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CADMIUM AND LEAD CONTENTS OF UNPACKAGED TAPIOCA EXPOSED FOR SALE IN SELECTED MARKETS IN LAGOS, SOUTH WEST NIGERIA

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ABSTRACT

The levels of cadmium and lead in unpackaged Tapioca, a cassava product, consumed as breakfast meal from five selected markets were investigated using the anodic stripping voltammetry. The levels of cadmium in tapioca ranged from 1.7 to 2.7ug/g, while the lead contents ranged from 5.2 to 7.6ug/g. Analysis of the results using the t- test shows that the lead level in tapioca samples from Agege, Orile Agege and Oyingbo did not differ significantly ($p \leq 0.05$) from each other. However, they differed significantly from those samples from Oke-Odo and Mushin. The cadmium levels in Tapioca samples from Agege, Mushin and Oke-Odo differed significantly ($p \leq 0.05$) from the samples of tapioca from Orile Agege and Oyingbo. The level of the contaminants did not exceed the level found in human milk in studies carried out by World Health Organization in selected countries. The results provide reliable information on the possible dangers arising from the consumption of unpackaged tapioca exposed to contaminants on high traffic motorways.

Keywords: Cadmium, Lead, Contaminant, Unpackaged Tapioca

INTRODUCTION

There is need for regular monitoring of toxic trace elements in biological materials and processed foods considering the harmful effects of toxic trace elements like cadmium and lead in the body. The symptoms and pathology of cadmium and lead poisoning are well documented (Adeloju and Bond, 1984; Stephen *et al.,* 1982). Concern has also arisen over the health effects of long term low level exposure to these elements (Kovar *et al.,* 1984).

In Nigeria, Tapioca, a cassava product taken as breakfast meal, and commonly consumed among local inhabitants is produced by frying starch in local utensils. It is sold in the unpackaged form in markets located along motor highways.

There are also reports that the cassava crop might accumulate these contaminants since they are mostly grown along traffic highways (Odoemena and Akpabio, 1997; Satzger *et al.,* 1982). The reasons had led to the speculation that the product may not be absolutely safe for human consumption.

This study was therefore undertaken to establish the level of cadmium and lead in unpackaged tapioca exposed for sale along motor highways in five selected markets in Nigeria.

An accurate, precise and sensitive method is needed for the determination of these elements in foods at concentration lower than can be determined by current official methods. (Rose, 1973; Smoley, 1992; Isao et al., 1988), hence, anodic stripping voltammetry was chosen because it has been developed and tested for its reproducibility and sensitivity (Stephen *et al.,* 1982; Adeloju and Bond, 1985).

MATERIALS AND METHODS

Sample Collection

The twenty (20) tapioca samples for this study were collected from 5 different markets located along motorways in Lagos; Southwest Nigeria. This represents four samples from each market.

Reagents

All acids used were Aristar grade (B.D.H. Chemicals). While other reagents were of analytical grade. Distilled and deionized water was used throughout.

All glass wares when not in use were kept in nitric acid and rinsed with water prior to use.

Preparation of Standard Solution

Stock solution of calmium and lead (each 20mg/litre) were prepared by dissolving their nitrate salts in 0.1M Hydrochloric acid solution, and stored in pre-washed polyethylene bottles.

The working standards were prepared on a daily basis by appropriate dilution of the stock solutions with 0.1M Hydrochloric acid solution. Distilled and deionized water was used in all solution preparations and for rinsing.

Sample Preparation

All glass wares were thoroughly soaked in 20% (v/v) HNO_3 for 24 hours and rinsed with distilled and deionized water to prevent contamination.

About 0.5g sample of tapioca was added to $10cm^3$ conc. Also, HNO_3 $1cm^3$ H_2S0_4 (conc.) in a $150cm^3$ conical flask. The contents of the flask were digested to about $5cm^3$ volume and cooled.

