

**Heavy Metal Contents of Some Selected Fruits and Vegetables Produced in Ikwo,  
Ebonyi State, Nigeria.**

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**ABSTRACT**

Heavy metal contents of fresh samples of some indigenous fruits and vegetables produced in Ikwo Local Government Area of Ebonyi State were studied using Atomic Absorption/Emission Spectrophotometer (AAS). The levels of Lead (Pb), Zinc (Zn) and Copper (Cu) were estimated in the *Pterocarpus mildbraedii*, *Abelmoschus esculentus* (Okra), *Amaranthus viridis* (Green), *Telefonium occidentale* and *Pterocarpus santalinoides*. The levels were also estimated in some selected fruits such as *Musa paradisiaca*, *Anacardium occidentale* (Cashew), *Afelia africana* and *Chrysophyllum albidum*. The result showed that all the fruits and vegetables contained less than 0.5mg/kg of Lead (Pb). The concentration of Zinc (Zn) in the fruits ranged from 8.82mg/Kg in Star apple to 34.91mg/kg in *Afelia africana* while its concentration in the vegetables ranged from 4.74mg/kg in *Amaranthus viridis* leaf to 81.86mg/kg in *Pterocarpus santalinoides*. The concentration of Copper (Cu) in the fruits ranged from 2.42mg/kg in *Anacardium occidentale* to 4.95mg/kg in *Chrysophyllum albidum* while its concentration in the vegetables ranged from 2.08mg/kg in *Amaranthus viridis* leaf to 9.66mg/kg in *Pterocarpus mildbraedii* leaf. The results show that the indigenous fruits produced in Ikwo accumulate these heavy metal in extents relatively within acceptable limits of these metals except for *Afelia africana* seed which was found to be higher in Zinc (Zn) content (34.91mg/kg) and *Pterocarpus santalinoides* which also revealed a very toxic level of Zinc (81.86mg/kg) which may pose a threat if consumed without proper processing to reduce it to acceptable level.

**Key words:** Heavy metal, indigenous fruits and vegetables.

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**INTRODUCTION**

The term heavy metal refers to any metallic chemical element that has a relatively high density and is toxic or poisonous at low concentration [1]. Some of the metals of utmost concern because of occupational or residential exposure are Lead (Pb), Zinc (Zn) and Copper (Cu). Small amount of these elements are common in our environment and can enter our body via food, drinking water and air, but trace amounts are actually necessary for health, though large amounts cause acute or chronic toxicity - poisoning [2],[3].

Heavy metal toxicity or poisoning could result damaged or reduced mental and central nervous functions, lower energy levels and damage to blood components including

organs like lungs, kidney, liver and other vital systems [4].

Vegetables are plant parts other than fruits, grains, spice, herb or nut, used by humans as food. There are plant parts, usually herbaceous that contain soft and edible portion, which is suitably served with the main course of a meal. Ikwo people are agrarian in nature, producing most of the food commodities such as vegetables, fruits, grains, tubers and spices sold and consumed in Abakaliki metropolis of Ebonyi State. However, the Ikwo is endowed with minerals which led to mining activities in the area. Vegetables are known to accumulate some of these minerals and their consumption may likely lead to toxicity and poisoning.

Fresh and dry fruits and seeds are natural staple food of man. They contain substantial quantities of essential nutrients in a rational proportion. They are excellent sources of minerals, vitamins and enzymes [5].

*Abelmoschus esculentus* (Okra) is a tall annual tropical herb belonging to the mallow family. It is cultivated for its edible green seedpod. It is also used in traditional medicine in the treatment of stomach problems especially as a laxative. *Amaranthus viridis* (Green) is a monoecious annual herb. It is a common leafy vegetable grown in the tropics as a good source vitamins such as vitamin A, vitamin B<sub>6</sub>, vitamin c, riboflavin, and folate, as well as dietary minerals including calcium, iron, magnesium, phosphorus, potassium, zinc, copper and manganese [6].

*Pterocarpus santalinoides* (Igbo: *Uturukpa*) is a thornless tall shrub or sometimes a small tree with a straight smooth stem, having a smooth bark and finely scaly, with a red-purple slash, extruding a red gum [7],[8]. It is used in soup preparation has a high nutritional value [5].

*Pterocarpus mildbraedii* (Igbo: *Oha/ora*) is one out of the three species of *Pterocarpus*, usually found in well-drained soil, rare in deep soils. It occurs in laterites as well as poor soil and it is found more frequently in acid soil [7]. This vegetable is very popular in the Eastern part of Nigeria and nutritionally important to the people. *Azelia africana* (Igbo: Akparata) is a large tree with a spreading crown. It bears pods with seeds which are used in the Eastern Nigeria as soup thickener.

*Musa paradisiacal* (Plantain) is a fast growing perennial arising from underground rhizomes. It is rich in organic matter when ripe and used as food but also used in the unripe form in herbal medicine preparation. *Anacardium occidentale* (English: Cashew). The fruit is rich in water content, carbohydrate, ascorbic acid and other important minerals [8]. *Chrysophyllum albidum* (Igbo: *Udara*), also known as Star apple has a soft pink or purple, milky, sweet pulp surrounding the gelatinous seed (Vincent, 1984). The pulp is edible when ripe and is known to be nutritionally rich [9].

## MATERIALS AND METHODS

The vegetables and the fruits were purchased from *Eke-Amagu* market in Ikwo Local Government Area of Ebonyi State. The vegetables and fruits were washed thoroughly with water to remove all adhering dirt on the surface and rinsed several times with distilled water to retain the freshness and were weighed fresh. The samples were digested and standard methods were used in the analysis. Buck Scientific Atomic Absorption/ Emission Spectrophotometer (AAS) for metal atomization and quantification were used for the metal analyses.

