RESEARCH ARTICLE

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Survey Heavy Metals Content in Cydonia Fruits Collected from Market Sites in Hamadan, Iran

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Background & Aims of the Study: High concentration of toxic metals in foodstuffs is among the public interest and therefore requires rapid methods to survey the concentration of these contaminants. In the present study, concentration of some heavy metals (lead, copper and arsenic) in Cydonia fruits from Hamadan city market were determined by atomic absorption spectrophotometry.

Materials & Methods: To this purpose, heavy metal concentration of 9 fruit samples were surveyed by ICP (710-ES) and compared to specified level by World Health Organization (FAO/WHO). Statistical analyses were done by SPSS 19.0.

Results: According to obtained resuls Pb content differed from 0.03 to 0.85 mg/kg, Cu concentration ranged from 0.09 to 0.21 mg/kg, As content has been ranged between 0.6 to 5.4 mg/kg the mean content of all metals in studied samples were lower than MPL.

Conclusions: According to our results using of fertilizer, pesticides and contaminated irrigation water has contributed to the elevation of heavy metal concentrations in agricultural soils and products significantly.

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Background

Heavy metals have remarkable contribution in different parts of environment as a result of mining, smelting, electroplating, energy and fuel production, power transmission, intensive agriculture, sludge dumping, melting operations and other human activities (1,2). High concentrations of all metals are toxic environmental pollutants (3).

Despite fruit and vegetables are one of the important parts of human diet, the effect of heavy metal contamination of these foodstuffs cannot be survived. Fruits have different beneficial vitamins, minerals, fibers and antioxidant components. Since, consumption of heavy metal-contaminated fruits have serious risk to human body health; contamination of food by heavy metals is among the most important parts of quality assurance of daily food (4,5,6). Biological half-lives of heavy metals is very long, and do not degrade biologically, thus have the potential for accumulation in organs of human, leading to dangerous side effects (7,8). Plants absorb contaminants using airborne, irrigation with polluted water and also by roots from polluted soils (9).

Content of heavy metals in some kinds of vegetables from Turkey were determined by Demirezen and Aksoy (10). The concentrations of some heavy metals have been investigated in different vegetables and fruits of Egyptian markets (4). Fytianos et al. (11) surveyed the levels of some heavy metals in leafy vegetables

from Northern Greece, and Sobukola et al. (12) determined the content of heavy metals in fruits and vegetables from Lagos, Nigeria.

Elbagermi et al. (13) evaluated lead, copper, zinc, cobalt, nickel, and cadmium content in some fruits and leafy vegetables of Misurata area of Libya.

Based on probability of heavy metals toxicity, persistence and cumulative property of them and absorption in human daily diet, it is necessary for the survey different items of food with international standards. Maximum recommended content by WHO for Copper, lead, and Arsenic in fruits are 20, 0.3 and 5 mg/kg, respectively (14).

Aims of the study:

Contamination of Cydonia fruit by studied heavy metals from the Hamadan province has not been determined yet; thus, the aim of present study was investigation the content of Pb, Cu, and As in Cydonia fruits from Hamadan province.

Materials & Methods

Sampling and analysis of fruits

Nine samples of Cydonia (quince) fruit were bought from local wholesale fruit in Hamadan city in September 2016. Frist 3 samples are belonged to Kurdistan province, second 3 samples are belonged to Esfsahan province and third 3 samples are from Hamadan province. The Genus Cydonia is from the family Rosaceae (which also contains apples and pears, among other fruits) and is one part of consumption fruit of human diets. After washing the quince samples with tap water, 5 g of each sample was placed in a porcelain crucible and ashed in an oven at 500 °C for 24 h. Then ashed material was dissolved in 4 mL concentrated HNO_3 (Merck, Germany), evaporated to dryness, heated again for 4 h to 500 °C, dissolved in 3 mL mixture of concentrated HNO_3 and H_2SO_4 (2:1 v/v), and diluted with deionized water up to 50 mL. Finally, for the As, Cu and Pb analyses, a Varian710-ES inductively coupled plasma-optical emission spectrometry (ICP-OES) was used(15). Dankan test was used for comparison between the average concentration of metals (As, Pb and Cu) in surveying samples and T test was used for one sample to compare the average concentration of above metals with national and international standards. Pearson correlation test was used for determining correlation between metals in vegetable samples. In this research, data were analyzed by SPSS 19.0statistically.

