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## DETERMINATION OF TRACE METAL ELEMENTS COMPOSITION IN BITTER LEAF, *VERNONIA AMYGDALINA* DEL

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### ARTICLE INFO

### ABSTRACT

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The research was conducted in the year 2018 to determine the level of trace metals concentration of bitter leaf, *Vernonia amygdalina* Del found in Sabon gari and Yankaba markets of Kano State. The study also aimed at comparing the levels of these metals with the recommended dietary allowance (RDA) limit. Atomic Absorption Spectrophotometric (AAS) method was used to determine the levels of the metals. Results of the analyses showed that copper (Cu) contents in bitter leaf from Yankaba market was 0.633mg/g, iron (Fe) 0.334mg/g, molybdenum (Mo) 0.031mg/g and lead (Pb) 0.048mg/g, respectively. On the other hand bitter leaf from Sabon gari market contained Cu 0.333mg/g, Fe 0.213mg/g, Mo 0.014mg/g and Pb 0.119mg/g, respectively. However, cadmium (Cd) was not detected in samples from both markets. From the findings of this study, it could be concluded that there was varied levels of trace metals in the fresh bitter leaf found in Sabon gari and Yankaba markets and they could not pose any health hazard to consumers as such it can be consumed as food since concentrations did not exceed the recommended dietary allowance (RDA) limit.

### INTRODUCTION

Leafy vegetables are widely used for culinary purposes; they are used to improve the quality of soup and also for their dietary intake. Chiefly, they are made up of cellulose, hemicellulose and pectin substances that give them their texture and firmness (Sobukola et al., 2007). Fresh vegetables are of great importance in the diet because of the presence of vitamins and mineral salts. They are very important protective food and useful for the maintenance of health and for prevention as well as treatment of various diseases (D'Mellow, 2003). However, these plants contain both essential and toxic metals at varied range of concentrations (Radwan and Salama, 2006).

Food plants that tolerate high concentration of potentially hazardous metals (phyto-accumulators) create greater health risks to consumer than those that are more sensitive. Food plants are more sensitive to copper (Cu) and zinc (Zn) than to lead (Pb) and cadmium (Cd). Excessive uptake of both essential and non-essential metals may results in adverse effect on soil biota (Alloway, 1990). Based on the persistent nature and cumulative behaviors as well as high probability of potential toxicity effect of heavy metals as a result of leafy vegetables and fruits consumption, there is need to test and analyze the levels of these trace elements in food items in order to ensure that their levels meet the agreed international requirements.

This is particularly important for farm produce cultivated in this part of the world, where only limited data on heavy metal contents of highly consumed agricultural material are available (Sobukola, et al., 2010).

The recommended dietary allowance (RDA) for iron in a selected serving size is 18mg/day for iron (Alaimo, et al., 1994). In plants, it plays a role in nitrogen fixation and nitrate assimilation through nitrate reductase which is a key enzyme in metabolic process in leguminous plants (Soetan, et al., 2010). Estimated daily requirement for molybdenum is between 0.1 and 0.3mg/day for adults. Exposure to cadmium can cause a number of harmful health effects; eating food or drinking water with high levels of cadmium can severely irritate your stomach and cause vomiting and diarrhea. Breathing high doses of cadmium can irritate and damage the lungs and can cause death. However, the greatest concern is from exposure to lower doses of cadmium over a long period of time. The lower and long term exposure to cadmium through air or diet can cause kidney stones and affect the skeleton which can be painful. Lung damage has also been observed (ATSDR, 2004). Pouls, (1999) have extended the sources of lead pollution by paints lead wastes, cell batteries, lead solders and forms. The toxicity of lead is widely acknowledged, with greatest risk for harm, even with only minute or short term exposure, to infants, young children and pregnant women (Pouls, 1999). Lead poisoning causes abdominal pain, irritability in slurred speech, mental retardation and anaemia (Smirjakova, et al., 2007).

