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Full length Research paper

Descriptive assessment of some selected heavy metals and micro-elements in *Amaranthusviridis L.,* sold at some major markets in Ibadan

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This study described and assessed heavy metals and micro elements in *Amaranthusviridis* sold at some major markets in Ibadan. Fresh samples of *Amaranthusviridis* was collected randomly from some major markets in Ibadan, Oyo State. The edible part on the plant was taken to the laboratory for heavy metal analysis to determine the level of selected micro-element namely: Manganese (Mn), Iron (Fe), Chromium (Cr), Lead (Pb) Copper (Cu), Zinc (Zn) and Nitrogen (N). The sample was washed and air dried, grinded and aid digestion was done using concentrated Hydrogen tetraoxonitrate(v) (HNO_3) by Atomic Absorption Spectrometer (ASS) method. Data on metal content from ASS was presented in descriptive statistics. Result reported confirmed that the vegetable collected from major markets in Ibadan contained substantial amount of heavy metals. However, all of them are consumable which had Chromium (Cr). The best concentration in vegetable was collected from Dugbe market thereby making it the best for consumption. Therefore, vegetables collected from Dugbe market in Ibadan should be consumed more.

Keyword: *Amaranthusviridis*, Heavy metals, Micro elements, Descriptive statistics, Markets.

INTRODUCTION

Vegetables are known to be the cheapest and readily available source of important proteins, vitamins, minerals, essential amino acids, iron, calcium and other nutritional requirements (Akan, *et al*., 2016) and earlier studied by (Aletor and Adeogun, 1995). They also form a major component of most Nigerian and other African dishes where the daily diet is dominated by starchy staple foods. Vegetables take up heavy metals in growth media such as soil, air and nutrient solutions by the roots or foliage (Lokeshwari and Chandrappa, 2006).

The term vegetable applies to edible part of the plant that stores food in roots, stems, or leaves. Vegetables are green and leafy-like in appearance hearing edible stems or leaves and roots of plants (Sharma, 2004). Vegetables constitute essential diet components by contributing carbohydrates, proteins, vitamins, iron, calcium and other nutrients that are in short supply. Vegetables also contain both essential and toxic elements over a wide range of concentrations. Metals in vegetables pose a direct threat to human health. Plants and vegetables take up elements by absorbing them from contaminated soils and waste water used for irrigating them as well as from deposits on different parts of the plants exposed to the air from polluted environment (Fontua *et al*., 2008).

Vegetables, especially those of leafy vegetables grown in heavy metals contaminated soils, accumulate higher amounts of metals than those grown in uncontaminated soils because of the fact that they absorb these metals through their roots (Muhammad *et al*., 2011). Vegetables accumulate heavy metals in their edible and non-edible parts. Absorption capacity of heavy metals depends upon the nature of vegetables and some of them have a greater potential to accumulate higher concentrations of heavy metals than others (Akan *et al.,* 2016).

Heavy metal toxicities have been reported to cause neurological disorders, central nervous system destruction, cancers of various body organs (ATSDR, 1999; 2000) and severe mental retardation in children (Udedi, 2003). There are always high toxic levels of heavy metals in plants grown closely to high traffic areas (Largerwerff and Speecht, 1970). Studies conducted in Nigeria by Akan *et al*. (2016) and earlier by Okunola*et al*. (2008) have shown that edible vegetables take up heavy metals especially those grown along road sides in urban areas. Contamination of edible vegetables with Cd, Cu and Ni had been reported from industrial and residential areas of Lagos State, Nigeria (Yusuf *et al*., 2003). Heavy metal concentrations in vegetables grown on dumped site and those grown in urban and pen-urban gardens in Ibadan metropolis, showed high levels of Pb and Cd (Chen *et al*., 2014). Higher accumulation of heavy metals were also 1und in vegetables and fruits grown in industrialized and urban areas than those in rural areas as reported by (Akan, 2016) and earlier studied by (Fytianos *et al*., 2001).

