Nickel Levels in Some Common Spices in Southeastern Nigeria

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ABSTRACT

The levels of Nickel (Ni) were determined in fifty different samples of common spices purchased from three major markets in Southeastern Nigeria using atomic absorption spectrophotometer. Two grams of dried ground samples were digested using 2:1 HNO_3 / $Hclo_4$ mixture and analysis of Ni metal were carried out. Results showed that ranges of detectable values µg/g of the common food spices and processed spice samples for Nickel (Ni) were 1.40-5.50 µg/g and 2.20-11.50 µg/g respectively. One way analysis of variance showed that the mean concentration of Ni in each selected common spice are all the same since P>0.05. The mean concentration of Ni in the various spices are the same with respect to location since P>0.05. The mean concentration of Ni in each processed food spices are the same at P>0.05 while the mean concentration of Ni in the various processed food spices are also the same with respect to location at P>0.05. The daily human intakes of Ni have been computed and was observed that the analyzed samples were below recommended values by FAO/WHO.

Keywords: Atomic Absorption Spectrophotometer, common food spices, Detectable, Nickel, Processed food spices and Southeastern Nigeria.

INTRODUCTION

Food spices are used as diet components often to improve colour, aroma, palatability and acceptability of food. Most natural spices consists of rhizomes, barks, leaves, fruits, seeds and other parts of plants (Sherma 2004). The addition of spices that may be contaminated with trace heavy metals to food as a habit may result in accumulation of these metals in human organs and lead to different health hazards

Heavy metals are those with atomic weights from 63.546 to 200.590 (Kjennish 1992), and specific gravity higher than 4 (Connell *et al.*, 1992). These metals may reach and contaminate plants, vegetables, fruits and canned foods through air, water and soil during cultivation (Husain *et al.*, 1995, Ozores *et al.*, 1997 and Geer *et al.*, 1989) and also during industrial processing and packaging (Tsoumbari *et al*., 1994). At present, there is little information about the safety of these spices with respect to heavy metals contamination in southeastern Nigeria, hence the present research was taken up to determine the level of Nickel in fifty selected food spices that are sold in three major markets in southeastern Nigeria.

EXPERIMENTAL

Fresh vegetables and other spices of plant origin were purchased from Onitsha, Enugu and Nnewi markets in Southeastern Nigeria. They were identified and classified according to their common and botanical names by the Department of Crop Science, University of Nigeria Nsukka.

Analyses

Reasonable quantities of fresh leafy and non-leafy spices were washed with tap water and dried at room temperature. The samples were placed in the watch glass and dried in an oven at 105^{o}C for six hours until constant weight was maintained. The dried samples were ground with wooden mortar and pestle and kept in acid leached nylon bags in a desiccators prio to digestion. The processed samples and dried spice samples were kept as purchased. The processed and dried samples were ground, packaged and left for analysis 2.00g of each ground sample were placed in 20ml $HNO_3/HCLO_4$ (2:1) mixture in a beaker covered with petri dish, digested on electric hot plate. The digest was diluted to 50ml with deconised water.

Analyses for chromium were carried out using a GBC Avanta ver. 2.02 Atomic Absorption Spectro-photometer equipped with air-acetylene flame.

Data Analysis

Daily intake of heavy metals from common spices

The daily intake of heavy metals through the consumption of common spices tested was calculated according to the equation (Qui *et al*., 2004).

Daily intake of metals (DIM) = DVC x VMC

DVC = daily spice consumption; VMC = mean vegetable metal concentrations (mg/day, dry weight). Where daily vegetable consumption was taken as 98g of vegetables per person per day as set by the FAO/WHO (1999), for heavy metal intake based on body weight for an average adult (60 kg body weight)

RESULTS AND DISCUSSIONS

Table 1: Mean concentration (n-3) of Nickel in the food spices (fruits, vegetables and other natural spices (dry weight µg/g)

Botanical names	Common name	Ni
Solanum anomalum	Buba anara	3.83 ± 2.05
Pisum sativum	Akidi	5.28 ± 5.22
Musa sapientum	Banana	1.77 ± 0.63
Doncas carrota	Carrot	2.30 ± 1.40
Cucumis sativus	Cucumber	2.05 ± 0.62
Solonum mologena	Garden egg	2.14 ± 2.53
Phaseohus vulgari	Green bearu (pas)	1,90 ± 0.84
Amaranthus hybridus	Green vegetable	2.02 ± 0.69
Lpomea batata	Irish potatoes	2.10 ± 1.07
Abelmosihus macnzphylla	Okro	1.81 ± 0.76
Allium cepa	Ordinary onious	2.24 ± 1.12
Carica papaya	Pawpaw	18.82 ± 0.76
Aranos conosus	Pineapple	2.24 ± 1.12
Musa paradisaca	Plantain	1.96 ± 0.11
Citrus cinensis	Sweet orange	2.53 ± 1.40
Solanum tuberosum	Sweet potatoes	1.82 ± 0.84
Lycopersicon esculenton	Tomatoes	2.33 ± 1.02
Pentaclethra macrophyll	Ukpaka	1.87 ± 0.85
Gongronema letifolium	Utazi	4.06 ± 3.57
Citraillus valgaris	Water melon	1.88 ± 0.10
Allium cepa	White onions	2.67 ± 0.69
Ocilimum gratisimum	Curry leaves	3.46 ± 2.70
Monodova mycistica	Efu	3.45 ± 0.27

