NNPublication Journal of Advance Research in Food, Agriculture and Environmental Science ISSN: 2208-2417

DOI: https://doi.org/10.53555/nnfaes.v9i6.1717 Publication URL: https://nnpub.org/index.php/FAES/article/view/1717

ASSESSMENT OF HEAVY METAL LOAD IN FRUITS AND VEGETABLES CONSUMED IN AND AROUND ANAMBRA STATE POLYTECHNIC, MGBAKWU

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Abstract

Fruits and vegetables are of plant source and are consumed a lot by human and animals. Fruits and vegetables could be contaminated with heavy or toxic metals through contaminated soil and water with these heavy metals. Contaminated fruits and vegetables consumed by man and animals will gradually build up of this toxins and if not detoxified faster in the body will build up to a concentration higher than the permissible level (Zurbrugg et al., 2003). Human activities such as industrial production, mining, agriculture and transportation release a high amount of heavy metals to the biosphere. The primary sources of metal pollution are the burning of fossil fuels, smelting of metal like ores, municipal wastes, fertilizers, pesticides and sewage (Xiaoli, 2007; Radwan and Salama, 2006; Wilson and Pyatt, 2007). The purpose of this quantitative study was to examine the level of heavy metal load of fruits and vegetables consumed in and around Anambra State Polytechnic, Mgbakwu, Southeast Nigeria. Local officials may utilize this study's results to develop a standard that can improve the quality of commercially sold fruits and vegetables in and around the locality.

Keywords: *heavy metal, load, fruits, vegetables, Anambra, State, Polytechnic*

INTRODUCTION

Heavy or toxic metals are trace metals which are detrimental to human health and having a density at least five times that of water. Once liberated into the environment through the air, drinking water, food, or countless varieties of man made chemicals and products, heavy metals are taken into the body via inhalation, ingestion and skin absorption. If heavy metals enter and accumulate in body tissues faster than the body's detoxification pathways can dispose of, then a gradual build-up of these toxins occurs. High concentration exposure is not a necessity to produce a state of toxicity in the body, as heavy metal accumulation occurs in body tissues gradually and, over time, can reach toxic concentration levels, much beyond the permissible limits. (Zurbrugg *et al.*, 2003). Human activities such as industrial production, mining, agriculture and transportation release a high amount of heavy metals to the biosphere. The primary sources of metal pollution are the burning of fossil fuels, smelting of metal like ores, municipal wastes, fertilizers, pesticides and sewage (Xiaoli, 2007; Radwan and Salama, 2006; Wilson and Pyatt, 2007).

Demirezen and Aksoy (2006) have investigated the concentrations of some heavy metals in different vegetables grown in various parts of Turkey. The levels of heavy metals (lead, cadmium, copper, and zinc) have been examined in selected fruits and vegetables sold in local Egyptian markets (2006). Fytianos et al. (2001) studied the contents of heavy metals in vegetables grown in an industrial area of Northern Greece, and Sobukola et al. (2010) investigated the concentrations of some heavy metals in fruits and leafy vegetables from selected markets in Lagos, Nigeria.

Based on their persistence and cumulative behavior as well as the probability of potential toxicity effects, the absorption of heavy metals in human diets as a result of the consumption of vegetables and fruits means that there is a requirement for the analysis of food items to ensure that the levels of trace heavy metals meet the agreed international standards. This is particularly important for farm products from parts of the world where only limited data on the heavy metal content are available. Knowledge of the contamination of fruit and vegetables with heavy metals from the Misurata areas of Libya has not yet been established; therefore, the present study was undertaken with the aim to compare and investigate the concentration of some specific heavy metals (Pb, Cd, Zn, Cu, Co, and Ni) found in some selected fruit and vegetables from Anambra state Polytechnic.

PROBLEM STATEMENT

There is an increasing understanding that contaminated fruits and vegetable consumption is responsible for several health-related disorders such as food poisoning infections.
The proliferation of unregulated sales of fruits and vegetables in Mgbakwu, Awka North and its surrounding environment has raised concerns about food quality and suitability for safe eating in line with regulatory standards. The weakened monitoring and production quality of fruits and vegetables necessitated the need for more research, as most fruits and vegetable sources were inadequately regulated to make them heavy metals contamination free.