Intake of vegetables is an important path of heavy metal toxicity to human being and based on persistent nature and cumulative behaviour as well as the probability of potential toxicity effects of heavy metals as a result of consumption of leafy vegetables, this study was carried out to determine the dry matter levels of Pb, Cd, Fe, Zn, and Cu in some selected vegetables that are consumed regularly by inhabitants in Ibadan metropolis.

Industrial and anthropogenic activities have made heavy metals ubiquitous in the environment, and humans are exposed to them in various ways (Wilson and Pyatt, 2017). Heavy metals such as Fe, Cu, Zn, and Ni are essential for proper functioning of the biological systems in plants and their deficiencies or excesses could lead to disruption of cells (Ward, 1995; Uwah *et al*., 2009). However, contamination of heavy metals in the ecosystem through water, soil, air and agricultural produce (and their consumption by humans) have been a great concern of health issues. Sources of heavy metal contamination in food chains are mainly from agricultural inputs such as fertilizers, pesticides (especially insecticides), organic manures and composts which may usually contain a wide variation of heavy metals as impurities (Singh, 2001).

In recent times, economic hardship has led many people into urban and pen-urban farming especially vegetable production which brings income within a very short period of time. In lieu of this, this study was targeted at vegetable farms that supply vegetables to some major markets in Ibadan. These farms are in close proximity to the urban and rural areas, they have access to hand dugwell/stream for irrigation and the farmers rely majorly on fertilizers and farm-yard manures to enhance vegetable yield. Consumption of such produce may pose certain health risks to the consumers (Onianwa and Ajayi, 1987; Nicholson *et al*; 2003) and recently by Okunola *et al*; (2008); there are possibilities of heavy metal uptake by the vegetables from traffic emissions and the soil amendments. World Health Organization revealed that the vegetable are valuable sources of fiber with 100's of result and anti-oxidants since Cr, Mn, N, Zn, Cu,Pb and Fe are essential components for various biological activities within the human body, elevated levels of them can cause numerous health consequences to mankind.

Data on metal content from ASS need to be presented in descriptive statistics for easy understanding which provide simple summaries about the sample and about the observations that have been made. Such summaries

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may be either quantitative (summary statistics) or visual, that is, simple-to-understand graphs (Babbie, 2009). These summaries may either form the basis of the initial description of the data as part of a more extensive statistical analysis, or they may be sufficient in and of themselves for a particular investigation. It provides a useful summary (tables) of many types of data. It may be used to describe the relationship between pair of variables (cross-tabulation, contingency tables, and graphical representation through scatter plots, quantitative measures of dependence and descriptions of conditional distributions). Some measures that are commonly used to describe a data set are measures of central tendencies (Mean, Median and Mode) and measures of dispersion (Standard deviation or Variance), the minimum and maximum value of the variables (Kurtosis and Skewness) (Yusuff, 2004).

Therefore, the quality and safety of vegetables from these terms are of major concern. Several works have been published on heavy metals in vegetables; however there is little information on the health risk index assessment in edible vegetables in Nigeria. This study, therefore, evaluated the health risk index of *Amaranthusviridis* L. from selected markets in determining the safety or health risk to the populace associated with the consumption of such vegetables.

METHODOLOGY

MATERIALS AND METHOD

The materials used for this experiment are: *Amaranthuisviridis*,Polythene bags, Markers,Paper Tape and AAS (Atomic Absorption Spectrometer). Fresh samples of *Amaranthuisviridis* were collected randomly from selected markets in Ibadan, Oyo state which include: Bodija, Dugbe, Oja-oba, Ojoo and Eleyele market.

The edible part of the plant being the leave was taken to the laboratory for heavy metal analysis to determine the level major or prominent heavy metals that are present in them. The edible portion of the vegetable (*Amaranthuisviridis*) was properly separated and washed to remove dust particle. The samples were then chopped into small pieces using a knife thereafter air-dried and oven-dried at 80°C.

Dried sample of *Amaranthuisviridis* was grinded into tine powder using a commercial blender and stored in a polythene bag for acid digestion. Acid digestion was done using Conc. HNO_3 by Atomic absorption spectrometer (ASS) method.

