Impact of Contaminated Vegetables, Fruits and Fodders on Human Health by Malir River Farms Karachi

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(Received 23rd December, 2004, revised 27th June, 2005)

Summary: The present research was designed to determine the geo-chemical sources and mobilization of nine trace elements in samples of plants (vegetables, fruits and fodders), from different parts of Karachi. Samples collected from farms located in the basin of and around Malir River (Map, 1) were considered polluted because here the industrial and municipal effluents were used for irrigation and different wastes (poultry, industrial and municipal) used as fertilizers. Samples collected from farms situated 45-km from Karachi along highway and from Sakeran Deh in Hub (Map, 1) were considered unpolluted because here water used for irrigation was obtained from wells and fertilizer used was not waste material. The results of analysis of these samples show that Cd, Cr, Hg, Ni and Pb pollution is most common in plants. All other elements are well within the permissible limits. Presence the trace metals focus the extant of pollution in farms of Malir areas.

Introduction

Concentration of traces heavy metals in plants is highly essential for good health of animals and human beings but the metals should of be within permissible limits as recommended by WHO (Table-1). Concentrations higher or lower than the recommended permissible limits have adverse effects on health. It is also known that in addition to development of various diseases, inequilibrium in concentration of heavy metals in the human body affects general health, growth and social behavior of human beings. The concentrations of heavy metals in human blood, flesh and bones have been investigated in different parts of the world and above normal concentrations are known to disturb the rate of body growth, mental development and the degree of sensitivities in the sufferers [1]. The imbalance of trace metals in human body may also affect the daily life activities to a great extent. Such conditions may also lead to illnesses of various types such as tumors, heart diseases, psychic conditions that damage the memory and intellectual abilities of human beings.

Damage the memory and intellectual abilities of human beings. The imbalance of heavy metal concentrations in plants, animals and human-beings has been related to Pollution in foods, soil and water. But, the exact causes of this imbalance in living organisms are yet to be clearly understood. The complex geo-chemical conditions that prevail both on the land and in the sea provide various types of food stuffs to the humans in different parts of the world have to be investigated thoroughly. In addition, the impact of climatic controls on agricultural products should also be investigated [2].

Keeping in view the above facts and their inter-relationships, it was decided to investigate the concentration of selected heavy metals like, cadmium (Cd), chromium (Cr), copper (Cu), iron (Fe), mercury (Hg), manganese (Mn), nickel (Ni), lead (Pb) and zinc (Zn), in the vegetables, fruits, fodders, of different places like farms around Malir River (considered polluted), farms Main Highway 45Km from Karachi (considered unpolluted), and Sakeran-B Deh Hub (considered unpolluted) farms. The wastes of the different industries, poultry and cattle along Malir River and its tributaries are among the major sources of toxic metals in water, soil and vegetables and therefore a potential source of transferring heavy metals to human beings.

Results and Discussion

Detailed geo-chemical and medical investigations have proved that serious health problems are caused by air, water, and soil pollution, vegetation grown on the soil using polluted water and waste as fertilizer [3].

Table-1: Dietary Intake Limits of Trace Elements under Study Their Effects on Human Health

S. No.	Elements	Physiological Significance of Element	Dietary Intake Limits	Effects
1.	Cadmium (Cd)	Not present at birth but increases with age.	0.5 ppm [8]	Excess of Cd affects arteries of human kidneys, causes cancer, incurable vomiting, nausea and diarrhea.
2.	Chromium (Cr total)	Essential for animals but not for plants.	0.24 ppm per day [1,8]	50ppm of Cr in diet has been found to induce growth depression together with liver and kidney damage.
3.	Copper (Cu)	Enrichment and depletion both cause diseases.	75 ppm [8]	It accumulates in liver, brain cells, in the cornea of the eyes & leads to neurological and liver diseases. Deficiency of copper causes anemia, Leukemia, skeletal defects and degeneration of the nervous system.
4.	Iron (Fe)	Essential component of hemoglobin	200ppm [8]	Low iron content in diet causes gastrointestinal infection, nose bleeding and myocardial infarction. Toxicity of iron affects the blood vessels.
5.	Mercury (Hg)	Mercury pollution is a serious health hazard.	0.3 mg per week [3]	Mercury poisoning leads to in-coordination in physiological functions, loss of vision, hearing & mental retardation. Excess intake is almost fatal. If immediate treatment is not given may cause inflammations, abdominal cramps with nausea and vomiting.
6.	Manganese (Mn)	62 % of the diabetic patients are at risk with higher Mn content.	35 ppm [8]	Deficiency of Mn causes myocardial infarction and the other
7.	Nickel (Ni)	It is essential for animals but not for human beings	2 ppm [8]	Signs of Ni deprivation in chicks, cows, goats, pigs, rats and sheep are numerous.
8.	Lead (Pb)	Lead has been known to have neurotoxic effects for a long time.	3mg per week [3]	Lead causes neurological symptoms ranging from peripheral nerve dysfunction to acute encephalopathy, memory loss and death. Accumulation of lead in the nervous system, bones, liver, pancreas, teeth, gums and blood, disturbs body functions.
9.	Zinc (Zn)	It is essential for animals and human beings.	100 ppm [8]	Zinc deficient diabetics fail to improve their power of perception. It plays an important role in wound healing and its addition to diet accelerates the growth of delayed sexual development. Its deficiency causes loss of sense of touch and smell.

