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MONITORING THE RISKS OF TRACE ELEMENTS IN SOIL, WATER AND PLANTS AS A RESULT OF INCREASING POPULATION AND HUMAN ACTIVITIES ALONG WITH MANSORIA CANAL

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ABSTRACT

Mansoria canal is one of the important irrigation canals along in west Cairo, Egypt. Most soils surrounded this canal irrigated from it, which consequently receives large quantities of low water quality due to human activities. The current study aimed to monitoring soil, grown plants and irrigation water along Mansoria canal from Abu Nomros area up to Riah El-Nassery and their effects on human health impacts. To attain these goals, soil, irrigation water and grown plant samples were collected along the study area, and their contents of micronutrients and some heavy metals *i.e.,* Cd, Co, Cr, Cu, Mn, Ni, Pb and Zn were determined. The results revealed that the available content of trace elements in soil locations under study was lower than the pollution values with the exception of Cr, Cu and Pb. Moreover, Mn, Cr, Zn and Cu were found at high concentrations in most plants exceeding the permissible ones, while other elements were recorded high concentration values than the permissible limits only in some plants. To predict the impacts on human health live in these areas during period of time, risk assessment of human health equations were conducted based on plant and soil ingestion beside of the dermal contact. The results indicated that Zn, Mn, Cr and Pb in all grown plants can possess health threat for children; whereas Cd shows a serious health impacts for children when feeding on cauliflower, cabbage, white potatoes and onion. Cobalt also might cause adverse health effects for children when feeding on pepper, lettuce, peanut, wheat grain and orange, while Cu may has a health impacts on children feeding all grown plants with the exception of cauliflower. No health impacts were expected for adults feeding these plants, with the exception of Cr and Zn in case of white potatoes and Cr, Cu, Mn and Zn in case of wheat grains. Finally, it must be kept in mind that some of grown plants which produced from contaminated areas might not be suitable for children consumption and has a negative impact on their health.

Keywords: West Cairo; Mansoria canal; Trace elements; Hazard index

INTRODUCTION

Heavy metals are ubiquitous in the environment, as a result of both natural and anthropogenic activities, and humans are exposed to them through various pathways, especially food chain. The essentiality of Fe, Mn, Cu and Zn are based on their role as metalloenzymes. These metals are cofactor of large number of enzymes (FDA, 2001). However, deficiency and toxic effects are observed (FDA, 2001 and Singh and Garg 2006). A high supplementation of Fe and Mn causes pathological events such as the iron oxides deposition in Parkinson's disease (FDA, 2001 and Powers, *et al*. 2003). Cu surplus had been associated with liver damage and Zn may produce adverse nutrient interactions with Cu. Also, Zn reduces immune function and the levels of high density lipoproteins (FDA, 2001). Other metals like Pb and Cd are toxic even at low concentration (Llobet, *et al*. 2003). Pb is known to induce renal tumours, reduce cognitive development, and increase blood pressure and cardiovascular diseases risk for adults and Cd may induce kidney dysfunctions, osteomalacia and reproductive deficiencies (FDA, 2001 and Ikem and Egiebor, 2005). Chromium has been reported to be toxic to animals and humans and Hexavalent Chromium, Cr (VI) reported to be a powerful carcinogen capable of modifying the deoxyribonucleic acid (DNA) transcription process in both animals and humans that may result in important chromosome aberrations (Raji and Anirudhan, 1998)

As essential part of food, vegetables are important source of these metals. Whereas, irrigation with low water quality, vehicular exhaust and industrial activities are the major sources of soil contamination with heavy metals. An increased metal uptake by food crops, vegetables and fruits grown on contaminated soils is often observed in wide world (Khan *et al*. 2008 and Damian *et al*., 2010). Vegetables cultivated in contaminated soils take up heavy metals in a significant quantities enough to cause potential health risks to the consumers (Singh *et al*. 2010; Yang *et al*. 2007; Lăcătuşu and Lăcătuşu, 2008).

