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Monitoring of Cd and Pb in Local and Imported Peanut Specimens of Iran Market

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Abstract: Market requirement to peanut and deficiency of production in Iran lead to import of peanut from different countries such as China, Iraq and Sudan. This research studied heavy metal contamination of available samples of peanut in Iran market. Experiments carried out in 9 replication on different peanut after morphological separation. Pb and Cd measured by atomic absorption spectrometer after enzyme digestion. Results showed maximum Cd (70.83 ppb) in Iranian peanut sample and minimum of Cd (25.50 ppb) recorded in Iraq peanut samples. Maximum and minimum of Pb measured in Iraq and Iran peanut samples, respectively (1186.60 and 476.73 ppb).

Key words: Peanut, Cd, Pb, environment, atomic absorption, Iran

INTRODUCTION

The peanut is a legume plant species that is usually cultivated for its fruit. Farmers in Africa and Asia grow about 90% of the world's peanuts (Nwokolo, 1996). The peanut plant is unusual because it flowers above ground and pods containing 1-5 seeds are produced underground. The peanut (*Arachis hypogaea*) better known worldwide as groundnut and to lesser extent as earthnut, monkeynut and goobers is not a true nut but rather an annual legume much like the bean or a pea (Nwokolo, 1996). Its seeds are rich source of edible oils and contain 40-50% fat, 20-50% protein and 10-20% carbohydrate. The seeds are nutritious and contain vitamin E, niacin, folacin, calcium, phosphorus, magnesium, zinc, iron, riboflavin, thiamine, potassium, etc. Peanuts, peanut oil and peanut protein meals constitute an important segment of world trade in oilseeds and products (Nwokolo, 1996).

Peanut is the 5th most important oil-seed in the world. Peanut is used for different purposes: food (raw, roasted or boiled, cooking oil), animal feed (pressings, seeds, green material, straw) and industrial raw material. First report on peanut entrance refer to 1910 and its culture in Ateshgah village in Guilan province at North of Iran. This time Guilan and Golestan regarded as main provices for peanut culture in Iran. Peanut culture area in Guilan measured 3000 ha which produce 11000 ton peanut, average production is 3.5-4 ton ha^{-1}. Best region for peanut production in this provinces are Rasht, Astaneh Ashrafie, Roudbar, Bandar Anzali and Talesh. Peanut culture area in Golestan measured 350-400 ha which produce 2000 ton peanut, average production is 3.5-4 ton ha^{-1}. Best region for peanut production in this provinces are Mino Dasht, Azad Shahr, Maraveh Tapeh and Kordkouy. Peanut production reach 5-5.5 ton ha^{-1} in some places of Astaneh Ashrafie specially Noghredeh and Bandare Kiashahr.

Human is faced with pollution of the environment but recently the problem of polluted environment is much more evident. The modern industrial, urban and traffic pollution is permanent and very universal. The universal character of modern pollution is presented on a form of wide front of the polluted air, water, soil and plants. One of the kinds of the polluted environment to which is dedicated a particular importance on the modern period is pollution from the traffic which is increasing rapidly and contributing on the matter of pollution of the environment. Different sorts of aerosol have the origin from the particles of carbon and Pb and Cd components and burning products of petrol. Heavy metal will lead to serious effects on environment because its degradation is not simple as synthetic contaminant which degrades by chemical and biological process. Its stability does not its movement by water and air. Main result of their stability associated dangerous problems and disease in plants and animals. Kidney incompetence is one of effects of concentration of heavy metals in human organs. Pb and Cd are two main heavy metals that store for 1460 and 200 day, respectively in human body. Daily acceptable absorption for Cd and Pb must be determined for various foods. The most significant use of cadmium is in nickel/

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cadmium batteries as rechargeable or secondary power sources exhibiting high output, long life, low maintenance and high tolerance to physical and electrical stress. Cadmium coatings provide good corrosion resistance, particularly in high stress environments such as marine and aerospace applications where high safety or reliability is required; the coating is preferentially corroded if damaged. Other uses of cadmium are as pigments, stabilisers for PVC in alloys and electronic compounds. Cadmium is also present as an impurity in several products including phosphate fertilizers, detergents and refined petroleum products.

Cadmium derives its toxicological properties from its chemical similarity to zinc an essential micronutrient for plants, animals and humans. Cadmium is biopersistent and once absorbed by an organism, remains resident for many years (over decades for humans) although, it is eventually excreted. In humans, long-term exposure is associated with renal disfunction.