Like many diseases in human beings, several diseases in animals also show a definite geographical distribution. This may be due to geographical variation in climatic conditions, soil, vegetation, regional differences in animal husbandry practices, and variation in resistance against diseases between breeds [4].

Cadmium (Cd)

The dietary limit in the foods and foodstuff for Cd is 0.5 ppm (Table-1). High contents of cadmium are damaging to human health and cause many diseases. It is a toxic element and it is not present at birth time but increases with age causing tubular growth, kidney damage, cancer, and diarrhea and incurable vomiting.

Plants

90.76 % of polluted samples (Table-2) and 66.66% unpolluted samples (Table-3) show higher contents of Cd than the permissible dietary limit (Graph 1).

This high content of Cd is passed on to human beings and animals causing sever damaging effect on

Table-2: Concentration of trace elements in polluted vegetables, fruits and fodders samples

S. #	Farms	Samples Code	Elements (in ppm) with permissible limits given below each elements								
			Cd 0.5	Cr 0.24	Cu 75.0	Fe 200.0	Hg 0.3 mg/week	Mn 35.0	Ni 2.0	Pb 3.0 mg/week	Zn 100.0
1.	Farm-1	Brinjal	0.816	5.116	6.510	52.350	1.155	16.750	5.733	10.033	26.116
2.		Beet root	0.933	5.066	10.100	315.416	2.578	87.083	1.233	0.783	74.833
3.		Chicco	0.316	4.800	0.933	116.333	1.274	12.650	7.350	7.716	11.066
4.		Fodder	0.833	5.400	12.133	256.666	2.815	178.333	8.750	8.083	54.783
5.	Farm-2	Beetle	0.683	4.733	3.766	238.333	1.392	46.666	9.700	14.466	29.850
6.		Papaya	0.003	0.660	0.171	7.733	0.569	1.126	0.420	0.496	1.643
7.	Farm-3	Ridge gourd	0.583	2.483	4.816	67.716	1.867	16.866	1.150	8.700	44.800
8.		Chicco	0.683	8.833	0.766	71.033	0.392	12.766	7.000	7.733	13.266
9.	Farm-4	Bottle gourd	0.600	4.833	6.666	41.950	0.948	18.216	6.683	4.150	26.583
10.		Cluster Bean	1.066	0.040	5.883	51.166	1.096	33.683	4.933	15.850	32.450
11.	Farm-5	Papaya	0.003	0.973	0.133	12.650	0.276	0.236	0.773	0.736	1.403
12.		Brinjal	1.000	2.066	9.500	50.766	0.918	12.050	2.800	7.883	27.850
13.		Mint	0.950	8.233	10.233	395.333	1.630	98.333	5.016	11.900	47.733
14.	Farm-6	Chicco	0.950	1.516	1.100	32.633	2.608	9.850	2.533	11.200	9.733
15.	Farm-7	Fodder	0.933	2.600	3.333	197.333	0.949	151.666	4.600	10.766	33.616
16.	Farm-8	Ridge gourd	0.900	2.983	9.650	44.516	0.385	21.816	4.766	5.450	47.900
17.	Farm-9	Ridge gourd	0.650	4.516	8.850	46.350	0.414	16.116	3.933	9.283	48.700
18.	Farm-10	Ridge gourd	0.900	6.766	15.566	68.933	1.718	13.633	2.066	20.866	78.683
19.		Okra	0.900	4.800	12.183	59.816	0.918	25.866	4.766	39.916	72.500
20.		Fodder	0.566	1.083	9.433	188.500	1.630	49.116	2.916	17.633	45.450
21.	Farm-11	Hyacinth Bean	0.483	0.040	4.800	61.333	0.859	15.750	4.483	13.350	32.383
22.		Fodder	0.600	0.250	5.333	372.666	1.066	57.400	4.300	13.616	51.666
23.		Ridge gourd	1.166	0.233	6.400	66.666	2.874	14.216	4.133	12.166	35.833
24.		Guava	0.816	0.040	4.116	37.500	0.657	8.466	3.333	3.466	12.833
25.		Fodder	1.283	0.950	7.716	194.000	0.704	60.116	5.033	11.000	27.683
26.		Ridge gourd	0.250	0.533	9.816	38.166	0.352	40.316	3.966	14.166	31.383
27.		Bitter gourd	1.116	0.200	8.266	55.666	0.634	34.833	6.550	7.380	36.933
28.	Farm-12	Ridge gourd	1.016	0.216	10.700	29.333	1.550	12.850	5.466	11.083	42.833
29.		Red Broad Bean	1.116	0.040	5.116	32.166	1.151	17.550	4.883	8.550	40.783
30.		Green chili	1.083	0.883	11.733	22.166	1.268	8.366	2.083	8.066	33.516
31.	Farm-13	Fodder	0.866	3.533	7.166	306.833	0.751	45.766	4.533	16.966	28.066
32.		Ridge gourd	1.116	0.483	10.050	36.333	0.634	27.933	5.333	3.833	47.316
33.		Green chili	1.166	0.150	8.560	31.833	1.124	22.966	3.816	8.016	28.050
34.	Farm-14	Mint	1.266	4.266	10.333	438.000	0.775	51.550	6.416	11.833	41.133
35.		Fodder	1.216	4.500	12.900	108.500	0.352	86.766	6.683	12.516	33.866
36.	Farm-15	Corn (seeds)	0.733	0.040	2.283	15.000	0.305	12.466	3.716	5.866	24.733
37.		Fodder	0.900	1.850	6.700	159.500	3.369	105.166	2.966	6.866	60.466
38.		Ridge gourd	1.216	0.040	7.566	40.833	0.369	25.066	5.650	13.166	40.216
39.		Bitter gourd	1.016	0.616	8.900	39.666	1.080	17.833	3.800	15.116	34.683
40.		Bottle gourd	1.150	0.650	8.116	81.666	0.751	16.133	3.500	5.500	32.383
41.	Farm-16	Bitter gourd	1.366	1.950	10.333	64.500	0.798	16.583	3.583	8.466	36.783
42.		Ridge gourd	1.233	2.666	15.166	38.333	1.574	41.400	5.533	7.016	46.100
43.		Green chili	1.233	0.466	10.200	33.666	0.869	11.033	4.200	12.216	40.516
44.	Farm-17	Bitter gourd	1.166	0.533	6.320	40.666	0.775	21.150	4.966	6.966	27.483
45.		Ridge gourd	0.966	0.850	10.900	75.666	0.563	17.483	4.083	8.600	27.366
46.		Okra	1.200	1.400	6.883	20.000	0.704	19.600	4.283	2.583	30.566
47.		Bottle gourd	1.000	1.033	11.066	32.666	0.375	17.250	4.250	4.633	27.000
48.	Farm-18	Ridge gourd	0.833	0.050	5.766	32.666	0.493	13.333	3.833	5.066	19.000
49.		Fodder	1.200	1.616	5.133	126.166	1. 030	32.466	4.066	10.216	28.000
50.	Farm-19	Fenugreek	2.550	0.040	10.950	276.666	1.109	114.950	10.250	10.800	60.200
51		Mint	0.883	1.816	13.533	62.000	0.924	95.266	5.450	12.933	37.250
52.		Sweet potato	1.150	0.040	4.833	287.666	0.392	88.066	3.983	20.316	17.700
53.		Bitter gourd	2.300	0.040	9.600	71.000	1.040	18.850	3.700	10.450	49.350
54	Farm-20	Ridge gourd	1.116	0.040	12.600	35.166	0.647	17.300	6.600	18.833	35.300
55.		Capsicum	1.116	0.100	9.000	30.166	0.254	13.833	3.250	15.250	36.400
56.		Fodder	1.250	0.566	7.400	274.500	0.416	36.600	5.116	24.533	33.166
57.	Farm-21	Fodder	1.500	1.533	9.266	285.666	0.485	37.366	6.033	12.400	33.783
58.		Spinach	0.900	3.033	9.533	499.333	0.554	80.883	6.666	17.816	36.516
59.		Ridge gourd	0.850	0.040	9.783	34.000	0.947	12.050	5.283	9.116	33.650
60.	Farm-22	Ridge gourd	0.300	0.040	11.483	30.666	0.300	16.550	5.633	14.466	60.916

