The health risk of exposure to heavy metals caused by the consumption of food products (rice, vegetables and bread)

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Abstract

Introduction: Humans are always exposed to pollution, these pollutions mainly include heavy metals and organic substances. These metals can enter vegetables, rice and bread in different ways. Considering the per capita bread, vegetables and rice in the Iranian food basket, especially in Hoveyzeh and Azadegan plain, we decided to calculate the risk of exposure to heavy metals caused by the consumption of these products.

Material and Method: The study area in the current research is Hoveyzeh and Azadegan plains, which are two southern cities in Khuzestan province. The food products studied to measure heavy metals are all kinds of vegetables, rice and bread. In order to calculate the health risk assessment, the formulas of Hazard Quotient and cancer risk were used.

Result: The present study measured the concentration of five heavy metals (arsenic, cadmium, chromium, lead, and nickel) in food such as rice, vegetables, and bread. The five common types of rice consumed in Hoveyzeh and Azadegan plains are Anbar, Domsiah, Tarom, Indian, and Pakistani. Comparison of the non-carcinogenic risk of heavy metals in two groups of children and adults showed that HI and HQ were smaller than 1 for both groups. The highest HQ and HI for children were related to arsenic, which were 0.0127 and 0.0137 for Tarom rice, respectively. But the highest HQ and HI for adults were related to arsenic, which were 0.0059 and 0.0064 for Tarom rice, respectively. Comparing the carcinogenic risk of heavy metals in two groups of children and adults showed that CRs and ILCR for both groups were smaller than $1*10^{-6}$. Therefore, foods such as vegetables, rice and bread consumed in the study area do not have cancer risk in terms of toxic heavy metals.

Conclusion: The results of these investigations show that the soil or water used for planting vegetables, rice or wheat contained large amounts of heavy metals and did not meet the standards required for irrigation and planting of these crops.

Keyword: risk assessment, heavy metal, cancer risk, food products

1. Introduction

Humans are always exposed to pollution. These pollutions, which mainly include heavy metals and organic substances, have natural and anthropogenic origins(1). Heavy metals include a group of metals whose atomic number is more than 50 and whose specific gravity is more than 6 grams per cubic centimeter. Among the important characteristics of these metals, we can mention strength, toxicity, weight, density, and high atomic number(2). Among all heavy metals, lead, nickel, cadmium, and arsenic are extremely toxic and dangerous, and can harm the body even in low concentrations. They enter the body through food, air, drinking water, etc.; since they are toxic and accumulate in body tissues, they cause irreparable damage(3). Heavy metals can enter cereals and finally bread in different ways. Flour-producing factories can also be contaminated with heavy metals. Water contaminated with heavy metals used in the preparation of bread dough can be considered a source of pollution(4). The type of fuel in bakeries affects the deposition of heavy metals in bread. The location of bakeries in the city and close to the industrial centers of the city is one of the most important issues related to pollution(5). Since one of the important sources of heavy metals transmission is water and food contaminated with these elements, and bread is one of the main foods, by measuring the heavy metals in bread, it is possible to find out the presence of these factors and if they are higher than the standard(6). Rice is one of the most consumed grains in the world, especially in Asian countries. The per capita consumption of rice in Iran, Asia, and the world is about 41, 85, and 65 kg/year, respectively(7). Since the population of Iran is increasing, the demand for rice is increasing day by day. Rice cultivated in the contaminated area can affect human health. Possible pollution is transferred from agricultural soils to the crops that grow on these lands(8). In general, rice can absorb heavy metals and other toxic elements through its roots from polluted soils and even from the air(9). There are several factors in the consumption of heavy metals in crops such as rice. In addition to this, human activities such as industrial and agricultural use, excessive use of chemical fertilizers and pest control agents, and ineffective and insufficient pollution control can cause heavy metals to enter food(10).