High exposure can lead to obstructive lung disease and has been linked to lung cancer although, data concerning the latter are difficult to interpret due to compounding factors. Cadmium may also produce bone defects (osteomalacia, osteoporosis) in humans and animals. In addition, the metal can be linked to increased blood pressure and effects on the myocardium in animals although, most human data do not support these findings. The average daily intake for humans is estimated as 0.15 μg from air and 1 μg from water. Smoking a packet of 20 cigarettes can lead to the inhalation of around 2-4 μg of cadmium but levels may vary widely.

In the general, non-smoking population the major exposure pathway is through food, via the addition of cadmium to agricultural soil from various sources (atmospheric deposition and fertilizer application) and uptake by food and fodder crops. Additional exposure to humans arises through cadmium in ambient air and drinking water. The objective of this study was to evaluate Cd and Pb concentrations in the peanut kernel of local and some foreign specimens in Iran market of North of Iran.

MATERIALS AND METHODS

Peanut sample collection carried out in April 2010 in North market. Samples of Iran, Iraq, China and Sudan peanut collect in 9 replications. All samples were without pod and green. About 100 g from each sample used for measurement of Cd and Pb by atomic absorption spectrometry. Metal contents (Cd and Pb) were extracted by acid digestion method (HNO_3, HCl and H_2O_2 (Soon and Abboud, 1993; Gupta, 2000). Recorded data transfer to SPSS 16 and analyzed.

RESULTS AND DISCUSSION

In this study, results of variance shown in Table 1 demonstrated that there was a significant difference between peanut groups regarding quantity of Cd ($F = 3.542$, $p<0.05$) and Pb ($F = 9.786$, $p<0.01$). According to results of Duncan test maximum of mean Cd recorded in Iranian peanut samples (70.83 ppb) and minimum recorded in Iraq peanut samples (25.50 ppb). Maximum and minimum of Pb heavy metal recorded in Iraq and Iran samples, respectively (Fig. 1 and Table 2).

Comparison of Fig. 1 and 2 showed that peanut maximum Cd had minimum Pb compared with other peanut groups. Pearson correlation test used for study of relationship Cd and Pb in peanut samples. According to Table 3, there is negative significant relationship between Cd and Pb ($p<0.01$). On the other hand, maximum Cd in peanut samples led to minimum Pb in it. The heavy metal concentration in plant tissues varies according to plant species and organs (Turner, 1973; Jarvis *et al*., 1976; Sterrett *et al*., 1983) and is dependent on the concentration of the metals in the soil (Bingham *et al*., 1975). Furthermore, several soil factors such as pH, cation exchange capacity and organic matter (Adriano, 1986) may affect the availability of Cd to plants. In agricultural soils, the Cd concentration is increasing because of the use of sewage sludges and phosphate fertilizers (Parr *et al*., 1978; Mortvedt, 1987; Rothbaum *et al*., 1986) in addition to input from the atmosphere. Some of different in Cd and Pb contents possibly due to various verities and its reaction to bioaccumulation of them.

Although, it is not an essential element for plant metabolism, Cd is absorbed by roots and translocated to aerial parts in which it may induce the appearance of toxicity symptoms such as chlorosis, necrosis, wilting or epinasty (Haghiri, 1973; Lee *et al*., 1976). Some physiological processes such as photosynthesis (Bazzaz *et al*., 1974; Weigel, 1985; Lamoreaux and Chaney, 1978), respiration, enzyme activity, water relations, polyamines accumulation and ethylene biosynthesis (Poschenrieder *et al*., 1989) have been shown to be affected by Cd.

Its better heavy metals content of aerial parts associated by study of morphological and symptoms and other physiological changes. When the metal enters the plant, it is transported from the roots to the above ground organs. The most plant species the highest Cd concentrations are usually found in roots (Adriano, 1986; Jarvis *et al*., 1976). It is demonestrated that the vegetative parts were more susceptible to soil metals than the reproductive parts. The presence of the six heavy metals did not affect the biomass production of peanuts as

Table 1: Variance analysis for Cd and Pb amount among different peanut samples

Variables	Sum of square	df	Mean square	F	Sig.
Cd					
Between groups	9961.937	3	3320.646	3.542*	0.025
Within groups	29996.675	32	937.396	-	-
Total	39958.612	35	-	-	-
Pb					
Between groups	2512513.782	3	837504.594	9.786**	0.000
Within groups	2738524.436	32	85578.889	-	-
Total	5251038.218	35	-	-	-