Another $19cm^3$ (conc.) $HN0_3$ was added and digestion repeated again to a volume of about $5cm^3$. The final volume of the digest was diluted to $50cm^3$ with distilled and deionized water in a $50cm^3$ volumetric flask.

Instrumentation

An EG & G Priceton Applied research microprocessor – based polarographic analyzer (PAR Model 384) equipped with a PAR Model 303 static mercury drop electrode and a PAR Model 305 stirrer was used to record all stripping voltammograms.

Preparation of Standard Plot

Ten millimeters of each of the standard solutions was added to the polarographic cell with fixed-volume scocorex micropipette with disposable tips, deaerated with purified nitrogen and subject to anodic stripping voltammetry determination. The current associated with the re-oxidation of metal was measured as peak height during anodic scanning.

The concentrations of the series of standard solutions were then plotted against the corresponding peak heights for each analyte.

Determination of Analyte in Sample

Aliquot ($5cm^3$) of the sample digest was transferred to the polarographic cell, deoxygenated and cadmium and lead determined under the following conditions:

E_i (initial) = -0.8v
E_f (initial) = 0.2v

Scan at 5m Vs^{-1}; Deposition within 60 secs; and 10µA Range

From the standard plot of each of the analytes, the concentration of each analyte in the sample was calculated as shown below using the peak height of the analyte
µg of analyte/gm of sample = B x 50/W x A (Stephen et al., 1982)

where:
A = Volume of sample taken for analysis
B = µg of analyte in sample solution aliquot
W = Weight of sample taken (g)
$50cm^3$ =V (Total volume to which the sample was made to solution)

RESULTS AND DISCUSSION

The results reveal a range of 1.6 to 2.7µg/g of cadmium and 5.2 to 7µg/g of lead in all the samples subjected to analysis.

Statistical analysis of the results using the t - test (Duncan, 1955) shows that the lead level of tapioca samples from Agege, Orile Agege and Oyingbo do not differ significantly ($p \leq 0.05$). However, they differ significantly ($p \leq 0.05$) from those samples from Oke-Odo and Mushin. Cadmium levels of tapioca sample from Agege, Mushin and Oke-Odo differ significantly ($p \leq 0.05$) from the samples of tapioca from Orile Agege and Oyingbo. The variation in the levels of the contaminants in all the samples could be due to contamination at different levels, the differences in the level of contamination of cassava tubes (Odoemena and Akpabio, 1997).

A comparison of the lead level found in tapioca in this study was done with that found in human milk for 5 different countries in another study by WHO (1973) shows that the lead level in tapioca compares with the level found in human milk for 3 different countries and lower than the value found in human milk for 2 different countries (Philippines and Hungary).

A comparison of the cadmium level found in tapioca in this study were done with that found in human milk for different countries. According to (WHO (1973) cadmium level in tapioca was higher than the value found in human milk in 4 different countries (Table 2).

Table 1: Mean concentration of cadmium and lead (µg/g) in Tapioca from five selected markets in Lagos, Southwest Nigeria

Sample sources	Cd level (µg/g)	Pb level (µg/g)
Agege	1.6 ± 0.11^b	7.6 ± 0.16^a
Mushin	2.7 ± 0.12^a	7.5 ± 0.16^a
Oke-Odo	2.6 ± 0.12^a	7.4 ± 0.22^a
Orile-Agege	1.7 ± 0.11^b	5.2 ± 0.099^b
Oyingbo	1.9 ± 0.12^b	5.3 ± 0.26^b

Data are means of 4 determinations; and
values in the same column with the same superscript are not significantly different ($p \leq 0.05$).

Table 2: A comparison of the levels of heavy metals in human milk from different countries (µg/g)

Elements	Countries				
	Guatemala	Hungary	Sweden	Philippines	Zaire
Lead	1.8	10.0	1.3	11.0	2.3
Cadmium	0.6	0.70	0.8	1.7	0.5

(WHO, No. 532 1973) and (WHO/IAEA, 1989).

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