ANALYSIS OF HEAVY METALS IN SELECTED IMPORTED FRUITS

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Abstract
In recent time, there is increasing concern for the presence of toxic metals in fruits imported to Nigeria. Nine imported fruits: peach dessert, pear packham, plums red, pomegranate, Kiwi fruits, nectarine, apricots, Clementine and lemon were collected from a popular shopping mall on three different occasions and analysed for Lead (Pb), Mercury (Hg), Chromium (Cr) and Arsenic (As), using Atomic Absorption Spectrophotometer. Results showed that Arsenic had the highest occurrence in Plum red, Apricot and Lemon (7.927±0.010, 7.740±0.007 and 7.301±0.001ppm) respectively. Mercury occurred in highest in pear, then pomegranate and Clementine (4.152±0.051, 2.197±0.001 and 1.946±0.00 6 ppm) respectively. High values of lead and Chromium occurred in almost all the samples. When compared with Codex standard Hg (0.10 ppm), Pb (0.10 ppm), As (0.50 ppm) and Cr (0.30 ppm), the values were mostly high indicating the high content of these toxic metals in imported fruits.

Keywords: *Imported fruit; Elemental analysis of food.*

Introduction

Recent information on the importance of fruit consumption especially their antioxidant activities has led to the astronomical increase in the rate at which they are consumed and consequently the high rate of importation of different varieties of fruits in the Nigerian markets. The demands for these fruits are high and so they are imported from all over the world with little or no monitoring of the level of contamination of these fruits.

A fruit is a part of a flowering plant that is derived from specific tissues of the flower, which can be one or more ovaries, and in some cases accessory tissues. Fruits are the means by which these plants disseminate seeds. They contain polysaccharides, sugars, vitamins, minerals and organic acids which provide their wonderful taste and excellent health properties. Fruits also contain high amounts of chemically active compounds, in particular phenolic compounds (Hui et al., 2006). They are used to increase the quality of soups (leafy vegetables) and also for their dietary purposes (Sobukola et al., 2007). They are made up of chiefly cellulose, hemi-cellulose and pectin ***Substances that give them their texture and firmness.***

Fruits are highly appreciated, tasty food and usually have exceptional nutritional qualities. However, they can be a potential source of toxic elements, some of them having an accumulative effect or leading to nutritional problems due to the low concentrations of essential elements (Tormen et al, 2011).

Trace metals are present in foods in amounts below 50 ppm and have some toxicological or nutritional significance. The elements such as sodium, potassium, calcium, and phosphorus are essential for humans, while metals like lead, cadmium, mercury, and arsenic are found to cause deleterious effects even in low levels of

10–50 ppm. However, iron, copper, and cadmium are found to be necessary in certain quantities in foods, but these elements can be harmful when ingested in high amounts. Other nontoxic metals which are not harmful when present in amounts not exceeding 100 ppm, include aluminum, boron, chromium, nickel and tin. The non-nutritive toxic metals which are known to have deleterious effects even in small quantities (below 100 ppm) are arsenic, cadmium, fluorine, lead, mercury, and others (Williams et al, 2009).

The occurrence of heavy, non nutritive toxic metals in fruits may be expected to be influenced by the nature of the fruit, the mineral composition of the soil from which it originated, the composition of the irrigation water, the weather conditions, the agricultural practices such as the types and amounts of fertilizers used, the types of pesticides, preservatives and other factors (Beattie and Quoc, 2000).

Heavy metal pollution is of significant ecological/environmental concern. This is due to the fact that they are not easily biodegradable or metabolized thus affecting the biological system such as humans, animals, plants and other biota (Yang et al, 2003). The human body requires both the metallic and the non-metallic elements within certain permissible limits for growth and good health. Therefore, the determination of elemental compositions in food and related products is essential for understanding their nutritive importance. Accordingly, the presence of some heavy metals in large quantities in the body may have a toxic effect (Jabeen et al., 2010). Rapid and unorganized urbanization and industrialization have elevated the levels of heavy metals in the environment of developing countries (Sobukola et al., 2010).

The aim of this study was to determine the heavy metal contents of some imported fruits consumed in the South Eastern part of Nigeria and to compare these results with the maximum admissible limit set in drinking water by CODEX.

Materials and Methods

Sample collection

Imported fruits, Peckham Pear, Pomegranate, Kiwi, Lemon, Nectarine, Apricot, Plum Red, Clementine and Peach Desert were collected on three different occasions from a popular retail shop at Enugu, Enugu state Nigeria. These were thoroughly washed, shredded with knives and dried in the oven at 105^{o}C to a constant weight. The dried samples were packaged in plastic bags.

Sample preparation

All the chemicals used were of analytical grade. All the wares were washed and dried before and after each of the experiments, to avoid contamination. Heavy metal analysis was conducted using Varian AA240 Atomic Absorption Spectrophotometer, according to the method of APHA 1995 (American Public Health Association). The analysis of the heavy metals was carried out three times for each sample and the mean value recorded.

Ashing of the samples

2g of the fruits samples each were collected in 20ml crucibles and heated in a muffled furnace at 550'c for two hours. The resulting ash were dissolved in 20ml of 20% H_2SO_4 and filtered. The filtrates were then transferred into a 100ml volumetric flask and made up to the mark with deionised water.