*Significant at p<0.05 and **Significant at p<0.01

Table 2: Mean amount of Cd and Pb by Duncan test

Countries	N	Cd (mean)	Pb (mean)
Iraq	9	25.50[a]	1186.60[b]
China	9	51.10[ab]	1009.80[b]
Sudan	9	59.05[b]	980.90[b]
Iran	9	70.83[b]	476.73[a]
Sig.		a: 0.086	a: 1.000
		b: 0.206	b: 0.168

Means for groups in homogeneous subsets are displayed

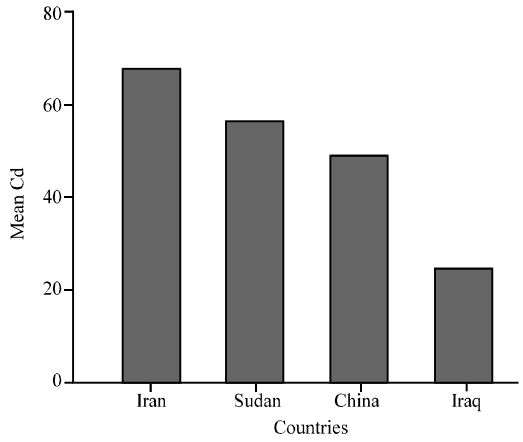

Fig. 1: Cd (mean)

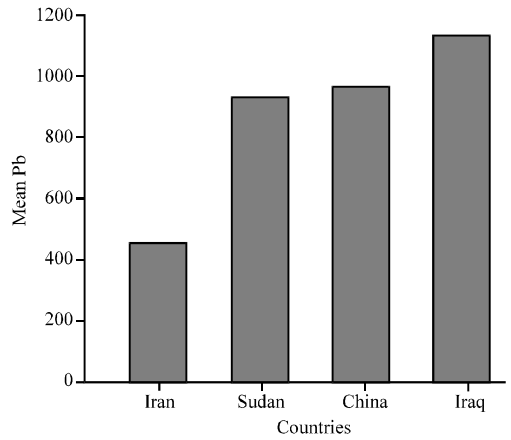

Fig. 2: Pb (mean)

shown in the Index of Tolerance (IT) and mean height close to or exceeding 100%. This only means that peanuts were able to tolerate the presence of these heavy metals

Table 3: Relationship between Cd and Pb among samples by Pearson's correlation coefficient

Variables		Cd	Pb
Cd	Pearson correlation	1	-0.583**
	Sig.	-	0.000
	N	36	36
Pb	Pearson correlation	-0.583**	1
	Sig.	0.000	-
	N	36	36

**Correlation is significant at the 0.01 level

even at higher contaminations (Ching *et al*., 2008). In this study, leaf Cd and Pb only recorded and detail study of seed is essential. Water and air regarded to main factors for transition of Pb in plant. Peanut field distance from road and its culture in village far from main cities road are important reason for little Pb contamination of Iranian peanut specimens.

Contaminated water and soil due to industrial sewage and Phosphate application in agricultural parts near industrial town identified as main reason for high Cd in local peanut specimens. It is reported that the concentration of Pb and Cd on three searched places has been higher in the locations near the road, except point three which the quantity of Cd has been higher in distance of 10 m far from the road. On all tested plants, the highest biomass has been found to the plants which are located in distance of 10 m far from the road. On all 3 searched points, there are noticed negative correlations among the concentration of Pb, Cd and biomass (Bytyqi *et al*., 2007).

Alloway (1990) declared that soil pollution by heavy metal resulting from phosphate fertilizer application has been a cause for concern in some countries. Wangstrand *et al*. (2007) declared that nitrogen fertilizers may increase Cd concentrations in plants even if the fertilizers do not contain significant levels of Cd. Urea play important role in North agricultural environment for crop production. In addition, Alloway (1995) concluded that phosphate fertilizer application in agricultural lands can cause increased levels of Cd, As, CR and Pb in soil and dramatically decreased soil pH that cause desorption of heavy metals from the soil matrix.

Atmospheric deposition, manures and sledges are the most important sources of lead in the agricultural soils (Nicholson *et al*., 2003). Perhaps water resources contaminated with sludge caused maximum Pb amount in peanut Iranian specimens.

CONCLUSION

Maximum Cd in Iran samples related to industrial town in near fields and maximum amount of Pb in Iraq samples demonstrated that fields are in near road with high traffic. Regarding to application of 60% of pesticide

in North of Iran, it is essential discrimination of peanut contamination to heavy metal for safe peanut production for market (Rahbar and Nazari, 2003). Many researchers studying contamination level in environment and its metabolism and final fate in human body for gaining to national standard for local weather condition.

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