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Research Article

Human Health Implications of Waste Dump Cultivated Vegetables in Anyigba, Kogi State, Nigeria

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Abstract: The study is purposely to determine the level of heavy metals in vegetables cultivated on waste dumps and seek its implication on the health of its consumers. Many of these waste dump sites have been converted to agricultural sites particularly for the cultivation of vegetables, to achieve both dietary and economic advantages. Farmers are taking advantage of the positive crop yield effect of these dumpsites. However, there are fears about the possible hazards of the consumption of such crops because of the presence of heavy metals. *Amaranthus caudatus* vegetables grown on an abandoned dumpsite and an adjacent plot were sampled and subjected to laboratory analysis to determine the levels of heavy metals. The result indicated a slightly higher presence of heavy metals in the adjacent plot, 7.27, 6.53 and 0.72 ppm for Fe, Zn and Cu respectively compared to the abandoned dumpsite where 7.10, 5.37 and 0.58 ppm respectively were recorded for the same elements; the values of the heavy metals were found to be within acceptable limits for human consumption. Although, it has been revealed that consumption of the vegetable may be safe in the short run; constant check must be made on the quality of the crop to avert possible human health hazards as a result of possible build up of the heavy metals due to mineralization.

Keywords: Dumpsite, heavy metals, urban wastes, vegetables, waste disposal

INTRODUCTION

Of the many problems associated with urbanization in especially sub-Saharan Africa, waste management crisis has assumed an important position. Today, waste disposal had became an acute problem in numerous urban centres across Africa (Pasquini and Harris, 2005), with formal waste collection ranging from 11 to 44% for households in cities such as Accra, Kinshasha, Lagos, Ibadan, Kaduna and Enugu (Pasquini and Harris, 2005) Nigeria has an enormous waste management problem and all over the country, there are examples of unsanitary open dumps and industrial contaminations which are continuously discharged into streams and rivers without treatment (Agunwamba, 1998).

The problem posed by poor management of solid waste in urban areas of Nigeria has been documented (Ayeni, 1978; Adedibu, 1983, 1986, 1994; Ayoade, 1983; Onorkhoraye, 1985; Mabogunje, 1988; Omuta, 1988; Musa, 2006). Urban waste crises in Nigeria can be ascribed to factors like rapid increase in urban population, heavy consumption pattern of urban dwellers and inefficiency of the authorities whose statutory responsibilities are to manage refuse in the cities. Consequently, dumpsites have become prominent and permanent features of almost all urban areas in Nigeria. The wastes consists of garbage from households, markets and small scale industries and simply dumped, rarely incinerated or burnt in the open (Ezeaku *et al*., 2003). Municipal solid waste disposal problems are becoming the most embarrassing environmental problems staring the nation today, as dumpsites are now being sadly used as landmarks and reference points for traveling directions (Aina, 1994).

Dumpsites are now becoming permanent features of the urban landscape in the country; the sites in some locations are being converted into cultivated fields or locations from where farm manure could be obtained. This certainly is expected since for long soil has been recognized to be an important medium for organic waste disposal (Loughry, 1973; Smith *et al*., 1996) and today, the composted urban waste is added to improve its fertility and as well crop yield (Garcia *et al*., 2000) as compost is rich in organic matter and serves as an important nutrient for plants (Garcia-Gomez *et al*., 2003). However, it may increase the level of potentially harmful trace metals and various persistent organic toxins (Ezeaku *et al*., 2003; Garcia *et al*., 2000).

Consumption of contaminated food through consumption of plants cultivated on contaminated soil or indirectly through consumption of milk or meat from a grazing animals that have injected contaminated plants or soil can transfer the contaminant to man. Other health hazards associated with the use of polluted water, soil, plants include; diarrhea, cholera, intestinal

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worms and typhoid fever. Agriculturalists are much worried about the pollution especially the entry of the toxic elements into food chain. Among the different polluting elements, heavy metals create serious problem whenever they get accumulated into the environment (Abubakar, 2007).

Anyigba is one of the rapidly growing urban areas in Kogi state, not just because it houses a University, but because for long it has served as an important commercial center linking most eastern and central parts of the country. Of the many dumpsites in the town, the one in the central part (at Obeya-Ojesa) is not only the biggest, but has over the years been partly converted into a site for agricultural activities particularly for the growth of amaranthus. The farmers there are resorting to this upon recognition of the positive effects of the site on crop yield. In fact, most of the commercial *Amaranthus* vegetable consumed in the town is produced on and around that site. There is therefore every reason to be concerned about the public health implications of this practice since crops grown on dumpsites typically immobilize heavy metals which eventually could find ways into human beings through the food chain processes (Okoronkwo *et al*., 2005; Segura-Munoz *et al*., 2006).

The objectives of this study are to:

(i) Determine the levels of some heavy metals (Pb, Cd, Zn, Cu, Mn, Fe, Al, As) in crop samples from the dump site and an adjacent site
(ii) Compare the results obtained from (i) above with other works to determine the safety level
(iii) Make recommendations on the consumption of *Amarathus caudatus* from the study site.

DESCRIPTION OF STUDY AREA

Anyigba lies between latitude 7°15" N and 7°29" N and longitude 7°11" E and 7° 32" E with an altitude of 420 m above sea level (Fig. 1). It has a population of about 71,327 and a growth rate of 3.25%. The town falls within the tropical wet and dry (Aw) climatic region and the guinea savanna, with mean annual temperature of 25°C and rainfall of 1600 mm. It is situated on the sedimentary formation of the Anambra basin and dominated by lateritic soil type with patches of hydromorphic and rich loamy soils.