## RESULTS

**Table 1: Heavy Metal Content of Vegetables Produced in Ikwo.**

SAMPLE	Lead (Pb) in mg/kg	Zinc (Zn) in mg/kg	Copper (Cu) in mg/kg
<i>Amaranthus viridis</i> (Green) leaf	<0.5	4.74±0.42	2.08±0.03
<i>Pterocarpus mildbraedii</i> (Oha) leaf	<0.5	27.06±1.20	9.66±0.16
<i>Telefontia occidentalis</i> (Ugu)	<0.5	21.77±1.42	4.79±0.82
<i>Pterocarpus santalinoides</i> (Uturukpa)	<0.5	81.86±2.54	7.26±0.67
<i>Abelmoschus esculentus</i> (Okra)	<0.5	15.54±1.08	4.25±0.19

**Table 2: Heavy Metal Content of Selected Fruits Produced in Ikwo Local Government Area of Ebonyi State.**

Sample	Lead(Pb) in mg/Kg	Zinc (Zn) in mg/Kg	Copper (Cu) in mg/Kg
<i>Anacardium occidentale</i> fruit	<0.5	11.31±0.21	2.42±0.04
<i>Musa paradisiaca</i>	<0.5	8.59±0.86	3.28±0.10
<i>Chrysophyllum albidum</i>	<0.5	8.82±0.34	4.95±0.16
<i>Afzelia africana</i> seed	<0.5	34.91±1.98	4.48±0.18

## DISCUSSION AND CONCLUSION

The concentration of zinc (Zn) in mg/kg varied in each of the food samples. *Afzelia africana* (Akparata) seed contained 34.91 mg/kg; *Abelmoschus esculentus* contained 15.54 mg/kg; *Musa paradisiaca* 8.59 mg/kg; *Chrysophyllum albidum* 8.82 mg/kg; *Telefontia occidentalis* 21.77 mg/kg; *Pterocarpus mildbraedii* 27.06 mg/kg; *Amaranthus viridis* 4.74 mg/kg; *Anacardium occidentale* 11.31 mg/kg and *Pterocarpus santalinoides* contained 81.86 mg/kg of Zinc.

The concentration of copper (Cu) also varied in all the samples with *Afzelia*

*africana* (Igbo: *Akparata*) seed having 4.48 mg/kg; *Abelmoschus esculentus* contained 4.25 mg/kg; *Musa paradisiacal* 3.28 mg/kg; *Chryophyllum albidum* 4.95 mg/kg; *Telefonium occidentale* 4.79 mg/kg; *Pterocarpus mildbraedii* 9.66 mg/kg; *Amarantus viridis* 2.08 mg/kg; *Anacardium occidentale* 2.42 mg/kg and *Pterocarpus santalinoides* contained 7.266 mg/kg of copper.

The concentration of Lead (Pb) in these food samples (fruits and vegetables) produced in Ikwo Local Government Areas were found to be in trace amounts (less than 0.5 mg/Kg). The normal level of lead in the body is between 0.1 - 0.5  $\mu$ mol/L (Debra, 1994)[10]. This result is in line with the standard reference nutrient intake of 0.2 -0.4 mgPb/day in the United Kingdom for adults [10]. High level of lead reduces intelligent quotient of school children especially those living in urban areas (it is estimated that every 10mg/dL increase of lead in the blood leads to 1 - 5 point decrease in the intelligent quotient of children [11]. This can equally result to aggressive delinquency and attention disorders in boys between the age of 7-11 years. World Health Organization stated that 10.0mgPb/day is appropriate for every individual [12].

The concentration of zinc (Zn) in fruits ranged from 8.82 mg/kg in star apple to 34.91 mg/Kg in *Azizelia africana* seed produced in Ikwo. The normal established safe and adequate level of zinc in the body is 10 - 15 mgZn/day [8]. Mills and Dalgano (1972) stated that the zinc value for some fruits of the savannah falls between 6.0 - 15 mg/dL. He however added that industrial pollution can increase the zinc content of plants to about 50 fold. The data generated from this work has not shown much deviation from this trend. *Azizelia africana* seed contained 34.9 mg/kg deposit of zinc indicative of potential toxicity. The zinc deposits in the vegetables ranged from 4.74 mg/kg in *Amarantus viridis* to 81.86 mg/Kg in *Pterocarpus santalinoides* [14].

The tolerable level of zinc in vegetables is between 15 - 30 mg/L [13]. This showed that vegetables produced and consumed in Ikwo is within the safe and tolerable range of zinc mineral deposit, except for *Amaranthus viridis* with a low amount of 4.74mg/kg (can lead to deficiency state) and *Pterocarpus santalinoides* with 81.88 mg/kg zinc deposit (can lead to over-load and toxicity). Zinc play an important role in protein synthesis and in gene expression as well as in wound healing and cellular transport processes[15].

Concentration of copper (Cu) in the fruits ranged from 2.42 to 4.95mg/kg in *Anacardium occidentale* and *Chryophyllum albidum* respectively. The daily average intake for adults is estimated at 2 - 5 mgCu/day. The copper content of these vegetables and fruits fall within acceptable tolerance level except for *Pterocarpus mildbraedii* 9.66 mg/kg and *Pterocarpus santalinoides* contained 7.266 mg/Kg of copper. Copper is associated with a number of metalloenzymes and is important in iron metabolism [16].

The consumption of these vegetables and fruits that are high in metal deposits can

lead to toxicity. However, this study show that indigenous fruits produced in Ikwo are relatively within normal limits of metal deposits except for zinc in *Afzelia africana* (Akparata) seed (34.91 mg/kg) and *Pterocarpus santalinoides* (Uturukpa) 81.88 mg/kg [17].

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