In Egypt, part of west Cairo areas depends on the use of Mansoria canal as a source of irrigation water, while this canal receives large quantities of untreated discharges in some locations as a result of increasing population and human activities. Therefore, the current research aimed to monitoring the available contents of trace elements i.e. Cd, Co, Cr, Cu, Mn, Ni and Pb in soil, water and plants of the study area. Also, distribution of these elements within the different types of vegetables grown on it was also investigated. Since soil contamination with trace elements can influence human health through different mechanisms *i.e.* ingestion (either deliberate or involuntary), inhalation and dermal absorption (Abrahams, 2002). Therefore, human health aspects of the investigated trace elements there in will be under study.

MATERIALS AND METHODS

Some locations surrounded El-Mansoria canal (west greatest Cairo, Egypt) was chosen for this study (figure 1). The study area started from Abu Nomros up to Riah El-Nassery. Different edible crops, such as lettuce (*Lactuca sativa*), cabbage (*Brasssica oleracea* var. capitata), Cauliflower (*Brassica Oleracea*. Botrytis L.), Onion (*Allium cepa*), Peanut (*Arachis hypogaea*), white potatoes (*Solanum tuberosum*), wheat (*triticum aestivum*) and Pepper (*Phaseolus Vulgaris*) were grown at such locations. Different samples (Soil, water and plant) were collected throughout the year which divided into four periods acting different seasons to determine some trace elements, i.e. Cd, Co, Ca, Cu, Mn, Ni and Pb. In each area 3 soil samples were taken from the 0-20 cm depth of the A horizon, air dried, crushed and sieved to pass through a 2 mm mill and prepared for analysis. Trace elements were extracted using NH_4HCO_3-DTPA (AB-DTPA) solution according to Lindsay and Novell (1978). All the collected samples of various plants were washed with double distilled water to remove airborne and soil pollutants. After washing, plant samples were oven dried at 70°C to constant weight, then ground, passed through a 2 mm sieve and stored at room temperature before analysis. Dried plant materials were digested by using a mixture of concentrated sulphuric- perchloric acids according to Chapman and Pratt (1961). The concentrations of Cd, Co, Cr, Cu, Mn, Ni and Pb were measured in soil and plant samples by inductively coupled plasma (ICP).

Risk assessment

Hazard evolution for human living in this area was assessed by calculating the average daily intake of heavy metals from soil and edible plants through different exposure pathways reported by Abdelhafez *et al*., (2012) as follows:

$$\text{ADD soil and plant ingestion} = \frac{C \times Ing\,R \times EF \times ED}{BW \times AT} \qquad \text{Eqs (1)}$$

$$\text{ADD soil dermal contact} = \frac{C \times Inh\,R \times EF \times ED}{PEF \times BW \times AT} \qquad \text{Eqs (2)}$$

$$\text{ADD dermal} = \frac{C \times SA \times SL \times ABS \times EF \times ED}{BW \times AT} \qquad \text{Eqs (3)}$$

Where ADD is the average daily dose of heavy metals, C the metal concentration of media (soil or vegetables; mg kg^{-1}), Ing R the ingestion rate per unit time, ED the exposure duration, EF the exposure frequency, BW the humans body weight, AT the average time, SL the skin adherence factor, SA the surface area of contact, ABS is the absorption factor, InhR is inhalation rate and PEF is particle emission factor. These parameters are presented in Table 1 and the toxicity indices of the elements are presented in Table 2.

These Data obtained from Lee, *et al*., (2006); Zheng, *et al*., (2010) ; Abdelhafez *et al*., (2012) and Pao *et al.* (1982).

Also, the obtained ADD values were used to determine the hazard quotient (HQ) and the hazard index (HI) as follows:

$$HQ = \frac{ADD}{RfD} \qquad \text{Eqs (4)}$$

$$HI = \sum HQs \qquad \text{Eqs (5)}$$

Where RfD is the reference dose which is defined as the maximum daily intake of contaminant without deleterious health effect (WHO, 2001). Consequently, if ADD > RfD, there are a possible deleterious health impact.

