HEAVY METALS IN AMARANTH GREEN LEAVES (*Amaranth hybridus L.*) AND WATER LEAVES (*Talinum fruticosum*) HARVESTED FROM FARMLANDS AROUND DANGOTE CEMENT PLANT IBESE OGUN STATE NIGERIA.

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Abstract

Concentrations of heavy metals (Fe, Cu, Cd, Cr, Pb) in amaranth green leaves (Amaranth hybridus L.) and water leaves (Talinum fruticosum) were examined. The concentration of these metals was determined using standard laboratory procedures using an atomic absorption spectrometer. The result showed a high level of heavy metal concentration in the order of Fe (10.23 mg/kg) > Cu (4.65 mg/kg) > Cd (2.42 mg/kg) > Pb (0.08 mg/kg) > Cr (0.06 mg/kg) in amaranth green leaves (Amaranth hybridus L.) when compared with heavy metal concentration detected in the water leaves (Talinum fruticosum) sample from four different farms around Dangote cement plants in Ibese, Ogun State, Nigeria in the order of Fe (7.52 mg/kg) > Cu (4.65 mg/kg) > Cd (1.53 mg/kg) Cr (0.03 mg/kg) is greater than Pb (0.08 mg/kg).The concentration of heavy metals (iron, copper, and cadmium) in green leaves (Amaranth hybridus L.) from four different farms around Dangote cement plants in Ibese, Ogun State, Nigeria was higher than the concentration of heavy metals in water leaves (Talinum fruticosum). It was observed that the concentrations of iron, copper, and cadmium in the amaranth green leaves (Amaranth hybridus L.) and water leaf (Talinum fruticosum) were above WHO/FAO (2011-2013) safe limits.

Keywords: water leaves; amaranth green leaves; heavy metals; ogun state

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Introduction

Growing populations, industrialisation, and natural resource extraction have all contributed to widespread pollution and poisoning of the ecosystem. Contaminants from historical and current industrial practices, as well as emissions from natural resources, are contaminating the entire earth (air, water, and soil). The threat to human health and environmental deterioration is growing, and there is evidence that this toxic mix is contributing to worldwide epidemic diseases [1].

Heavy metals, unlike organic waste, are non-biodegradable and can build up in living tissues, resulting in a variety of diseases and ailments. Metals like cadmium and copper are cumulative poisons that pose a risk to the environment and are reported to be extremely poisonous [2]. Heavy metals can build up to dangerous levels in soil as a result of long-term waste-water application. Metal contamination of vegetables owing to soil and air contamination puts their quality and safety at risk [3].

Because heavy metals have the ability to accumulate in soil for a long time, the levels of pollution in agricultural soil are quite important [4]. Metal ions at high concentrations in the soil environment may endanger the quality of soils, plants, natural waters, and human health [5]. The possibility of food contamination through the soil-root interface makes heavy metal accumulation in agricultural plants a major issue [6]. Therefore, it is essential to monitor the heavy metal contamination/pollution levels of amaranth green leaf (Amaranth hybridus L.) and water leaf (Talinum fruticosum) grown around dangote cement in Ibese in Yewa (Egbado) North Local Government area.

Vegetables are an essential component of the human diet. In addition to being a potential source of key nutrients, vegetables are important functional dietary components because they include protein, vitamins, iron, and calcium, all of which have significant health benefits [7]. Vegetables cultivated in heavy metal-contaminated soils, particularly leafy vegetables, acquire higher levels of metals than those grown in non-contaminated soils because they absorb these metals through their leaves [8].

Excessive accumulation of heavy metals in agricultural soil can lead to contamination of the soil, as well as food quality and public health concerns. Guerra et al. (2012) reported evidence of heavy metal contamination/pollution of agricultural soils and the uptake of heavy metals in vegetables and fruits in Romania and Brazil. They also stated that the toxic effects of some heavy metals in vegetables, such as Cu and Pb, target several human body organs, including the liver, kidneys, spleen, and lungs, causing a variety of biochemical defects. Because of the potential health danger to local residents, food crop uptake is a major concern [10].

As a result, the purpose of this study is to determine the presence of heavy metals in amaranth green leaves (Amaranth hybridus L.) and water leaves (Talinum fruticosum) planted around the Dangote cement plant in Ibese, Ogun State, Nigeria, as well as to evaluate their levels and compare them to standards set by relevant standard bodies such as WHO/FAO [2013].

Materials and Methods

Study Area

The research area is located in Ibese, via Ilaro, about 120km from Lagos in Yewa (Egbado) North LGA of Ogun State, Nigeria. Its geographical coordinates are 6° 58' 0" North, 3° 2' 0" East.

Sample Collection and Treatments

Fresh amaranth green leaves (Amaranth hybridus L.) and water leaves (Talinum fruticosum) were collected from four different farms around the Dangote cement plant in Ibese Yewa (Egbado) North LGA of Ogun State, Nigeria. The samples were gathered in polythene bags that were labelled with the location of each sample. Each vegetable sample was pooled together to ensure adequate representation before being separated into two pieces for composite replicate analysis (Iyaka, 2007). The vegetables were cleaned twice with distilled water to eliminate soil particles, dust and other impurities. They were sliced with a knife to aid in drying at room temperature. The samples were air dried on tiles in the laboratory for three days before being oven dried at 80 o C for four days to achieve a constant weight.The dried samples were crushed and finely ground using a porcelain mortar and pestle to pass through a 250 µm mesh sieve. Then, each of the processed powders was subjected to acid digestion, and the concentrations of the heavy metals in the solutions were determined using an atomic absorption spectrophotometer equipped with an air-acetylene burner.