#### **Aim and Objective**

The aim and objective of this research was conducted to determine the levels of copper (Cu), iron (Fe), molybdenum (Mo), cadmium (Cd) and lead (Pb) contained in leaves of *V. amygdalina* obtained in metropolitan markets of Kano, Nigeria and to compares these levels with approved international standards for food consumption.

#### **MATERIALS AND METHODS**

##### **Site of the Study**

The study was conducted in the year 2018 at some selected metropolitan markets of Kano

State. The State is located on 11°59'47"N, 8°31'0"E (Kowal and Knabe, 1972).

##### **MATERIALS OF THE STUDY**

Plastic and glass-wares used in this study were washed with detergent and rinsed with water before immersion in 10% nitric acid (HNO<sub>3</sub>) solution; finally, rinsed with distilled water. Analytical grade reagents and distilled water were used throughout the analysis.

##### **Sample Collection**

Bitter leaf, *V. amygdalina* Del was purchased from Yankaba and Sabon gari markets in Kano metropolis and the leaves were cut into pieces, washed and air dried on the laboratory benches and then dried in an oven at 80°C for 6 hours.

##### **Sample Preparation**

The dried materials were ground to powder using mortar and pestle, 1.0g of the ground samples were weighed separately and poured into 250cm<sup>3</sup>, a mixture of HNO<sub>3</sub> and HCl (1:3) was added. The mixture was digested on a hot plate until a clear solution was obtained, the beaker was cooled and the content was diluted with 20cm<sup>3</sup> distilled water, filtered and made up to 50cm<sup>3</sup> mark volumetric flask (Funtua, et al. 2008). Blank solution was prepared and the solutions were analyzed for copper, iron, molybdenum, cadmium and lead using ALPHA 4 model, Atomic Absorption Spectrophotometer. A calibration plot of absorbance against concentrations of each element under investigation was constructed and finally the concentration of the element was determined from the calibration curve by extrapolation.

##### **RESULTS AND DISCUSSION**

In Table 1 as well as Figure 1, the concentrations of Cu in bitter leaf varied between 0.633 and 0.333mg/g with bitter leaf from Yankaba market having the highest value and that of Sabon gari with the least respectively. These values obtained from research are higher compared to the result published by Barminas, et al. (1998), with 0.018mg/g of Cu. The difference in Cu level could be due to the fact that many soils are geographically deficient in certain minerals and therefore food plants grown in them lack those nutrients, or it could be due to the problem caused by over farming or poor soil management (Barminas, et al., 1998).

The highest iron content of 0.334mg/g was found in bitter leaf from Yankaba market while that of Sabon gari contained 0.213mg/g. Available literature shows that bitter leaf were reported by Ayoola et al. (2010), Barminas, et al.(1998) and Asaolu, et al. (2010), to contain 0.277mg/g, 0.204mg/g and 0.840mg/g of iron respectively. The values obtained are in agreement with those obtained in this work. According to research carried by Barminas et al. (1998), an average culinary preparation contains about 300mg of the fresh leaves of vegetables and this would result in an intake of 30g dry weight leaves per serving portion (Table 1 and Figure 1).

In the result obtained from Table 1 as well as Figure 1, the concentration of molybdenum ranged from 0.014mg/g to 0.031mg/g in bitter leaf from Sabon gari and Yankaba respectively. No much work was found for the composition of Mo in various plants only that reported by Freiburger, et al. (1998), which show low Mo concentration below the detection limit (<0.005mg/g) of the machine used for the analysis carried out on *Corchorus tridens*, but they reported low levels of Mo in