Vegetable sample (lg) was digested after adding 15rnl of tri-aid mixture (HNO_3, $H_2SO_4$and $HCLO_4$ in ratio 5:1:1) at 80°C until a transparent solution was obtained. After cooling, the digested sample was tittered using filter paper and then be analysed by Atomic Absorption Spectrometer (AAS) using a nitrous oxide-acetylene flame for Arenic and air-acetylene flame for cadmium, chromium, lead and zinc respectively.

Statistical Analysis

Descriptive statistics such as pie charts, bar charts, tables, mean and standard deviation were used to analyze data on metal content obtained from AAS.

RESULTS AND DISCUSSION

The result presented below shown heavy metals present in the vegetables collected from live markets in Ibadan metropolis. It was observed that vegetables collected from Oja-Oba had the least percentage of manganese (0.04). For copper, it was also observed that vegetables collected from Dugbe and Ojoo had the least percentage of copper with a value of 0.004%. Vegetables from Dugbe contained less zinc when compared with all other samples with a percentage value of 0.04. Vegetables collected from Eleyele had the least percentage of iron and N with values of 0.38 and 0.0009.

Sample	Mn(%)	Cu(%)	Zn(%)	Fe(%)	Pb(%)	Cd(%)	N(%)
Dugbe	0.02	0.004	0.04	0.22	0.0004	0.00012	0.0006
Ojoo	0.02	0.004	0.02	0.24	0.0008	0.0009	0.0006
Oja Oba	0.04	0.002	0.03	0.28	0.005	0.00012	0.0008
Bodija	0.02	0.002	0.02	0.2	0.004	0.00012	0.0009
Eleyele	0.02	0.003	0.03	0.38	0.014	0.0015	0.0009
Mean	0.024	0.003	0.028	0.264	0.0048	0.0012	0.0008
Standard deviation	0.00894	0.00100	0.00837	0.07127	0.00549	0.00021	0.00015

Manganese (Mn)

The result presented in figure 1 below revealed that vegetables collected from Oja Oba had the highest percentage of manganese which suggests that the vegetable is not suitable for human consumption because of the highest percentage of heavy metal present (Wilson and Pyatt, 2017).

