Analysis of Heavy Metals in Vegetables Sold in Ijebu-Igbo, Ijebu North Local Government, Ogun State, Nigeria

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Abstract - A preliminary market study was conducted to assess the level of certain heavy metal in selected vegetable sold in Obada market and Atikori market, harvested from three farm-lands located in Ayesan, Dagbolu and Osunbodepo in Ijebu North Local Area Government. The vegetables were bitter-leaf *(Vernonia amygdalina)*, fluted pumpkin *(Talfaria occidentalis)*, water-leaf *(Talinum triangulare)*, and jute mallow *(Corchorus olitorius)*. The samples were analysed for heavy metals (Cr, Mn, Ni, Co, Cu, Cd, Zn, Pb, and Fe) using Atomic Absorption Spectrophotometer (AAS, Perkin Elmer model 2130), in accordance with AOAC. The result obtained showed, Jute Mallow had highest value of Zinc with 111.23 and lowest value of Co with 3.50; fluted Pumpkin had highest value of Mn with 45.50 and lowest value in CO with 1.75; Water Leaf had Zn with highest value 186.75 and Cd has the lowest; Bitter Leaf had Zn with 90.50 and Cd with 1.50.

Keywords - Farm, Heavy Metals, Site, spectrophotometer, Vegetables

INTRODUCTION

Heavy metal contamination of vegetables cannot be under-estimated as these foodstuffs are important components of human diet. Vegetables are rich sources of vitamins, minerals, fibres, 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 [1], [2],[3],[4]. A number of studies have shown heavy metals as important contaminants of the vegetables [5],[1],[6], [7].

Heavy metals are defined as a group of elements having a density which is greater than 5 g/cm^3. Its contamination issue in human dietary uptakes have elicited significant responses and worldwide concerns pivotally entailing vegetables consumption [8]. Vegetables constitute an important part of the human diet since they contain carbohydrates, proteins, vitamins, minerals as well as trace elements. Accumulation of heavy metals by vegetables may depend on plant species as well as concentration of heavy metal. Generally, vegetables contamination with heavy metals derives from factors such as the application of fertilizers, sewage sludge or irrigation with wastewater [9], [10],[11].

AIMS AND OBJECTIVE

This research is aimed at investigating the presence and concentrations of some of the heavy metals on the edible vegetables sold in some selected market in Ijebu - Igbo, Ogun State, Nigeria.

MATERIALS AND METHODS

STUDY AREA

Four types of leafy vegetables were randomly picked from two markets located in industrial, residential and commercial areas in Ijebu - Igbo, Ogun state Nigeria in August (wet season), 2014.

The vegetables include bitter-leaf *(Vernonia amygdalina)*, flutted pumpkin *(Talfaria occidentalis)*, water-leaf *(Talimum triangulare)*, jew mallow *(Cochorus olitorus)*. The markets are located at Obada station, Atikori, while the farm sites are situated at Ayesan, Dagbolu, Osunbodepo.

SAMPLE COLLECTION

The four vegetables (flutted pumpkin, jew mallow, water leaf and bitter leaf) were harvested from three different farm-land located at Ijebu North Local government which are Ayesan, Dagbolu and Osunbodepo. They were put into separate polythene bags and labelled accordingly. They were then taken immediately to the laboratory for preparation and analysis.

SAMPLE ANALYSIS

The vegetables samples were destalked, washed with tap water and thoroughly rinsed with distilled water, then dried in an oven at 105ºC. They were then pulverized to fine powder using a laboratory grinder. The fine powder was put into polythene bags and preserved in the desiccator.