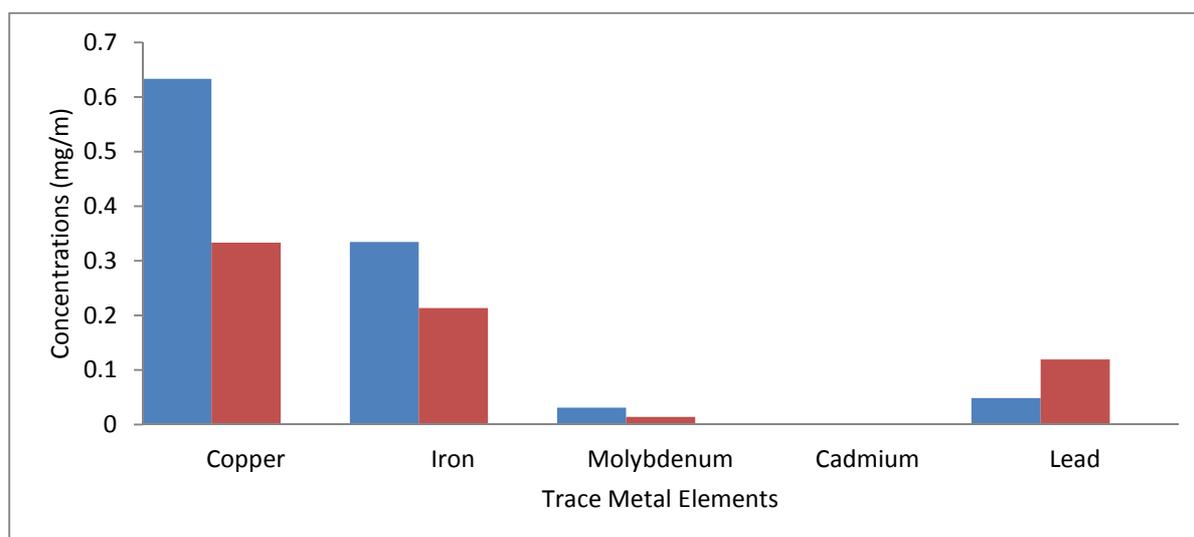
other plants like *Amarantus viridus* (0.0075mg/g), *Ximenia americana* (0.063mg/g), *Moringa oleifera* (0.00745mg/l) and *Maerua crassifolia* which contain as much as 0.022mg/g. The recommended daily allowance for Mo ranges from 0.075 to 0.250mg/g (Nielson, 1996).

Similarly, Table 1 as well as Figure 1 revealed that the level of lead varied from 0.048mg/g in bitter leaf from Yankaba market to 0.119mg/g in bitter leaf from Sabon gari market. This may be attributed to gas fumes released to the atmosphere through automobile engines and vehicle exhausts. Dike (2010), reported *V. amygdalina* and *Adansonia digitata* to have 0.0082mg/g and 0.0053mg/g respectively. Asaolu et al. (2010) also reported mean content of Pb in *Corchorus olitorus* and *Amarantus caudus* to be 0.05mg/g and 0.07mg/g respectively. The values reported by Asaolu (2010) are not significantly different from those reported in this work. Therefore the lead levels in the leafy parts of bitter leaf analyzed seems not to be alarming except in excessive consumption.

**Table 1: Concentration of Trace Elements Analyzed (mg/g) in *V. amygdalina* from Yankaba and Sabon gari markets**

Sample area	Copper	Iron	Molybdenum	Cadmium	Lead
Yankaba	0.633	0.334	0.031	ND	0.048
Sabon gari	0.333	0.213	0.014	ND	0.119

ND = not detected



**Figure 1: Trace Elements Analyzed (mg/g) in *V. amygdalina* Del from Yankaba and Sabon gari Markets**

**CONCLUSION**

Varied levels of trace metals were indicated between fresh vegetables obtained from Sabon gari and that of Yankaba markets. Comparatively, bitter leaf from Yankaba had the highest level of Cu. In addition, bitter leaf of Sabon gari had higher concentration of Pb. Of all the trace metals found in bitter leaf, Mo had least concentrations in both markets, while Cd could not be found at all.

**RECOMMENDATIONS**

- Elements investigated did not pose any health hazard to consumers; as such it can be consumed as food since concentrations

did not exceed the recommended dietary allowance (RDA) limit.

- In addition, from the findings of this study it could also be recommended that periodic examination of these metal compositions in food stuff should be carried out so as to determine the levels of the metals for safe consumption.
- Further more research in the area of proximate composition of the nutritional materials of the leaves and stem of bitter leaf should be encouraged so as to determine the complete nutritional contributions of the plant to human health.

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