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Determination of Heavy Metals in Fruit Spices

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ABSTRACT: *The concentrations of some heavy metals such as lead (Pb), Cadmium (Cd), Cobalt (Co0 and Selenium (Se) present in common fruit spices available at local markets in Nigeria were determined using Atomir Absorption Sprectrophotometry (AAS). The study showed differences in metal concentrations according to the locations. The concentration of lead (Pb) ranged from trace to 12-30 mgkg^{-1} on dry weigh basis where as that of cadmium (Cd) was ranged from 1.20 mgkg^{-1} to 3.00 mgkg^{-1}.The concentration level of cobalt was from zero to 0.60 mgkg^{-1}. While variable levels of selenium were detected from zero to 12.05 mgkg^{-1}. Some of these concentrations are above the standard limit approved by WHO and FAO. No risk from daily intake of the most of fruit spices under study for hazardous Pb, Cd, Co and Se if the human take about 20g of spices per day. But there are dangerous from thyme and ginger for lead.*

Key words*: Atomic Absorption Spectrophotometer, Cadmium, Cobalt, Heavy metals, Lead, Selenium* **.**

I. INTRODUCTION

Spices are dried parts of plants, which have been used as diet components often to improve color, aroma, palatability and acceptability of food. They consist of rhizomes, barks, leaves, fruits, seeds, and other parts of plant [1] Most of these are fragrant, aromatic and pungent. The bulk of the dry material of spices contains carbohydrates, and organic compounds having diverse functional groups. The addition of spices that may be contaminated with trace and heavy metals to food as a habit may result in accumulation of these metals in human organs and lead to different health troubles.

The wide spread of contamination with heavy metals in the last decades has raised public and scientific interest due to their dangerous effect on human health [2] This has led researchers allover the world to study the pollution with heavy metals in air, water and foods to avoid their harmful effect [3] and to determine their permissibility for human consumption. Heavy metals are those with atomic weights from 63.546 to 200.590 [4] and specific weight 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 [5], [6], [7] and also during industrial processing and packaging [8] Thus several studies were done to determine the concentration of heavy metals in spices, dry fruits and plant must[1],[2],[5] and to study their dangerous effects. Subjecting to trace and heavy metals above the permissible affect the human health and may result in illness to human fetus, abortion and preterm labor, and mental retardation to children. Adults also may experience high blood pressure, fatigue and kidney and brain troubles (FAO 1984). Our country Nigeria cultivate spices among a lot of food stuff from. These spices may be subjected to contamination by way or more as described above. We are not aware of published data or results about the contamination and concentration of trace and heavy metals in spices available in the local markets of Ihiala except that of [9] and[10] , which were done for a very few kinds of spices. The objective of this work is to estimate the levels of some heavy metals (lead, cadmium, cobalt, and selenium that may be present in spices available in local markets in Ihiala town. Also, the levels of investigated metals were recommended by the international Organization FAO and WHO).

II. MATERIALS AND METHODS

Spices samples were collected from local markets, recognized and classified according to their English name, Scientific name (Table 1). Sample origin is not specified.

SAMPLE PREPARATION

Samples were cleaned and oven-dried at 80^{o}C for approximately 12 hours before chemical analysis. The dried samples were ground in a wooden morta till obtaining fine particles that pass through a 0.5mm mesh and kept dry for analysis.

Table 1: Scientific and Common names of Studied Spices

Common Name	Scientific Name	Family
Black pepper	Capsicum nigrium	Piperaceae
Ginger	Zingiber afficenalis	Zingibera Ceae
Garden sage	Salvia officinalis	Labiatae
Thyme	Thymus vulgaris	Labiatae
Nutmeg	Myristica frangrance	Myristicaceae

