Assessment of Heavy Metals in some Local and Imported Vegetables that collected in Erbil market

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Abstract

In Erbil city, 4 types of imported and local vegetables (tomato, pepper, eggplant and zucchini) were collected. X-ray fluorescence spectrometer XRF was used to analyze the heavy metals, including Lead (Pb), Manganese (Mn), Zinc (Zn), Cadmium (Cd) Titanium (Ti), Silver (Ag), Rubidium (Rb), Arsenic (As) and Antimony (Si) in vegetables, as well as the health risks they pose in Erbil. In the vegetable samples, the mean values mg kg-1 varied from 43-107, 10-28, 14-44, 10-14, 29-290, 106-164, 5-23, 0.3-0.9, 0.8-10, respectfully the heavy metals in the local and imported vegetables exceeded FAO/WHO safe limits for heavy metals concentration in vegetables. Most of the studied heavy metals are higher than acceptable limits of the FAO/WHO standards.

Keywords: Heavy metal, Vegetables, FAO/WHO

1-Introduction:

Vegetables are a healthy element of a diet since they provide potassium, fiber, and vitamins. Regular vegetable consumption reduces the risk of cardiovascular disease and several cancers, especially digestive tract tumors (Aysha et al., 2017). However, consuming greens grown in heavy metal-contaminated soil may have deleterious consequences on a person's metabolic and physiological systems (Li et al., 2018). Heavy metals may accumulate in agricultural plants from an overabundance of organic and inorganic fertilizers used in the fields, posing a health risk to consumers who consume these products. (Akter et al., 2017, Meng et al., 2018). Experts from all around the world are very worried about the health effects of the high concentrations of dangerous substances in soil, water, and plants. The possibility of damage from these factors might lead to these dangers. Many cases of heavy metal contamination in products have been documented. (Mahmood et al., 2020, Sayo et al., 2020). Heavy metals are not biodegradable; therefore, they accumulate in the soil and may threaten the local environment (Plants, animals and humans) (Tariq et al., 2019). The heavy metals may cause cancer, genetic mutations, and toxicity. Absorption and ingestion are the most common routes of exposure to toxic metals for humans. (Sayo et al., 2020). The primary route of exposure for humans to some of these metals is via the soil-crop system, which involves the intake of heavy metals (Solidum et al., 2012). According to the kind of heavy metal such as arsenic and

cadmium, they may cause a range of cancers as well as neurotoxicity, shortness of breath, effects that are teratogenic and mutagenic, and other health problems. (Mahdavi et al., 2018). The objective of the research is to determine the levels of heavy metals in local and imported vegetables in Erbil city markets and the health risks associated with eating such vegetables.

2. Material and Method:

2.1 Study area:

Erbil, Iraqi Kurdistan's capital, has more than a million people. A site was selected which is one of Erbil vegetables markets at Latitude 36.17803 and Longitude 43.922652.

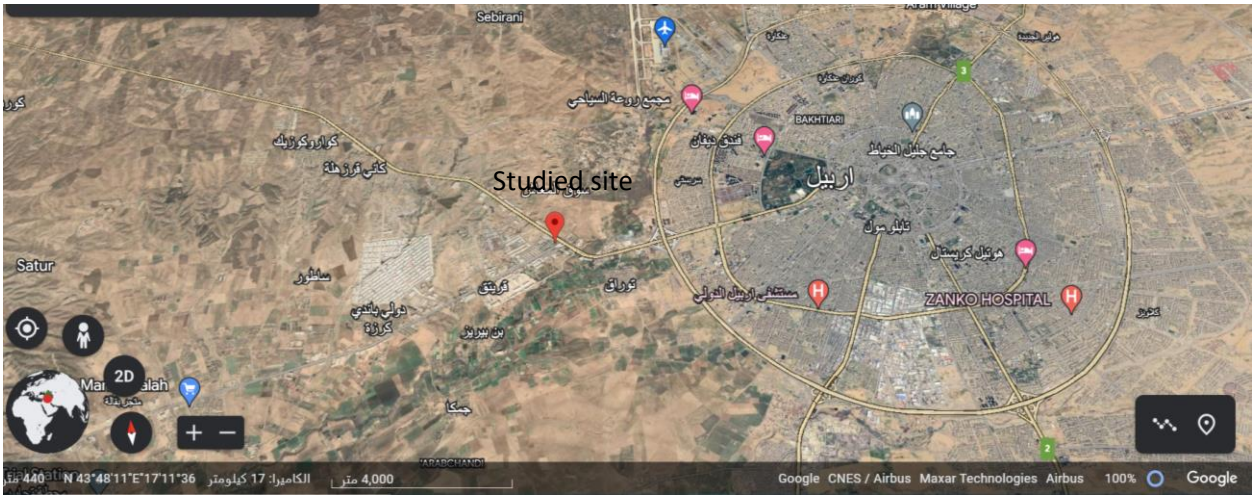

Figure 1: Location Map of the study area showing the sample location

2.2 Sampling:

Stainless steel knife was used to obtain about 1 kg of edible parts of different local and imported vegetables: eggplant (Solanum melongena L.), zucchini (Cucurbita pepo), tomato (Solanum L.), and pepper (Capsicum annuum) were collected from Erbil market during November. Each vegetable sample was cleaned with tap water and distilled water to remove debris and dust particles. The edible sections of the samples were oven dried for 72 hours. After drying, materials were ground into a fine powder and kept in containers until analyzed. X-ray fluorescence spectrometer XRF was used to analyze the types of heavy metals which are: Lead (Pb), Manganese (Mn), Zinc (Zn), Cadmium (Cd) Titanium (Ti), Silver (Ag), Rubidium (Rb), Arsenic (As) and Antimony (Si). XRF works by a process whereby electrons are displaced from their atomic orbital positions, releasing a burst of energy that is