Table-2: Continued.

S. #	Farms	Samples Code	Cd 0.5	Cr 0.24	Cu 75.0	Fe 200.0	Hg 0.3 mg/week	Mn 35.0	Ni 2.0	Pb 3.0 mg/week	Zn 100.0
61.		Fenugreek	0.650	0.040	11.900	56.333	0.462	24.233	6.100	26.216	46.500
62.	Farm-23	Bottle gourd	0.883	0.040	11.066	48.666	0.416	19.533	4.533	8.500	26.950
63.		Ridge gourd	0.850	0.040	9.700	33.166	0.947	12.230	5.633	11.033	51.483
64.	Farm-24	Brinjal	0.750	0.040	15.733	35.833	0.924	12.250	3.283	14.016	50.983
65.		Ridge gourd	0.800	0.040	11.716	49.666	0.670	15.066	6.058	19.766	57.333
	%Above limits		90.76%	64.61%	--	18.46%	96.923%	30.76%	93.85%	93.85%	--
	%With in limits		9.23%	35.38%	100%	81.54%	3.076%	69.23%	6.15%	6.15%	100%

Table-3 Concentration of trace elements in unpolluted vegetables, fruits and fodders samples

S. No.	Farms	Samples Code	Cd 0.5	Cr 0.24	Cu 75.0	Fe 200.0	Hg 0.3 mg/week	Mn 35.0	Ni 2.0	Pb 3.0 mg/week	Zn 100.0
1.	Farm-1 (Main High way 35 Km from Karachi)	Brinjal	0.32	0.04	8.26	97.45	0.050	13.21	2.00	6.92	2.38
2.		Carrot	0.46	1.76	3.86	110.23	0.050	18.66	2.98	3.0	17.46
3.	Farm-2 (Main High way 45 Km from Karachi)	Brinjal	0.54	0.16	7.96	174.01	0.045	16.98	4.32	2.88	24.82
4.		Fodder	1.36	6.08	10.15	2854.01	0.05	156.21	10.52	16.44	37.66
5.	Farm-3 (Sakeran-B Deh Hub)	Brinjal	0.34	0.12	10.46	96.61	0.05	13.52	3.72	2.04	25.32
6.		Chico	0.67	0.12	0.79	87.61	0.023	3.66	1.86	2.44	5.6
7.		Guava	0.64	1.44	5.16	85.82	0.032	19.72	3.76	BDL	14.08
8.		Fodder	1.04	2.26	11.12	362.41	0.027	54.12	4.91	8.02	42.98
9.	Farm-4 (Sakeran-B Deh Hub)	Guava	0.53	1.10	6.26	95.61	0.028	22.34	1.91	6.66	16.26
	% Above limits		66.66%	55.55%	___	22.22%	___	22.22%	66.66%	44.44%	___
	% Within limits		33.33%	44.44%	100%	77.77%	100%	77.77%	33.33%	55.55%	100%

their health. Plants which they were grown and some from polluted water and soil high in these elements may have absorbed much of these elements.