OBJECTIVE OF THE STUDY

The main objective of this study is to determine the percentage of heavy metals in fruits and vegetables sold and consumed in and around Anambra State polytechnic Mgbakwu.

MATERIALS AND METHODS

Study Area

The study area is around Anambra State Polytechnic, Mgbakwu, Awka North Local Government Area, which is made up of nine villages. The town is with a population of over five hundred and also houses. However, the town is characterized by low level of environmental sanitation, no slums but scattered poor housing in and with lack of potable water and improper management of wastes especially in the indigenous core areas characterized by high density and low income populations mostly the Indigence.

Sampling Of Fruits And Vegetables

From the fruits and vegetable markets, about 5 fruits and vegetables sold in the town at the time of this study, will be selected by simple random sampling method (here, the selection of units from a population is based on the principle of randomization. Every unit of the population has a calculable (non-zero) probability of being selected.

Random sampling

A subset of the population in which every member of the population has an equal likelihood of being selected.) from various vendors. The distributions of samples were as follows: 5 fruits and vegetables will be picked from the shops around for ease of calculation and also the higher the sample size the better the representation of each sample in the actual population. It the assumption that the fruits or vegetable quality will be satisfactory relying on the fact that the quality control of those fruits and vegetables is very high in the large scale industries.

Therefore all the fruit samples from the 5 different types will be collected from different sellers in different outlets. These will be purchased directly from fruits and vegetable vendors in the shops in and around the state polytechnic. The samples will be collected and stored in cool boxes and transported to the laboratory. The number collected on a day will immediately be processed for elemental analysis.

Digestion

About 2g each of the fruit and vegetable samples will be placed separately in a digestion flask and 20ml of Aqua-Regia (65ml,nitric acid,8ml,perchloric acid and 2ml sulphuric acid) solution introduced. The fruit and vegetable samples will then be subjected to acid digestion on a hotplate at 450^0 for 20-35mins and make up to 50ml mark with distilled water and taken to the AAS machine for analysis.

Determination of Heavy Metals in Vegetables

Powdered ashed samples of the vegetables, 2g each, were accurately weighed into the digestion vessel in flame hood, 5ml of concentrated $HN0_3$ was added and evaporated on a hot plate to the lowest volume possible. Thereafter 10ml each of concentrated $HN0_3$ and $HClO_4$ were added and the content of the beaker evaporated gently. The appearance of a light coloured, clear solution indicated complete digested. The solution was not allowed to dry during digestion. The beaker containing digestion sample was washed with deionised water and filtered. The filtrate was put into100ml volumetric flask cooled and diluted to mark and mix thoroughly. Portion of this solution was taken for required metals determination by aspirating it into the Solar Thermo Elemental Atomic Absorption Spectrometer (AAS), model SE 71906 instrument.

RESULTS

Table 1: Concentration of Heavy metals (ppm) in Vegetation samples and W.H.O Approved limit.

Samples	Cd	Cr	Mn	Ni	Pb
SP A	0.119	0.137	0.00	0.059	0.252
SP B	0.078	0.029	0.00	0.00	0.064
SP C	0.231	0.059	0.00	0.02	3.001
SP D	0.119	0.09	0.00	0.00	0.00
SP E	0.075	0.136	0.135	0.00	0.02
W.H.0 Approved Limit	0.2	0.2	10	1.5	0.3

KEYS:
SP A: Bitter leaf
SP B: Water leaf
SP C: Curry leaf
SP D: Green amaranth
SP E: Fluted pumpkin

