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POTABLE WATER AS A SOURCE OF HEAVY METALS IN THE BLOOD OF HEART PATIENTS OF KARACHI PAKISTAN

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Abstract

Geomedicinal studies of the blood samples of thirty two patients from Karachi metropolitan area have been carried out for quantitative estimation of important trace elements such as Pb, Zn. Cu, Cd, Mn and Hg from whole blood samples show depletion and enrichment in the blood of patients suffering from heart diseases.

It appears significant to describe that 53.13% of the patients who live in those areas of Karachi where hub water is being supplied and is depleted in pb content. The patients live in those localities where Indus, Damloti and ground water in use for daily life are 46.88%. 90.47% water samples in use by inhabitant of Karachi contain higher Pb content than the recommended allowable limit. It is describe that Hub, Indus and ground water is being supplied depleted in Zn content according to recommended WHO limit 3.0 ppm. Cu concentration in the blood of the heart Patients shows depletion similarity with Zn.

The concentration of Cd in the blood of heart patients under study reveals general depletion of Cd content in the blood with reference to the recommended Allowable limit 0.007 ppm. The highest content of Hg recorded in three patient were suffering from 3-vassal diseases and the lowest Hg content was noted suffering from mitral valve stenosis.

An attempt has also been made in order to correlate the trace element content of drinking water and the whole blood trace elemental composition of the heart patients. It is found that the possible source of trace elements contaminations come from various sources of potable water.

***Keywords**: Heart, Depletion, Enrichment, Indus River water, Hub River water, Trace, metals, contaminations.*

Introduction

The concentration of heavy metals in traces is highly essential for health of plants, animals and human beings but the metals should be within allowable limits (WHO, 1993 and Neil, 1993), otherwise the contents of these elements would imbalance the equilibrium of health (Underwood, 1997). It is also known at present that the inequilibrium in concentration of heavy metal in human bodies affects the health, growth and the social behavior of the human being in addition to the development of various diseases. The enrichment and depletion of the heavy metals than the allowable concentrations in human blood, flesh and bones have been investigated in different parts of the world and observed to disturb the rate of body growth, mental development and the degree of sensitivities in the sufferers (Lag, 1990). The imbalance of heavy metals in human body may also affect the daily life activities to a great extent. Such conditions may also facilitate the development of cancer, various types of tumors and heart diseases. Such condition may also cause psychic conditions that damage the memory and intellectual ability of human-beings shown in Table 1.

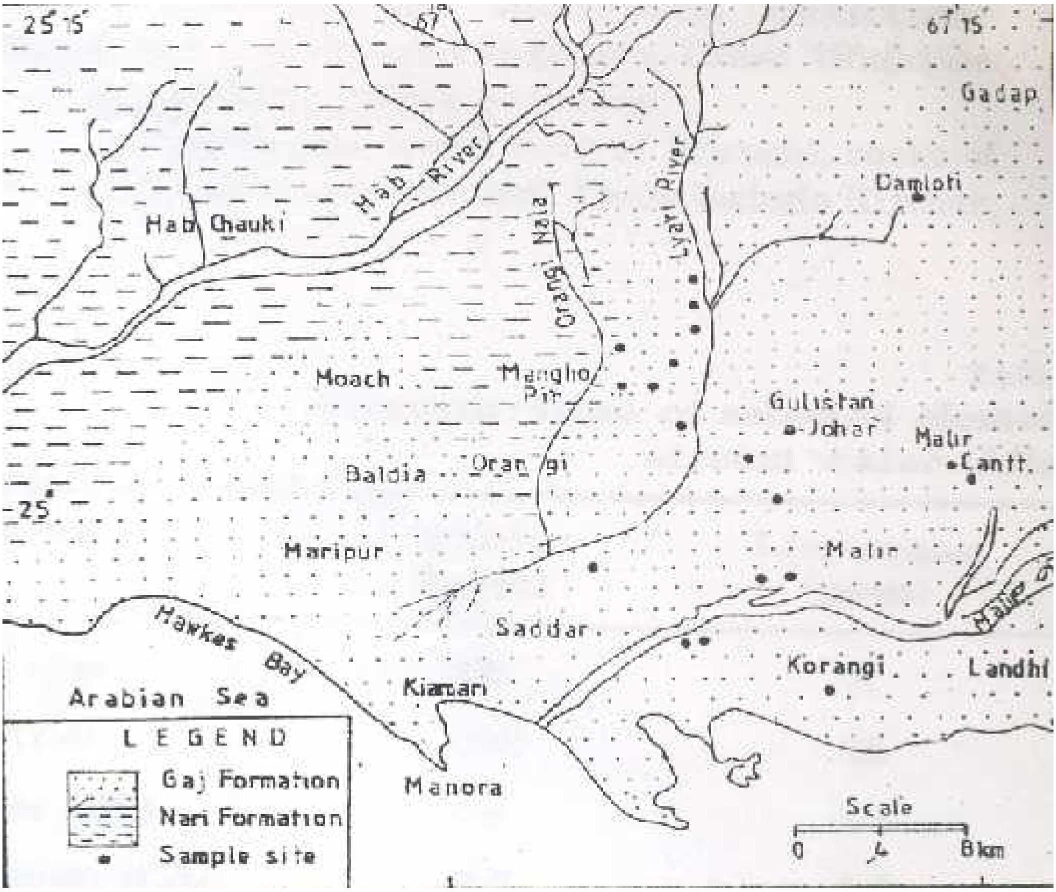
Table 1: Allowable Limits of Trace Elements for Blood andTheir Toxic Effects on the Human, Health (Curtis, 1990, Ellenhorn, 1988 and Council, 1980)