3.0 g of each sample was accurately weighed into clean platinum crucible and ashed at 450-500ºC then cooled to room temperature in a desiccator. The ash was dissolved in 5 ml of 20% hydrochloric acid and the solution was carefully transferred into a 100 ml volumetric flask. The crucible was well rinsed with distilled water and transferred to the flask and made up to the mark with distilled water and shaken to mix well. The samples were then analysed for heavy metal determination using Atomic Absorption Spectrophotometer (AAS, Perkin Elmer model 2130). The determination of the following heavy metals (Cr, Mn, Ni, Co, Cu, Cd, Zn, Pb, and Fe) contents of the sample solutions was carried out in accordance with the procedure of the[12].

RESULTS

TABLE 1: The Arithmetical Means of the Heavy Metals in the four vegetable Samples from the Three Locations in mg/kg.

Sample	Cr	Mn	Ni	Co	Cu	Cd	Zn	Pb	Fe
Jew Mallow	1.50	9.75	19.25	3.50	9.75	1.50	111.23	8.00	5.10
Flutted Pumpkin	1.75	45.50	16.75	1.75	11.00	1.25	79.75	6.75	6.75
Water Leaf	5.27	6.75	19.00	3.00	7.75	1.50	186.75	7.00	6.75
Bitter Leaf	2.25	37.25	15.75	2.25	8.00	1.50	90.50	6.25	2.95

