

## Levels of Heavy Metals in Some Soup Thickeners Used In Abomege in Ebonyi State, Nigeria

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**Abstract:** Samples of *Afzelia Africana*, *Brachystogia Nigerica* and *Macuna-sloanei*, were collected from Abaomege in Onicha L.G.A of Ebonyi State and were analyzed for heavy metals using Atomic Absorption Spectrophotometer (Bulk scientific, VGP 210 model, USA) The results revealed the mean concentration of heavy metals content in *Afzelia Africana* was found to be Zn ( $0.42 \pm 0.03$ ); Fe ( $0.42 \pm 0.03$ ); Cr ( $0.02 \pm 0.01$ ). *Brachystogia Nigerica*; Zn ( $0.16 \pm 0.02$ ); Ni ( $0.62 \pm 0.04$ ); Fe ( $0.43 \pm 0.03$ ) and *Macuna-sloanei*: Zn ( $0.22 \pm 0.01$ ) Ni ( $0.43 \pm 0.03$ ), Fe ( $0.41 \pm 0.03$ ) and Cr ( $0.03 \pm 0.01$ ). It was observed that Pb, As, Cd and Cu were not detected in any of the samples. From the results the level of Ni in *Brachystogia Nigerica* was the highest concentration recorded. Levels of all the heavy metals in the investigated soup thickeners were all below World Health Organisation Maximum Level (WHO ML). Heavy metal in food is known to be toxic to human health at elevated concentration, hence regular monitoring is essential for safety of the consumers.

**Keywords:** *Afzelia Africana*, *Brachystogia Nigerica*, *Macuna-sloanei* and Abaomege

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### I. Introduction

Thickening agents or thickeners are substances which when added to an aqueous liquid, increase its viscosity. They provide body, increase stability and improve suspension of added ingredients. Thickening agents are often used as food additives and in cosmetics and personal hygiene products. Food additives are substances added to food to preserve flavour or improve its taste and appearance [1]. In most of the ancient civilisation some seeds are used as soup thickeners and some as soup condiments. Thickeners usually improve the taste and nutritional value of foods [2]. These soup thickeners include *Afzelia Africana*, *Brachystogia Nigerica* and *Macuna-sloanei*, popularly known as *akparata*, *okobo* and *achi* respectively in Igbo land. These seeds are the most commonly used thickening agents in South Eastern part of Nigeria. In Nigeria, the leaves of *Afzelia Africana* are eaten as vegetable by humans and the ground seeds are used as soup thickeners. The roots are used to treat gonorrhoea, chest pains, kidney problems and snake bites [3]. *Macuna-sloanei Africana* is found throughout the tropics and are often used green manure and cover crops. Most of the species are used for medicinal or therapeutic applications [4]. *Brachystogia nigerica* grows in avalanche in Nigeria, Cameroon, Ghana and Ivory Coast mainly along river bank or swampy areas, though it can be found in well drained soils [4].

In the Igbo speaking part of South Eastern Nigeria, soup is in the centre of the people's daily food and culture. Almost all carbohydrate diet is accompanied with one form of soup or another. These seeds are mainly used as thickeners because of their thickening properties in soups. However, an investigation on the concentration of the heavy metals in soup thickeners will help to ascertain whether the thickener is safe for human consumption. High concentration of heavy metals in thickener will inevitably be harmful to human health. Heavy metals are given special attention throughout the world due to their toxic effects even at very low concentrations [5]. Several cases of human disease, disorders, malfunction and malformation of organs due to metal toxicity have been reported [6]. Many researchers have documented heavy metals loads in foodstuffs around the world such as from East Asia [7], Egypt [8] and Nigeria. In Nigeria and other developing countries such data are not readily available. The aim of the work, therefore, is to use atomic absorption spectroscopy (AAS) to determine the heavy metal concentration in different soup thickener and compare their levels with World Health Organization (WHO) Maximum Limit of heavy metal in edible plants.

### II. Materials And Method

Samples of seeds of *Afzelia africana*, *Brachystogia Nigerica* and *Macuna-sloanei* were collected at Abaomege in Onicha Local government Ebonyi State. They were soaked in water for three days, grinded with agate mortar and digested. We digestion of the sample was done by following a procedure described by [9]. 5 g of each sample was weighed into different beakers and they were dissolved in 30mL of mixed acid ( $\text{HNO}_3/\text{HClO}_4$  in the ratio 5:1) for 24 hr. The mixture was then heated on a hot plate till a clear solution showing complete digestion of sample was observed. This is evident when brown fumes changed to white. The solution was filtered with WHATMAN NO.4 filter paper into 250ml standard volumetric flasks and make up mark and

transferred it to air-tight bottles in preparation for AAS analysis. Atomic Absorption Spectrophotometer (Bulk scientific, VGP 210 model, USA) was used for the determination of the heavy metals in the digested samples. All measurements were done in triplicate for the sample and standard solution.