DISCUSSION OF RESULTS

Table 1 shows the concentration of heavy metals (ppm) in vegetation samples and W.H.O approved limit. It was discovered that cadmium has the highest concentration 0.231 in SPC (curry leaf) and low concentration of 0.075 in SPE (Fluted pumpkin), Chromium has highest concentration of 0.137 in SPA (Bitter leaf) and low concentration of 0.029 in SPB (Water leaf), manganese has highest concentration of 0.135 in SPE (Fluted pumpkin) and low concentration in other samples, nickel has highest concentration of 0.0059 in SPA (Bitter leaf) and low concentration in SPB, SPD, SPE and also lead has highest concentration of 3.001 in SPC (Curry leaf) and low concentration in SP D (Green amaranth). The heavy metals in the vegetation samples was below the W.H.O approved limits except in sample SPC (curry leaf) which showed higher concentrations in Cadmium and Lead above the W.H.O permissible limit.

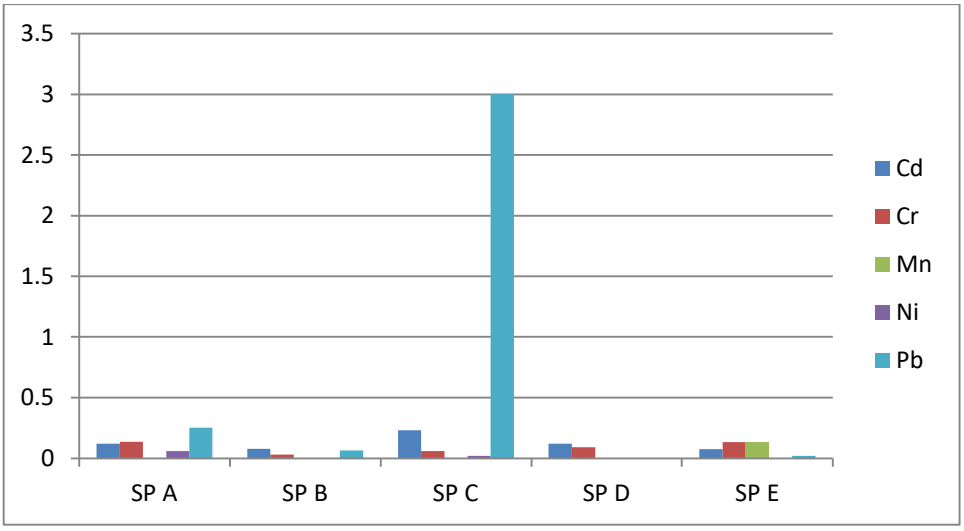

Figure 2

Figure 2 shows that sample C have high concentration of cadmium (Cd) followed by A, D, B and lasty E with W.H.O approved limit higher than the Cd concentration in the vegetable samples with the exception of sample C which is sightly above the approved limit.

Figure 2 shows that the concentration of chromium (Cr) in the samples analyzed is higher in Sample A, followed by sample E, D, C and lastly in Sample B. This results are within W.H.O approved limit.

Figure 2 shows that the concentration of manganese (Mn) heavy metal is only present in Sample E and it within the W.H.O approved limit. The reason for the other samples not having manganese present in them is because of the position where they started growing may have no accumulation of manganese in the soil.

Figure 2 shows that the concentration of nickel (Ni) heavy metal is only present in sample A being higher than in sample C and it is within W.H.O approved limit . samples B, D and E have no Nickel concentration in them because of the position they started growing may have no accumulation of nickel in the soil.

Figure 2 shows that the concentration of lead (Pb) in sample C is higher than that of sample A, followed by sample B, E and D. Lead concentration is far above W.H.O approved limit in sample C with the rest of the samples being within the approved W.H.O limit. This is because of the dumping by the paint industries which is rich in lead.

CONCLUSION

it was observed that SPC vegetable sample collected around Anambra State Polytechnic Mgbakwu has lead and cadmium contamination above the acceptable limit which posed a great risk to the consumers and may cause diseases such as kidney failure, bones, lungs diseases, abdominal pains, constipation, amnesia etc. Chromium, manganese and nickel were present in the vegetables but within the W.H.O approved limit but with further dumping of refuse will accumulate more and above the acceptable limit in the body of the consumers posing a great health risk to the environment and the biosystem at large.

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