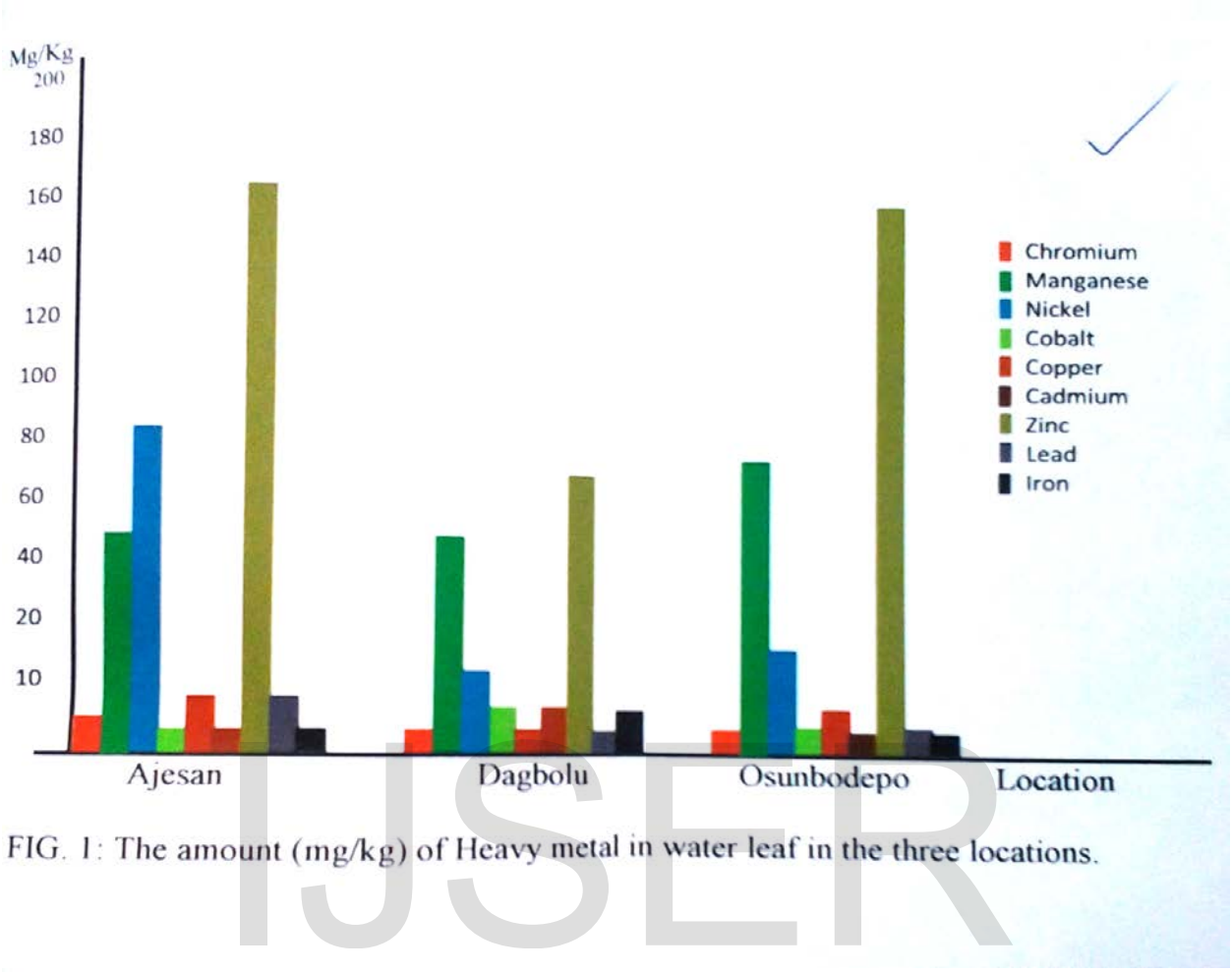

FIG. 1: The amount (mg/kg) of Heavy metal in water leaf in the three locations.

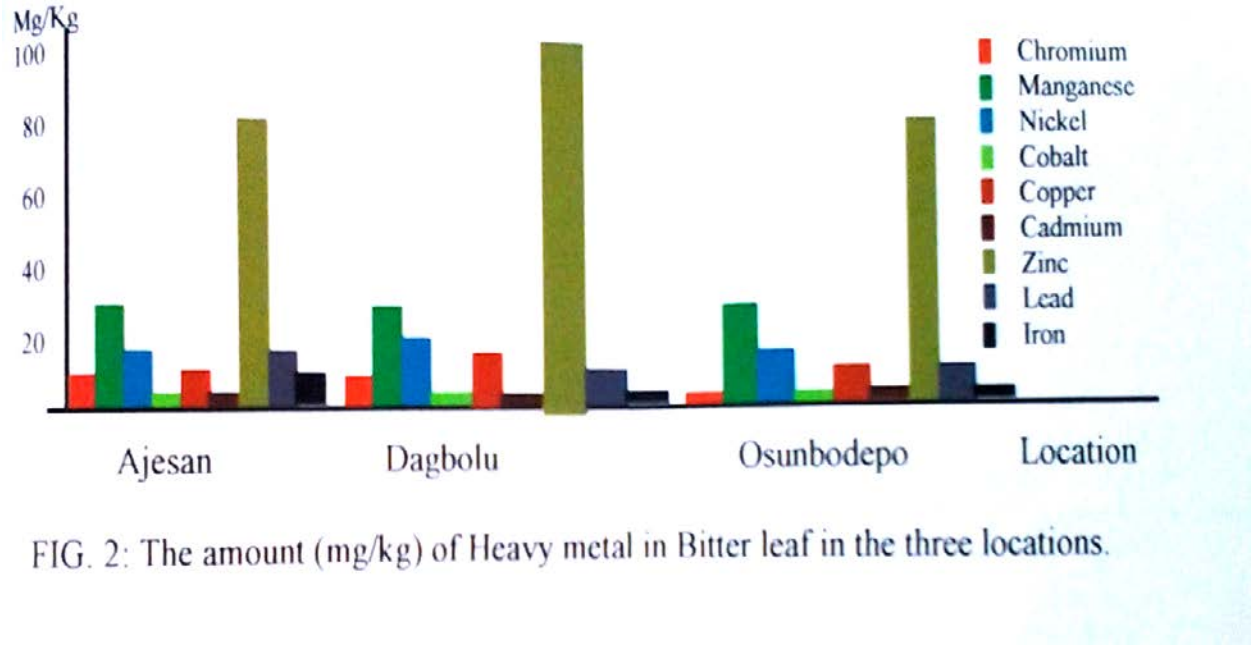

FIG. 2: The amount (mg/kg) of Heavy metal in Bitter leaf in the three locations.