Vegetables are an important part of a healthy diet. The main way of entering the body of heavy metals is through food, especially vegetables(11). Considering that irrigation with sewage has become a common thing, if the standards are not met, especially for products that are consumed raw, it can threaten people's health(12). Although vegetables provide an important part of carbohydrates, proteins, and vitamins for the body; it is necessary to explain that due to the high absorption rate of heavy metals, they can pose a threat to human health and ultimately pose risks to human society. By using chemical fertilizers and pesticides, farmers lead to the increase of these metals in the soil and plants(13).

Considering the per capita amount of bread, vegetables, and rice in the food basket of every Iranian and the possibility of their contamination in Hoveyzeh and Susangerd cities (probably due to the use of low-quality salt, the number of different sources of water used, the type of fuel used by each bakery for baking bread, the use chemical fertilizers containing phosphates during grain cultivation, as well as the location of bakeries in the city and close to the industrial centers and heavy traffic of the city, and other environmental factors), we decided to investigate the possibility of the presence of heavy and toxic metals in the food of the people of Hoveyzeh and Susangerd.

2. Material and Method

2.1. Study area

Azadegan plain is one of the cities of Khuzestan province and its center is Susangerd city. Its geographic coordinates are 31.55 degrees North and 48.17 degrees east. The height of this city is 15 meters above sea level. Azadegan Plain is located in northwest of Ahvaz and 55 km away from this city. Hoveyzeh is located in the southwest of Susangerd and Bostan is located in the northwest of Sosangerd, and the Karkhe River passes through it. The people of this city are Arabic-speaking and the main occupation of the people is agriculture. The population of this city is 51,431 people. Among the other cities of Azadegan plain, we can mention Bostan, Abu Hamizah, and Kot Sayednaim(14).

Hoveyzeh city is one of the cities of Khuzestan province with a population of 30,750 people. This city has two cities named Hoveyzeh and Rafi. The city of Hoveyzeh has a section named Nissan and two villages named Bani Saleh and Nissan. Most of the residents of this city are Arabs and speak Arabic. 31.46 degrees north and 48.07 degrees east are the geographical coordinates of this city. Its area is 370,000 ha (15).

2.2. Sampling and preparation of samples

The sampling of vegetables was done randomly in autumn and winter seasons. Vegetable samples included basil, radish, watercress, and leek. Then about one kilogram of each was separated as a sample. After washing the samples with distilled water, we dried them in an oven at 105°C for 24 hours and weighed them. Ultimately, we perform acid digestion for all samples, inject them into the ICP-OES device, and report the amount.

Five types of rice were selected to calculate the risk assessment of the consumption of heavy metals in rice. The samples were randomly selected. The studied kinds of rice included Anbar, Tarom, Pakistani, Indian, and black tail rice. In order to measure the heavy metals in the sample, first one kilogram of them is washed with distilled water and dried in an oven at a temperature of 105 degrees Celsius for 48 hours. We grind 0.5 grams of a dried rice sample and then perform acid digestion on it. In the end, we inject the digested sample into the ICP-OES device and report its amount.

Sampling of bread was also done randomly from bakeries in the city. The types of bread studied included Barbari, Lavash, and Sangak. To measure the heavy metals in them, we first collect one kilogram of bread from each bakery. Then we dry them in the oven at 105 degrees Celsius and chop them separately. 25 grams of each of the breads are digested with nitric acid and at the end we inject them into the ICP device and report their amount.