### III. Results

Table 1 presents the result of AAS analysis of heavy metals in *Afzelia Africana*, *Brachystegia nigerica* and *Macuna-sloanei* collected from Abaomege in Ebonyi State.

**Table 1:** Levels of heavy Metals in *Afzelia Africana*, *Brachystegia nigerica* and *Macuna-sloanei*

Concentration (ppm)				
Metal	<i>Afzelia Africana</i>	<i>Brachystegia nigerica</i>	<i>Macuna-sloanei</i>	WHO ML
Lead	N.D	N.D	N.D	0.3
Zinc	0.42 ± 0.03	0.160 ± 0.02	0.22 ± 0.01	100
Arsenic	N.D	N.D	N.D	0.1
Cadmium	N.D	N.D	N.D	0.1
Nickel	0.42 ± 0.03	0.62 ± 0.03	0.43 ± 0.03	1.63
Iron	0.42 ± 0.03	0.43 ± 0.03	0.41 ± 0.03	20
Chromium	0.02 ± 0.01	N.D	0.03 ± 0.01	0.05

WHO ML – World Health Organization Maximum Limit;

ND – Not Detected

### IV. Discussion

Lead, arsenic and cadmium were not detected in the samples of soup thickeners. The three heavy metals are known to be toxic to human body. The results of this work are comparable with those reported by [10].

The levels of zinc ranged from 0.160 ± 0.02 ppm to 0.42 ± 0.03 ppm which are far below the WHO ML (100 ppm). Zinc is one of the least toxic metals and it is very essential element in human diet as it is required to maintain the proper functions of the immune system, normal brain activity and is fundamental in the growth and development of the foetus [11]. Zinc deficiency in the diet may be more detrimental to human health than excess Zinc in the diet [12]. Zinc shortage causes birth defect and anaemia, stomach cramps and vomiting and Skin irritation etc. Although the average daily intake of Zinc is 7-16.3 mg Zn/day, the recommended dietary allowance for it is 15 mg Zn/day for men and 12 mg Zn/day for women [13].

The levels of nickel in the investigated thickeners ranged from 0.42 ± 0.03 ppm to 0.62 ± 0.03 ppm they were below the WHO ML (0.1 ppm). Excess and deficiency of Ni in vegetables and fruits are detrimental to human health [14]. Deficiency of Nickel have been linked with hyperglycemia, hypertension, depression, sinus congestion, fatigue, reproductive failures and growth problems in humans, while excess intake of Ni leads to hypoglycemia, asthma, nausea, headache, and epidemiological symptoms like cancer of nasal cavity and lungs. The prescribed safety limit of Nickel is 3 to 7 mg/day in humans [15].

The levels of iron in the investigated thickeners ranged from 0.41 ± 0.03 ppm to 0.43 ± 0.03 ppm they were far below the WHO ML which is 20 ppm [16]. However, the WHO ML has not yet been established for iron for medicinal plants [17]. Iron is an essential metal required by man for growth and metabolism. It is an integral part of many proteins and enzymes for maintaining good health because it facilitates the oxidation of carbohydrates, protein and fat to control body weight. Low iron content causes gastrointestinal infection, nose bleeding and myocardial infection [18]. Excess amounts result in toxicity and even death [19].

Chromium was not detected in *Brachystegia nigerica* but concentration of 0.02 ± 0.01 ppm and 0.03 ± 0.01 ppm were less than WHO ML. Chromium toxicity in human includes kidney and liver damage, skin rashes, stomach upset and ulcer, respiratory problems and lung cancer and alteration of genetic materials [20].

### V. Conclusion

All studied metals were found to be below WHO ML, hence they are all fit for human consumption. However, prolong consumption of plants with heavy metals will lead to bioaccumulation of the metals in human body. Metals are non-biodegradable and therefore the body does not have the mechanism to excrete it once they are there. Presence of heavy metals in the body inevitably predisposes the affected person to health challenges. Regular evaluation of heavy metals in edible substances is very indispensable.

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