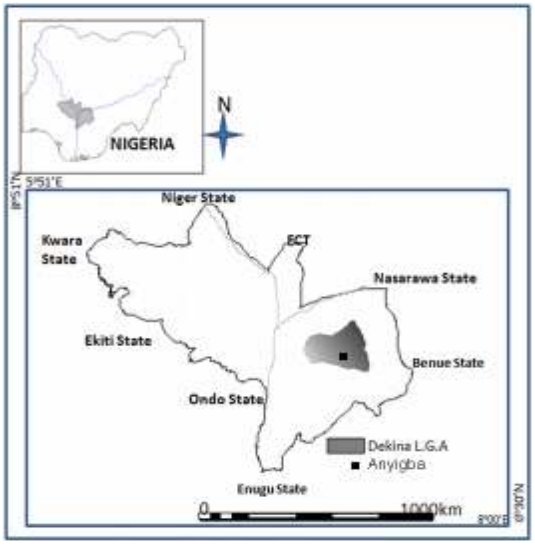

Fig. 1: Nigeria showing the study area Anyigba

MATERIALS AND METHODS

Six plots measuring approximately 4 m^2 were established on both the waste dump and control sites and on each *Amaranthus caudatus* crop was planted. All the plots were fenced to protect them from any external influence (such as by grazing animals or fresh waste dump). Planting, weeding and harvesting were done manually and neither fertilizer nor manure or any external soil fertility input was applied. At the end of the growing season, the cultivated crops were harvested by cutting all the edible parts (the stalk and leaves). The harvested samples were adequately marked and labeled and transported to the laboratory for analysis.

The plant tissue were analysed for the presence of heavy metals using the wet digestion method. The Atomic Absorption Spectrophotometer (AAS) was used to read the extracts from the samples.

RESULTS AND DISCUSSION

Iron (Fe) and Zinc (Zn) were discovered to be the most predominant elements in the study area as they show higher mean values, 7.27; 7.10 and 6.53; 5.37 ppm respectively, on both the Adjacent plot and dumpsite relative to the other elements (Fig. 2). Fe is an abundant nutrient element required by plants and humans and its toxicity is not common. Over concentration of Zn, on the other hand, kills or stunts plants, minimizing possibilities for poisoning of animal and humans consuming them. The mean values reveal that the adjacent plot recorded absolutely higher figures in all the elements, these points to the fact that there are higher heavy metals content on the adjacent plot.

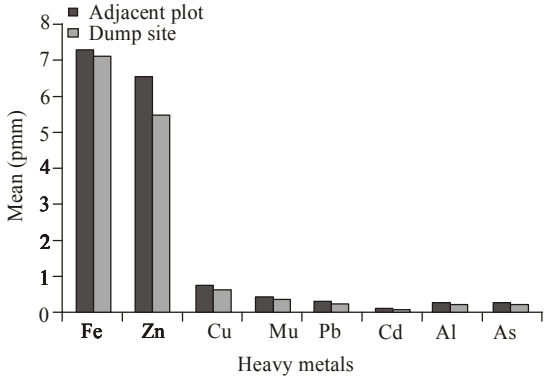

Fig. 2: Mean values of selected metals in plants of the dump site and adjacent plot

Table 1: Range of some selected metals determined for plants of the dump site and adjacent plot

	Adjacent plot	Dump site
Heavy metals	Range (ppm)	Range (ppm)
Fe	6.00-9.20	6.30-7.90
Zn	4.00-8.60	4.40-6.40
Cu	0.55-0.90	0.60-0.75
Mn	0.37-0.50	0.35-0.46
Pb	0.22-0.36	0.25-0.31
Cd	0.06-0.10	0.05-0.08
Al	0.23-0.33	0.22-0.30
As	0.21-0.34	0.13-0.28

Laboratory analysis (2008)

Table 2: Comparison of mean values of elements investigated with other works within acceptable limits

Heavy metals (ppm)	Adjacent plot	Aiwonegbe and Ikhuoria (2007)	Tudunwada *et al*. (2007)
Fe	7.27	13.97	3.620
Zn	6.52	5.93	1.704
Cu	0.72	-	3.750
Mn	0.44	-	3.296
Pb	0.29	0.13	1.476
Cd	0.07	0.12	-
Al	0.29	-	-
As	0.27	9.30	-

However, this conclusion must be drawn with some caution because the higher values of metals on the adjacent plot are ascribable to the higher range of the elements (Table 1).

Table 2 shows a comparison of the mean values of the various elements with values obtained in other related works that are within acceptable limits for human consumption. Apart from Al which was not investigated by any of the researchers, other elements were found to compare favorably with the other results. Fe was discovered to have a mean value (7.27 ppm) which falls below (Aiwonegbe and Ikhuoria, 2007) but higher (Tudunwada *et al*., 2007). While Zn and Pb recorded higher values than the other works, Cu, Mn, Cd and As had lower values.

All elements are found to be within tolerable limits and therefore pose no danger to human health. The higher metal values recorded on the adjacent plot appears a misnomer against the background that the metals are generated on the dump site, however, lateral underground movement and over land flow of water during rainy season have been suggested as the possible causes of higher metals on the adjacent plot.

CONCLUSION

The growth in the consumption and cultivation of vegetables underscores the importance of the crop. The increased production particularly on dumpsites raises some worry over the safety of the crop for consumption. The result obtained from this work revealed that the vegetables from the study site are suitable for human consumption. However, constant check on the level of heavy metal must be ensured to monitor the level of heavy metals in the soil to prevent possible build up of metals in soil and plants due to mineralization.

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