



Investigation of toxic metals content of parsley (*petroselinum crispum*) obtained from local farms in Baz Kia Gorab region (Lahijan city, north of Iran)

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ABSTRACT

Heavy metals are one of the problems that have arisen for humans with the development of societies. Heavy metals are toxic and can cause many problems and affect health. In this study, the content of toxic metals such as arsenic (As), cadmium (Cd), lead (Pb), and mercury (Hg) in parsley (*petroselinum crispum*) prepared from local farms in Baz Kia Gorab region (Lahijan city, north of Iran) were investigated. For this purpose, parsley was obtained from three local farms and the content of toxic metals was evaluated by a flame atomic absorption spectrophotometer. The results showed that the levels of these metals were higher than the standard.

1. Introduction

The rapid evolution of technology, economic development, climate change, excessive consumption of natural resources and rapid urbanization have caused the environment to be exposed to many types of toxins and pollution [1,2]. Every year, plastics, herbicides, insecticides, fungicides, waste burning and industrial untreated wastewater cause water, soil and plant pollution, and these pollutions can exist in the environment for a long time and have harmful effects [3-35]. Meanwhile, heavy metals can be considered at the top of the list of environmental toxins. The risk of heavy metals pollution are increasing and they harm human health by accumulating in water, soil, plants and through transmission in the food chain [36]. Heavy metals such as As, Cd, Pb, Hg, nickel, cobalt, and iron are among the most important environmental pollutants in areas with high anthropogenic pressure [37]. Heavy metals in higher concentrations prevent plant growth and production, which acts as stress for plants, which ultimately has an adverse effect on flora, fauna, and adjoining areas [38]. For example, it has been reported that Pb and Cd cause a delay in germination, induce membrane damage, mineral leakage, and also prevent root elongation and chlorophyll production [39-41]. Some of these heavy metals have

bioaccumulation, they can accumulate through absorption at the primary producer level and then through consumption at the consumer levels in the ecological food chain [42]. In biological systems, these metals can damage mitochondria, lysosomes, deoxyribonucleic acid, proteins, carbohydrates, nuclei, etc., and may cause cell cycle variation, carcinogenesis, or apoptosis [43]. Parsley (see Figure 1) is native to the Mediterranean region but is widely cultivated throughout the world [44].



Figure 1. Parsley (*petroselinum crispum*).

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Due to its aromatic and attractive leaves, it is widely used in many different foods [45]. Also, due to its phenolic compounds and flavonoids, it has a special place in modern medicine [46]. Herein, the concentration of heavy metals such as Pb, Hg, As, and Cd in parsley as one of the most popular vegetables in Baz Kia Gurab region (Lahijan city, north of Iran) were investigated.

2. Results and Discussion

The content of toxic metals in the samples is summarized in Table 1.

Table 1. Toxic elements concentrations in parsley samples

Metal (mg/kg)	Range	Mean ± SD ^d
Pb	^a 1.6 - 2.1	^a 1.85 ± 0.1
	^b 1.3 - 2.0	^b 1.62 ± 0.11
	^c 1.3 - 1.9	^c 1.51 ± 0.1
Cd	^a 0.04 - 0.91	^a 0.72 ± 0.05
	^b 0.32 - 0.82	^b 0.55 ± 0.05
	^c 0.33 - 0.79	^c 0.57 ± 0.02
Hg	^a 0.04 - 0.09	^a 0.07 ± 0.03
	^b 0.009 - 0.07	^b 0.04 ± 0.02
	^c 0.009 - 0.06	^c 0.04 ± 0.02
As	^a 0.1 - 0.2	^a 0.17 ± 0.04
	^b 0.08 - 0.17	^b 0.12 ± 0.01
	^c 0.08 - 0.17	^c 0.11 ± 0.1

Note: ^aSample I, ^bSample II, ^cSample III, SD = Standard deviation. ^{**}The international standard for Pb, Cd, Hg, and As is 0.3, 0.2, 0.01 and 0.1, respectively [47,48].

The results show that the amounts of toxic metals are high and in fact it can be said that the investigated samples are contaminated with these toxic metals. The high content of toxic metals in the samples can have many reasons. Generally, soil, water and air pollution can be considered as the main factors [18,49]. These toxic metals are absorbed by plants and their accumulation in the body occurs when humans consume plants [50]. The question that arises is how these resources are contaminated. The answer to this question is shown in Figure 2.