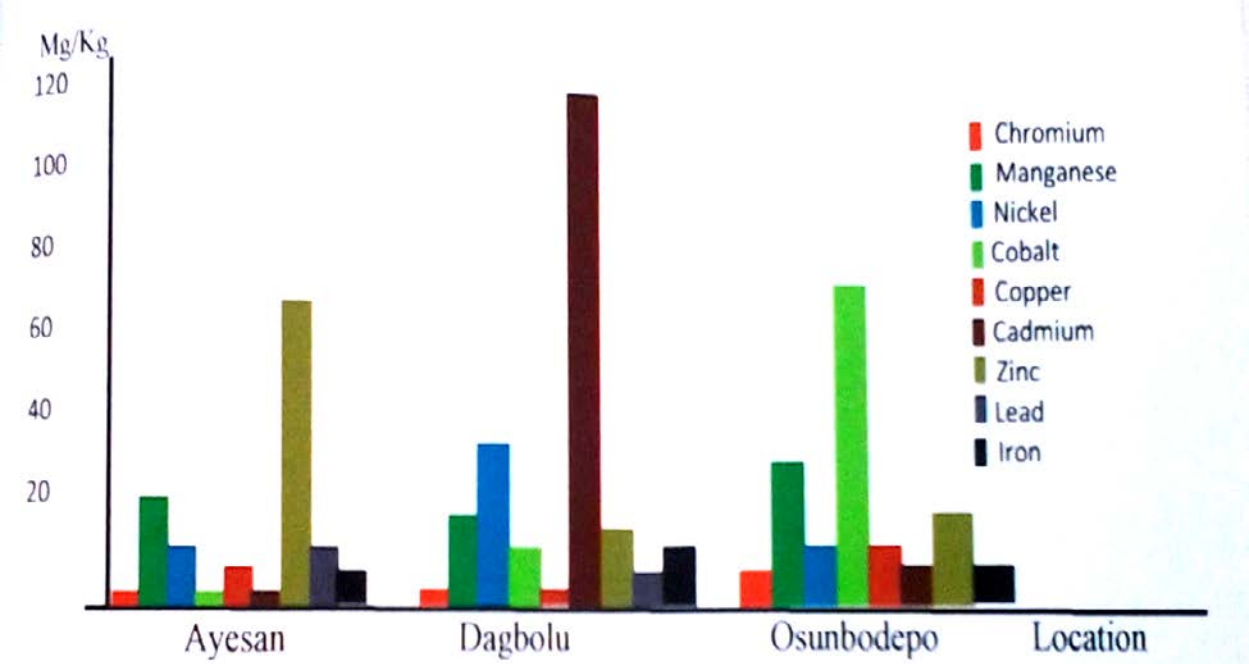

FIG. 3: The amount (mg/kg) of Heavy metal in Jew Mallow in the three locations.