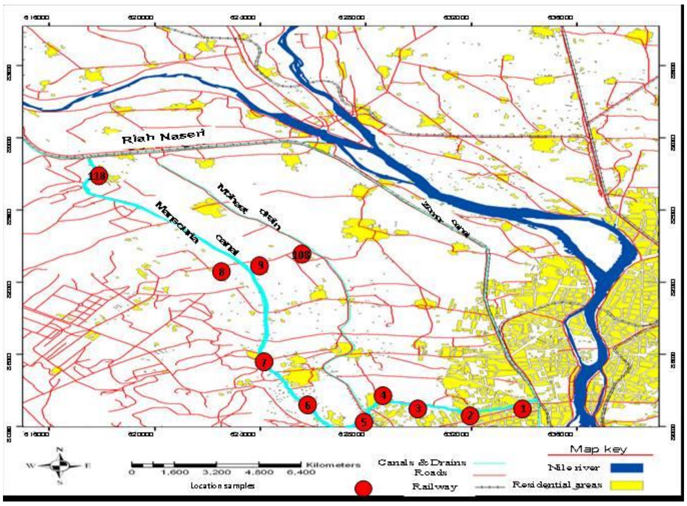

Figure 1: Map of the studied area showing sample locations.

Table (1): The parameters used to characterizing the ADD and hazard index (HI) values.

Parameter	Description	Value		Unit
		Adult	Children	
C	Contamination level	--		mg kg^{-1}
IR	Ingestion rate per unit time			
	Soil	100	200	mg day^{-1}
	White Potatoes	84.5	62	g day^{-1}
	Cabbage	11.8	5.9	g day^{-1}
	Onion	20.9	10.45	g day^{-1}
	Pepper	8.3	4.15	g day^{-1}
	Lettuce	21	11	g day^{-1}
	Peanut	23	20	g day^{-1}
	Cauliflower	1.9	0.95	g day^{-1}
	Wheat grain	362.2	181.3	g day^{-1}
	Orange	16.9	8.45	g day^{-1}
EF	Exposure frequency	350		days year^{-1}
ED	Exposure duration	30	6	Years
BW	Body weight	70	15	kg
AT	Average time	30	6	Years
SL	Skin adherence factor	0.7	0.2	mg cm^{-2} h^{-1}
SA	Exposure skin area	5700	2800	cm^{2}
ABS	Dermal absorption factor	0.001		Unitless
InhR	Inhalation rate	20.0	7.60	m^{3} kg^{-1}
PEF	Particle emission factor	1.36E+09		m^{3} kg^{-1}

Table 2: Relative toxicity parameters used in this study.

RfD	Elements							
	Mn	Cu	Zn	Pb	Cd	Co	Cr	Ni
Ingestion	0.046	0.04	0.02	0.0035	0.001	0.02	0.003	0.14
Dermal	0.04	0.012	0.0054	0.0005	0.00001	0.016	0.0075	0.0056
Inhalation					0.00057	0.0001		

RfD reference dose (mg kg^{-1} day^{-1}), Data obtained from Ferreira-Baptista and Miguel (2005); EPA, (2002); Abdelhafez *et al*., (2012); IRIS, (2007) and ATSDR, (2007).

RESULTS AND DISCUSSION

Available trace elements in soil:

Table (3) reveals that AB-DTPA extractable micronutrients *i.e.* Mn, Zn and Cu were relatively high as compared with heavy metals in the studied soil; presumably due to the addition of fertilizers which contains low amounts of heavy metals as compared with micronutrients (Abdelhafez *et al*., 2012). Most available of trace elements were relatively low when comparing with that of critical levels conducted by Podlešáková *et al*., (2002), with the exception of Cr, Cu and Pb. This mainly attributed to the alkaline conditions of the studied soil which decreased the solubility and availability of Co (Wendling *et al*., 2009 and Luo *et al*., 2010) and Ni (Weng *et al*., 2003). Also, Moraghan and Mascani (1991) and Morel (1997) concluded that the bioavailability of zinc, lead and copper from soil decreases with increasing pH. The decreased availability of metals is affected by higher adsorption and precipitation in alkaline and neutral environments. While Cu, Pb and Cr were relatively higher than the permissible limits in soil according to Podlešáková *et al*., (2002), mainly due to excessive mineral fertilization addition beside herbal and insect pesticides which commonly contain considerable quantities of these elements (Abdelhafez *et al*., 2012).

Table (3): AB-DTPA extractable trace elements in the studied soil.