2.3. Average Daily Dose

The average daily intake dose (ADDs) of heavy metals from the consumption of food such as bread, vegetables and rice is obtained in terms of (mg/kg.d) from equation 1. Table 1 also shows the parameters for calculating ADDs

$$\text{ADD} = \frac{C * IR * EF * ED}{At * BW} \left(\frac{mg}{Kg} . day\right) \qquad \text{Eq (1)}$$

Table1: ADDs calculation parameters

Concentration	**C**	**mg**	**-**
Ingestion Rate	IR	(mg/day)	82
Exposure Frequency	EF	(day)	365
duration of human exposure	ED	(year)	60
Averaging time of human exposure	At	(year)	70
Body Weight	BW	(kg)	70

Non-carcinogenic risks

In fact, HQ is the ratio between the amount of exposure to heavy metals and their reference dose (RfD), which is used to express non-toxic effects (Eq 2). The RfD is different for each pollutant. For example, its amount for the consumption of arsenic, cadmium, nickel and lead through digestion is equal to 0.0003, 0.001, 0.046, and 0.02 respectively. From the sum of HQ, the hazard index (HI) is obtained (Eq

3). If this value is less than 1, there is no non-carcinogenic risk, while HI >1 means that there is a non-carcinogenic risk(16).

$$HQ = \frac{ADD}{RfD} \qquad \text{Equation (2)}$$

$$HI=\sum_1^i HQ_s \qquad \text{Equation (3)}$$

Carcinogenic risks

Carcinogenic risk (CR) for each carcinogen is obtained by multiplying ADD by slope factor (SF) (Eq 4). SF values for arsenic, cadmium, nickel, and lead are 1.5, 0.38, 1.7, and 0.0085, respectively. The incremental lifetime cancer risk (ILCR) is obtained from the sum of carcinogenic risks(17). (Eq 5)

$$CR = ADD * SF \qquad \text{Equation (4)}$$

CR: Carcinogenic or cancer risks

SF: slope factor

$$ILCR=\sum_1^i CR \qquad \text{Equation (5)}$$

$ILCR<1*10^{-6}$: There is no risk of carcinogenesis.

$ILCR>1*10^{-4}$: There is a risk of carcinogenesis.

$1*10^{-6}< ILCR<1*10^{-4}$: The risk created is acceptable.

3. Result

3.1. Heavy metal Concentration

The present study measured the concentration of five heavy metals (arsenic, cadmium, chromium, lead, and nickel) in food such as rice, vegetables, and bread. The five common types of rice consumed in Hoveyzeh and Azadegan plains are Anbar, Domsiah, Tarom, Indian, and Pakistani. It should be noted that the studied population mainly uses amber rice. Table 2 shows the concentration of metals in food. This table shows that the amount of arsenic in five types of consumed rice was higher than the standard limit determined by the National Standard Institute of Iran (0.15 mg/kg). Exposure to arsenic caused by skin contact or food consumption even in small amounts (0.05 mg/kg) can increase the risk of skin, lung, urinary tract, and bladder cancer(18). The high concentration of arsenic in rice can be related to the irrigation of fields with water from wells(19). The concentration of arsenic in consumed rice was reported in the following order: Tarom> Domsiah> Anbar> Indian> Pakistani. None of the consumed rice had exceeded the permissible limit of cadmium. The national standard of Iran has declared the permissible limit of cadmium in consumed rice to be 0.6 mg/kg(20). The lowest concentration of Cd was reported in Pakistani rice (0.18 mg/kg) and the highest in Tarom rice (0.55 mg/kg). The introduction of cadmium into the food chain can lead to serious damage to the lungs and bones, anemia and sometimes increased blood pressure(21). Rice is a plant that can easily absorb cadmium through its roots; its absorption takes place under conditions of increased oxidation and reduction potential and in the form of divalent cadmium(22). The concentration of Ni and Cr in none of the consumed rice samples did not exceed the permissible limit of the Iranian national standard (10 mg/kg). Chromium is also needed in trivalent form as a vital element for the human body, while hexavalent chromium will be very toxic and harmful(23). Nickel is one of the other harmful heavy metals that causes disturbances in the biological activities of cells, delay in growth, reduction of hematopoiesis and interference in iron absorption(24). Nickel metabolites can cause skin inflammations and cardiovascular disorders. Nickel can also have a teratogenic and malformation effect(25). But the concentration of Pb in all consumed rice (except Indian rice) exceeded the permissible limit. Anbar rice had the highest concentration of Pb and Indian rice had the lowest. Pb is one of the heavy metals that is usually found abundantly in grains and rice. Many researchers have reported its high amount in agricultural products. Of course, plant species have differences in the accumulation, absorption and tolerance of heavy metals(26). The use of sewage sludge and phosphate fertilizers in agricultural lands and residues from the consumption of fossil fuels and irrigation of agricultural crops with sewage are among the factors that can cause Pb contamination(27). The decreasing trend of Pb concentration in consumed rice is as follows: Anbar>Domsiah>Tarom>Pakistani> Indian