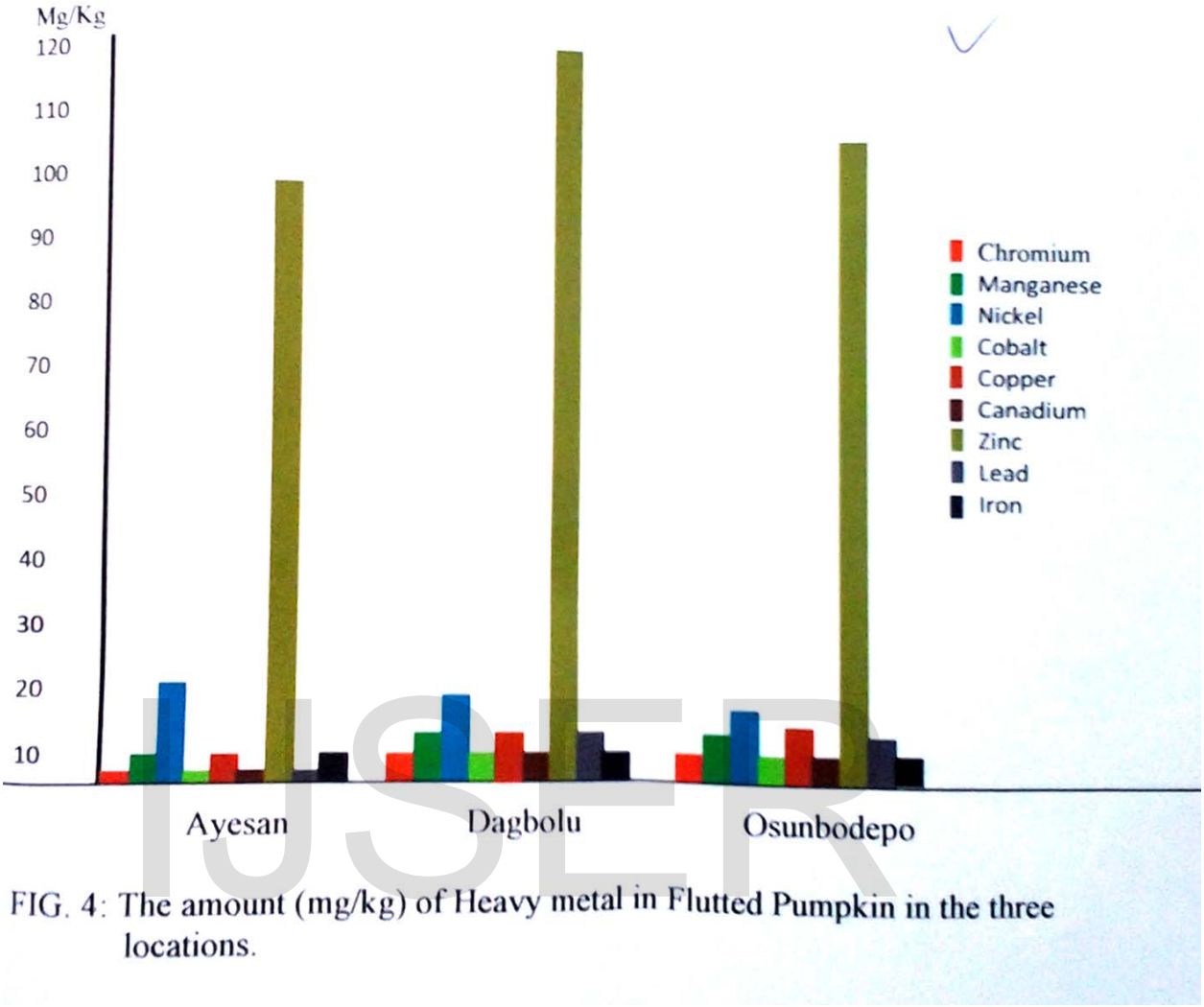

FIG. 4: The amount (mg/kg) of Heavy metal in Flutted Pumpkin in the three locations.