Soil samples	Cd	Co	Cr	Cu	Mn	Ni	Pb	Zn
Wheat Soil[a]	0.02	0.12	0.06	8.36	17.59	0.42	4.36	8.22
n = 4	(Nd-0.04)	(Nd - 0.34)	(0.01-0.13)	(6.1-11.47)	(3.99-39.79)	(Nd - 0.84)	(3.12-7.36)	(4.62-16.4)
Vegetables soil[b]	0.013	0.508	0.088	3.99	7.0	0.33	1.456	5.487
n = 7	(Nd - 28)	(Nd - 3.36)	(0.03-0.18)	(0.04-8.34)	(0.27-27.3)	(Nd - 1.4)	(Nd - 2.57)	(0.53-13.3)
Orange soil[c]	0.01	Nd	0.02	0.02	6.71	0.33	1.16	2.60
Critical value[d]	0.06	2.0	0.00	1.00	100.0	4.00	1.00	30.0

[a] **Mean concentration of trace elements (mg/kg) in soil farmed with wheat along Mansoria canal;**
[b] **Mean concentration of trace elements (mg/kg) in soil farmed with different vegetables along Mansoria canal;**
[c] **conc., of trace elements in soil (mg/kg) farmed with orange trees;**
[d] **critical values of trace elements in soil (Podlešáková et al., 2002)**

Total content of trace metals in the plants grown on the studied area:

Similar trends with that obtained for the concentration of trace elements in soil were also observed for the content of trace elements in different plants as shown in table (4). Where, the micronutrients elements *i.e.* Mn, Cu and Zn recorded higher concentrations than that of heavy metals in all grown plants. The content of Mn, Cu, Cr and Zn were ranged between 17.7 - 92.2, 7.1 -197.3, 1.2 - 8.4 and 1.2 - 91.6 mg kg^{-1}, respectively. The permissible limits set by WHO/FAO (1984) were 2.00, 3.00, 0.0 and 27.4 mg kg^{-1} for Mn, Cu, Cr and Zn, respectively. When comparing the content of trace metals in the studied plants with that of the permissible limits reported by WHO/FAO (1984), it was found that the content of Zn in orange was within this limit, while other plants accumulate Mn, Cu, Cr and Zn above these limits. This might be attributed to the excessive addition of mineral fertilization which contains large quantities of these elements.

Table (4): Total content of trace elements in different plants grown along Mansoria canal.

Plant Name	Cd	Co	Cr	Cu	Mn	Ni	Pb	Zn
Wheat[a]	Nd[b]	0.3	1.9	102.2	20.25	2.65	0.55	40.5
n[c] = 2		(0.1-0.5)[d]	(1.7-2.1)	(7.1-197.3)	(17.7-22.8)	(2.6-2.8)	(Nd - 1.1)	(1.2-79.8)
Cabbage	0.033	Nd	6.07	62.23	54.53	2.17	1.47	51.43
n = 3	(Nd - 0.1)		(5.6-7.0)	(8.1-160.8)	(40.9-67.8)	(Nd - 3.7)	(Nd - 3.7)	(23.8-91.6)
Cauliflower	0.5	Nd	8.4	11.4	64.5	5.0	5.3	41.9
Lettuce	Nd	3.0	2.3	10.1	92.2	3.2	1.0	32.2
Onion	Nd	0.1	2.2	18.4	44.9	2.00	1.2	47.2
Peanut	Nd	0.1	2.9	21.7	65.8	Nd	11.5	55.1
Pepper	Nd	1.0	2.85	27.4	65.95	1.35	0.1	37.05
n = 2		(Nd - 2.0)	(1.2-4.5)	(23.2-31.6)	(64.3-67.6)	(Nd - 2.7)	(Nd - 0.2)	(34.1-40.0)
Potato	0.1	Nd	6.1	8.5	47.3	2.7	0.3	50.1
Orange	Nd	0.3	3.4	10.8	21.8	1.5	0.8	11.6
Critical value[e]	0.21		0.0	3.0	3.0	1.63	0.43	27.4

[a] Mean concentration of trace elements (mg/kg) in wheat grains along Mansoria canal;
[b] Not detected; [c] Number of samples;
[d] Numbers in parenthesis are arithmetic average (min–max);
[e] critical values of trace elements in edible plants (FAO/WHO, 1984)