Sr. #	Elements	Allowable Limits	Biological Function	Effects
1	Lead (Pb)	0.02 ppm	Toxic	Lead is cumulative poison. Bones are the major reservoir of the Pb in the body. Children absorb a greater proportion of ingested than the adult (Ellenhorn, 1988). 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 function (Curtis, 1990).
2	Zinc (Zn)	0.5 - 1.2 ppm	Essential	Zn is an essential component of about a hundred enzymes in total through the number of containing enzyme in vertebrates is much smatter. Cd, Hg and Pb binding very strongly to this metal. It plays an important role in wound healing and its addition to diet accelerates the growth of delayed sexual development. Zinc deficient diabetics fail to improve their power of perception. Its deficiency causes loss of sense of touch and smell (Crounse et al, 1983 and Council, 1980).
3	Copper (Cu)	0.75 - 1.5 ppm	Essential	It accumulates in liver, in the cornea of the eyes and leads to liver diseases (Crounse et al, 1983).
4	Cadmium (Cd)	0.007 ppm	Toxic	In the Lumbago- type pain progressed to become sever bones damage with multiple fractures of the softened bones. Death was attributed to kidney failure. The main target organs for cadmium are the kidney and liver (Crounse et al, 1983).
5	Manganese (Mn)	0.17- .1 ppm	Essential	Deficiency of Mn causes myocardial infarction and the other.
6	Mercury (Hg)	30 - 40 ppb	Toxic	Mercury poisoning leads to in coordination in physiological functions, loss of vision, hearing & mental retardation. Excess intake is almost fatal (Ellenhorn, 1988).

Anthropogenic activities now have a major impact on the global and regional cycles of most trace elements and mobilization of toxic metals in the human food chain, respectively from different sources (atmosphere, water and soil) has been calculated (Nergis, 1996 and Zia et al, 2001). Keeping in view the above facts and their inter-relationships, it was decided to investigate the some heavy metals like Pb, Zn, Cu, Cd, Mn and Hg concentration in the blood of the people living in Karachi metropolitan, inhabitant intake potable water from various sources. These heavy metals are well known to cause serious and incurable diseases due to their imbalance concentration in human being (Underwood, 1997, Hambidge, 2003 and Milne et al, 1985).

The water supply sources for the inhabitants of metropolitan are mainly from Indus and Hub River in addition to the limited supply of water from Damloti wells of Malir Basin and the sporadic utilization of subsurface water in different parts of the city shown in Fig.1 (Nergis, 1996 and Nergis et al, 2000).

Figure 1: Map of Karachi, Showing the Water Samples Locations



The Indus River passes through a cross section of rocks which range in composition from ultra-basic to acidic of igneous rocks origin, the metamorphic rocks of nearly all grades having varied chemical compositions with respect to heavy metals and non-metallic elements and the sedimentary rocks of varying chemical compositions shown in Table 2 (Nergis, 1996).

Table 2: Concentration of Selected Elements in Various Rock Types and in Stream Water

S. #	Elements	Shale (ppm)	Limestone (ppm)	Sandstone (ppm)	Water (ppm)	Mobility
1	Lead (Pb)	20	8	7	3	Low
2	Zinc (Zn)	100	25	16	20	Fairly high
3	Copper (Cu)	50	15	10	8	Intermediate
4	Cadmium (Cd)	0.2	0.1	0.01	0.09	High
5	Manganese Mn)	850	1,100	100	7	Medium low
6	Mercury (Hg)	0.5	0.2	0.3	0.01	Moderate

In addition to the rocks encountered, the varying geochemical controls starting from its origin from Lake Mansawar (geologic name) down to Indus delta activate the degree of mobility of heavy metals and non-metallic elements (Nergis et al, 2000 and Anne, 1989). Moreover the industrial wastes of different cities on either sides of the River Indus and its tributaries are among the major sources of heavy metals contribution to the water. Thus the water in use is expected to be a potential source for carrying heavy metals in the blood of the inhabitants of metropolitan (Nergis, 1996 and Nergis et al, 2000). The water reservoir built on Hub River represents another geological and geochemical consideration due to its vast catchment's area and the channel of water passing through varieties of ophiolites, mélanges and sedimentary clastic and non-clastic rocks (Naseem et al, 1997).

