HEAVY METAL LEVELS IN ROOTS AND LEAVES OF SOME VEGETABLES GROWN IN ILARO, YEWA SOUTH L.G.A. OGUN STATE

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ABSTRACT

Four metals of environmental concern were analyzed. This study is aimed at determining levels of heavy metals in some vegetables grown in Ilaro. The levels of Pb, Co, Cr, and Fe were determined in the roots and leaves of spinach (Amaranthus caudatus), groundnut (Arachis hypogaea), and beans (Phaseoulus Vulgaris) grown in Ilaro Ogun State, Nigeria and in soil where the vegetables were grown, using FAAS techniques. The results revealed that heavy metals were higher in the roots than the leaves in all the vegetables investigated and that the levels of the heavy metals were higher in the soil samples than the vegetables. For instance 0.75mg/kg of Cr and 0.55 mg.kg of Cr were obtained in the leaves and roots of groundnut, respectively. The heavy metals levels in the soil samples ranged from 0.33mg/kg of Pb to 4.48 mg/kg of Fe. The order of contamination of the heavy metals in both the soil and vegetable samples were; Fe>Co>Cr>Pb. It could be concluded that spinach, groundnut and beans obtained in Ilaro contained Co, Cr, Pb, and Fe in variable concentrations due to different farming activities such as application of fertilizers and irrigation with waste water. The heavy metal levels were lower than the WHO maximum limit of the heavy metals in plants. Hence the vegetables are considered safe for consumption.

Key words: FAAS, fertilizers, Ilaro, heavy metals, vegetables, waste water.

INTRODUCTION

Heavy metals are sometimes called “trace elements” they are those transition metals having high relative atomic masses between 53.546 and 200.590, with specific gravity greater than 4.0g/cm^3 {APHA,1992}. Living organism requires some among of trace elements such as iron, Lead, Cobalt and Chromium, but in excess they may be toxic. Heavy metals contamination is a general term use to describe a condition in people having abnormally high levels of toxic metals in their body. Common ones are mercury, Lead, Cadmium, Chromium, Nickel, Cadmium and Arsenic. This contamination can be very real, detrimental to health and deadly. Contaminations of plants by heavy metals are common. Some occur as a result of untreated water used for irrigation, unapproved usage of chemicals, and other as a result of combustion and discharging of fossil fuel from industries, vehicles and other machineries to the soils. Discharging of sewage sludge and animals wastes are all sources of heavy metals contamination of soils and plants {Bokhari and Ahmed, 1985}. Continue eating of crops that contain levels of heavy metals may cause serious health problems. Even though more researches and investigation have been conducted about the effect of heavy metals in different vegetable crops, there is still a lot of work to be done, considering the importance of vegetables to human health. Various classes of vegetables are grown and consumed as food in different parts of Ogun State {FAO/WHO, 2001}. These crops are often irrigated with all forms of available wastewater considering the drying nature off the area and to enhance increase productivity, fertilizers and other chemicals are occasionally applied. This study is aimed at determining the levels of Iron, Cobalt, Lead and Chromium in the roots and leaves of spinach, groundnut and beans grown in Ilaro, as well as determining the concentrations of the heavy metals in the soils where the vegetables are grown.

MATERIALS AND METHODS

SAMPLES AND SAMPLING

The samples (soils, as well as roots and leaves of Spinach, groundnut and beans) were collected in March 2011. Samples were randomly collected from three (3) different vegetable farms in Ilaro. The samples were collected using the techniques by (EC/UN-ECE, 1995). Samples were collected in the March 2011. The samples were homogenized to obtain representative samples. The samples properly labeled and transported to the laboratory in clean polythene bags for analyses.

DIGESTION OF SAMPLES

Soil and sliced vegetable samples were dried in an oven at 105^0C for 24h until they were brittle and crisp (Kabata-Pendias and Pendias, 1985). A portion (2g) of dried, disaggregated and sieved plant and soil samples were placed separately in $100cm^3$ Teflon beakers and then digested with $1cm^3$ concentrated nitric acid and $10cm^3$ hydrochloric acid at 550^0C for about 3 hours. The digests were filtered into a $100cm^3$ volumetric flask {Kennish et al., and EC/UN-EC, 1995}. Levels of Fe, Co, Pb and Cr in the vegetable and soil samples were determined using an SP 1900 Pye Unicam Atomic Absorption Spectrophotometer (AAS).