III. DETERMINATION OF METAL CONCENTRATION

For determination of heavy metal concentrations, a wet digestion of the dried samples was done according to the method described [10] using concentrated H_2SO_4 and 30% H_2O_2 mixture. To a 0.5g of dry ground sample placed in 100m beaker, was added 3.5m of 30% H_2O_2. The content of the beaker was heated to 100^{o}C and the temperature was gradually increased to 250^{o}C and left at this temperature for 30 minutes. The beaker was cooled and more 1ml of 30% H_2O_2 was added to the digestion mixture and the contents were reheated again. The digestion process was repeated more than one time until clear solution was obtained. The clear solution was transferred into 50ml volumetric flask, and completed to the mark with double distilled deionised water. A blank digestion solution was made for comparison. A standard solution for each element under investigation was prepared and used for calibration. Metal measurement was performed with a Perkin-Elmer Model 2380 Atomic Absorption Spectrometer, double beam and deuterium background correction. Hollow cathode lamps of Pb, Cd, Co and Se were used at specific wave length of every metal. Measurements were done against metals standard solutions. The daily intake (mg kg^{-1} day $^{-1}$) was calculated based on these suppose.

1. The human weight is 50kg and
2. The human intake from spices per day is 20g.

The daily intake (mg kg $^{-1}$ day $^{-1}$) = metal concentration in spice x 20/1000/50.

IV. RESULTS AND DISCUSSION

Table 2: Elements Concentrations (mg kg $^{-1}$) on dry weight basis of studied common spices Elements mg kg -1 on dry weight bases elements.

Spices Name	Pb	Cd	Co	Se
Capsicum nigrum	nd	nd	nd	nd
Zingiber afficenalis	0.58	0.06	0.30	nd
Salvia officenalis	nd	nd	nd	4.20
Thymus vulgaris	0.85	nd	0.63	6.60
Myristica fragrance	nd	0.04	nd	nd
Standard limit	0.30	0.20	0.40	3.50

nd= Beyond detectable limit

The contents of Pb, Cd, Co and Se in different common spices were presented in Table 2. The values of metal concentrations were compared with the maximum permissible concentration of 0.30, 0.2, and 3.50 mgkg $^{-1}$ for Pb, Cd, Co and Se respectively as recommended by Codex Alimentarius Commission [13] . The lead contents of different samples are given in Table 2. As comparing with standard limit the thymus vulgaris has the highest content of lead (0.85 mg kg $^{-1}$) that exceeds the standard level recommended by [13] (0.30 mgkg^{-1}). Sample of zingiber afficinalis also contained higher concentrations of lead (0.58 mg kg $^{-1}$) than that recommended by [13] However, zero readings were obtained for salvia officinalis and Myristica fragrance.

As shown in Table 2, the concentrations of Cadmium of all the samples under investigation were under the maximum permissible concentration (0.20 mgkg^{-1}) of cadmium [13] The amound of cadmium was in the range 0.04 mgkg^{-1} in myristica fragrance to 0.06 mgkg $^{-1}$ for zingiber afficinalis. This presence of cadmium might be due to the use of cadmium containing phospheha fertilizers, or from the practice of growing these plants on soil amended with sewage sludge, or both. However, other samples like capsicum nigrum, salvia officinalis and thymus vulgaris show no detectable amount of cadmium. These results agree with what was reported earlier [12] that lead concentration in food products ranged from undetectable levels to a few mgkg-1 of wet weight. Varied level of cobalt concentration were found as shown in Table 2. Samples of capsicum nigrum, Salvia officinale, and myristica fragrance are free from cobalt while the rest of the samples contained variable amount of cobalt 0.30 – 0.63 mgkg^{-1}.

The levels of selenium are given in Table 2. The data shows variation in concentration of selenium for the investigated spices. Thus zero readings were obtained for capsicum nigrum, zingiber afficenalis and myristica fragrance. The rest of samples contained amount in the range 4.20 mgkg^{-1} in salvia officenalis to 6.60 mgkg^{-1} in thymus vulgaris. The concentration of these two samples exceeded the recommended [13] level (3.50 mgkg-1).

The results in Table 3 showed that no risk from daily intake of the most of spices under study for hazardous Pb, Cd, Co and Se if the human intake is about 20g of spices per day. But there are dangerous from thymus vulgaris and zingiber afficenails for lead.