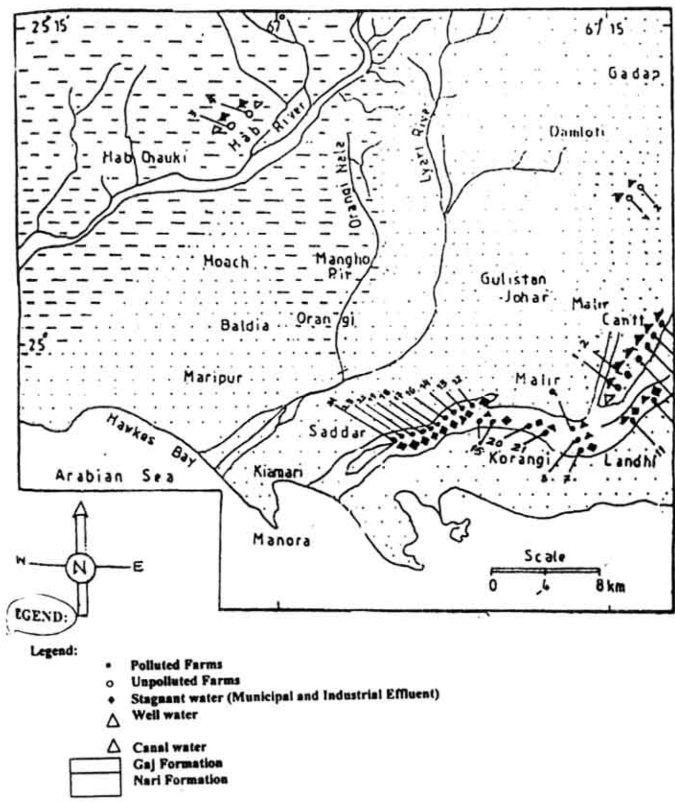
Chromium (Cr_{Total})

It is an essential element for animals but not for plants [5]. The dietary intake limit in food is 0.24 ppm. High content of chromium in diet has been found to induce growth depression, together with liver and kidney damage. Chromium toxicity usually occurs in an industrial environment. It is also induces cardio-vascular diseases [6].

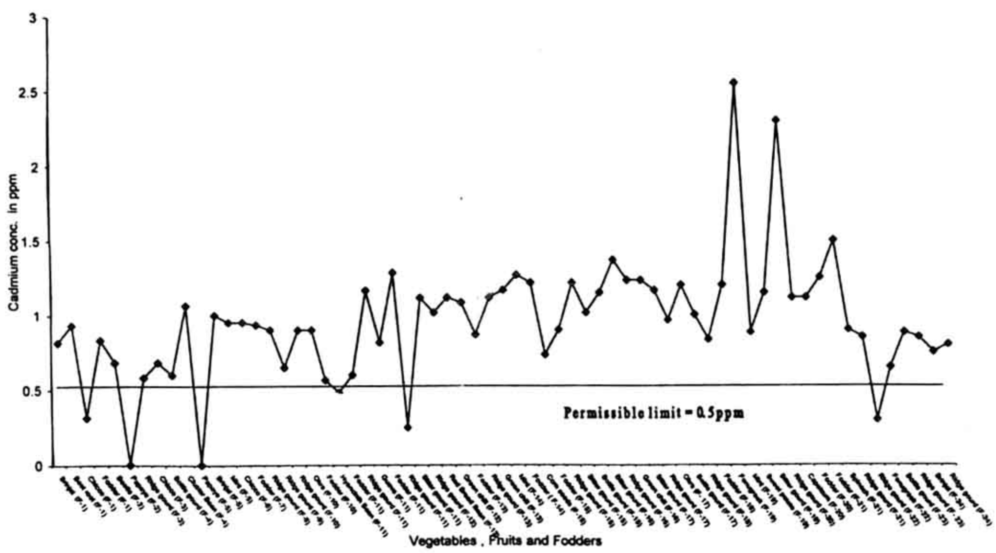
Plants

64.61% polluted samples (0.25 - 8.833 ppm) (Table-2) and 55.55% unpolluted samples (1.10 - 6.08) (Table-3) show high concentration of chromium than permissible dietary limit (0.24 ppm), 35.38 % polluted (0.04 - 0.233 ppm) and 44.44% unpolluted samples (0.04 - 0.12 ppm) show within dietary limit (Graph 2, Table-2-3).