RESULTS AND DISCUSSION

Levels of the heavy metals obtained in the vegetables and soil samples are shown in table 1.

Table 1: Heavy metals levels (mg/kg) in soil as well as in the roots and leaves of some vegetables obtained in Ilaro, Ogun State.

Vegetables / Soil	Heavy metals (mg/kg)			
	Co	**Cr**	**Pb**	**Fe**
Groundnut				
Leaves	ND (ND)	0.55±0.005 (0.52-0.55)	ND (ND)	1.78±0.005 (1.76-1.80)
Roots	0.83±0.005 (0.82-0.84)	0.75±0.005 (0.73-0.76)	ND (ND)	2.44±0.005 (2.43-2.44)
Beans				
Leaves	0.45±0.002 (0.44-0.45)	0.17±0.0.01 (0.16-0.19)	ND (ND)	1.45±0.00 (1.44- 1.46)
Roots	0.77±0.005 (0.75-0.78)	0.47±0.00 (0.46-0.48)	0.07±0.00 (0.06-0.08)	2.54±2.52 (2.52-2.55)
Spinach				
Leaves	0.17±0.00 (0.16-0.18)	0.21±0.005 (0.20-0.23)	ND (ND)	1.39±0.01 (1.38-1.40)
Roots	0.45±0.005 (0.44-0.47)	0.34+0.005 (0.32-0.35)	0.04±0.00 (0.03-0.05)	1.51±0.005 (1.50-1.52)
Soil	1.04±0.005 (1.02-1.05)	0.86±0.00 (0.85-0.87)	0.33±0.00 (0.32-0.34)	4.48-0.005 (4.46-4.49)

Note: The mean values were calculated in triplicate

From the results, Fe with 2.54±0.001mg/kg was found to be highest in the roots of the Beans. Similarly, Fe 1.3±0.01mg/kg was found to be the least in the leaves of Spinach. The concentration of Fe in the soil was 4.48±0.005 mg/kg which was the highest in the soil. The concentrations of the other heavy metals were equally higher in the soil than in the vegetables, with the heavy metals concentration higher in the roots than the leaves of the vegetables. The results were in agreement with previous studies. Pb was not detected in groundnut as well as in the leaves of beans. Similarly, Co was not detected in the leaves of groundnut. The heavy metals levels in the soil samples ranged from 0.33±0.00 mg/kg of Pb to 4.4 mg/kg of Fe. The order of contamination of the heavy metals in both the soil and vegetables were: Fe>Co>Cr>Pb. It could be concluded that Spinach, groundnut and beans obtained in Ilaro, Ogun State contained Co, Cr, Pb, and Fe in variable concentrations due to intensive and different farming activities such as application of fertilizers and irrigation with waste water.

CONCLUSION

Spinach, groundnut and beans samples obtained in Ilaro contained some heavy metals (Co, Cr, Pb and Fe) in variable concentrations due to intensive and different farming activities such as application of fertilizers and irrigation with wastewater in the area. The heavy metal levels were higher in the soil than the vegetable samples. Similarly, the concentrations of the heavy metals were higher in the roots than the leaves in all the vegetables. The levels of heavy metals under study in the vegetables were lower than the published threshold values considered toxic for mature plant tissues as well as the critical value or values regarded as excessive. The values considered as toxic are: 10 to 200 mg/kg for Fe and 30 to 300 mg/kg for Pb {Opeland, 2000}.While the critical values or values regarded as excessive are Fe: >200-500 mg/kg and Pb:>4-30 mg/kg {Rodojevic and Bashkin,1990}. The heavy metal levels were also lower than

the WHO maximum limit (ML) of heavy metals in vegetables. The WHO maximum limits (ML) of some metals in vegetables are Pb, 0.3mg/kg; Zn, 100mg/kg; Cd, 0.1mg/kg: Mn, 500mg/kg; Fe, 425 mg/kg; Cu, 73 mg/kg; Ni, 67mg/kg and Co, 50 mg/kg {USEPA, 1996}. The consumption of these vegetables as food may not constitute possible health hazards to humans and animals at the time of the study.

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