Preparations of Reference Solution

A series of standard metal solutions in the optimum concentration range were prepared, the reference solutions were prepared daily by diluting the single stock

element solutions with water containing 1.5ml concentrated nitric acid per litre. A calibration blank was prepared using all the reagents except for the metal stock solutions. Calibration curve for each metal was prepared by plotting the absorbance of standards versus their concentrations.

Results and Discussion

Table 4.1: ***Heavy metals analysis in selected fruits***

Sample	Lead (ppm)	Mercury (ppm)	Chromium (ppm)	Arsenic (ppm)
Peach Desert	0.130±0.001	0.000±0.000	0.256±0.001	0.000±0.000
Clementine	0.255±0.006	1.964±0.006	0.642±0.001	0.000±0.000
Plums Red	0.021±0.001	0.000±0.000	0.569±0.001	7.927±0.010
Apricots	0.148±0.001	0.000±0.000	0.885±0.001	7.740±0.0007
Nectarine	0.000±0.000	0.000±0.000	0.465±0.003	0.000±0.000
Lemon Imp	0.048±0.001	0.000±0.000	0.328±0.001	7.301±0.001
Kiwi Fruits	0.028±0.002	0.000±0.000	0.676±0.005	0.004±0.001
Pear Packham	0.213±0.001	4.152±0.051	0.397±0.006	0.000±0.000
Pomegranate	0.239±0.001	2.197±0.001	0.142±0.003	0.000±0.000
CODEX	0.1	0.1	0.3	0.5

The concentrations of heavy metals in the fruits at the different periods of sampling are shown in both the table and the histogram. The results of the analyses clearly show that Arsenic has the highest values in all the fruits samples analysed with the following values in Plums Red (7.927±0.010 ppm) Apricot Pear (7.740 ± 0.0007 ppm) and Lemon (7.301±0.001ppm). In similar analysis conducted on fruit juices sold in the market in Romania. it was found that most of the juices contain more than maximum permissible limits of the heavy metals in drinking water (Dehelean and Magdas, 2013). The concentration of arsenic was higher than the estimate amount from the World Health Organization (0.5 ppm) in pomegranate, lemon imp, plums Red and Apricots Pear but not present in peach dessert, Clementine, nectarine and wiki Fruits . The occurance of Mercury was very significant in fruits like Clementine (1.963±0.006 ppm), Pear Packham (4.152±0.051 ppm) and Pomegranate (2.197±0.001 ppm), Chromium having minimum values in apricots (0.885±0.001ppm), kiwi fruit (0.676±0.005 ppm), Clementine (0.642±0.001 ppm) and plums red (0.569±0.001 ppm) and the values for lead having appeared relatively small in pear packham (0.239±0.001 ppm), clementine (0.255±0.006 ppm) and pomegranate (0.239±0.001 ppm).

Lead is of environmental health significance. When absorbed in the human system, it causes many disruptions to human health and, if exposed for a long time, can cause death. It was also observed it was above the estimated amount given by CODEX (0.1 ppm), therefore can cause toxic effect to human. Analysis made by Sobukola et al on local fruits has shown Lead content in fruits (Pineapple, 0.128 ± 0.03 ppm; Orange, 0.106 ± 0.01 ppm; Grape, 0.092 ± 0.00 ppm; Pawpaw, 0.072 ± 0.06 ppm and Banana, 0.118 ± 0.07 ppm). values from this work show that Lead is generally present in almost all fruits both home and abroad. The high levels of Pb in some of these plants may probably be attributed to pollutants in irrigation water, farm soil or due to pollution from the highway traffic (Qui et al., 2000).

The presence of mercury in pear packham, clementine and pomegranate

were high. Comparing the concentrations obtained from this study with the W.H.O. (1996) standard for heavy metals in fruits, these three fruits samples had concentrations higher than the permissible levels stipulated for the metal. The high levels of the heavy metals can be due to the fact that environmental pollution seems to be prevalent in the country these fruits were cultivated as reported from various studies carried out on the environment. High concentrations of heavy metals have been determined in the analysis of water e.g., concentrations of nickel, manganese, chromium, mercury etc. exceeding the WHO (1996) standard (Christensen, 1995). Chromium (Cr) has been noted from the analysis and data above that presence of Cr is in all the selected fruits and in little amount. The consumption of those selected fruits are not toxic to human unless when consumed in large amount it tends to pose a threat to human and might even lead to death if exposure for long. The general observation was the occurrence of heavy metals in all the selected fruits analyzed with most above the standard/estimated values. These fruits may be toxic when consumed by human in excess amount since heavy metals are not that toxic; but only when their concentrations exceeds a certain threshold ("it is the dose that makes the effect") (Sobukola et al., 2010).

Conclusion

Heavy metal occurrence in selected foreign fruits samples sold in the Southeast Nigeria was observed. Elevated mercury and arsenic levels in pear peckham, pomegranate, plums red and apricots sampled are of concern. The sources of high levels of metals in fruit samples may include use of pesticides, use of wastewater for irrigation farming and use of artificial fertilizers. In assurance of safety to consumers against health risk of heavy metal intake, it would be in their interest that regular assessment of sources of heavy metals from areas that can impact on food safety be carried and routine analyses be carried out on imported fruits before dumping into the Nigerian market. This study has brought forth baseline data on heavy metal contamination of selected fresh fruits imported into the country. It could be said that the consumers of fresh fruits in Nigeria are at risk of heavy metal contamination especially the ones studied in this work.

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