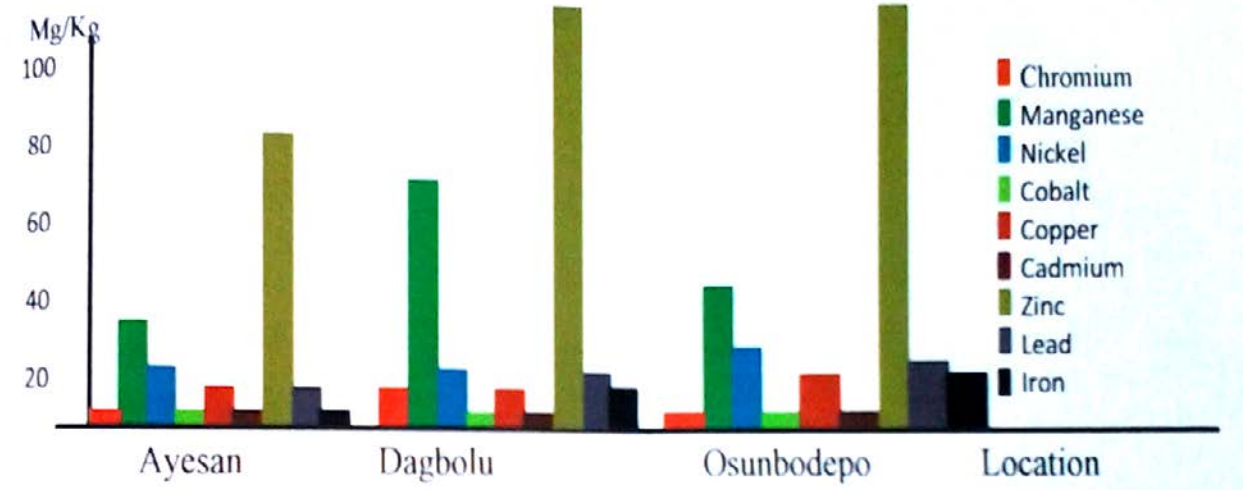

FIG. 5: The amount (mg/kg) arithmetical means of Heavy metal in the four vegetable samples from the three locations

DISCUSSION

Table 1 shows that for Mn, Jew mallow has the least concentration (9.75 mg/kg) and waterleaf has highest (62.75 mg/kg). The average value is 38.1 mg/kg which is very high. The concentration range for Ni is 15.75 mg/kg (Bitter leaf) to 19.25 mg/kg (jew mallow) and an average of 17.69 mg/kg. The average concentration of Cu found in the four vegetable samples is 9.13 mg/kg with a range of 7.75-11.00 mg/kg. The lowest concentration is recorded for water leaf and the highest is fluted pumpkin respectively.

For Co, the concentration range for these vegetable samples is from 1.75-3.50 mg/kg in fluted pumpkin and jew mallow, respectively. The average concentration is 2.63 mg/kg. The results also revealed that bitter leaf, jew mallow and waterleaf had Cd concentrations of 1.50 mg/kg while fluted pumpkin had 1.25 mg/kg. Concentrations of Zn in the vegetable samples are outrageously high (79.75-186.75 mg/kg).

The lowest being recorded for fluted pumpkin and the highest for waterleaf. Bitter leaf and jew mallow recorded 90.50 mg/kg and 111.25 mg/kg, respectively. These high concentrations are similar to the observed results by Odukoya *et. al.*, (2000). The concentration of Pb in the four vegetables studied is 6.25 to 8.00 mg/kg (bitter leaf and jew mallow, respectively) Waterleaf had a concentration of 7.00 mg/kg and fluted pumpkin, a concentration of 6.75 mg/kg.

Figure 1 shows concentrations of these metals in bitter leaf (*Vernonia amygdalina*) in the order of Zn>Mn>Ni>Cu>Pb>Cr > Co>Cd. Concentrations of the metals in waterleaf (*Talinum triangulare*) are presented in Fig. 2 and are in the order of Zn>Mn>Ni>Cu>Pb>Cr>Co>Cd. Figure 3 shows the metal concentrations for Jew mallow in the order of Zn>Ni>Mn> Cu>Pb>Co>Cr >Cd. Results for fluted pumpkin (*Telfairia occidentalis*) are presented in Fig. 4 and the metal concentrations are in the order of Zn>Mn>Ni>Cu>Pb>Cr> Co>Cd. Water leaf has the highest concentration of the metals Zn, Mn, Ni, Co, Cr and Cd followed by jew mallow. Fluted pumpkin ranks second in the concentrations of Mn and the highest for Cu.

CONCLUSION

The results obtained for the four vegetables under study for the nine heavy metals imply that the consumption of these vegetables is risky as this will lead to a lot of health problems. As regular consumption of these vegetable will expose the consumers to heavy metal toxicity as the years goes by.

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