characteristic of a specific element. This release of energy is then registered by the detector in the XRF instrument, which in turn categorizes the energies by element.

3 Results and discussion:

Local tomato, pepper, eggplant and zucchini heavy metal concentrations show inTable 1, and the imported vegetables show in Table 2. The minimum concentration of metals recorded are Zinc in tomato and pepper in both local and imported, while in eggplant both imported and local Zinc was greater than FAO/WHO acceptable limits, and in local zucchini was less, but the imported was greater. Both local and imported tomato were low in Manganese. While the other metals in all vegetables and in both local and imported recorded as greater than FAO/WHO acceptable limits. Due to some reasons like, Heavy metals can accumulate in the soil due to industrial pollution, mining activities, and the use of certain fertilizers and pesticides. When vegetables are grown in contaminated soil, they may absorb these metals and accumulate them in their tissues. If vegetables stored in containers that contain heavy metals. This can occur if the containers are made from materials that contain these metals, or if they have been contaminated during manufacturing or storage. Heavy metals can be present in the air, and if vegetables are stored in areas with high levels of air pollution, they can become contaminated. This is more likely to occur in urban areas or near industrial facilities. If vegetables are stored near other items that contain heavy metals, such as batteries or electronic devices, they can become contaminated through cross-contamination. If vegetables are stored in water that is contaminated with heavy metals, they can become contaminated.

Table 1: FAO/WHO standard concentrations of heavy metals in vegetables (mg/kg).

Types of vegetables	Pb	Mn	Zn	Cd	Ti	Ag	Rb	As	Sb
Tomato	0.1	10-20	20-40	0.1	0.01	0.001	0.1	0.01	0.01
Pepper	0.3	2	50	0.1	0.01	0.001	0.1	0.1	0.01
Eggplant	0.3	3.3	30	0.05	0.14	0.005	5.5	0.04	0.015
Zucchini	0.1	2.3	20	0.1	1	0.01	0.7	0.1	0.1

Table 2: Heavy metal concentration of four local vegetable samples (mg/kg).

Types of vegetables	Pb	Mn	Zn	Cd	Ti	Ag	Rb	As	Sb
Tomato	44	12.8	14.5	11.7	191.3	133.5	5.4	N/D	0.8
Pepper	47.9	16.7	20.2	10.6	N/D	106	14.11	0.8	N/D
Eggplant	107.5	28.9	42.1	13.3	290.4	146.7	16.21	N/D	10.3
Zucchini	43.6	12.4	35.9	12.7	201.5	164.2	11.0	0.3	N/D

Table 3: Heavy metal concentration of four imported vegetable samples (mg/kg).

Types of vegetables	Pb	Mn	Zn	Cd	Ti	Ag	Rb	As	Sb
Tomato	44.7	10	17.7	11.7	29.7	123.2	8.5	N/D	7.6
Pepper	59.1	20.5	18.7	12.5	N/D	122	23.7	0.9	N/D
Eggplant	86.2	21.1	49.5	10.8	112.3	135.5	31	N/D	1.8
Zucchini	59	28.7	18	13.2	17.7	127.8	14.3	N/D	N/D

4 Conclusion:

Zinc and manganese were the only two heavy metals with concentrations lower than the Food and Agriculture Organization/World Health Organization's restrictions for heavy metals concentrations in tomato as in both local and imported, same as the concentration of zinc in pepper, both local and imported were lower, but zinc was lower in imported eggplant only while in local was higher. The number of heavy metals (lead, cadmium, titanium, silver, rubidium, arsenic, and antimony) present in the vegetables both imported and local have

exceeded the FAO/WHO permissible concentrations of heavy metals in vegetables this may have several reasons such as: Soil contamination: Heavy metals can accumulate in soil from industrial activities, such as mining and smelting, or from the use of contaminated fertilizers and pesticides. When vegetables are grown in contaminated soil, they may absorb these metals through their roots and accumulate them in their tissues. Water contamination: Heavy metals can also enter the food chain through water pollution. If vegetables are irrigated with contaminated water or grown in areas where the water supply is contaminated, they may absorb these metals and accumulate them in their tissues. Air pollution: Some heavy metals, such as lead and mercury, can be transported through the air and deposited onto crops. This can occur near industrial areas or near roads with heavy traffic. Processing and packaging: Vegetables can also become contaminated with heavy metals during processing and packaging, if the equipment or packaging materials contain heavy metals.

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