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Detection and estimation of metals and toxic heavy metals in imported spices

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Abstract

An imported spices in Iraqi local markets at city of Baghdad, from different places of the world, they collected in order to measure and assess metals and toxic heavy metals, because of its negative impacts on human health, where they works on occurrence of disorders and can cause cancers in humans bodies. One g weight of each sample were digested and analyzed by atomic spectrometry flame (Flame Atomic Absorption Spectrophotometer). Results calculated and represented by unit of ppm, results showed that, there are some kinds of spices contaminated with Iron (Fe) more than allowed limits. Results compared with another samples, by a number of physical tests carried out on some types of spices, analyzed previously, showed that these samples of spices, contains (Fe) filings, which came as a result of grinding and crushing, so should be avoided so what kinds of spices inflict damage on human health. In addition, a higher concentration of lead (Pb) found in several kinds of spices.

Keywords: Spices, Toxic heavy metals, Minerals, Atomic absorption spectroscopy.

Introduction

Spice is a substance or group of substances, which usually add to the different types of food in small quantities, in order to give a flavor to the different foods. Manufactured spices can give flavor depending on the type of product, from all parts of the plant such as seeds, roots, leaves, fruits and bark used spices in areas other than food as preservatives for food, such as using material turmeric as a preservative (Mido and Satake, 2003). also can use in the medical field such as the use as a narcotic substance cloves (Adriano, 2001) and also a spice used in religious rituals and in some cosmetics.

Due to increase of using imported spices in most of the world including Iraq. Therefore, should determine safety of these products. Due to importance in uses as a food or as a part of food, especially produced spices at tropical regions like black pepper, turmeric due to the lack of availability of toxic heavy metals, thus should be fixing limitations and allowed limits of concentrations for heavy metals especially Cadmium, lead, Nickel and Mercury (Temple and Bisessar, 2007). The presence of heavy metals in the soil usually at low concentrations, but according to an environmental industrial contamination, also agricultural additives and industrial wastes, therefore producers shall measure contents of plants from toxic heavy metals and hazardous on human health for accumulation in various body organs and toxicity due to the events of metabolic disorders (Baker *et al.,* 2010). Also lead to increase or decrease the essential minerals for the human body (such as Copper, Zinc and Iron) effects satisfactory undesirable (Masoud and Jaffer, 1997), but the toxic heavy metals (such as Chromium, Nickel, Lead and Cadmium) can cause an occurrence of serious pathological human health where Cadmium causes the occurrence of such oesteomolica, pyelonephritis (Shummacher *et al.,* 1991). The lead increasing in higher levels is can showing from cancerous tumors and renal problems (Grath *et al.,* 2009). Due to the increasing of imported spices using in the manufacture and preparation of foods, so research aims is to detect and set metals and toxic heavy metals in spices, and determine the extent of safety and compliance with the standard specifications of food.

Materials and Methods

Sampling: Samples of imported spices collected from the local markets from city of Baghdad. Along study period from the 1st of January 2013 till the 1st of June 2013, the names of various commercial and produced by the company Attar trade originating in the United Arab Emirates and backed under local names of spices (turmeric, cloves, nutmeg lioness, black pepper, cinnamon, cumin, sweet bean, ginger, coriander, red pepper, kubba spices, coiled spices,

kebab spices, sausage spices, roast beef spices and mix rice spices).

Determination of metals and toxic heavy metals: According to (Haswell, 1988). Elemnts (Lead Pb, cadmium Cd, chromium Cr, cobalt Co, copper Cu, iron Fe), detected by flame atomic absorption spectroscopy (Flame Atomic Absorption Spectrophotometer) type Buck Model VGP-210. As a weight of one g for each sample of spices, which added to 20ml of a mixture from concentrated nitric acid (HNO_3), high purity acid and perchloric acid concentration ($HCLO_4$) with ratio of 2:1, the mixture heated and digested at a temperature of 80°C. until reached samples close to the drought slightly, cooled and filtered by paper Whatman 541 filtration and complements the size of the filtrate to 25 ml in a volumetric bottle 25ml by distilled water. Certain wavelengths used for each element and the passage of slot packet optical wavelength for the item (Slit) as shown in the Table (1) (Billett *et al.,* 1999).