The water of Damloti wells represents the sub-surface water which has its own geochemical and physical characteristics. The use of this water can give its own result on the health and digestion of the people using this water. The tube wells water which is being exploited sporadically in different parts of metropolitan has its own geochemical characteristics that can not be compared with other sources of water in use by the inhabitants of city (Nergis, 1996).

Material and Methods

Blood Sampling

Thirty two (32) blood samples were collected from the patients suffering from heart diseases admitted at the National Institute of Cardiac Vesicular Diseases (NICVD). Disposable hyphenised syringes (5-cc) were used to collect patient's blood samples which were refrigerated immediately. Weigh each blood sample by determined using analytical balance. The samples were digested in a test tube with 5-ml mixture of nitric acid (HNO_3) and hydrochloric acid (HCl) in a ratio of 20:1. Each sample was made up to 15-ml by diluting with deionized/distilled water. After the shaking it for 10- minutes in a vibrator, the tubes were put on the water bath for 30-minutes at 60 ^oC for homogenization. Hydrogen peroxide (H_2O_2 -35%) was added slowly until the samples were cleared (Zinterhofer et al, 1971 and Wiled, 2005). For the estimation of lead each replicate 6-ml heparinized whole blood sample took in to a 10-ml volumetric flask, added in order 1-ml of 2% of ammonium pyrrolidine dithiocarbomate (APDC), 1.5-ml of methyl isobutyl ketone (MIBK), shacked for 5-minutes and then added 1-ml of deionized water. Centrifuged blood samples at about 700g for 10-minutes. Lead extraction is performed in MIBK and APDC for several reasons: higher sensitivity is achieved; viscosity variation and ionic interferences are minimized; certain impurities insoluble in APDC are removed (Zinterhofer et al, 1971).

Water Sampling

Twenty one (21) water samples were collected with help of water supply map of Karachi Development Authority, showing the sources of water and their distribution in the localities as Damloti Wells, Suction pumps, Hub dam supply and Indus River supply water in various parts of metropolitan shown in Fig.1. 2.5 liters plastic bottles rinsed with 1:1 hydrochloric acid (HCl) and washed with distilled water were used for the collection of water samples added the preservatives 10-20 ml of acids (1% HNO_3, 1% HCl, 1% H_2SO_4) mark the bottles as sample code, recoded the field parameters concentration by portable equipments i.e., pH, temperature, turbidity and total dissolved solids. Sample were treated/ digested for metal analysis (Wiled, 2005 and Wiled et al, 1990).

Estimation of individual elements was carried out from digested samples using atomic absorption spectrometer (Perkin Elmer, Model 3100). 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.

Results and Discussion

Lead (Pb)

The increasing in industrialization activities in many parts of the world have further affected the Geo-chemical mobility of the heavy metals in soil, sediments and water under varying Eh and pH conditions. Thus the distribution of heavy metals in soils and ground waters show changes in their content. The present industrialization factor is considered to be very important to create an imbalance in heavy metals uptake in drinking waters from rivers, springs and tube wells are major sources of heavy metal imbalance concentration in human body, under variable environmental conditions in which the people live. According to the WHO allowable limit of Pb concentration in human; blood should be 0.02 ppm given in Table 1, for healthy life, but the blood investigation of the patients under study exhibits prominent deviation in concentration from the recommended limits. Accumulation of lead in the nervous system, bones, liver, pancreas, teeth, gums and blood disturbs body function (Hambidge, 2003). The concentration of lead in blood and the rate of its excretion in urine and half-life of lead in the blood is 1-2 months, after established of a steady state early approximates the out put, under normal condition, concentration of lead in soft tissues change little. However the concentration of lead in bone appears to increase and its half-life in bone has been estimated to be 20 to 30 years (Neil, 1993).