Also Cd content in all studied plants were within the permissible limits reported by WHO /FAO (1984), except cauliflower plants, which has higher amounts of Cd (0.5 mg kg^{-1}) than the permissible limits (0.21 mg kg^{-1}). The lowest content of Pb (0.1 mg kg^{-1}) was found in Pepper and the highest content was found (11.5 mg kg^{-1}) in Peanut, while the permissible limit of Pb reported by WHO/FAO (1984) for edible plants was 0.43 mg kg^{-1}. When comparing metal limit in the studied plants with those proposed by WHO/FAO

(1984), it was found that all plants accumulated Pb above the permissible limit, except of peeper and white potatoes. Pepper, Peanut and orange were found within the permissible limits reported by WHO/FAO (1984) for Ni content in edible plants (1.63 mg kg^{-1}), while other plants accumulated Ni above this limit. Finally, the recorded high content of trace elements in grown plants may indicate a potential health hazardous effect on the food chain.

Trace elements in water canal El-Mansoria.

Irrigation water from El-Mansoria canal was taken to evaluate the contamination with different elements. The results revealed that the concentration of most trace elements at El-Mansoria canal used for irrigation were within the permissible limits set by FAO (1992). Water used to irrigate cauliflower plants in some locations was exceed than the permissible limits in case of Ni and Mn as shown in table (5). Also irrigation water recorded higher concentration of Mn in onion, while irrigation water for wheat plants was above the permissible limits set by FAO (1992). This was led to excessive accumulation of these elements in grown plants irrigated with this type of water.

Table (5): Trace elements concentration in El-Mansoria channel used for irrigation of studied plants (mg L^{-1}).

Plant Name	Cd	Co	Cr	Cu	Mn	Ni	Pb	Zn
Wheat water[a]	0.0007	0.0033	0.0037	0.016	0.142	0.409[b]	0.0037	0.0147
n = 3	(Nd- 0.002)	(0.003- 0.004)	(Nd- 0.007)	(0.006- 0.022)	(0.007- 0.25)	(Nd- 1.227)	(Nd - 1.1)	(Nd- 0.006)
Cabbage	0.0003	0.0037	0.0003	0.0127	0.0687	Nd	0.0057	0.0237
n = 3	(Nd - 0.001)	(0.002- 0.006)	(Nd- 0.001)	(Nd- 0.025)	(Nd- 0.172)		(Nd - 0.013)	(0.002- 0.054)
Cauliflower	0.002	0.004	Nd	0.018	0.25	1.227	0.006	0.016
Lettuce	0.001	Nd	Nd	0.006	0.002	Nd	0.002	0.014
Onion	0.0003	0.002	0.0007	0.0137	0.2337	Nd	0.0047	0.0267
Peanut	0.001	Nd	Nd	0.004	Nd	Nd	0.0075	0.0105
Pepper	0.001	0.001	Nd	0.007	0.083	0.002	0.001	0.0475
n = 2	(0.001- 0.001)	(Nd- 0.002		(Nd- 0.014)	(0.028- 0.138)	(Nd- 0.004)	(Nd- 0.002)	(0.018- 0.077)
Potato	Nd	0.003	Nd	0.01	0.034	Nd	0.013	0.002
Orange	Nd	0.002	0.001	0.03	0.172	Nd	0.004	0.015
Critical value[c]	0.01	0.05	0.1	0.2	0.2	0.2	0.5	2.0

[a] Mean concentration of trace elements (mg/kg) in irrigation water which irrigate this plant;
[b] above critical values; [c] critical values of trace elements in irrigation water (FAO, 1992)

Human health aspects of the investigated trace elements in the studied area.