In the present study, four types of vegetables (cress, chive, basil, and radish), which are often used by the people of the study area, were selected as samples. The concentration of As, Cd, and Pb in all four types of vegetables exceeded the standard limit. According to the standard of the World Health Organization (WHO) and the Food and Agriculture Organization (FAO), the concentration of As, CD and Pb should be less than 0.7, 0.05 and 0.1 mg/kg of vegetables, respectively. The use of chemical fertilizers can add an average of 0.0008 to 0.93 mg of lead per kilogram and also 0.0005 to 0.5 mg of cadmium per kilogram of soil; this amount added to the soil can be absorbed by plants and vegetables over time(28). Among vegetables, Radish has the highest concentration of As, Pb, Cr, and Ni, while Cress has the lowest amount. The decreasing distribution of As and Pb is as follows. Radish (5.36)>Chive (4.61)>Basil (3.15)>Cress (2.4). One of the most important factors of high levels of heavy metals in vegetables is the use of insecticides, fungicides and pesticides, which are absorbed through the stems and leaves of plants in addition to the roots(29). In a research conducted by Cheng et al. under the title of using wastewater and the accumulation of heavy metals in soil, the results indicated that there is a correlation between heavy metals in soil and plant tissues(30).

In the present study, three types of bread, Barbari, Sangak, and Lavash, were sampled. The results of the tests showed that Lavash bread has the highest amount As (1.31 mg/kg), Cd (0.2 mg/kg), and Ni (1.2 mg/kg), while it also had the lowest amount of Cr (0.056 mg/kg). The standard limit of As, Cd, Pb, and Ni in consumed bread is 0.15, 0.15, 0.15, and 10 mg/kg, respectively. The highest concentration of Cr (1.44 mg/kg) and the lowest concentration of Pb (0.056 mg/kg) were observed in Barbari bread. The concentration of arsenic in Barbari and Lavash bread, the concentration of cadmium in Lavash bread, as well as the concentration of lead in all breads, exceeded the limits declared by health organizations.

The contamination of agricultural products with heavy metals is significant due to the cumulative effects of heavy metals and the adverse effects caused by them in human societies, as well as the threat to food security(31). Exceeding the average concentration of Cd, As, and Pb element from the standard limit can be considered as soil pollution due to geological origin, excessive use of chemical fertilizers, especially phosphate fertilizers, use of insecticides, use of urban sewage for land irrigation, traffic of vehicles on the side of the road (cultivated wheat) (32). During a research conducted with the aim of evaluating heavy metals in Hamadan bread, it was found that the average of cadmium, lead and nickel has increased due to wear and tear of bakery equipment(33).

Table2: Concentration of heavy metals in food

Food	Type	As (PPM)	Cd	Cr	Ni	Pb
	Anbar	1.67	0.36	0.37	0.001	**0.95**
	Domsiah	2.53	0.48	0.24	0.014	**0.35**
Rice	Tarom	2.73	0.55	0.13	0.008	**0.24**
	Hendi	1.5	0.22	0.005	0.004	**0.012**
	Pakistani	1.4	0.18	0.019	0.061	**0.2**
	Cress	2.4	0.199	0.457	0.78	**0.163**
	Chive	4.61	0.16	0.998	1.09	**0.321**
Vegetable	Basil	3.15	0.13	1.22	1.13	**0.256**
	Radish	5.369	0.254	1.36	2.5	**0.361**
	Barbari	0.16	0.13	1.44	0.8	**0.054**
Bread	Sangak	0.11	0.15	1.12	0.61	**0.36**
	Lavash	1.31	0.2	0.056	1.2	**0.28**