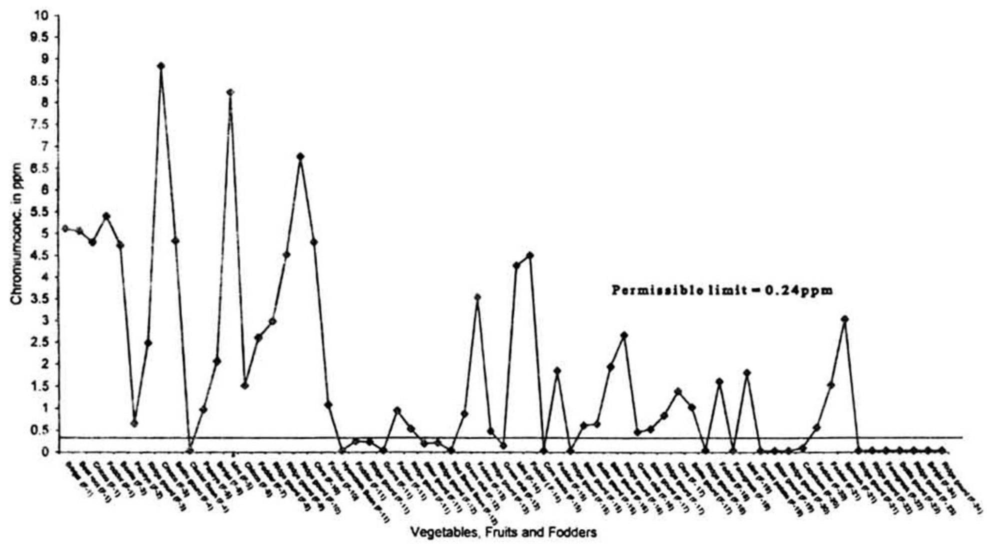
Some of this Cr passed to vegetation from soil and enters the food chain. Since the water irrigating the vegetables fields is low in Cr, it is suggested that most of the Cr in the plants is absorbed from the soil on which these are grown. Thus Cr, contribution to vegetation by soil is rather limited. The weathering of the rocks, industrial wastes, municipal sludge's, which these soil formed and prepared for agricultural purposes, may have contributed most of the Cr in the soil.



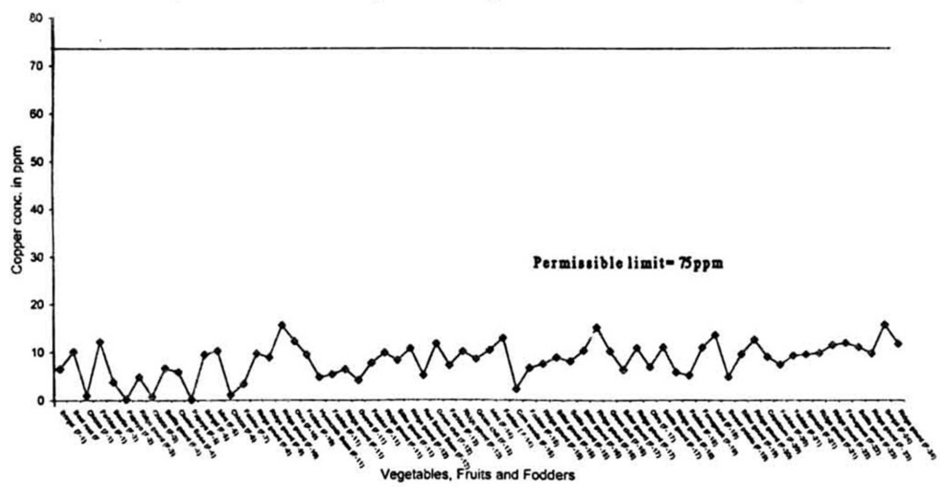
Map 1: Karachi Showing Locations of Polluted and Unpolluted Samples Sites of Malir River, Highway and Hub River Area under Study.



Graph 1: Cadmium in polluted vegetables, fruits and fodders samples.



Graph 2: Chromium in polluted vegetables, fruits and fodders samples.



Graph 3: Copper in polluted vegetables, fruits and fodders samples.

Copper *(Cu)*

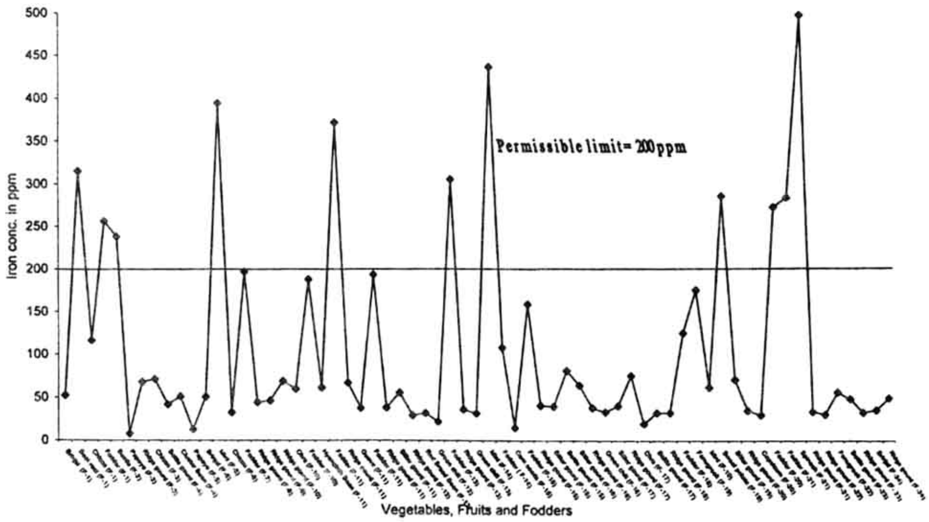
It is an essential trace element for plants as well as human beings. Dietary intake limit in foods is 75.0 ppm. Contamination and depletion of copper causes different diseases. Copper being less mobile than many other elements, its concentration in soil, water and content by vegetables, fruits and fodders are low.

Plants

100 % polluted and unpolluted samples show (0.133 – 15.733 ppm) copper concentration within recommended limit (75.0 ppm) (Graph 3). Copper deficiency in children showed a syndrome of neutropaenia, anemia and bone demineralization, which were all, reversed by copper supplementation. A similar syndrome in adults has been reported during total potential nutrition with copper deficient solution [7].