The hazard index "HI" reported by Abdelhafez *et al*. (2012) was calculated as a measurement for the implications of ingesting plant and soil besides the dermal contact for health risk assessments. There is no doubt that the contact pathways vary between adults and children (Zheng *et al*., 2007). Thus, the hazard indexes of the studied trace elements should be considered separately for these two age stages. However, if these values exceeded than 1, the adverse health impacts were observed. Generally, the calculated values of hazard (HI) for children exceeded "one" were existed with Zn, Mn, Cr and Pb for all grown plants (Table 6). Such results indicate that serious health problems might occur for children when feeding on vegetables or products obtained from this area. Whereas, chronic exposure to Cr may result in liver, kidney and lung damage (Zayed and Terry, 2003).Copper may cause serious health problems for children when feeding on vegetables or products obtained from this area, since the hazard index was above one in case of all studied plants with the exception of cauliflower. Also, Cd shows a serious health impacts for children when feeding on cauliflower, cabbage, white potatoes and onion, while there wasn't any health impacts with other grown plants. This might be attributed to excess concentration of Cd (0.5 mg kg^{-1}) at Cauliflower than the permissible limits set by WHO/FAO (1984) which was 0.21 mg kg^{-1}. While in case of cabbage and onion higher concentrations of Cd was set at soil of it than the other locations. Highly ingestion rate of white potatoes cause a serious health impacts for children, since the hazard index was recorded 4.43, for Cd causes both acute and chronic poisoning, adverse effect on kidney, liver, vascular and immune system (Heyes, 1997). Cobalt also might cause adverse health effects for children when feeding on pepper, lettuce, peanut, wheat grains and orange, since the hazard index was above one. On the other hand, the calculated hazard indexes for adults were below "one" for all elements in all grown plants, except Cr and Zn for white potatoes and Cr, Cu, Mn and Zn for wheat grains. This might be attributed to high amount of ingestion rate of wheat and white potatoes as compared with other products. No adverse health impacts were expected for Ni in all studied plants for adults and children, since the HI recorded lower values than 1.0, except of white potatoes, and wheat grains. Although, there were some studied plants showed higher concentrations of Ni than the permissible limits set by WHO/FAO (1984), no hazard effects were exist. This might be attributed to high maximum daily intake of Ni without deleterious health effect (WHO, 2001) as compared with other elements. Ni toxicity in human is not a very common occurrence because its absorption by the body is very low (Onianwa *et al*., 2000).

Table (6): Hazard Index (HI) of the investigated trace elements in the studied area.

Plant type		Cd	Co	Cr	Cu	Mn	Ni	Pb	Zn
Cauliflower	Adult	0.01	< 0.01	0.03	< 0.01	0.02	< 0.01	0.13	0.06
	Children	1.19	< 0.01	2.17	0.39	2.61	0.24	54.66	21.51
Cabbage	Adult	0.01	< 0.01	0.18	0.33	0.12	< 0.01	0.19	0.44
	Children	1.43	< 0.01	11.39	29.78	15.22	0.13	86.08	74.45
Pepper	Adult	< 0.01	0.02	0.06	0.07	0.12	< 0.01	0.13	0.18
	Children	0.36	13.35	12.19	21.7	38.53	0.12	60.79	55.58
Onion	Adult	0.02	< 0.01	0.07	0.08	0.10	< 0.01	0.23	0.28
	Children	2.00	0.57	12.89	32.25	19.12	0.35	95.23	58.98
Lettuce	Adult	< 0.01	0.42	0.11	0.07	0.37	< 0.01	0.16	0.33
	Children	< 0.01	33.41	10.73	26.78	100.3	0.18	57.69	79.47
Peanut	Adult	< 0.01	0.04	0.15	0.09	0.23	< 0.01	0.49	0.42
	Children	< 0.01	19.94	17.52	15.13	37.95	< 0.01	46.68	42.64
White Potatoes	Adult	0.06	< 0.01	1.12	0.15	0.59	0.01	0.28	1.53
	Children	4.43	< 0.01	91.63	33.96	69.77	1.19	110.21	205.77
Wheat grain	Adult	< 0.01	0.72	1.5	6.07	1.05	0.05	0.68	4.84
	Children	0.02	48.89	84.78	352.9	69.05	2.88	163.01	293.9
Orange	Adult	< 0.01	0.3	0.13	0.03	0.08	< 0.01	0.13	0.09
	Children	0.01	1.80	7.75	1.69	23.64	0.42	49.29	22.14