It appears significant to describe that 53.13% of the patients who resided in those areas of metropolitan where Hub river water is being supplied and is depleted in Pb content according to recommended limits of 0.01ppm. The patients living in those localities where Indus, Damloti and ground water is used in routine activities are 46.88%. Sixteen patients out of thirty two suffer from mitral stenosis and unstable angina shown in Table 3 & Table 4

Table 3: Metals concentration in blood samples of heart patient (Mitral Stenosis Disease)

Sr. #	Heart disease	Sex	Age	Pb 0.02 ppm	Zn 0.5-1.2 ppm	Cu 0.75-1.5 ppm	Cd 0.007 ppm	Mn 0.1 ppm	Hg 30-40 ppb	PH 7.35-7.45	O_2 80-99 %	CO_2 35 -45 mm/Hg	WBC 4000-11000 C/ µL	RBC 4-6 M /µL
1	Mitral Stenosis	F	25	0.06	0.5	0.3	0.004	0.18	9.5	7.43	26.7	38	10800	4.87
2	Mitral Stenosis	F	15	0.06	0.73	0.3	0.004	0.56	11.34	7.45	94	33	7600	4.5
3	Mitral Stenosis	M	50	0.06	0.73	0.93	0.004	0.33	25.0	7.47	80	42	10600	4.52
4	Mitral Stenosis	M	35	0.06	0.73	0.93	0.004	0.23	26.6	7.47	22.20	34	10400	3.6
5	Mitral Stenosis	M	20	0.06	0.6	0.58	0.004	0.37	4.1	6.88	19.6	30	6600	4.38
6	Mitral Regurgitation	M	17	0.04	0.6	0.16	0.002	0.4	4.4	7.42	26	45	10900	3.5
7	Mitral Stenosis	M	63	0.06	0.7	0.11	0.004	0.6	7.0	7.39	50.2	39.4	7600	5.0
8	Mitral Regurgitation	M	35	0.5	0.7	0.14	0.004	0.5	4.5	7.34	51.4	39	10500	4.5
9	Mitral Regurgitation	F	14	0.06	0.8	0.11	0.002	0.5	12.1	7.4	48.9	39.1	10100	5.4
	Higher then the Limits	--	--	100%	--	--	--	100%	--	--	--	--	--	--
	Within the Limits	--	--	--	100%	100%	100%	--	100 %	100%	100%	100%	100%	100%

Following table showing enrichment of Pb contents in their blood under study ranging from 0.02 to 0.5 ppm. 90.47% water samples contain higher Pb concentration than the recommended allowable limits. Soft water will dissolve Pb from different sources and affect the function of the blood (Zia, at al, 2001). The soft acid water increases the solubility of lead and high levels account for the increased incidence of hypertension and cardiovascular mortality in areas with soft-water supply. The contribution of increase lead absorption to gout, hypertension, nephropathy, and neurotoxicity remain to be determined (Zia et al, 2001 and Hambidge, 2003).

Table 4: Metals concentration in blood samples of heart patient (Unstable Angina)

Sr. #	Heart disease	Sex	A ge	Pb 0.02 ppm	Zn 0.5-1.2 ppm	Cu 0.75-1.5 ppm	Cd 0.007 ppm	Mn 0.1 ppm	Hg 30-40 ppb	PH 7.35-7.45	O_2 80-99%	CO_2 35 -45 mm/Hg	WBC 4000-11000 C/ µL	RBC 4-6 M/ µL
1	Unstable Angina	F	35	0.04	0.7	0.13	---	0.04	5.1	7.40	41	42	4000	3.0
2	Unstable Angina	M	65	0.03	0.7	0.1	0.002	0.03	3.7	7.37	86.2	39.1	4300	5.5
3	Unstable Angina	M	45	0.02	0.8	0.01	0.002	0.07	10.7	7.42	45	40.5	6700	4.8
4	Unstable Angina	M	50	0.08	0.8	0.01	0.002	0.08	10.0	7.39	47.9	34.9	6800	4.7
5	Unstable Angina	M	45	0.05	0.9	0.12	0.003	0.5	12.5	7.41	49.6	39	8900	4.6
6	Unstable Angina	M	65	0.06	0.7	0.01	0.004	0.01	5.8	7.44	45.6	34.9	6600	4.5
7	Unstable Angina	M	45	0.04	0.8	0.01	0.001	0.06	9.4	7.44	33	41.4	10200	4.5
	Higher then the Limits	---	---	100%	---	---	---	---	---	---	---	---	---	---
	Within the Limits	---	---	---	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%

Zinc (Zn)

Zn is an essential component of about a hundred enzymes in total through the number of containing enzyme in vertebrates is much smatter (Milne et al, 1985). It plays an important role in wound healing and its addition to diet accelerates the growth of delayed sexual development. Zn content in the blood of heart patients lies within the allowable range of 0.5 to 0.9 ppm. Zinc deficient diabetics fail to improve their power of perception. Its deficiency causes loss of sense of touch, smell and cardiovascular diseases (Milne et al, 1985 and Anne, 1989). Deficiency in human causes growth retardation, delay sexual and skeletal maturation, development of orificial and acral dermatitis diarrhea, alopecia, failure of appetite and appearance of behavioral change. Reduced growth rate and impaired resistance to infection are frequently and other effects (Nergis et al, 2000). It appears significant to describe that Hub, Indus Rivers and ground water is being supplied depleted in Zn content shown in Table 5 according to recommended WHO limit i.e., 3.00ppm.