3.2. Non-carcinogenic risk assessment

The non-carcinogenic risk results obtained from the present study are shown in Table 3. Comparison of the non-carcinogenic risk of heavy metals in two groups of children and adults showed that HI and HQ were smaller than 1 for both groups; Therefore, foods such as vegetables, rice, and bread consumed in the study area do not pose a non-carcinogenic risk in terms of toxic heavy metals. The highest HQ for kids was related to arsenic, which was 0.0127, 0.0045, and 0.0061 for Tarom rice, radish, and Lavash bread, respectively. The highest value of HI for kids was related to arsenic, which was 0.0137, 0.0048 and 0.0016 for Tarom rice, radish and Barbari bread, respectively. The highest HQ for adults was related to arsenic, which was 0.0059, 0.0017, and 0.0028 for Tarom rice, radish, and Lavash bread, respectively. The highest value of HI for adults was related to arsenic, which was 0.0064, 0.0018, and 0.0031 for Tarom rice, radish, and Lavash bread, respectively.

The non-carcinogenic risk for kids is as follows: Tarom (0.0127) > Domsiah (0.0118) > Anbar (0.0078) > Indian (0.0070) > Pakistani (0.0065)

The non-carcinogenic risk for adults is as follows: Tarom (0.0059) >Domsiah (0.0055) >Anbar (0.0036) >Indian (0.0032) >Pakistani (0.0030)

According to the USEPA guidelines, because the value of HI in all kinds of vegetables, rice and bread is less than one, so the non-carcinogenic risk does not threaten the health of consumers(34). In Qureshi et al.'s study, the concentration of heavy metals in all vegetables was lower than the standards; therefore, in this study, the low absorption of heavy metals by vegetables shows that the health risks for humans are negligible(35). Also, in the study of Woldetsadik et al., the concentration of heavy metals in all vegetables was lower than the standard level. On the other hand, the concentration of lead was higher than the standard, which is due to the irrigation of vegetables with sewage(36). In the study by Roba et al., THQ for metals zinc, copper, lead and cadmium were higher than one, indicating that consumers may experience potential health risks(37).

According to Mousavi et al.'s research, the hazard quotient of the metals cadmium, lead and nickel in cultivated rice of Khuzestan province was higher than 1; These results show that the consumption of rice cultivated in this province increases the non-carcinogenic potential(38). Hazard Quotient of heavy metals cadmium, lead and nickel in rice of Hunan region in China is reported to be 2.29, 0.045 and 0.216, respectively, and cadmium has non-carcinogenic risk potential for humans(39). The risk of heavy metal contamination of soil, plant and rice in the east coast of India was investigated. The health index (HI) values of adults (1.561) and children (1.360) show the adverse effect on their health in the near future(40).