Values of HI >1 indicate adverse health impacts, and are in bold

Conclusion

AB-DTPA extractable micronutrients *i.e.* Mn, Zn and Cu were relatively high as compared with heavy metals in the studied soil. But available trace elements were relatively low as compared with the pollution levels with the exception of Cu, Cr and Pd. On the other hand, all plants accumulate Mn, Cu, Cr and Zn above the permissible limits set by WHO/FAO (1984). Also there were some plants accumulate Cd, Co, Ni and Pb above the permissible limits. Health risk assessments based on plant and soil ingestion beside of the dermal contact were conducted. The results reveal that Zn, Mn, Cr and Pb in all grown plants can possess health threat for children; whereas Cd shows a serious health impacts for children feeding only on cauliflower, cabbage, white potatoes and onion. Cobalt also might cause adverse health effects for children feeding on pepper, lettuce, peanut, wheat grain and orange, while Cu may has a health impacts on children when feeding on all grown plants, except cauliflower. No health impacts were expected for adults feeding on these plants, except Cr and Zn for white potatoes and Cr, Cu, Mn and Zn for wheat grains. Finally, the excessive addition of mineral fertilizers which contains large quantities of trace elements beside the contamination of irrigation water resulted in the contamination of grown plants with trace elements, accordingly the food obtained from studied areas is might not be suitable for children consumption.

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متابعة مخاطر العناصر النادرة في الأرض والمياه والنبات نتيجة الزياده السكانيه والانشطه السكانيه علي طول ترعة المنصوريه

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ترعة المنصورية هي واحدة من قنوات الري في غرب القاهرة، مصر حيث تروي الأراضى الزراعية فى تلك المنطقة بمياهها التي تتلقى كميات كبيرة من المخلفات نتيجة الانشطه البشريه. وتهدف الدراسة الحالية إلى قياس مستوى تلوث التربة من العناصر النادره في منطقة غرب القاهرة وآثارها على محتوي النباتات النامية فى تلك المنطقة من هذه الملوثات. لتحقيق هذه الأهداف، تم جمع عينات التربة والنبات من منطقة غرب القاهرة على طول ترعة المنصورية (منطقة أبو النمرس وحتي رياح الناصري)، وتم تحليل محتوياتها من العناصر النادره (الكادميوم، الكوبالت، الكروم، النحاس، المنجنيز، النيكل، الرصاص، والزنك). وأظهرت النتائج أن محتوى العناصر النادره فى الاراضى الزراعية لمنطقة الدراسة كانت أقل من قيم التلوث باستثناء النحاس, الكروميوم والرصاص. وعلاوة على ذلك، فقد وجد المنجنيز، الكروم، الزنك والنحاس بتركيزات عالية في جميع النباتات المزروعة تجاوزت تلك المسموح بها، في حين سجلت العناصر الأخرى تركيز أعلي من الحدود المسموح بها في بعض النباتات المزروعة دون غيرها. وأشارت تقييمات المخاطر الصحية المتوقعة على الانسان في خلال فترة زمنيه تتجاوز الثلاثين عاما للبالغين وستة أعوام للاطفال أن قيم امتصاص العناصر موضع الدراسه من النبات و التربة (الزنك والمنجنيز والكروم والرصاص) في جميع النباتات تسبب تهديدا صحيا للأطفال، في حين قد يسبب الكادميوم آثار صحية خطيرة للأطفال عندما تتغذى على القرنبيط، والملفوف، والبطاطا البيضاء والبصل. أيضا الكوبالت قد يسبب آثار صحية ضارة للأطفال عندما تتغذى على الفلفل، والخس، والفول السوداني، حبوب القمح والبرتقال. يكون للنحاس أثار صحية ضارة على الأطفال عند التغذية على جميع النباتات التي تزرع باستثناء القرنبيط. ومن المتوقع أنه لا توجد أضرارصحية علي البالغين عند التغذيه على هذه النباتات، مع استثناء الكروميوم والزنك في حالة البطاطا البيضاء والكروميوم، النحاس، المنجنيز والزنك في حالة حبوب القمح، عموما فان الاسراف في استخدام الاسمده المعدنيه والزياده السكانيه والنشاط السكاني قد تؤدي الي تلوث النباتات التي تزرع في غرب القاهرة بتلك العناصر ووفقا لذلك ينصح بأن الطعام المتوفر في منطقة الدراسة ربما لا يكون مناسب لاستهلاك الأطفال.

قام بتحكيم البحث

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