Table 5: Elemental concentrations in drinking water used by varied patients (Zinterhofer et al, 1971, Wiled, 2005, Wilde et al, 1999 and WHO, 2006)

Sr. #	Water Sample Sources	Pb 0.01 ppm	Zn 3.00 ppm	Cu 2.0 ppm	Cd 0.003 ppm	Mn 0.4 ppm	*Hg 0.006 ppm*
1	Indus source	0.14**	0.20**	0.05***	BDL	BDL	*BDL*
2	Indus supply	0.11***	0.12***	0.07***	BDL	BDL	*BDL*
3	Hub reservoir	0.01***	0.09***	0.03***	BDL	BDL	*BDL*
4	Hub supply	0.02***	0.28**	0.04***	BDL	BDL	*BDL*
5	Damloti	0.22**	1.80*	0.41*	BDL	BDL	*BDL*
6	Green Town well	0.11**	0.08***	0.61*	BDL	BDL	*BDL*
7	Mehmoodabad well	0.08***	0.11***	0.06***	BDL	BDL	*BDL*
8	Khokkrapar well	0.18**	0.14***	0.31**	BDL	BDL	*BDL*
9	Korangi well	0.11**	0.13**	0.15**	BDL	BDL	*BDL*
10	Landhi well	0.14**	0.80*	0.03***	BDL	BDL	*BDL*
11	Gulshan-e-Iqbal well	0.19**	0.15***	0.22**	BDL	BDL	*BDL*
12	Golden Town well	0.10***	0.57**	0.08***	BDL	BDL	*BDL*
13	F.B. Area well	0.25**	0.19**	0.06***	BDL	BDL	*BDL*
14	F.B. Area well	0.22**	0.22***	0.04***	BDL	BDL	*BDL*
15	Ibrahim Hyderi well	0.17**	1.30*	0.20**	BDL	BDL	*BDL*
16	North Karachi well	0.24**	0.14**	0.21**	BDL	BDL	*BDL*
17	Garden well	0.07**	0.57**	0.12**	BDL	BDL	*BDL*
18	Korangi well	0.16***	0.03***	0.27**	BDL	BDL	*BDL*
19	Gulshan-e-Iqbal well	0.20**	0.03***	0.31**	BDL	BDL	*BDL*
20	F.C. Area well	0.24**	1.50*	0.19**	BDL	BDL	*BDL*
21	F.B. Area well	0.18**	0.53*	0.15**	BDL	BDL	*BDL*
	Higher then limits	95.23%	----	----	----	----	----
	Within limits	4.76%	100%	100%	----	----	----
	SE (δ_n)	*0.001*	*0.0053*	*0.0039*	----	----	----

*, **, *** = significant at 0.05, 0.01, 0.001, SE = Standard Error, BDL = Blow Detection Limit

Copper (Cu)

It is essential element. The concentration of Cu in the blood of the heart Patients shows similarity in pattern depletion with Zn. Relationship between the water in use both of Indus, Hub Rivers and ground water and the Cu content in human blood can be established because the water themselves contain Cu less than the allowable limits 2.0 ppm. Copper deficiency was first described in malnourished Peru children showed a syndrome of neutropaenia, anemia and demineralization which were all revealed by Cu supplement.

Copper toxicity occurs in conjunction with the spray of grapes (known as copper sulfate fungicide (bordeaus mixture). The prototype functional excess of Cu in humans is an outosomal recessive disorder known as Wilson's diseases (Hepatolenticular degeration). Geochemical factor involving ratio of these elements certainly affect animals and they could theoretically affect humans, certainly those with limited diet, increased nutritional requirement (growth, pregnancy) or diseases states which after absorption or metabolism.

Cadmium (Cd)

It generally classified as a toxic element and accumulates with age, especially in kidney and it is suspect in the etiology of cancer and cardiovascular disease. The known geochemical implication of Cd in human health relate to bone and renal diseases in population exposed to (industrially) contaminated drinking water, lung renal dysfunction in industrial workers exposed to air-borne (Milne et al, 1985). Environmental contamination in Japan caused a diseases called itai-itai (ouch-ouch), which was characterized by sever arthralgias and osteomalacia in middle-aged woman with low calcium and vitamin D intake. The full syndrome scoured only in postmenopausal women who had several pregnancies (Anne, 1989 and Naseem et al, 1997).