Table3: Non-carcinogenic risk results

Food	Type	HQs (Kids) As	Cd	Cr	Ni	Pb	HI
Rice	Anbar	0.0078	0.0005	0.0001	$7*10^{-7}$	0.0003	0.0088
	Domsiah	0.0118	0.0006	0.0001	$9.8*10^{-6}$	0.0001	0.0127
	Tarom	0.0127	0.0007	$6*10^{-5}$	$5.6*10^{-6}$	$9.6*10^{-5}$	0.0137
	Hendi	0.0070	0.0003	$2.3*10^{-6}$	$2.8*10^{-6}$	$4.8*10^{-6}$	0.0073
	Pakistani	0.0065	0.0002	$8.9*10^{-6}$	$4.2*10^{-6}$	$8*10^{-5}$	0.0069
Vegetable	Cress	0.0020	$5.09*10^{-5}$	$3.9*10^{-5}$	$9.9*10^{-6}$	$1.1*10^{-5}$	0.0021
	Chive	0.0039	$4.09*10^{-5}$	$8.5*10^{-5}$	$1.3*10^{-5}$	$2.3*10^{-5}$	0.0040
	Basil	0.0026	$3.32*10^{-5}$	0.0001	$1.4*10^{-5}$	$1.8*10^{-5}$	0.0028
	Radish	0.0045	$6.49*10^{-5}$	0.0001	$3.1*10^{-5}$	$2.6*10^{-5}$	0.0048
Bread	Barbari	0.0007	0.0001	0.0006	$5.6*10^{-5}$	$2.1*10^{-5}$	0.0016
	Sangak	0.0005	0.0002	0.0005	$4.2*10^{-5}$	0.0001	0.0014
	Lavash	0.0061	0.0002	$2.6*10^{-5}$	$8.4*10^{-5}$	0.0001	0.0006

Food	Type	HQs (Adult) As	Cd	Cr	Ni	Pb	HI
Rice	Anbar	0.0036	0.0002	$8.1*10^{-5}$	$3.2*10^{-7}$	0.0001	0.0041
	Domsiah	0.0055	0.0003	$5.2*10^{-5}$	$4.6*10^{-6}$	$6.5*10^{-5}$	0.0059
	Tarom	0.0059	0.0003	$2.8*10^{-5}$	$2.6*10^{-6}$	$4.5*10^{-5}$	0.0064
	Hendi	0.0032	0.0001	$1*10^{-5}$	$1.3*10^{-6}$	$2.2*10^{-6}$	0.0034
	Pakistani	0.0030	0.0001	$4.1*10^{-6}$	$2*10^{-6}$	$3.7*10^{-5}$	0.0032
Vegetable	Cress	0.0007	$1.9*10^{-5}$	$1.5*10^{-5}$	$3.8*10^{-6}$	$4.5*10^{-6}$	0.0008
	Chive	0.0015	$1.5*10^{-5}$	$3.2*10^{-5}$	$5.3*10^{-6}$	$9*10^{-6}$	0.0015
	Basil	0.0010	$1.2*10^{-5}$	$4*10^{-5}$	$5.5*10^{-6}$	$7.2*10^{-6}$	0.0011
	Radish	0.0017	$2.5*10^{-5}$	$4.4*10^{-5}$	$1.2*10^{-5}$	$1*10^{-6}$	0.0018
Bread	Barbari	0.0003	$8.5*10^{-5}$	0.0003	$2.6*10^{-5}$	$1*10^{-5}$	0.0007
	Sangak	0.0002	$9.8*10^{-5}$	0.0002	$2*10^{-5}$	$6.7*10^{-5}$	0.0006
	Lavash	0.0028	0.0001	$1.2*10^{-5}$	$3.9*10^{-5}$	$5.2*10^{-5}$	0.0031

3.3. Carcinogenic risk assessment

The carcinogenic risk results obtained from the present study are shown in Table 4. Comparing the carcinogenic risk of heavy metals in two groups of children and adults showed that CRs and ILCR for both groups were smaller than $1*10^{-6}$. Therefore, foods such as vegetables, rice and bread consumed in the study area do not have cancer risk in terms of toxic heavy metals. The highest CRs for children were related to arsenic, which were $4.1*10^{-7}$, $1.4*10^{-7}$ and $1.9*10^{-7}$ for Tarom rice, radish and Lavash bread, respectively. The highest amount of ILCR for children was related to arsenic, which was $4.5*10^{-7}$, $2.3*10^{-7}$ and $4.1*10^{-7}$ for Tarom rice, radish and Lavash bread, respectively. The highest CRs for adults were related to arsenic, which were $9.6*10^{-7}$, $2.8*10^{-7}$ and $4.6*10^{-7}$ for Tarom rice, radish, and Lavash bread, respectively. The highest ILCR value for adults was related to arsenic, which was $1.1*10^{-6}$, $4.6*10^{-7}$ and $9.6*10^{-7}$ for Tarom rice, radish and pita bread, respectively.

