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Assessment of Heavy Metals on Soil and Two Varieties of Vegetables in Ibadan Metropolis

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Abstract:

Green leafy vegetables (GLVs) are important part of diets in the south-west region of Nigeria. In this investigation, the concentrations of some heavy metals Mn, Zn,Cu, Pb, Cd and Ni in both the soil and selected vegetables (shoots) grown in four major area (Apete, Oojo, Airport and Odo Ona in Ibadan, Nigeria were assessed using atomic absorption spectrophotometer. The results of the analysis of the two selected vegetables in all the four locations showed that Amaranthus had the highest concentration of Mn (190.52 mg kg^{-1}) at Apete, the lowest concentration was observed at Oojo with a value of (3.43 mg kg^{-1}), Similarly, highest concentration of Mn (173.53 mg kg^{-1}) was observed at Oojo while the lowest concentration of all the metals in celosia was Ni (4.12 mg kg^{-1}) at Odo Ona. Cadnium and Lead were not detected in the vegetable samples just as it was observed in soil samples across the four locations. Generally, the concentration of these metals are in the order of Zn > Mn > N > Cu in all the soil samples *from the four locations investigated in this study. The study concluded that atmospheric depositions and marketing systems of vegetables play a significant role in elevating the levels of heavy metals in vegetables having potential health hazards to consumers of locally produced foodstuffs.*

Key words: leafy, metals, gastro-intestinal, vitamins and vegetables

INTRODUCTION

Vegetables constitute an important part of the human diet since they contain carbohydrates, proteins, vitamins, minerals as well as trace elements. The contamination of vegetables with heavy metals due to soil and atmospheric contamination poses a threat to its quality and safety. Dietary intake of heavy metals also poses risk to animals and human health. High concentrations of heavy metals (Cu, Cd and Pb) in fruits and vegetables were related to high prevalence of upper gastrointestinal cancer (Turkdogan *et al.,* 2003). Cultivation areas near highways are also exposed to atmospheric pollution in the form of metal containing aerosols. These aerosols can be deposited on soil and absorbed by vegetables, or alternatively deposited on leaves and fruits and then absorbed. High accumulation of Pb, Cr and Cd in leafy vegetables due to atmospheric depositions has been reported by (Voutsa *et al.,* 1996).

Heavy metal contamination of vegetables cannot be underestimated as these foodstuffs are important components of human diet. Vegetables are rich sources of vitamins, minerals, and fibers, and also have beneficial anti oxidative effects. However, intake of heavy metal-contaminated vegetables may pose a risk to the human health. Heavy metal contamination of the food items is one of the most important aspects of food quality assurance (Khan *et al*., 2008). Emissions of heavy metals from the industries and vehicles may be deposited on the vegetable surfaces during their production, transport and marketing. (Al Jassir *et al.*,. 2005), The prolonged consumption of unsafe concentrations of heavy metals through foodstuffs may lead to the chronic accumulation of heavy metals in the kidney and liver of humans causing disruption of numerous biochemical processes, leading to cardiovascular, nervous, kidney and bone diseases (Jarup, *et al.*, 2003). Researchers have also stressed that these metals could bio accumulate in crops, especially when cultivated along construction sites and are consumed by man and livestock (Tulonen *et al.*, 2006). Human exposures to heavy metals have been the focus of increasing attention among researchers, health and nutrition experts due to their impact on public health (Tulonen *et al.*, 2006).

MATERIALS AND METHOD

Study area

Soil and freshly harvested leafy vegetables at eight weeks after planting (Celosia and Amaranthus) were collected from four different locations Apete, Oojo, Airport and Odo Ona in Ibadan metropolis, Ibadan. Nigeria

Sample collection

The soil samples were collected and brought back to the laboratory, air dried, crushed with porcelain mortar and pestle and passed through 2 mm mesh size sieve and were stored at room temperature before analyses (Sharma *et al.*, 2009). Vegetables were selected from the four different locations on each site and were transported to the laboratory. Edible parts of the selected vegetables were washed and air dried, and then oven dried at a temperature of 65°C for 24 hours. After drying, the samples were pulverized into fine powdery form for the analysis. The atomic absorption spectrophotometer was used to quantify the metals in the soil and vegetables.