V. CONCLUSION

In conclusion, according to [14] the minimal risk levels for hazardous Pb, Cd, Co and Se through oral route and has acute effect are 0.0002, 0.0002, 0.01, 0.005 mg kg^{-1} day $^{-1}$ respectively. Whereas human needs from spices is very few grams per day there is no risk from used the spices under study in the food. And an also there should be thorough control for imported food stuff at customs to meet FAO/WHO recommendations and tolerable daily intake limits for heavy metals, and to avoid the passing for human consumption and prevent unknown disease.

Table 3: Daily Intake ($Mgkg^{-1}$ day $^{-1}$) more than 20g of metals of common spices effect based on 50g of human body.

Spices	Lead	Cadmium	Cobalt	Selenium
Capsicum nigrum	**No effect**	**No effect**	**No effect**	**No effect**
Zingiber afficenals	**Acute**	**No effect**	**No effect**	**No effect**
Salvia officenalis	**No effect**	**No effect**	**No effect**	**No effect**
Thymus vulgaris	**Acute**	**No effect**	**No effect**	**No effect**
Myristica fragrance	**No effect**	**No effect**	**No effect**	**No effect**

REFERENCES

[1] Wahid M; a Satter A, nd Durrani S. K. (1989) Concentration of selected heavy metals in spices, dry fruits and plant nuts. Pland Foods for Human Nutrition. 39 (3) 279 – 286.

[2] Gilbert, J. (1984): Analysis of food contamination Elsevier App. Sci. Pups London 1.

[3] Zakrzewski, S. F. 1991. Principle of environmental toxicology. ACS

[4] Kennish, M. J. 1992. Ecology of Estuaries. Anthropogenic effects. (RC Press, Inc. Boca Raton, F/. Nitrates, Nitrites and N-nitroso compounds. Geeneva, World Health Organization, 1978 (Environmental Health Criteria 5).

[5] Husain, A. Baroon Z. Al-klalafawi, S. Al-Ati T. and Sawaya W. (1995): Heavy metals in fruits and vegetables grown in Kuwait during the oil well fires. Arab Gulf J. Sci Research 13: (3) 535 – 542.

[6] Ozores Hempton M. Hanlon E; Bryan, H and Schaffer B. (1997): Cadmium, Copper Lead, nickel, and zinc concentrations in tomato and squash grown in MSW compost-amended calcareous soil. Compost Sci. and utilization 5: (4) 40 – 45.

[7] Geert, E. W. Van Loon Johannes, and T. Kars. 1989. Heavy metals in vegetables grown in the Netherlands and in domestic and imported fruits, Z Lebensm unters Forsch 190:34-30.

[8] Tsoumbaris, P. and Tsoukali – Papadopoulon H (1994): Heavy metals in common food stuff quantitative analysis. Bulletin of environmental contamination and toxicology. 53: part 1. Pp. 61-66.

[9] Selim, A. I. Al-Jasser M. S. and A-Eed M. A. 1994. The fatty acids composition and the chemical characteristics of some umbelliferae spices. Annals of Agric.

[10] Al-Eed, M. A., Al-Jasser M. S. and Selim A. L. (1997): The chromatographic determination of fatty acids content and the chemical characteristics of some Saudi spices. J. Agric. Sci. Mansoura. Univ; 22(5): Sci. Moshtohor. 32 (4): 1995 – 2004.

[11] Oehme, F. W. (1989): Toxicity of heavy metals in the environment. Marcel Dekker, Inc. New York, Part 1, 1.

[12] Waldraw, H. A. Stofen, D. (1974) Sub-dionical lead poisoning. Academic Press, London.

[13] FAO/WHO 1984. Joint FAO/WHO Food Standards Program, Codex Alinientarius Commission Contamination. CAC/Vol. XVII. FAO, Roma and WHO, Geneva

[14] ATSDR (2001): Agency for toxic substances and disease registry. From web of http://www.absdr.cdc.gov/mrls. html Professional reference book, Washington, DC,