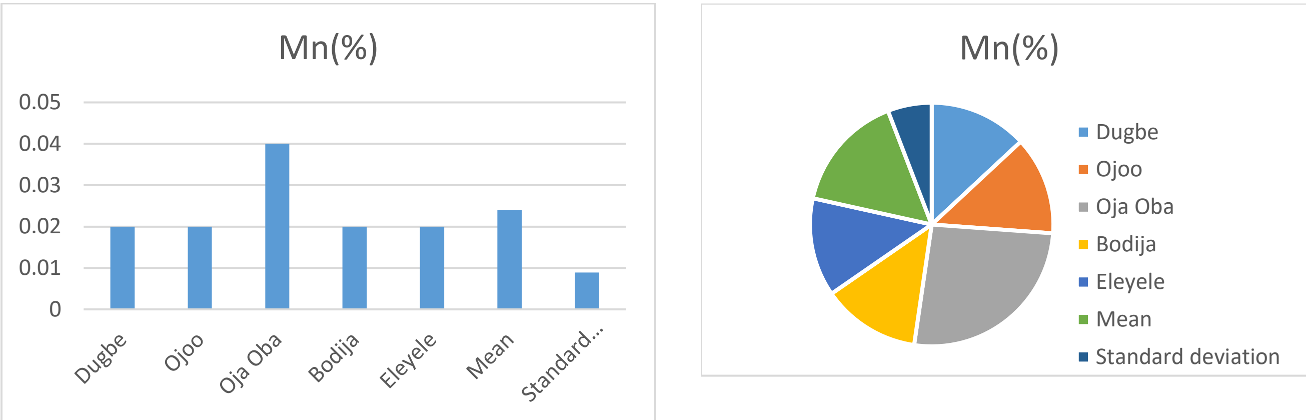


Figure 1: Mn (%) in Amaranthusviridis

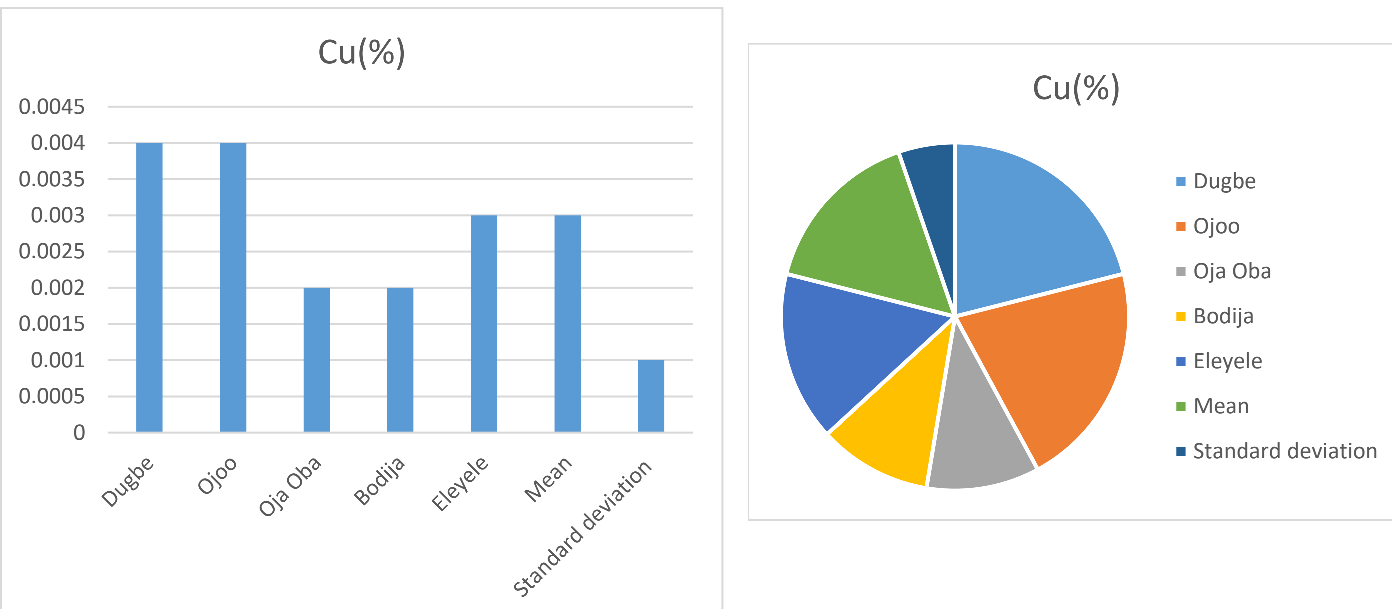


Figure 2: Cu (%) in *Amaranthusviridis*

Copper (Cu)

Vegetables collected from Dugbe and Ojoo showed the highest percentage of presence of copper, followed by samples of vegetables collected from Eleyele in figure 2 below. Vegetables obtained from Oja Oba and Bodija gave least percentage of presence of copper. However, Cu at high levels becomes phytotoxic causing inhibition to plant growth (Chen *et al*, 2014).

Zinc (Zn)

Vegetables collected from Dugbe had the highest percentage of zinc followed by samples of vegetable collected from Oja Oba as shown in figure 3 below. Samples of vegetable obtained from Ojoo and Bodija showed the least percentage of presence of zinc. High zinc level in the body helps cell production and immune functions. It is also an essential part of growth, sexual development, and reproduction (Muhammed *et al*., 2011).