Iron (Fe)

It is an essential element for human beings and animals and is an essential component of hemoglobin .The dietary limit of iron in the food is 200.0 ppm. Low iron content in diet causes gastro-



Graph 4: Iron in polluted vegetables, fruits and fodders samples.

intestinal infection, nose bleeding, and myocardial infarction.

Plants

18.46 % polluted samples (238.33 - 499.34 ppm) and 22.22 % unpolluted samples (362.41 - 2854.01 ppm) show concentration of iron higher than the dietary limits in the foods and 81.54 % polluted (7.73 - 197.33 ppm) and 77.77% unpolluted samples (95.61 - 174.01 ppm) show Fe concentration within the permissible limit (Graph 4). This is due mainly low contents of Fe in the soil and water of the area. It is also suggested plants do not readily absorbed Fe in large quantities. Thus it is concluded that Fe contents are within limit in the plants. Iron deficiency reduces the level of hemoglobin in blood, producing anemia, which in turn reduces the transport of oxygen for energy production in the cells, leading to listlessness [8].

Mercury (Hg)

It is a toxic element and pollution by mercury causes, serious health problems. Dietary intake permissible limit in foods is 0.3mg/ week [8]. Hg poisoning leads to in coordination in physical function, loss of vision, hearing and mental retardation, and even death. Even though Hg is not readily soluble in water, its high content in plants suggests its transport through vapors and capacity of the plants to readily absorb it. High mobility of Hg is controlled by organic matters [8].

Plants

96.923% polluted samples (0.305 - 3.369 ppm) show higher contamination of mercury. Whereas 100% unpolluted samples (0.023 - 0.05 ppm) show Hg content within the range in the areas under study (Graph 5).

Mercury is not known to be essential in any way to animals or human beings, yet it is capable of entering the human food chain in many ways.

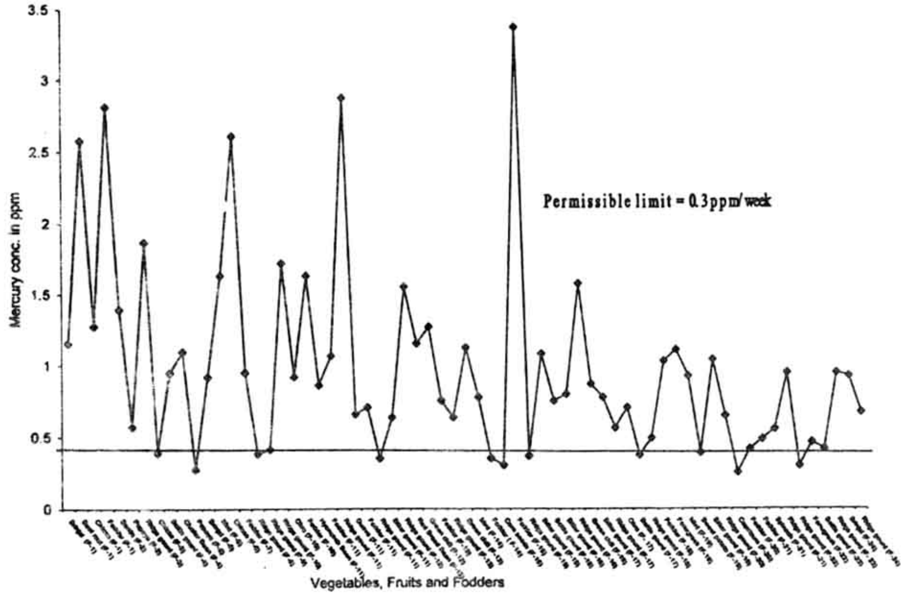
Manganese (Mn)

Deficiency of the manganese causes myocardial infarction and other cardiovascular diseases. The higher contents of manganese are a risk for diabetic patients.

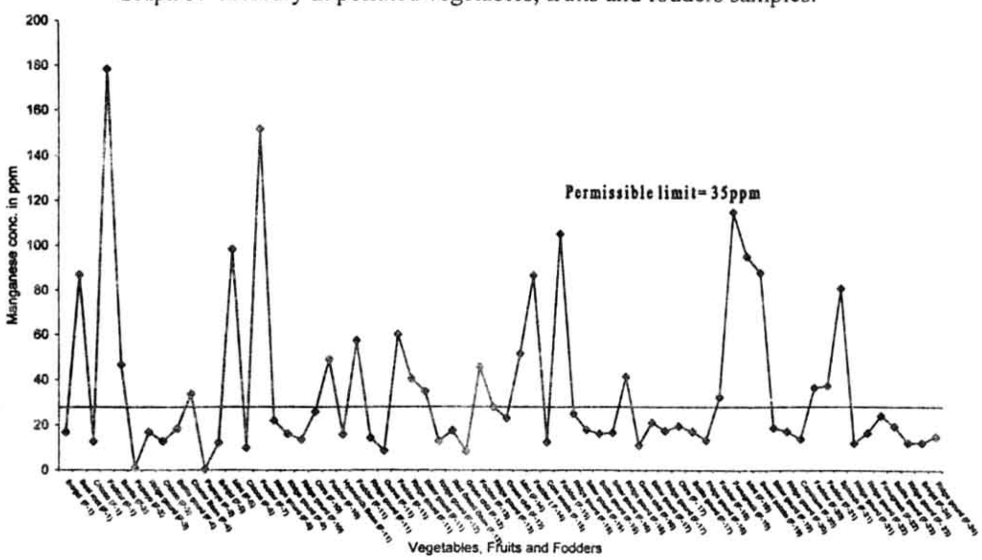
Plants

30.76 % polluted (36.60 - 178.33 ppm) and 22.22 % unpolluted vegetables fruits and fodders samples (54.12 – 156.21 ppm) show high concentration of manganese. 69.23 % polluted (0.23 -34.883 ppm) and 77.77 % unpolluted samples (3.66 - 22.34 ppm) are under the dietary limit (Graph 6).