The concentration of Cd in the blood of heart patients under study reveals general depletion of Cd content in the blood with reference to the recommended allowable limits 0.007 ppm (Naseem et al, 1997). The patients under study appear in three sub groups of the patients with respect to Cd content in their blood. The group showing the highest relative content of Cd in their blood (0.001-0.004 ppm) was mainly found to suffer from mitral stenosis, mitral regurgitation, angina, and myocardial infarction and complete heart block. These patients were fond of fatty foods and the male patients were chain smokers. It appears possible that the relative concentration of Cd in the heart patients can be described with reference to types of the heart diseases and to some extent with the types of the food in use.

The Cd concentration in the waters samples under study were consumed by the patients with Cd contents are blow detection limit i.e., 0.001ppm shown in *Table 5*, than the recommended limits 0.003 ppm (Hambidge, 2003). Hence apparently it appears logical to anticipate that the patients should have higher Cd concentration in the blood but this is not so in case of the heart patients under study. However the sub group established due to variable concentration of Cd in blood of the patients can be taken as the indicator related to variable physiological functions of the body of the patients to retain Cd in the blood. It appears reasonable to anticipate that the rejection by the physiological function of the body for Cd starts functioning at least in case of heart patients.

Manganese (Mn)

Deficiency of Mn causes myocardial infarction. Include impaired growth, skeletal abnormalities, disturbed or depressed reproductive function, ataxia of the newborn and defect in lipid and carbohydrate metabolism, at 0.35mg/day man lost weigh and suffered depressed, growth of hair and nail, dermatitis and hypercholesterolemia (Nergis et al, 2000). Three patients suffering from 3-vessel diseases show high contents of Mn 0.3 - 0.38ppm and patients of mitral stenosis showing the higher contents of Pb ranges from 0.18 to 0.5 ppm in their blood. Twenty five out of thirty two patients cardiac block, aortic, myocardial infarction, atrial septal defect, acute inferior wall, Rheumatic heart disease, high lateral wall, post parturition cardiomyopathy showed Pb content of range 0.002 to 0.08 ppm in their blood shown in Table 6-8 as compared to limit 0.1ppm (Underwood, 1997). Mn concentration in the Indus, Hub and ground water under the blow detection limit 0.4ppm shown in Table 5.

Table 6: Metals concentration in blood samples of heart patient (Heart Block)

Sr. #	Heart disease	Sex	Age	Pb 0.02 ppm	Zn 0.5-1.2 ppm	Cu 0.75-1.5 ppm	Cd 0.007 ppm	Mn 0.1 ppm	Hg 30-40 ppb	PH 7.35-7.45	O_2 80-99 %	CO_2 35 -45 mm/Hg	WBC 4000-11000 C/ µL	RBC 4-6 M /µL
1	Complete Heart block	F	45	0.003	0.89	0.14	0.001	0.07	8.2	7.34	38	49.5	11500	5.2
2	Complete Heart block	M	47	0.008	0.95	0.13	0.004	0.07	12.1	7.34	47.8	48.1	11300	4.5
	Higher then the Limits	---	---	---	---	---	---	---	---	---	---	100 %	100 %	---
	Within the Limits	---	---	100 %	100 %	100 %	100 %	100 %	100 %	100 %	100 %	---	---	100 %

Table 7: Metals concentration in blood samples of heart patient (Myocardial Infarction)

Sr. #	Heart disease	Sex	Age	Pb 0.02 ppm	Zn 0.5-1.2 ppm	Cu 0.75-1.5 ppm	Cd 0.007 ppm	Mn 0.1 ppm	Hg 30-40 ppb	PH 7.35-7.45	O_2 80-99 %	CO_2 35 -45 mm/Hg	WBC 4000-11000 C/ µL	RBC 4-6 M /µL
1	Myocardial Infarction	M	55	0.03	0.9	0.14	0.001	0.03	5.1	7.39	50	42.2	17700	4.5
2	Myocardial Infarction	M	45	0.02	0.7	0.1	0.001	0.02	5.5	7.44	49.2	45.0	21000	6.0
3	Myocardial Infarction	M	55	0.09	0.7	0.13	0.001	0.07	12.1	7.39	48.9	38.2	12700	5.6
4	Myocardial Infarction	M	39	0.02	0.5	0.01	0.004	0.04	6.1	7.39	42.9	36.1	11200	5.2
	Higher then the Limits	---	---	---	---	---	---	---	---	---	---	---	100 %	---
	Within the Limits	---	---	100 %	100 %	100 %	100 %	100 %	100 %	100 %	100 %	100 %	---	100 %

Table 8: Metals concentration in blood samples of heart patient (Different heart Diseases)