Iron (Fe)

Vegetables collected from Eleyele market when subjected to laboratory test, the result depicts that the presence of iron (Fe) as heavy metal is more pronounced when compared with the results obtained from other samples. It was also observed that samples of vegetable

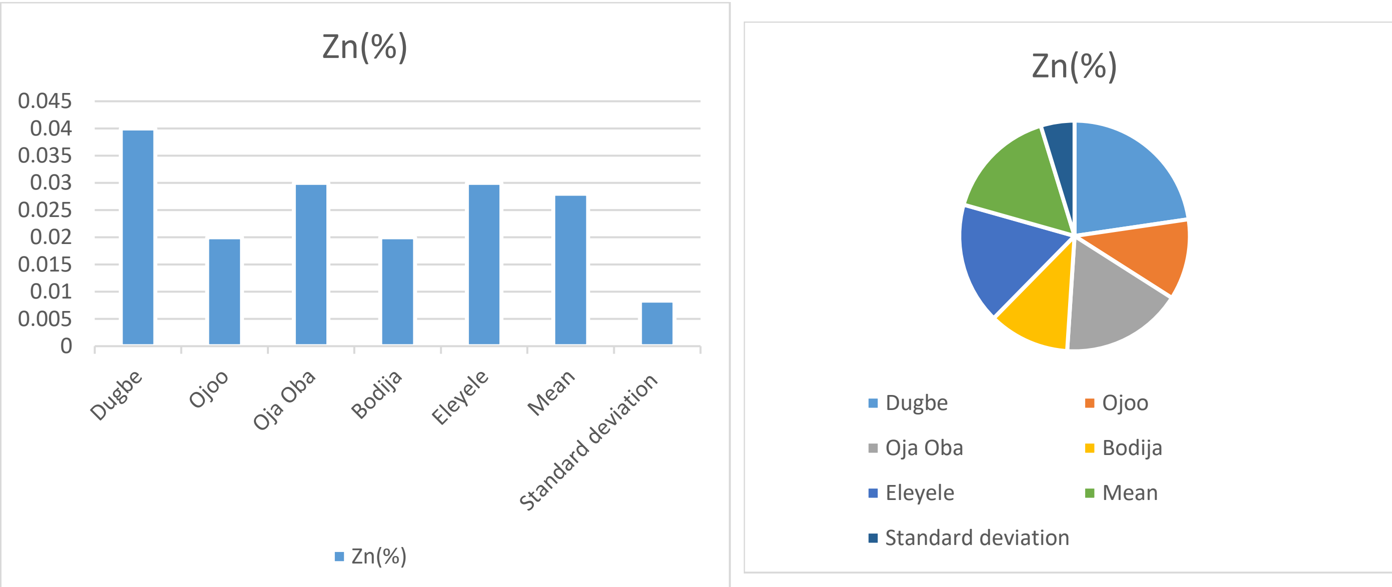


Figure 3: Zn (%) in *Amaranthusviridis*

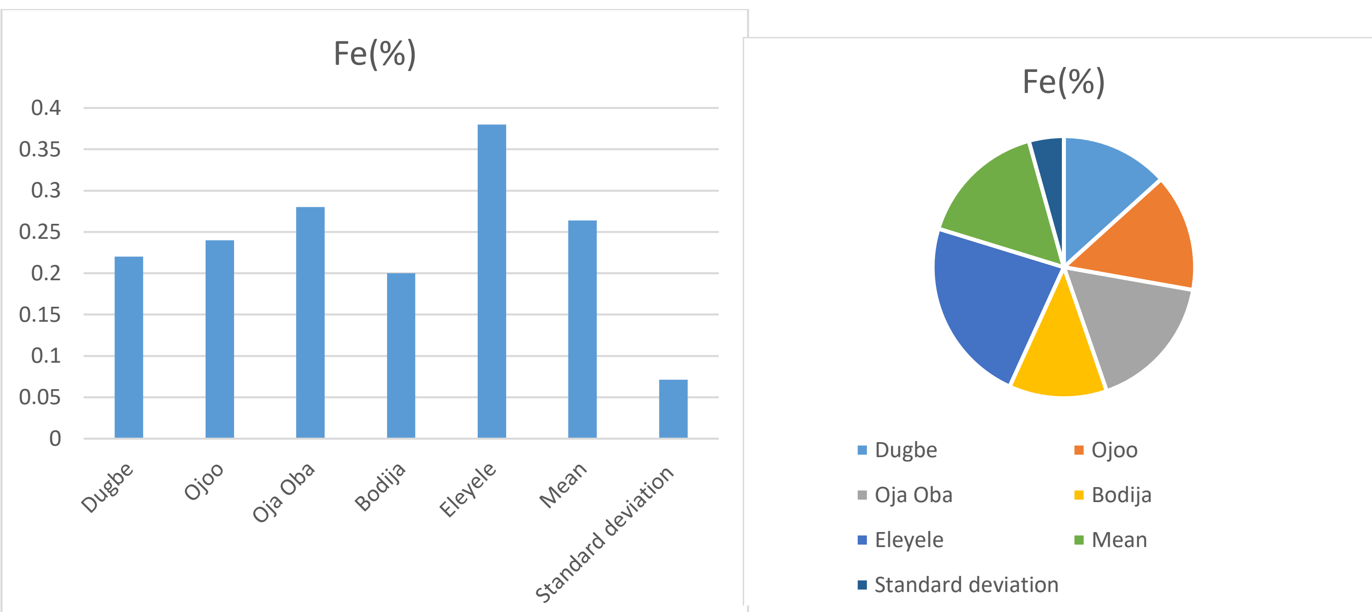


Figure 4: Fe (%) in *Amaranthusviridis*

collected from Bodija showed least percentage of presence of iron. Iron deficiency can cause anemia and lead to symptom like fatigue (Chen *et al*., 2014).

Lead(Pb)

Vegetables collected from Dugbe for Lead (Pb) in samples of vegetables collected from five different markets as presented in figure 5 below. It was observed from the result that samples from Eleyele showed the highest percentage of Lead while the least is obtained from vegetables collected from Dugbe. Exposure to high levels of Lead may cause anemia, weakness, and kidney and brain damage. Very high Lead exposure can cause death. It can damage a developing baby's nervous system. Even, low-level Lead exposures in developing