Results

Concentration of measured heavy metals is presented in Table 1.

Table 1) Heavy metal concentrations in sampled fruits

Sample number	Pb	Cu	As
Standard concentratiom	**0.3**	**20**	**5**
1	0.41	0.6	3.8
2	0.63	0.7	4.6
3	0.85	0.8	5.4
4	0.06	0.11	0.6
5	0.10	0.16	0.66
6	0.14	0.21	0.72
7	0.03	0.09	0.8
8	0.03	0.14	0.86
9	0.03	0.19	0.92

As shown in table 1, the total levels of lead in the collected samples have been ranged from 0.03 to 0.85 mg/kg with the maximum concentration in sample 3. Copper levels in the collected fruits differed from 0.09 to 0.8 mg/kg with the maximum content in sample 3. Finally arsenic content has been differed from 0.6 to 5.4 mg/kg with the maximum content in sample 3.Statistical results show that the average concentration of copper in all samples are lower than the WHO/FAO standards in all samples. Also the concentrations of Pb in samples 1, 2 and 3 are above recommended levels. The concentration of Arsenic in sample 3 is above standard level.

The Dankan's test results (different roman letters are presented in each column of table 2)

indicate statistical significant differences (P<0.05) in the contents of As, Cu, and Pb between some brands of quince. This means that no significant differences were observed in the content of As, Cu and Pb between quince samples was cultivated in Isfahan and Hamadan Province. However, the significant differences were observed in the content of As, Cu and Pb between quinces samples were cultivated in Kurdistan Province compared with samples from other provinces.

The Pearson's correlations analyses were performed between metal concentrations in quince samples to understand the relationships between them. The results showed that there was positive correlations found between As and Cu (r=0.991, P<0.01), between As and Pb (r=0.987, P<0.01) and between Cu and Pb (r=0.993, P<0.01) (table 2).

Table 2) Correlation between the total contents of heavy metals in quince samples.

Elements	As	Cu	Pb
As	1		
Cu	0.991	1	
Pb	0.987	0.993	1

Discussion

Although different effects of heavy metals, in high concentrations, in plants have been studied for many years, exposure to these elements continues and even increasing. Crops can absorb these contaminants from contaminated soils and concentrate them in different parts easily. Fruits are important part of human diets. So evaluation of agricultural products is necessary. Comparison of our results with standard levels (FAO/WHO) showed which the average concentrations of copper in all samples are lower than the presented standards by WHO in all samples. This result agrees with the conclusions of Kibria et al and Lin et al (16,17). The levels of As and Pb in sample 3 are above standard. According to Dankan's test concentration of all measured heavy metals in samples cultivated in Isfahan and Hamadan province are lower than which cultivated in Kurdistan province. The result of Pearson's correlations test showed positive correlations between heavy metals in quince samples. This means that these metals have same origin. This result agrees with the conclusions of Jahangard et al. 2016 (18). Existence of heavy metals in studied samples shows the absorption of these metals can take place from different ways. Thus, information about the intake of heavy metals through the food chain is important in assessing risk of human health.

Conclusion

Fruits are among the main sources of essential heavy metals; these are also the way through which we are exposed to various toxic metals. These elements are easily accumulated in the edible parts of the agricultural products so many serious systemic health problems can develop can result of an excessive accumulation of dietary some elements for example Cd, As and Pb in the human body. This paper investigated the concentration of Pb, Cu, and As in Cydonia fruits in Hamadan province. According to our results using of fertilizer, pesticides and contaminated irrigation water has contributed to the elevation of some metal content in agricultural soils and products significantly. So there is a serious concern about daily food safety resulting environmental contamination.