The risk of carcinogenesis for kids is as follows:

Tarom ($4.1*10^{-7}$) > Domsiah ($3.8*10^{-7}$) > Anbar ($2.5*10^{-7}$) > Indian ($2.2*10^{-7}$) > Pakistani ($2.1*10^{-7}$)

The risk of carcinogenesis for adults is as follows:
Tarom ($9.6*10^{-7}$) > Domsiah ($8.9*10^{-7}$) > Anbar ($5.8*10^{-7}$) > Indian ($5.2*10^{-7}$) > Pakistani ($4.9*10^{-7}$)
In a study in Thailand, they showed that vegetables grown in landfills have carcinogenic and non-carcinogenic risks, and the highest carcinogenic risk is related to arsenic and lead metals(41). In the study of Sultana et al., the results of the study showed that the region of Bangladesh is unsuitable for growing vegetables due to the risk of consuming more heavy metals that affect food safety. Manganese, lead, and iron elements are the most non-carcinogenic heavy metals; while cadmium causes the greatest risk of cancer(42). The carcinogenic risk of cadmium, lead and nickel in the samples of rice grown in Khuzestan province (Iran) was more than 10^{-4}, which indicates that the consumption of rice grown in this province has the potential of carcinogenic risk(43). The amount of carcinogenic risk of cadmium and nickel metals in rice of Hunan region in China is reported to be 0.0343 and 0.0039, respectively, which was higher than 10-4, and the consumption of this rice has the potential to cause cancer in humans(44).

Table 4: Carcinogenesis risk results

CRs (Kids)							**ILCR**
Food	Type	As	Cd	Cr	Ni	Pb	
Rice	Anbar	$2.5*10^{-7}$	$1.3*10^{-8}$	$1.8*10^{-8}$	$1.7*10^{-9}$	$8.1*10^{-10}$	$2.8*10^{-7}$
	Domsiah	$3.8*10^{-7}$	$1.8*10^{-8}$	$.12*10^{-8}$	$2.3*10^{-8}$	$2.9*10^{-10}$	$4.3*10^{-7}$
	Tarom	$4.1*10^{-7}$	$2.1*10^{-8}$	$6.5*10^{-9}$	$.13*10^{-8}$	$2*10^{-10}$	$4.5*10^{-7}$
	Hendi	$2.2*10^{-7}$	$8.3*10^{-9}$	$2.5*10^{-10}$	$6.8*10^{-9}$	$1*10^{-11}$	$2.4*10^{-7}$
	Pakistani	$2.1*10^{-7}$	$6.8*10^{-9}$	$9.5*10^{-10}$	$1*10^{-8}$	$1.7*10^{-10}$	$2.3*10^{-7}$
Vegetable	Cress	$6.5*10^{-8}$	$1.3*10^{-9}$	$4.1*10^{-9}$	$2.4*10^{-8}$	$2.5*10^{-11}$	$9.5*10^{-8}$
	Chive	$1.2*10^{-7}$	$1.1*10^{-9}$	$9.1*10^{-9}$	$3.3*10^{-8}$	$4.9*10^{-11}$	$1.7*10^{-7}$
	Basil	$8.6*10^{-8}$	$9*10^{-10}$	$.11*10^{-8}$	$3.5*10^{-8}$	$3.9*10^{-11}$	$1.3*10^{-7}$
	Radish	$1.4*10^{-7}$	$1.7*10^{-9}$	$.12*10^{-8}$	$7.7*10^{-8}$	$5.6*10^{-11}$	$2.3*10^{-7}$
Bread	Barbari	$2.4*10^{-8}$	$4.9*10^{-9}$	$7.2*10^{-8}$	$1.3*10^{-7}$	$4.6*10^{-11}$	$2.3*10^{-7}$
	Sangak	$1.6*10^{-8}$	$5.7*10^{-9}$	$5.6*10^{-8}$	$1*10^{-7}$	$3*10^{-10}$	$1.8*10^{-7}$
	Lavash	$1.9*10^{-7}$	$7.6*10^{-9}$	$2.8*10^{-9}$	$2*10^{-7}$	$2.3*10^{-10}$	$4.1*10^{-7}$