Deficiencies in animals result in skeletal abnormalities and postural defects. This is also exhibited by the offspring's of Mn deficient mothers. Whole cereals and some varieties of tea are rich in manganese; vegetables are intermediate and meat,



Graph 5: Mercury in polluted vegetables, fruits and fodders samples.



Graph 6: Manganese in polluted vegetables, fruits and fodders samples.

fish and dairy products are low. It is less toxic than many elements [7].

Nickel (Ni)

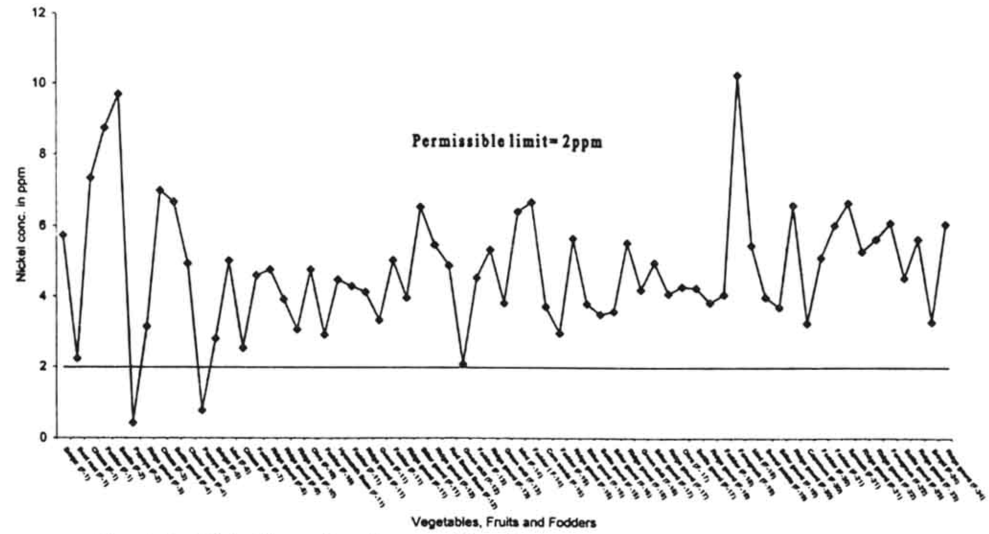
The dietary allowable intake limit for Ni in food is 2.0 ppm. It is reported that sign of nickel deprivation in chicks, cows, goats, pigs and sheep are numerous. It is essential for animals but not for the human beings [5]. Its high content is highly injurious to eyes. The mobility of Ni is relatively limited (pH > 6.5).

Plants

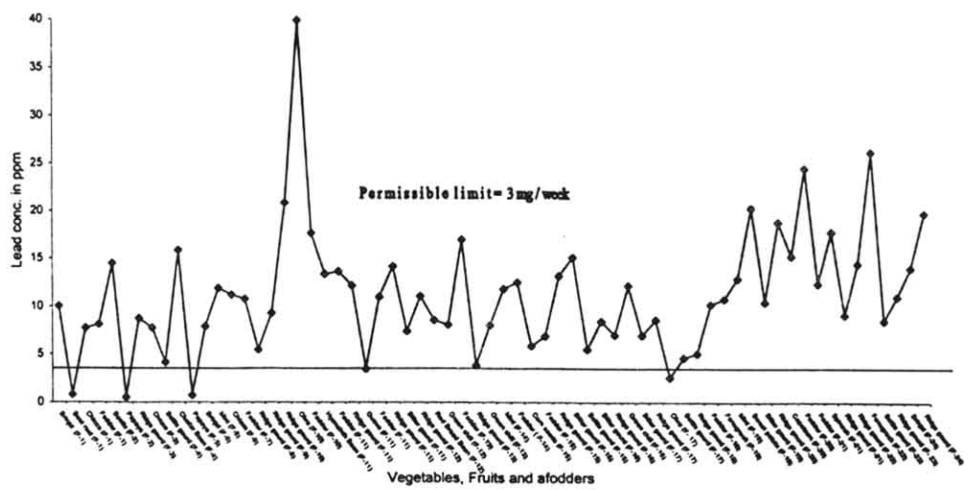
93.85 % polluted (2.066 - 10.25 ppm) and 66.66 % unpolluted samples show (2.0 10.52 ppm) contamination by nickel, where as, 6.15 % polluted (0.42 - 1.233 ppm) and 33.33% unpolluted samples show (1.86 - 1.91 ppm) Ni content under the limits (Graph 7).

Lead (Pb)

It is a toxic element and has been known to show neurotoxic effects for a long time. The dietary



Graph 7: Nickel in polluted vegetables, fruits and fodders samples.



Graph 8: Lead in polluted vegetables, fruits and fodders samples under study.