Figure 2. Baz Kia Gurab region [51].

The investigated region (Baz Kia Gurab) is located on both sides of the main road (see Figure 2). The pollution of resources by heavy metals from automobile is a big concern. These metals are released from burning fuel, corrosion of batteries and roadside safety fences, wear of brake linings, wear of tires, and leakage of oils [52,53]. Also, an industrial town, a hospital, and a filling station are located near this region (see Figure 3).

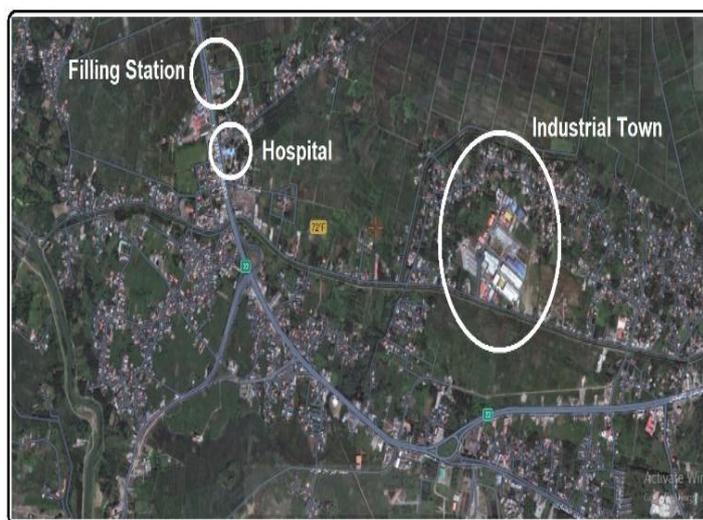


Figure 3. The location of industrial town, hospital, and filling station in Baz Kia Gurab region [54].

Normally, there should not be an industrial town and a hospital near the place of human habitation (due to pollution). Industrial sewage, factory waste, and chemical industries are other causes of pollution. The high amounts of heavy metals are a serious threat to human health due to their accumulative properties, high stability and toxic effects, and since these compounds are not metabolized in the body, they can be stored in body tissues such as muscles and bones and cause diseases such as mental retardation, hearing impairment, immune system dysfunction, brain diseases, blindness, muscle weakness, and cancer [55]. In this study, the soil and water of this region have not been evaluated, but according to the obtained results, it can be said that the water and soil are contaminated because heavy metals enter the plant through pathways such as soil and water. The results show that sample I contains more toxic metals. It can be said that this is due to the proximity to the road and the industrial town (see Figure 4). Also, the amount of toxic metals in samples II and III does not differ much. Due to the low price of parsley and due to the high use of parsley by local people in their meals, there is a concern that the people of this region will receive more than their daily allowance intake of heavy metals.



Figure 4. The location of the investigated samples in Baz Kia Gurab region [54].

3. Experimental

3.1. General

The samples were gathered from Baz Kia Gurab region in Lahijan (north of Iran). The concentrations of heavy metals were investigated on a flame atomic absorption spectrometer (SavantAA, GBC). Nitric acid (65%), hydrochloric acid (37%), hydrogen peroxide (30%), potassium chloride, and all other solvents and chemicals were purchased from Merck Chemicals Co. (Germany) and used as received.

3.2. Preparation and analysis of samples:

Digestion and statistical analysis of samples were performed according to the procedure which was described in the literature [56-60]. Briefly, nitric acid, hydrochloric acid, hydrogen peroxide and potassium chloride were used for digestion and deionized water for dilution. The samples (200 mg) was used in digestion vessels (containing 10 ml of HNO_3 and 12 ml of H_2O_2) and then the volume of each solution reached 50 ml using deionized water.

4. Conclusion

To sum up, the amount of toxic metals in parsley (*petroselinum crispum*) prepared from local farms in the Baz Kia Gorab region was investigated. The results showed high levels of toxic metals that can have significant harmful effects on humans. This study showed that vegetables and fruits should be evaluated continuously, because the supply of the society's needs comes from these local farms (especially in the north of Iran). Investigating the content of toxic metals in local farms in other regions, as well as investigating the microbial contamination of vegetables, is very necessary, which will be discussed in the following studies.

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