Sample Digestion

A measured weight (5 g) of powder sample was placed in a 250 mL conical flask, followed by 5 mL of concentrated H_2SO_4, 50 mL of concentrated HNO_3, and 10 mL of concentrated HCl. In a fuming hood, the contents of the tube were heated to 200 °C for 1 hour before cooling to room temperature. To finish the digestion of organic matter, 20 mL of distilled water was added and the liquid filtered through filter paper. Finally, the mixture was transferred to a 50 mL volumetric flask, filled to the mark, and put aside for at least 15 hours. Using an atomic absorption spectrometer (AA500F), the resulting supernatant was tested for Fe, Cu, Pb, Cd, and Cr.

Table 1. Mean concentration of heavy metals (mg/kg) in green leaves (*Amaranth hybridus L.*) and water leaves (*Talinum fruticosum*) grown in four different farm in Ibese, Yewa (Egbado) LGA of Ogun State, Nigeria.

Parameters (mg/kg)	Amaranth green leaves	Water leaves
Iron	10.23±0.32	7.52±0.84
Copper	5.28±0.22	4.65±0.03
Lead	0.25±0.03	0.08±0.07
Cadmium	2.42±0.03	1.53±0.02
Chromium	0.06±0.01	0.03±0.02

Results

The mean concentrations of heavy metals (Fe, Cu, Pb, Cd, Cr) obtained for the water leaves and amaranth green samples planted at four different farms around the Dangote cement factory in Ibese, Yewa (Egbado) North Local Government Area of Ogun State, Nigria are summarised in Table 1. The concentration of heavy metals detected in the amaranth green leaves (Amaranth hybridus L.) from different farms around the Dangote cement factory in Ibese, Ogun State, Nigeria showed high levels of heavy metal concentrations in the order of Fe (10.23 mg/kg) > Cu (5.28 mg/kg) > Cd (2.42 mg/kg) > Pb (0.25 mg/kg) > Cr (0.06 mg/kg). Except for Pb (0.25 mg/kg) and Cr (0.06 mg/kg), concentrations of all other metals (Fe, Cu, and Cd) were above the permissible limits of FAO (2005) and WHO (2013) safe limits. The concentration of heavy metals detected in the water leaves (Talinum fruticosum) from four different farms around the Dangote cement factory in Ibese, Ogun State, Nigeria show high levels of heavy metal concentrations in the order of Fe (7.52 mg/kg) > Cu (4.65 mg/kg) > Cd (1.53 mg/kg) > Cr (0.03 mg/kg) > Pb (0.08 mg/kg). It was observed that iron, copper, and cadmium were above the WHO/FAO safe limi.

Discussion

Contaminated food, on the other hand, is a key source of heavy metals for humans. Lead levels in amaranth green leaves (Amaranth hybridus L.) and water leaves (Talinum fruticosum) planted in four different farms around the Dangote cement plant in Ibese are 0.08 mg/kg and 0.25 mg/kg, respectively. Lead toxicity can lead to auto-immunity, a condition in which a person's immune system attacks their own cells, resulting in kidney, nervous system, and circulatory system problems [11]. Heavy metals identified in amaranth green leaves and water leaves, according to research, may pose a health risk to humans in Ibese through the dietary pathway [12]. However, lead levels in both vegetables are below the WHO/FAO recommended maximum of 0.2 mg/kg.

Copper concentrations of 4.65 mg/kg and 5.28 mg/kg were discovered in amaranth green leaves and water leaves from four different farms around the Dangote cement plant in Ibese. Copper levels in both vegetables were greater than the WHO/FAO permitted limit of 0.05-0.5 mg/kg. The chemical nature of excess dietary copper and its interaction with other dietary minerals increase sensitivity to its hazardous effects. Acute poisoning symptoms include hypotension, nausea, hemoglobinuria or haematuria, jaundice, stomach discomfort (diarrhea), and unconsciousness [9].

The amount of cadmium found in amaranth green leaves and water leaves from four different farms around the Dangote cement plant in Ibese surpassed the FAO/WHO (2011) recommended limit of 0.1 mg/kg. The concentration of cadmium in amaranth green leaves (2.42 mg/kg) is higher compared to that of water leaves (1.52 mg/kg). Acute cadmium exposure can cause pulmonary and renal effects.

Iron is a trace element that is required by all living things. It is required for the production of heme protein and a variety of enzyme systems in humans [12].Because the maximum level of iron in foods recommended by FAO/WHO (2011) is 0.8 mg/kg, the iron levels obtained from amaranth green leaves (10.23 mg/kg) and water leaves (7.52 mg/kg) grown on four different farms around the Dangote cement plant in Ibese were significantly beyond the tolerated limit. Acute poisoning of iron can cause siderosis (iron deposition on tissue) in the liver, pancreatic, adrenal, thyroid, pituitary, and heart in humans, depending on the chemical type [12].

Chromium concentrations in amaranth green leaf and water leaf from farm land around the Dangote cement plant in Ibese were 0.06 mg/kg and 0.03. Both readings were below the acceptable maximum of 2.30 mg/kg. Chromium plays an important role in the metabolism of cholesterol, glucose, and fats. Its deficiency causes sperm count reduction, increased body fat, and hyperglycemia, while high concentrations are toxic and carcinogenic [7].

Conclusion

The findings of heavy metal analysis in amaranth green leaves (Amaranth hybridus L.) and water leaves (Talinum fruticosum) harvested from four different farms around Dangote cement plants in Ibese, Ogun State, Nigeria revealed that, with the exception of chromium and lead, all other heavy metals were found to be over FAO/WHO acceptable values. Some heavy metals are non-biodegradable, and their buildup in the body can cause a variety of illnesses and ailments. Local governments should be able to curtail the indiscriminate discharge of industrial effluents containing these heavy metals so that local communities near cement companies are not endangered.

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