Sr. #	Heart disease	Sex	Age	Pb 0.02 ppm	Zn 0.5-1.2 ppm	Cu 0.75-1.5 ppm	Cd 0.007 ppm	Mn 0.1 ppm	Hg 30-40 ppb	PH 7.35-7.45	O_2 80-99 %	CO_2 35 -45 mm/Hg	WBC 4000-11000 C/ µL	RBC 4-6 M /µL
1	Atrial Septal defect	M	55	0.01	0.74	0.16	0.001	0.029	8.3	7.54	79	31.3	7400	5.44
2	Acute inferior Wall	M	45	0.01	0.8	0.13	0.001	0.05	8.2	7.88	33	41.4	10200	4.5
3	Rheumatic Heart disease	M	15	0.02	0.8	0.13	0.001	0.07	8.6	7.37	38.7	43.7	7600	4.2
4	High lateral Wall	M	27	0.01	0.89	0.13	0.001	0.05	13.0	7.32	42.6	44	9200	3.9
5	High lateral Wall	F	50	0.02	0.6	0.13	0.001	0.05	6.3	7.39	46	40	6500	4.5
6	Post parturition Cardiomyopathy	F	20	0.01	0.5	0.16	0.002	0.03	7.1	7.42	52.1	39.9	8500	4.2
7	Aortic Stenosis	M	37	0.02	0.95	0.14	0.001	0.03	5.1	7.42	30	34	10500	4.5
	Higher then the Limits	---	---	---	----	----	----	----	----	---	---	---	----	---
	Within the Limits	---	---	100%	100 %	100 %	100 %	100 %	100 %	100 %	100 %	100 %	100 %	100 %

Mercury (Hg)

It is a toxic element that is widespread in the environment (Milne et al, 1985). The symptoms of mercury poisoning in humans vary widely. They include metallic taste, thirst and salivation, abdominal pain, vomiting, diarrhea, ataxia and tremor (Hambidge, 2003). The concentration of Hg in blood of the heart patients generally show that its content less than the allowable limits for Hg, concentration in human blood with the exception of 3- vassal disease patients have Hg concentration higher given in Table 9 than the allowable limits (40 ppb).

Table 9: Metals concentration in the blood samples of heart patients

Sr. #	Heart disease	Sex	Age	Pb 0.02 ppm	Zn 0.5-1.2 ppm	Cu 0.75-1.5 ppm	Cd 0.007 ppm	Mn 0.1 ppm	Hg 30-40 ppb	PH 7.35-7.45	O_2 80-99 %	CO_2 35 -45 mm/Hg	WBC 4000-11000 C/ µL	RBC 4-6 M /µL
1	3-Vassal disease	M	20	0.01	0.5	1.03	0.001	0.38	73.1	7.48	94	41	7800	4.97
2	3-Vassal disease	M	53	0.01	0.8	1.06	0.001	0.32	71.3	7.49	97	36	7900	3.92
3	3-Vassal disease	M	65	0.01	0.4	1.3	0.001	0.3	47.4	7.49	96	39	6800	4.6
	Higher then the Limits	---	---	---	---	---	---	100%	100%	100%	---	---	---	---
	Within the Limits	---	---	100%	100	100%	100%	---	---	---	100%	100%	100%	3.33%

It is remarkable to note that the heart patients under study were found to have Hg concentration within allowable limit in their blood. The highest content of Hg recorded in three patient were suffering from 3- vassal diseases and the lowest Hg content was noted suffering from mitral valve stenosis.

The patients suffering from 3-vessel disease showed more erratic values of Hg concentration after the patients of mitral stenosis, Hg concentration in most of the patients under study ranges between 4-25 ppb. It is not possible to describe sub groups with respect to types of heart diseases and Hg content in their blood. However it appears probable to conclude that the Hg content usually depletes like other heavy metals under study in the blood, of heart patients with few exceptions. The Hg content in water samples under study were blow detection limit Table 5. It is also significant to note that the patients suffering from stenosis were using more marine fishes which contain Hg higher than the allowable limits but the blood of the patients did not show any positive relationship with the contents of Hg in their food. In such patients the Hg content ranges between 4-26 ppb.

Conclusion and Recommendations

It is describe that 53.13% of the patients who live in those areas of Karachi where Hub river water is being supplied and is depleted in Pb content according to recommended value 0.01ppm. The patients live in those localities where Indus, Damloti and ground water in use for daily life are 46.88%. Sixteen Patients out of thirty two suffering from Mitral Stenosis and Unstable Angina showing enrichment of Pb contents in their blood under study ranging from 0.02 to 0.5 ppm.90.47% water samples used by Karachi peoples Contains higher Pb concentration than the recommended allowable value 0.01ppm.

