaves and fish samples were respectively grinded into powdery form using ceramic mortar. 1g of each grounded samples were weighed into separates beakers using electronic weighing balance.

10mls of a mixture of nitric acid and perchloric acid in the ratio of 3:2 were added to each beaker.

The samples were then heated to a temperature of 70^{o}C using water bath and hot plate for about 35-45 minutes for complete digestion of the samples. The solutions where allowed to cool to room temperature and then each solution was filtered and the filtrate diluted to a final volume of 100ml using deionized water.

Analysis: The digested samples were aspirated by atomic absorption spectrometer and analysed for heavy metal contents that is cadmium, arsenic, lead and copper. The concentration of the elements were automatically determined or directly recorded from the digital scale of AAS and displayed on the AAS screen in ppm (part per million). The atomic absorption spectrometer has cathode lamps which are used accordingly for each elemental determination.

However, blanks and standard solutions were prepared accordingly for the metal determination in AAS.

RESULTS AND DISCUSSION

The samples investigated for heavy metals are food items that supply essential nutrient and minerals for bio chemical functions in the human body.

For example, stock fish and Cray fish are used almost on daily basis for preparation of many diets that provides basic protein requirements in the body while the leaves apart from their rich vitamin, and mineral contents are also very medicinal (Harri *et al*., 2003)

Table1 showed that the mean levels of Cu in the leaf samples increased in the following order curry>green>pumpkin>scent leaves with mean values of 0.41± 0.035ppm, 0.317±0.055ppm, 0.204±0.008ppm and 0.147±0.071ppm respectively as shown in figure 1.

Also, the mean concentrations of Pb in the leaf samples decreased as follows: curry>green>scent>pumpkin leaves with mean values of 0.17±0.041ppm, 0.128±0.031ppm, 0.115±0.01ppm and 0.097±0.011ppm respectively.

The mean concentrations of As in the leaves samples decreased as follows; pumpkin >green>curry>scent leaves with mean values of 0.271+- 0.014ppm, 0.099±0.17ppm, 0.093±0.030ppm and 0.061±0.008ppm respectively.

The mean concentrations of Cd in the leaf samples decreased as follows: scent>grean>pumpkin>curry leaves with mean values of 0.104±0.028ppm, 0.069±0.023ppm, 0.068±0.007ppm and 0.044±0.016ppm respectively.

In the four heavy metals selected for analysis the order of accumulation in the leaf samples analyzed were quite different.

The use of fertilizer and different environments where these leaves were grown and harvested could have determined their respective heavy metal bio accumulation (Elbugrermi, 2012).

All the leaves analyzed accumulated heavy metals far

Table 1 Mean concentrations of the heavy metals in the leave samples from Emene market enugu state (ppm).

sample	Cu	Pb	As	Cd
Pumpking leaves	0.204± 0.008	0.097 ±0.011	0.271 ±0.014	0.068±0.007
Scent leaves	0.147±0.071	0.115±0.010	0.061±0.008	0.104±0.028
Grean leaves	0.317±0.055	0.128±0.031	0.099±0.017	0.069±0.023
Curry leaves	0.401±0.035	0.171±0.041	0.093±0.030	0.044±0.016
WHO STD	300	0.50	5.0	0.50

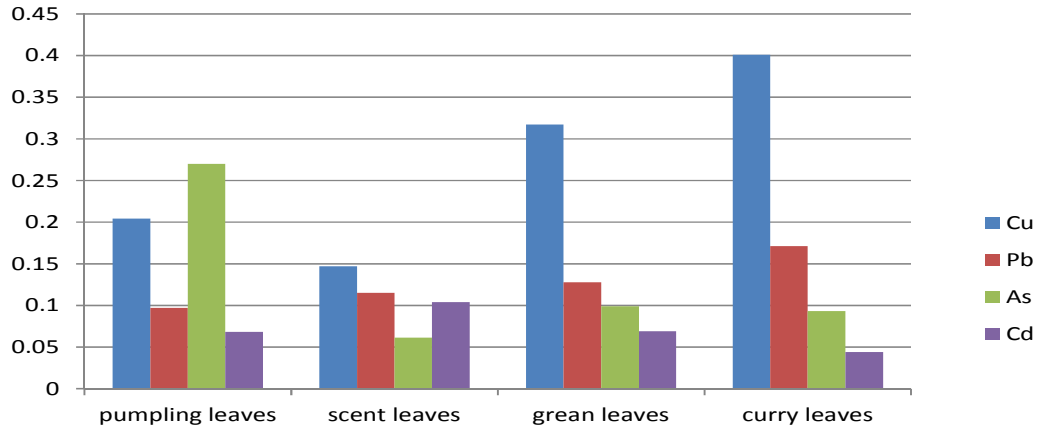

Figure 1 Bar chart representation of the mean concentration of heavy metals in consumable leaves from Emene Market Enugu state