RESULTS AND DISCUSSION

Assessment of Heavy Metals on Soil Samples

The heavy metal concentration in soil from Apete, Oojo, Odo – ona and Airport are presented in figure 1 below. In the location assessed there is the presence of Manganese, copper, zinc and nickel while there was no presence of cadmium and lead. In all the metals detected, Mn appear to be most abundant in all the four locations except in Apete (426.21 mg kg^{-1}). Zinc was second in ranking with highest concentration in Apete (60.11 mg kg^{-1}), while the lowest concentration was observed in Oojo (29.14 mg kg^{-1}). Highest concentration of Ni was observed in soil from Odo-ona (32.58 mg kg^{-1}) while the lowest concentration of (11.21 mg kg^{-1}) was observed in Apete. Similarly, soil from Odo - ona also gave the highest Cu concentration (20 mg kg^{-1}) while the lowest concentration was observed in Oojo soil. However, Cd and Pb were not detected in all the soils from these four locations.

Generally, the concentration of these metals are in the order of Mn > Zn > N > Cu in all the four locations investigated in this study. It is important to note also that apart from Ni, all other trace element is required by both plants and animals, though in small amounts. Apete had the highest concentration of zinc and the least concentration in nickel.

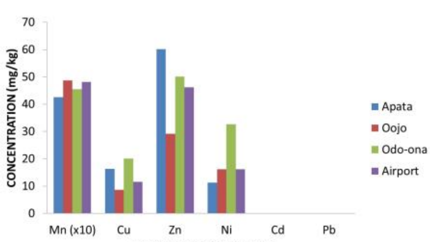


Figure 1: Assessment of heavy metals in soil samples

Assessment of Manganese content in vegetables samples

The manganese content concentration in the two vegetables assessed at different location as shown in the figure 2 below. Amaranthus vegetable recorded a higher concentration (190.52 mg kg^{-1}) than in Celosia in Apete, Odo-ona and Airport while the lowest concentration of (89.23 mg kg^{-1}) was observed at Airport. Celosia vegetable had a higher concentration at Oojo (173.53 mg kg) while the lowest concentration of (49.51 mg kg^{1}) was observed at Airport.

Assessment of Copper content in vegetables samples

The copper content concentration in the two vegetables assessed at different location as shown in the figure 3 below. The concentration of copper in Celosia are in the following order Apete > Odo Ona > Airport > Oojo, the concentration ranged from (12.13 mg kg^{-1}) in Apete to (4.41 mg kg^{-1}) in Oojo .The concentration of Cu in Amaranthus shows the highest concentration was observed in Amarathus grown at Apete (9.53 mg kg^{-1}) while the one grown at Oojo had the lowest value of (3.43 mg kg^{-1})

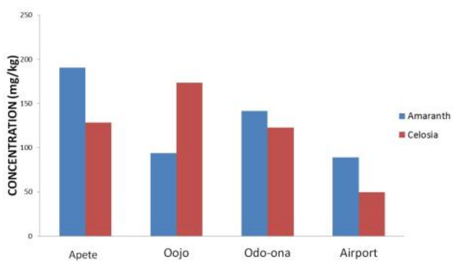
Assessment of Zinc content in vegetables samples

The zinc content concentration in the two vegetables assessed at different location as shown in the figure 4 below. The concentration of zinc was higher in the Amaranthus had the highest concentration at Airport (82.84 mg kg^{-1}), this is followed by Odo ona (80.10 mg kg^{-1}), Apete (53.12 mg kg^{-1}) while Oojo had the lowest concentration of (37.75 mg kg^{-1}).

In contrast, celosia from Apete gave the highest concentration of Zn (43.55 mg kg^{-1}) while the lowest concentration was observed in celosia from Oojo just like in Amarathus. There is an indication that Amaranthus may be a good hyper – accumulator of Zn going by the results from these four locations.

