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ASSESSMENT OF SOME HEAVY METALS PRESENT IN 'BANANA (*MUSA ACUMINATA*), MANGO (*MANGIFERA INDICA*) AND ORANGE (*CITRUS SINENSIS*)' FRUITS SOLD IN OFFA METROPOLIS OF KWARA STATE, NIGERIA.

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Abstract

Some heavy metal contents of 'banana (Musa acuminata), mango (Mangifera indica) and orange (Citrus sinensis)' fruits hawking in Offa Metropolis were investigated using Atomic Absorption Spectrophotometer. The results of the analysis shows that cadmium was not detected in the banana, but a value of 0.009ppm was recorded for the mango and 0.019ppm for the orange samples analyzed respectively. While chromium was not detected in the mango sample, values of 0.001ppm were recorded in the banana and orange samples each. Increasing values of 0.001ppm, 0.002ppm and 0.008ppm concentrations of lead were recorded in the banana, orange and mango samples respectively. Nickel was not detected in the mango sample, but values of 0.001ppm and 0.010ppm were recorded in the orange and banana samples respectively. All the values of heavy metals detected were below WHO maximum permissible limits for their dietary consumption, rendering them safe for human consumption in the area concerned.

Keywords: *Banana, Mango, Orange, Heavy Metals*

Introduction

According to Yadav (2010), 'irrespective of its atomic mass or density, any toxic metal may be called heavy metal'. They are members of transition elements that exhibit metallic properties, such as some metalloids, lanthanide and actinides. They 'cause environmental pollution' (Chen, 2003). Guidotti and Ragain (2007) had earlier reported that heavy metals include 'Lead (Pb), Cadmium (Cd), Mercury (Hg), Arsenic (As), Chromium (Cr), Copper (Cu), Selenium (Se), Nikel (Ni), Silver (Ag) and Zinc (Zn)'. According to Cleveland Clinic (2024), 'heavy metals disrupt metabolic functions by accumulating in the body organs'.

Eating fruits can provide the body with nutrients and antioxidants that can boost overall health because they contain vitamins, minerals, fibre and flavonoids (Seilkop, and Oller, 2003). According to Salnikow, *et al.,* (2000), 'plants accumulate heavy metals in their aerial tissues by absorbing them from the air, water or soil'. Plants have the ability to absorb the micronutrients from the air, water and soil, at any concentrations (Sainikow, *et al.,* 2002).

In addition, fruits can be contaminated by using ripening agents such as carbides by the fruit vendors. Although all metals are toxic at higher concentrations, nevertheless, living organisms need some amounts of heavy metals for their proper functioning. However, too much of heavy metals can cause damage to the cells of the living organisms; these include mercury, plutonium and lead. Yet, vanadium, tungsten, and even cadmium can be of some good use to the body under some conditions (Cangul *et al.,* 2002).

Therefore, our focus is to investigate the concentrations of some heavy metals present in 'banana (*Musa acuminata*), mango (*Mangifera indica*), and orange (*Citrus sinensis*)' fruits, hawking in Offa metropoly.

Study Area

This research work was carried out in the Offa Metropolis of Kwara State, Nigeria.

Sources of Materials

The fruit samples; 'orange (*Citrus sinensis*), mango (*Mangifera indica*), and banana (*Musa acuminata*)' used in this research work were purchased at Idi-agbon area, in Offa Kwara State. They were washed with distilled water, identified by a botanist at the department of Biological Sciences, Federal Polytechnic, Offa, Kwara State Nigeria.

Preparation of Samples

Each fruit was peeled and sliced into small pieces and then dried in the oven at 60^0C for a period of 12 hours. Each dried sample was grinded into fine powder using laboratory mortar and pestle and kept in a clean, dry polythene bag for analysis.

All chemicals used for the analysis were of analytical grades supplied by BDH Chemicals, UK, London.

Wet Digestion Procedure

The digestion flask was washed and cleaned properly, then rinsed with distilled water. Two (2) grams of each sample were weighed into a digesting tube, followed by adding one tablet of selenium catalyst, 10ml of concentrated per chloric acid and 10ml of concentrated nitric acid (ratio 1:1). Then, the tube was put inside a digestion block, and slowly heated until totally digested.

Heavy Metal Analysis

The digested samples were washed into 100ml volumetric flasks each and made up with de- ionized water. Each metal was determined from the samples using Atomic Absorption Spectrophotometer (AAS).

Results and Discussion

The result of the analysis carried out on the digested fruit samples using the Atomic Absorption Spectrophotometer are as recorded in table 1

Table 1: Some heavy metal contents of 'banana (*Musa acuminata*), mango (*Mangifera indica*) and orange (*Citrus sinensis*)' fruits

Sample	Arsenic (As) (*ppm*)	Cadmium (Cd) (*ppm*)	Chromium (Cr) (*ppm*)	Lead (Pb) (*ppm*)	Mercury (Hg) (*ppm*)	Nickel (Ni) (*ppm*)
Banana	N D	N D	0.001	0.001	N D	0.010
Mango	N D	0.009	N D	0.008	N D	N D
Orange	N D	0.019	0.001	0.002	N D	0.001

KEY: N D= Not Detected

In all the three fruit samples analyzed, arsenic and mercury were not detected. Cadmium was not detected in the banana, but a value of 0.009ppm was recorded for mango and 0.019ppm for the orange analyzed respectively. While chromium was not detected in the mango sample, values of 0.001ppm were recorded in the banana and orange samples each. Increasing values of 0.001ppm, 0.002ppm and 0.008ppm concentrations of lead were recorded in the banana, orange and mango samples respectively. Nickel was not detected in the mango sample, but values of 0.001ppm and 0.010ppm were recorded in the orange and banana samples respectively.

The adverse effects of 'Arsenic (As), Cadmium (Cd), Chromium (Cr), Lead (Pb), Mercury (Hg) and Nickel (Ni)' had been reported by Gupta *et al.,* (2017), Cavallo, (2003), Fang *et al.,* (2014), Danadevi *et al.,* (2004), Bridges & Zalups, (2017), and Cangul *et al.,* (2002) respectively.

Generally, the heavy metal contents of the fruits analyzed were 'below the permitted levels of heavy metals intake' set by the World Health Organization (WHO, 2018, 2019 & 2020).

Conclusion

In conclusion, the results of analysis have shown that banana, mango and orange fruits hawking in Offa Metropolis contained low levels of metals analyzed.

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