Mandora mynstica	Ehulu	2.04 ± 0.88
Allium sativum	Garlic	1.80 ± 1.01
Zingber officinule	Ginger	2.37 ± 1.06
	Janser	3.94 ± 3.02
	Kamanpari	2.79 ± 0.54
	Kpafura	3.076 ± 2.41
	Millo	1.74 ± 1.44
Pipeguineense	Mkpulu uziza	4.09 ± 1.38
Myristica fraginace	Nut meg	1.42 ± 0.87
	Onyesibelu	2.42 ± 0.99
	Orima	1.91 ± 1.52
Piper nigium	Red pepper	2.61 ± 0.44
	Rosemary	5.53 ± 1.93
Ocimium americanus	Scent leaves	3.31 ± 2.17
Thymus vulgaria	Thyme	2.72 ± 1.41
Xylopia aethiopica	Uda	3.65 ± 1.39
Range		1.40 - 5.50
WHO FAO 2001 µg/g		67
P-value		P>0.05

Nickel was detected in 98.3% of the fruits, vegetables and other natural spices with a range from 0.15µg/g in orima from Onitsha samples to 11.05 µg/g in white onions from Nnewi sample. The mean concentration of Ni ranges from 1.40 – 5.50 µg/g. The mean concentration of Ni in fruits, vegetables and other natural spices of the study are lower than the WHO/FAO permissible limit of 67µg/g.

Table 2: Mean Concentration of Nickel (µg/g dry weight) in fruits, vegetable and other natural spices from each market.

	Enugu		Nnewi		Onitsha	
Metal	Fruits and vegetables	Other natural spices	Fruits and vegetables	Other natural spices	Fruits and vegetables	Other natural spices
Ni	3.34 ± 1.46	3.38 ± 1.15	2.57 ± 2.00	2.45 ± 1.56	1.35 ± 0.75	6.72 ± 2.00

One way analyses of variance showed the mean concentration of Nickel in each selected common spices are all the at P>0.05. The mean concentration of Nickel in the various spices are the same with respect to location at P>0.05.

Table 3: Mean concentration of Nickel (µg/g) (dry weight) in processed spices.

Common Name	Conc of Ni
Benny	5.98 ± 3.33
Fried rice seasoning	5.19 ± 3.42
Maggi star	11.53 ± 5.93
Mixed spices	2.15 ± 1.83
Nut meg	3.32 ± 1.36
Onga	9.90 ± 1.95
Pepper	6.23 ± 4.33

Eshallot	2.64 ± 1.86
Steak seasoning	3.26 ± 0.86
White maggi	5.90 ± 1.09
Range	2.20 - 11.50
WHO 1996.FAO 2001µg/g	67
P-value	P>0.05

Nickel was detected in all the analysed processed spice samples ranging from 0.58 µg/g in eshallot from Onitsha samples to 9.72 µg/g in Benny from Nnewi sample. generally, the Ni concentrations in fruits, vegetables and other natural spices are higher than the concentrations of Ni in processed samples. This is an indication of the effect of the heat applied during the processing of samples that reduces the quantity of heavy and toxic metal in substances. The concentration of Ni µg/g in the processed samples are far lower than the WHO 1996 and FAO 2001 permissible limit of 6µg/g).

Table 4: Mean Concentration of Nickel µg/g in processed spices from each market.

Metal	Enugu	Onitsha	Nnewi
Ni	6.77 ± 4.63	4.03 ± 3.17	10.92 ± 8.45

One way analysis of variance showed that the mean concentration of Nickel in each selected common spices are the same at P>0.05. There is no significance difference. The mean concentration of Nickel in the various spices are the same with respect to location at P>0.05.

Table 5: Estimation of Nickel intake through consumption of fruits, vegetables and other natural spices. in southeastern Nigeria.

Heavy metal	Mean conc µg/g	Daily intake µg/dry	WHO/FAO limit µg/g
Ni	2.20 ± 11.50	0.009 - 490	500

Source: b = Shuaibu *et al.*, in (2012)
Except in Pawpaw (18.82 ± 0.76) our estimated daily intakes for nickel in the fruits, vegetables and other natural spices studied here is below WHO/FAO PTDI limit (Table 5).

Validation of Method Used
This method has been used and published by Poof COB Okoye my supervisor

CONCLUSION
The results reported here confirm that the food spices obtained from the three major markets in Southeastern Nigeria contained reduced or trace amount of nickel. The level of nickel obtained do not appear to pose any serious health hazard problem of concern yet.

RECOMMENDATIONS
We recommended that people living in contaminated areas should not eat large quantities of vegetables to avoid excess accumulation of heavy metals in the body. Regular monitoring of these toxic heavy metals from fruits vegetables and other natural spices is essential to prevent excessive build up in the food chain and as the spice samples are transported from different sources.

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BIOGRAPHY

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