Footnotes

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Conflict of Interest:
The authors declared no conflict of interest.

References

1. Welch RM, Shuman L. Micronutrient nutrition of plant. Crit Rev Plant Sci 1995;14(11):49–82.
2. Samarghandi MR, Nouri J, Mesdaghinia AR, Mahvi AH, Nasseri S, Vaezi F. Efficiency removal of phenol, lead and cadmium by means of UV/TiO2/H2O2 processes. Int J Environ Sci Technol 2007;4(1):19–25.
3. Page AL, Miller RH, Keeney DR, Editors. Methods of soil analysis. Part 2: chemical and microbiological properties. 2nd ed. American Society of Agronomy, Madison; 1982. p. 149–58.
4. Radwan MA, Salama AK. Market basket survey for some heavymetals in Egyptian fruits and vegetables. Food Chem Toxicol 2006;44(8):1273–78.
5. Rezaei Raja O, Sobhanardakani S, Cheraghi M. Health risk assessment of citrus contaminated with heavy metals in Hamedan City, potential risk of Al and Cu. Environmental Health Engineering and Management Journal; 2016,3(3):131-135.
6. Khan S, Cao Q, Zheng YM, Huang YZ, Zhu YG. Health risks of heavy metals in contaminated soils and food crops irrigated with wastewater in Beijing, China. Environ Pollut 2008;152(3):686–92.
7. Jarup L. Hazards of heavy metal contamination. Br Med Bulletin 2003;68(1):167–182.
8. Sathawara NG, Parikh DJ, Agarwal YK. Essential heavy metals in environmental samples from Western India. Bull Environ Contam Toxicol 2004;73(4):756–61.
9. Al Jassir MS, Shaker A, Khaliq MA. Deposition of heavy metals on green leafy vegetables sold on roadsides of Riyadh City, Saudi Arabia. Bull Environ Contam Toxicolvol 2005;75(5):1020–1027.
10. Demirezen D, Aksoy A. Heavy metal levels in vegetables in Turkey are within safe limits for Cu, Zn, Ni and exceeded for Cd and Pb. J Food Quality 2006;29(3):252–65.
11. Fytianos K, Katsianis G, Triantafyllou P, Zachariadis G. Accumulation of heavy metals in vegetables grown in an industrial area in relation to soil. Bull Environ Contam Toxicol 2001;67(3):423–30.
12. Sobukola OP, Adeniran OM, Odedairo AA, Kajihausa OE. Heavy metal levels of some fruits and leafy vegetables from selected markets in Lagos, Nigeria. African J Food Sci 2010;4(2):389–93.
13. Elbagermi MA, Edwards HGM, Alajtal AI. Monitoring of heavy metal content in fruits and vegetables collected from production and market sites in the misurata area of LibyaAnalytical Chem 2012;2012:1–5.
14. Husain A, Baroon Z, Al-khalafawi M, Al-Ati T, Sawaya W. Toxic metals in imported fruits and vegetables marketed in Kuwait. Environ Int 1995;(21)6:803–5.
15. Ward NI, Reeves RD, Brooks RR. Lead in soil and vegetation along a New Zealand state highway with low traffic volume. Environ Pollut 1979;9:243-251.
16. Kibria MG, Islam M, Alamgir M. Influence of waste water irrigation on heavy metal accumulation in soil and plant. Int J Appl Nat Sci 2012;1(1):43-54.
17. Lin HT, Won SS, Li GC. Heavy Metal Content of Rice and shell fish in Taiwan. Food Drug Anal 2004;12(2):167-74.
18. Jahangard A, Ghobadia A, Sohrabia M, Beigmohammadi Z. Determination and Evaluation of Copper, Lead and Zinc in Leek Vegetable from Some Olericulture Farms of Hamedan, Iran. Arc Hyg Sci 2016;5(2):64-68.