The concentration of nickel was highest in Celosia at the Airport location while the least concentration was recorded in Odo-ona location. The concentration was also higher in Apete location. There was equal concentration in the two vegetables at Oojo location.

The nickel content concentration in the two vegetables assessed at different location as shown in the figure 5 below, the results shows that celosia had the highest concentration of Ni at Airport while the Amaranthus had the lowest (7.54 mg kg^{1}). At Oojo, both Amaranthus and celosia had the same concentration of Ni. Similarity at Apete Celosia had the same concentration of Ni just as in Oojo but Amaranthus at the location had (7.55 mg kg^{-1}) Odo-Ona location gave the lowest concentration of Ni in Celosia (4.12 mg/kg^{-1}) except in Amaranthus that is greater than that of Apete. Generally, Ni concentration in Amaranthus follows the order Airport,> Oojo >, Odo-Ona> Apete. However, in Celosia Airport >, Oojo >, Apete >, Odo-Ona.



Location

Figure 2: Manganese content in vegetable at different location

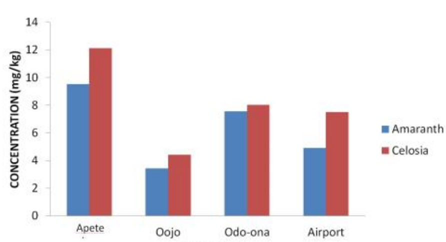


Figure 3: Assessment of Copper content in vegetables at different location

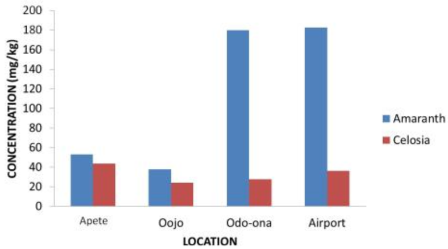
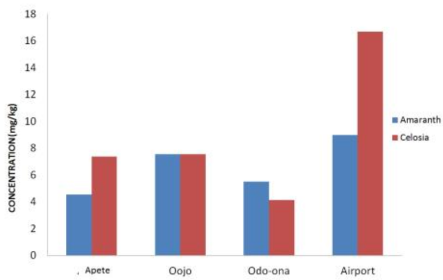


Figure 4: Assessment of Zinc content in vegetables at different location



CONCLUSION

The concentration of these metals are in the order of Mn > Zn > N > Cu in all the soil samples from the four locations investigated in this study. It is important to note also that apart from Ni, all other trace element is required by both plants and animals, though in small amounts.

The results of the analysis of the two selected vegetables in all the four locations showed that Amaranthus had the highest concentration of Mn at Apete, the lowest concentration was observed at Oojo. Similarly, highest concentration of Mn was observed at Oojo while the lowest concentration of all the metals in celosia was Ni at Odo Ona. Cadnium and Lead were not detected in the vegetables.

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REFERENCES

Al-Jassir, M. S., Shaker, A. and Khaliq, M.A., Deposition of heavy metals on green leafy vegetables sold on roadsides of Riyadh city, Saudi Arabia. Bull. Environ. Contamination Toxicol., 75: 1020-1027, 2005.

Jarup, L., Hazards of heavy metal contamination, British Medical Bulletin 68, 167-182, 2003.

Khan, S., Cao, Q., Zheng, Y. M., Huang, Y. Z. and Zhu, Y. G., Health risks of heavy metals in contaminated soils and food crops irrigated with wastewater in Beijing, China. Environmental Pollution 152(3):686–692, 2008.

Türkdogan, M.K., Fevzi, K., Kazim K., Ilyas, T. and Ismail, U., Heavy metals in soil, vegetables and fruits in the endemic upper gastrointestinal cancer region of Turkey. Environmental Toxicology and Pharmacology 13:175–179, 2003.

Voutsa, D, Grimanis, A and Samara C., Trance Element in vegetable grown in industrial area in relation to soil and air particulate matter Environmental Pollution, 94, 325-335, 1996.