Hub, Indus and ground water is being supplied depleted in Zn content according to recommended WHO value 3.00 ppm.The concentration of Cu in the blood of the heart patients shows similarity in pattern depletion with Zn. Relationship between the water in use both of Indus, Hub and ground water and the Cu content in human blood can be established because the water themselves contain Cu less than the allowable limits 2.0 ppm. Cd in the blood of heart patients under study reveals general depletion of Cd content in the blood with reference to the recommended allowable limits 0.007 ppm. Three patients suffering from 3-vessel diseases show high contents of Mn 0.3-0.38 ppm and Patients of mitral stenosis showing the higher contents of Pb ranges from 0.18 to 0.5 ppm in their blood.

It is remarkable to note that the heart patients under study were found to have Hg concentration within allowable limit in their blood. The highest content of Hg recorded in three patients was suffering from 3-vassal diseases and the lowest Hg content was noted suffering from mitral valve stenosis. However it appears probable to conclude that the Hg content usually depletes like other heavy metals under study in the blood, of heart patients with few exceptions. The data thus generated provides a valuable preliminary delineation point for further work for implementation for treatment application of different drinking water and waste water of industries. Alarming concentration of toxic element Pb has been found in drinking water and these calls for intensive and extensive investigation. Vegetable, fruit and fodder is the sole source of food to inhabitant of metropolitan should extensively investigate the flesh, tissues sample in both human being and animals, in addition the blood and tissue samples from human beings and animals, mainly living on the vegetables.

References

Anne, M.L. (1989). Earth Science Mapping for Planning, Development and Conservation 64-65.

Berkman, D.A. (1995).Field Geologist's Manual Monograph No. 9; Australian Institute of Mining and Metallurgy. Victoria pp55.

Curtis, D.K. (1990). Heavy Metals and Heavy Metal Antagonist. Pharmacologist Basis of Therapeutics, Edt., Good Man and Gilman's 2 (8), 1592-1613.

Crounse, G.R. Walter, J.P. John, B. and Richard, L.M. (1983). Geochemistry and Man Health and Disease, 311-12.

Ellenhorn, J.M. Burcelux, D.G (1988). Diagnosis and Treatment of Human Poisoning, Medical Toxicology, Elsevier, 1030-1050.

Hambidge, M. (2003). Biomarker of Trace Mineral Intake and Status, J. Nutr. 133:948S 955S.

Lag, J. (1990). General Survey of Geomedicine, Geomedicine 2-23.

Lawrence, C.R. and Johns, M.W. (1990). A Geomedical Appraisal of Australia & New Zealand pp230.

Milne, D.B. Ralston, N.V. and Wallwork, J.C. (1985). Zinc Contents of Cellular Compositions of Blood: Methods for cell Separation and Analysis Evaluated, Clin. Chem. 31:65-69.

Naseem, S. Sheikh, S.A. Mallick, K.A. (1997). Lasbela area Balochistan Pakistan. Geosciences Journal Korea, 1, 0-15.

National Research Council, (1980). Recommended Dietary Allowances, 9th Edn., National Academy of Science, Washington D.C. pp. 210.

Neil, P.O. (1993). Environmental Chemistry, 2nd Edn.; Edt.; Chapman and Hall, London, 85-105.

Nergis, Y. (1996). Geochemical Sources of Heavy Metal Poisoning in Inhabitants of Karachi. pp 11-126.

Nergis, Y. Naseem, S. Mallick, K.A. (2000). Geological Sources of Heavy Metal Distribution in the Blood of Cancer Patients, Hamdard Medicus XLII, 13-26.

Underwood, E.J. (1997). Trace Elements in Human and Animal Nutrition, Academic Press N.Y. pp 115.

Wilde, F.D. Radtke, D.B. and Iwatsubo, R.T. Edts., (1999).Collection of Water Samples: U.S. Geological Survey Techniques of Water-Resources Investigations, Book 9, Chap., A4.

Wiled, F.D. (2005). Preparation for Water Sampling: U.S. Geological Survey Techniques of Water-Resources Investigation, Book 9, Chap., A1.

World Health Organization, WHO. (1993). Guide lines for Drinking water Quality, 1st Edn., Geneva pp 210-246.

World Health Organization, WHO. (2006). Guide lines for Drinking water Quality, pp 112-129.

Zai, I.M. Khan, N. Khan, M.J. and Khattaq, R.A. (2001). Heavy Metals status in some selected soils of Peshawar and Nowshehra District, J. Chem. Soc. Pak. Vol. 23 No 1. 23.

Zinterhofer, L.J.M. Jatlow, P.I. and Fappiano, A.J. (1971). Lab. Clin. Med., Atomic Absorption Determination of Lead in Blood and Urine in the Presence of EDTA, 78, 644.