Table (1): Wavelengths and amount of slot passage of the package for each optical element

No.	Elements	Wavelengths (nm)	Slit (nm)
1	Lead (Pb)	217.1	0.7
2	Cadmium (Cd)	228.9	0.7
3	Chrome (Cr)	357.9	0.7
4	Cobalt (Co)	240.8	0.2
5	Copper (Cu)	324.7	0.7
6	Iron (Fe)	248.6	0.2

The equation C (ppm) = C1 (ppm) x V (ppm) /Wt. (gm) (Cooksey and Barnett, 1979), is used to calculate the concentrations of the following elements through reading device and the weight of each sample and the amount of ease each sample are as follow, the final results were calculated for each element concentration in part per million (ppm) as shown in Table (2).

Results and Discussion

Results determined the concentration of (Pb), in samples of examined spices as a free from contamination with (Pb) except (Nut lioness) as it contained a concentration of 5.1 ppm of (Pb) as shown in Table (2), a recorded concentration is much higher than allowed limits in spices amounting to 1 ppm according to the World Health Organization (WHO, 2012). Accumulative impacts of (Pb), of human body and can cause Anemia, pallor of skin abdominal pain, nausea, vomiting and paralysis in the joints (Kerber, 2002).

In addition, leads to kidney damage, reduce fertility, and increase the chance of occurrence of the failure of the pregnancy or the occurrence of congenital malformations (Grath *et al.,* 2009). Assessment of (Cd) in the samples varied spices in focus ranged among (0.71- 1.89) ppm Table (2) these concentrations are within allowed limits, amounting to 3ppm, according the (WHO, 2012). Has not assigned to any of the elemental concentration of (Cr) and (Co) in spice products where the concentration of these elements is less than the limits of detection of operator. As for the element, (Cu) concentrations ranged among (2.34 - 11.41) ppm concentrations that fall within the limits of this component in the spice, amounting to 20 ppm, according to the (WHO, 2012).

Results showed values of (Fe) among (7.4 – 278.5)ppm. Table (2), also showed 15 product of spices contained (Fe), from a total number of 16 samples, as a percentage (93.7%) more than allowed limits, which is 25ppm. according to (WHO, 2012). A physical test for several spices products (Ikeda *et al.,* 1995), showed (Fe) filings in these products especially in clove, which resulting from crushing and grinding spices during the manufacturing process. The increasing of (Fe) impact human health causing increase a proportion of (Fe) in Blood to stomach pain, constipation, weakness and vomiting, also impact immune system, coma and even death convulsions (Manoguerra *et.al.,* 2005).

Table (2): Concentration of metals and toxic heavy metals in samples of spices ability portion million (ppm)

No.	Name of product	Weight (gm)	Lead (Pb)	Cadmium (Cd)	Copper (Cu)	Chrome (Cr)	Cobalt (Co)	Iron (Fe)
1	turmeric	1.0051	UDL	0.75	6.87	UDL	UDL	46.2
2	cloves	1.0051	UDL	0.88	9.76	UDL	UDL	278.5
3	nutmeg lioness	1.0028	5.1	0.93	8.66	UDL	UDL	199.4
4	Black pepper	1.0077	UDL	UDL	5.44	UDL	UDL	98.7
5	Cinnamon	1.0000	UDL	UDL	8.77	UDL	UDL	89
6	Cumin	1.0035	UDL	1.89	2.34	UDL	UDL	7.4
7	Sweet bean	1.0022	UDL	UDL	4.56	UDL	UDL	94.7
8	Ginger	1.0080	UDL	UDL	11.34	UDL	UDL	83.3
9	coriander	1.0044	UDL	UDL	7.76	UDL	UDL	94
10	Red pepper	1.0031	UDL	UDL	8.89	UDL	UDL	44.3
11	Kubba spices	1.0821	UDL	UDL	12.27	UDL	UDL	102.28
12	Coiled spices	1.0582	UDL	1.06	11.41	UDL	UDL	126.5
13	kebab spices	1.0031	UDL	UDL	10.83	UDL	UDL	120.00
14	Sausage spices	1.0245	UDL	UDL	9.43	UDL	UDL	47.00
15	Roast beef spices	1.0104	UDL	UDL	8.62	UDL	UDL	52.82
16	mix rice spices	1.0491	UDL	0.71	9.67	UDL	UDL	67.42

Conclusions and Recommendations

The results showed a higher concentration of heavy elements in imported spices and non-compliance to the standard specifications for food, which can pose a risk to human health due to the accumulation of these elements in the internal organs such as the liver, kidneys, sensitive and brain. Therefore, we recommend to tightening controls on health products imported spices and determine the extent of its safety and suitability for human consumption.

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