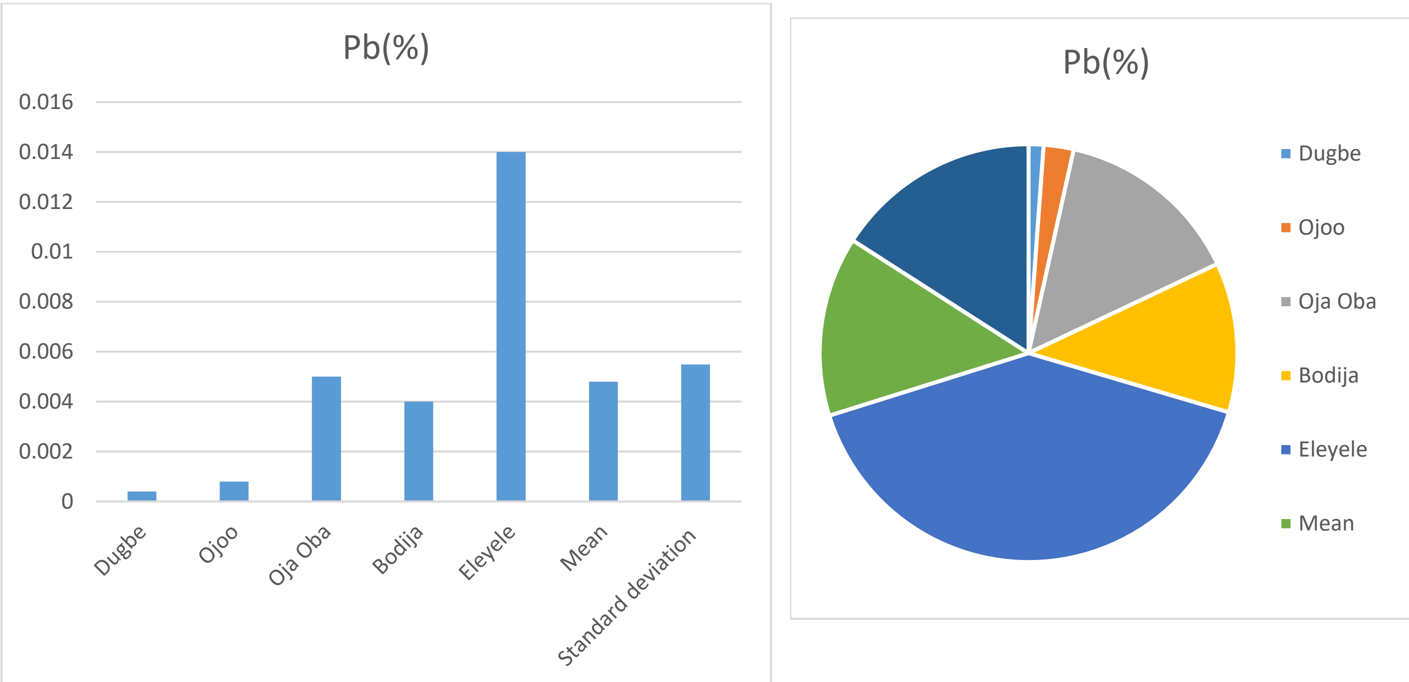


Figure 5: Pb (%) in Amaranthusviridis

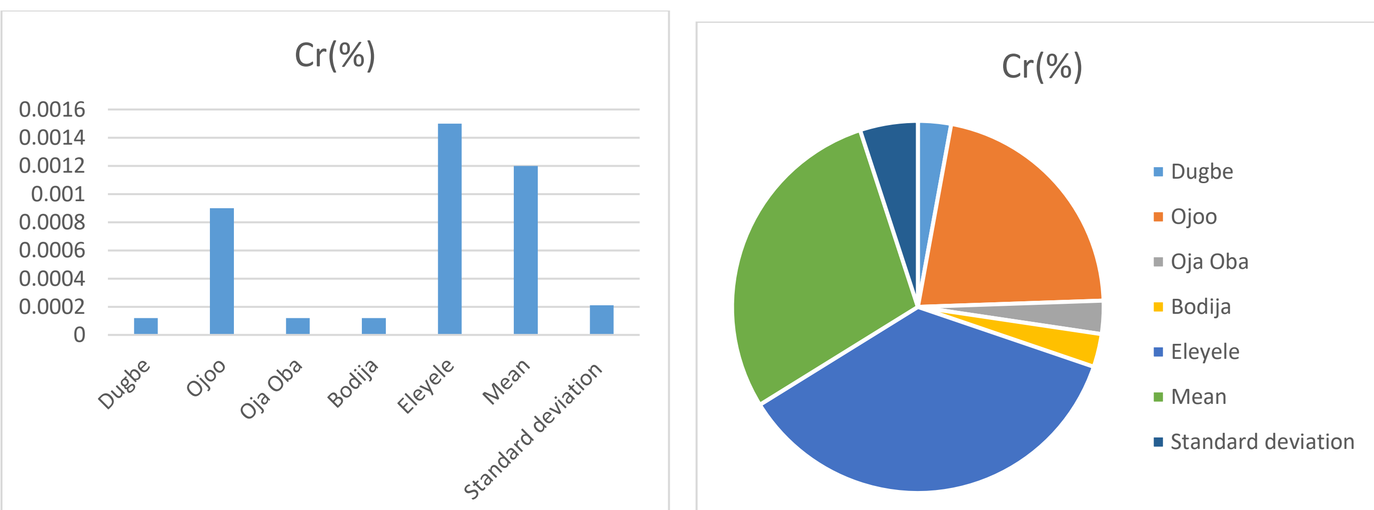


Figure 6: Cr (%) in *Amaranthusviridis*

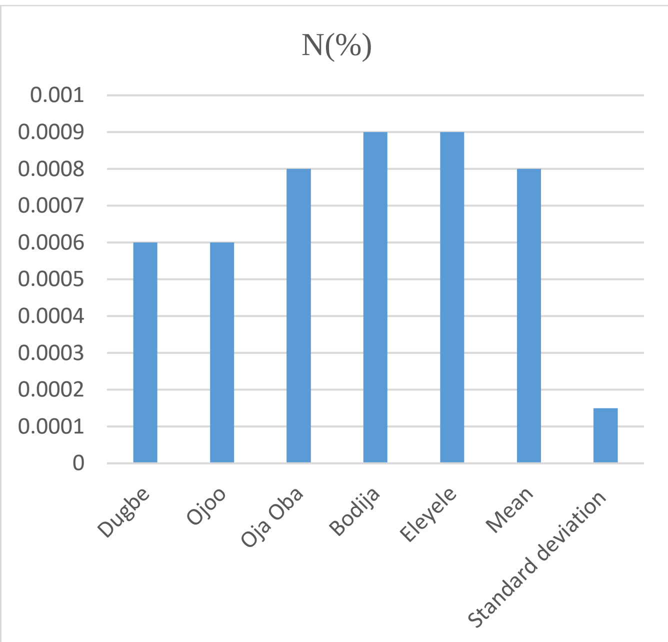
babies have been found to affect behaviour and intelligence (Akan *et al*., 2016).

Chromium (Cr)

The result presented in figure 6 above shows that vegetables collected in Eleyele is heavier with Chromium (Cr) than all other vegetables collected from other markets meanwhile, it was observed that vegetables obtained from Ojoo contained the least presence of Cr .High Chromium is essential trace mineral that improve insulin sensitivity and enhance protein, carbonhydrate, and lipid metabolism. It is a metallic element that people need every small quantity. Low level of Chromium may likely develop high blood sugar and high cholesterol (Akan *et al*; 2016) which also corroborate the findings by earlier worker (Muhammed *et al*; 2011)

Nitrogen (N)