Table 2 Mean concentrations of the heavy metals in stock fish and Cray fish samples sold in ogbete main market Enugu state.

Sample	Cu	Pb	As	Cd
Stock fish	0.178±0.023	0.192±0.023	0.250±0.017	0.102+-0.034
Cray fish	0.402±0.025	0.098±0.008	0.050±0.008	0.150±0.017
WHO STD	300	0.509	5.0	0.50

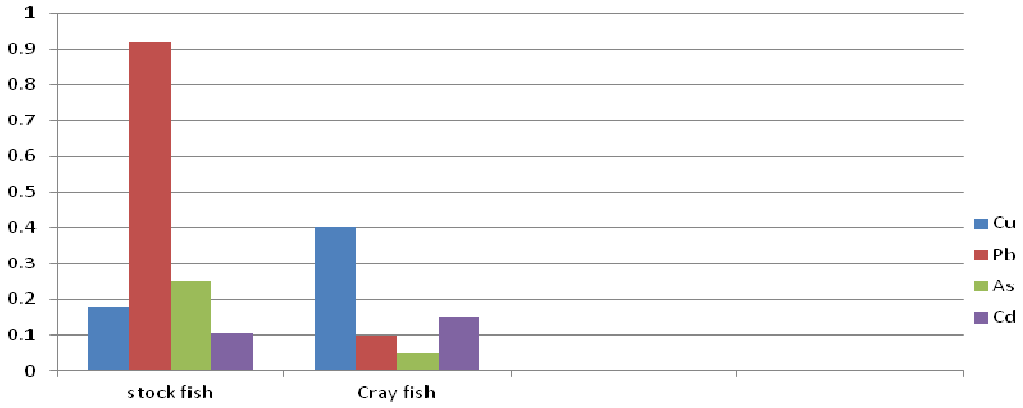

Figure 2 Bar chart representation of the mean concentration of heavy metals in stock fish and Cray fish sold in ogbete main market Enugu state

below the permissible levels recommended by WHO. To the inhabitants and the general public patronizing the markets for the analyzed food substances, that is good news.

Table 2 showed that the mean concentrations of Cu in the fish samples decreased as follows; Cray fish > stock

fish, mean values of 0.402±0.025ppm and 0.178±0.023Ppm respectively.

Figure 2 showed that mean concentrations of Pb in the fish samples decreased in the following order; stock fish > Cray fish, with mean values of 0.192±0.017ppm and 0.098±0.008ppm respectively.

The mean concentrations of As in the fish samples decreased as follows; stock fish> Cray fish, with mean values of 0.250±0.165ppm and 0.050±0.019ppm respectively.

The mean concentrations of Cd in the fish sample decreased in the following order; Cray fish> Stock fish, with mean values of 0.150±0.017ppm and 0.102±0.034ppm.

The analyzed heavy metals in the fish samples were within the permissible levels of safety set for each of the metals by WHO. The mean values of 11.38±0.350ppm 2.88± 0.17ppm and 4.02±0.60ppm for Cu, Pb and Cd respectively obtained by (Mohammed etal., 2012) in spinach leaves in eastern district of Saudi- arebia markets were higher than that reported for the leaf vegetable in this research.

CONCLUSION

From the analysis, cadmum arsenic, copper and lead were found present in all the food samples (stock fish, Cray fish, pumpkin, Scent, curry and green leaves) sourced from two markets (Emene and Ogbete) in Enugu state, south eastern part of Nigeria.

The mean levels of the heavy metals in the analysed food substances sold in the markets were below the maximum permissible levels recommended for the metals by WHO.

The analysis showed that the heavy metals in the food items are within safe limits for consumption by the people.

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