CRs (Adult)							**ILCR**
Food	Type	As	Cd	Cr	Ni	Pb	
Rice	Anbar	$5.8*10^{-7}$	$3.2*10^{-8}$	$4.3*10^{-8}$	$3.9*10^{-9}$	$1.8*10^{-9}$	$6.6*10^{-7}$
	Domsiah	$8.9*10^{-7}$	$4.2*10^{-8}$	$2.8*10^{-8}$	$5.5*10^{-8}$	$6.9*10^{-10}$	$1.1*10^{-6}$
	Tarom	$9.6*10^{-7}$	$4.9*10^{-8}$	$1.5*10^{-8}$	$3.1*10^{-8}$	$4.7*10^{-10}$	$1.05*10^{-6}$
	Hendi	$5.2*10^{-7}$	$1.9*10^{-8}$	$5.8*10^{-10}$	$1.5*10^{-8}$	$2.3*10^{-11}$	$5.6*10^{-7}$
	Pakistani	$4.9*10^{-7}$	$1.6*10^{-8}$	$2.2*10^{-9}$	$2.4*10^{-8}$	$3.9*10^{-10}$	$5.3*10^{-7}$
Vegetable	Cress	$1.2*10^{-7}$	$2.6*10^{-9}$	$8*10^{-9}$	$4.6*10^{-8}$	$4.8*10^{-11}$	$1.8*10^{-7}$
	Chive	$2.4*10^{-7}$	$2.1*10^{-9}$	$1.7*10^{-8}$	$6.5*10^{-8}$	$9.6*10^{-11}$	$3.2*10^{-7}$
	Basil	$1.6*10^{-7}$	$1.7*10^{-9}$	$2.1*10^{-8}$	$6.7*10^{-8}$	$7.6*10^{-11}$	$2.5*10^{-7}$
	Radish	$2.8*10^{-7}$	$3.4*10^{-9}$	$2.3*10^{-8}$	$1.4*10^{-7}$	$1*10^{-10}$	$4.6*10^{-7}$
Bread	Barbari	$5.6*10^{-8}$	$1.1*10^{-8}$	$1.6*10^{-7}$	$3.1*10^{-7}$	$1*10^{-10}$	$5.5*10^{-7}$
	Sangak	$3.8*10^{-8}$	$1.3*10^{-8}$	$1.3*10^{-7}$	$2.4*10^{-7}$	$7.1*10^{-10}$	$4.2*10^{-7}$
	Lavash	$4.6*10^{-7}$	$1.7*10^{-8}$	$6.5*10^{-9}$	$4.7*10^{-7}$	$5.5*10^{-10}$	$9.6*10^{-7}$

4. Conclusion

The results of these investigations show that the soil or water used for planting vegetables, rice or wheat contained large amounts of heavy metals and did not meet the standards required for irrigation and planting of these crops. Therefore, there is a need for related organizations to carry out regulatory measures. In this regard, in order to reduce food contamination, the following suggestions are provided:

- Training farmers in the field of correct irrigation and fertilization.
- Teaching farmers and people about the harmful effect of heavy metals on the body and ways to control and reduce it.
- Substitute vegetables with lower absorption of heavy metals.
- Identifying sources of pollution and controlling its reduction.
- Inspection and maintenance of water and soil resources used for planting vegetables by health and environmental officials.

Authorship contribution:

MF: Data collection, Writing original draft preparation; **AS:** Formal analysis; **AN:** Conceptualization, methodology, supervision, acquisition, project administration.

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