It was observed from the result presented in the figure 7 below that samples of vegetables collected from Bodija had the highest percentage of Nitrogen (N). This was followed closely samples obtained from Eleyele. Samples of vegetables obtained from Dugbe and Ojoo showed the least percentage of the presence of N. More Nitrogen fuel the growth of vegetables. It is used to synthesize amino-acids, proteins, chlorophyll, nucleic acids, and enzymes in human which builds blocks to make hairs, muscles, skin and other important tissues. Human cannot survive without nitrogen (Chen*et al*; 2014) which is in line with the earlier findings of Lokeshwari Chandrappa, (2006).



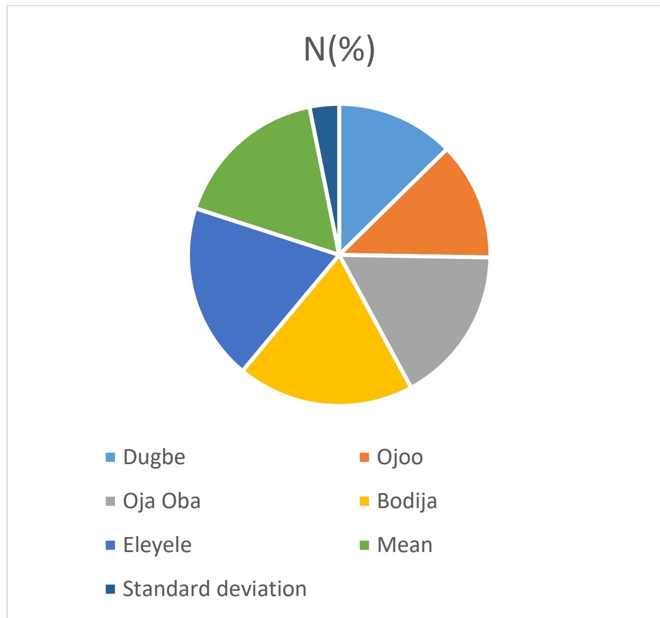


Figure 7: Ni (%) in *AmaranthusViridis*

CONCLUSION

The result reported here confirms that the vegetables collected from selected markets in Ibadan contained substantial amount of heavy metals, hence all of them are consumable while that of Lead (Pb) which recorded the lowest concentration in vegetables collected from Dugbe made the best for consumption.

RECOMMENDATION

We, therefore, recommend that the vegetables collected from Dugbe market in Ibadan should be consumed more.

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