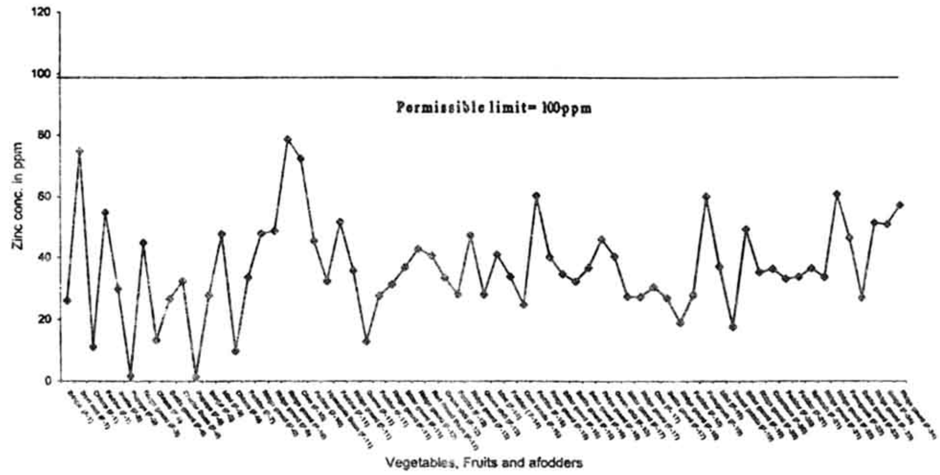
intake limit in the food is 3 mg/ week. The accumulation of Pb in nervous system, bones, liver, pancreas, teeth, gums and blood disturb the body functions. The mobility is relatively low (adsorption with Fe and Mn insoluble in organic matters) [9-13].

Plants

93.85 % polluted (3.466 - 39.916 ppm) and 44.44 % unpolluted samples (3.0 - 16.44 ppm) show high contamination of lead. 6.15% polluted (0.736 - 2.583 ppm) and 55.55 % unpolluted samples (2.04 - 2.44 ppm) are under the permissible dietary limit (Graph 8). The high Pb content of plants suggests that the element is readily absorbed by the plant. It is also suggested that widespread, availability of plumbum deposited on plant leaves from the exhaust fumes of automobiles.

Zinc (Zn)

It is an essential element for human being. The dietary limit is 100 ppm. Zinc deficient diabetics fail to improve their power of perception. It plays an important role in wound healing and accelerates the growth of delayed sexual development. Its deficiency



Graph 9: Zinc in polluted vegetables, fruits and fodders samples.

causes loss of sense of touch and smell. Mobility is moderately high and in-soluble in-organic matters. [11, 14, 15].

Plants

100 % polluted (1.403 - 78.683 ppm) and unpolluted samples (2.38 - 42.98 ppm) are under the dietary limit (Graph 9).

Experimental

Collection and Preparation of Vegetable samples

From polluted and unpolluted areas the samples of vegetables, fruits, fodders (Table-2) were systematically collected and analyzed for the quantitative estimation of cadmium, chromium, copper, iron, mercury, manganese, nickel, lead, and zinc.

Sixty-five polluted and nine unpolluted samples (400-800 grams each, eatable parts) of vegetables, fruits and fodders composite of different species (5 samples of each specie of each sample for composite) were collected in clean-labeled paper bags from where water and soil samples were collected in the study areas. The samples were dried in shade, grind and meshed to prepare for Lab analysis.

Estimation of individual elements was carried out from digested samples using Atomic Absorption Spectrometer (Perkin Elmer, Model 3100) in Hydrochemistry Hamdard University Karachi. Addition of chemicals and others reagent for experiment were set according to the specifications (Analytical Methods for AAS Rev., January 1982) given in the instruments working manual. The concentration of each element was estimated with reference to standard solution of the element.

Conclusions

All samples of vegetables, fruits and fodders analyzed show a broad concentration of one or the other element. Some samples have high contents of more than one toxic element. Analytical results are summarized to bring to focus the pollution problem which is creating by industrial waste. Effects of high concentration of toxic elements described earlier are also briefly mentioned to highlight the pollution problem.

Recommendations

Basic objective of this investigation was to collect geochemical data on selected trace elements occurring in vegetables, fruits and fodders of Malir River farms by industries. In an attempt to trace the sources of these toxic elements from out side the study areas were also analysed. The data thus generated provides a valuable starting point for further work for implementation for treatment application of different waste of industries.

Alarming concentration of toxic elements has been found in vegetables, fruits and fodders and these calls for intensive and extensive further investigation.

In addition to the blood and tissue samples from human beings, animals, mainly living on the vegetables, fruits and fodders of the areas should be analyzed for trace elements to see the effect of polluted food on health.

It is hoped that the present working will attract the attention of the government as well as universities, research organizations and the NGO'S in this field to the formulate a long term research policy on the health problem with cooperation of industries.

Acknowledgments

The results of this study are part of the first author's Ph.D thesis submitted to the Department pharmacy and Herbal Science, Hamdard University Karachi.

I am greatly indebted to my supervisor, Prof. Dr. S. I. Ahmed, dean Faculty of Pharmacy and Director Dr. HMI Institute of Pharmacology and Herbal Sciences, for guiding my research work which has initiated under the guidance of (late) Prof. Dr. Jul Lag, Agricultural University, Norway.

My thanks are due to Dr. S. A. Bilgrami Co-supervisor for his continued interest during the research work. I am grateful to National Drainage program (WAPDA) for the sanction of a grant for this project.

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