

SURVEY OF SOME SELECTED HEAVY METALS IN DRINKING WATERS OF QUETTA CITY IN REGION OF BALUCHISTAN

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ABSTRACT: The main objectives of this study is to report the presence of heavy metals like lead, zinc, copper, cobalt, cadmium, nickel, chromium, Molybdenum and manganese in some collected samples water from the different parts of Quetta. The analysis was conducted at the analytical laboratory with inductively coupled plasma by emissions instruments on Perkins Elmer ICP 400 and was compared with WHO standards which were found within the permissible limit. It was done due to the correlation of chronic diseases and the geological environment. The geochemical environments are needed important factors in the severe issues of health. In many diseases, the chemistry of portable water was seen very significant factor.

Keywords: Heavy Metals, Atomic Absorption Spectroscopy & Drinking waters.

1. INTRODUCTION

Pakistan is naturally gifted with huge reservoirs of surface and subsurface waters estimated in the proximity of an amount of 128300 million m³ and 50579 million m³ per year respectively [1]. However, the fast-growing population at the exponential rate has rendered these sources insufficient to cater to the needs of the population. In addition, agricultural extension and industrialization have further aggravated the situation in consuming these water resources, dwindling the availability of per capita water by 5600 m³ to 1000 m³ per annum [2]. The seasonal drought periods also contribute to the scarcity of water resources in Pakistan. The rapidly increased gaps in water supply and demand have thus constrained the animate and inanimate life. In this scenario, drinking water has been a matter of serious concern in areas like the Baluchistan province. It is, therefore, imperative to monitor and determine the quality standards of drinking water from the perspective of international standards (WHO).

Baluchistan, the biggest province of Pakistan claiming 46% of the total area of a country, is the worst-hit province in respect of water resources [3]. Mostly, arid with lowest rain fall as compared to other provinces. There are two plains in the west of Pakistan like Kachi and Indus plains with a ten thousand years history of migration living in this water-scarce area [4]. For the purpose of this study, however, four districts of Baluchistan such as Jaffarabad, Nasirabad, Bolan, and Sibi district were targeted for this study [5].

The parameters of water quality have greatly influenced the rate of growth and the development of the aquatic life in general and fish in particular as a potential source of food items for humans.

The pure drinking water in the thickly populated countries of Asia with meager financial resources such as in Pakistan and India, the drinking water of WHO quality standards is not available easily. In general, out of six billion peoples on earth, more than one million do not have access to pure water and approximately 2.5 billion peoples remain short of systems to cater their hygienic needs in this respect [6]. In particular, the most conducive hot and humid seasonal conditions incubate different types of bacterial diseases. In addition to adults about six million children per year are affected at the rate of twenty thousand children a day [6]. The earth contains seventy percent of water but mostly water is salty and only three percent of water is available on the surface of the earth that is fit for drinking. The potable water is found in lakes, rivers and ground aquifers which is only 1% of total water on earth. Presently thirty-

one countries representing populations of 2.8 billion peoples like China, Kenya, Ethiopia, India, Nigeria, and Peru etc. are facing water quality issues. The rapid growth of population further, aggravating the situation in this cross section of the world [7]. The serious shortage of hygienically available water for human consumption demand necessary efforts to manage the reservoirs of water by saving water with different techniques and recycling of water [8].

The scarcity of drinking water of WHO standards reciprocates the detrimental impact on human health and the economy of any country in many ways [9]. The various contaminants like virus, bacteria, HV, salt and other inorganic matter, the cause of serious health hazards, need to be treated [10].

About five hundred million peoples affected by diarrhea according to the report of WHO in each year mostly in Asia, Africa and America [11]. The spreading of cancer by heavy elements carried by water in living beings has been extensively studied [12]. The pathogens present in portable water with other harmful agents claim about 2.5 million lives by diarrheal diseases per year [13]. PCRWR [14] and WHO [11] stated that after installing new water supply lines in thirty villages of Japan, the intestine disorder lowered by seventy percent and trachoma by sixty-four percent and the death toll of children and youngsters fell by fifty-two percent. In Uttar Pradesh [14], when rehabilitation and improvement works of water conducted out the results showed that with cholera and typhoid, the death rates decreased by seventy-four percent, and sixty-three percent of those suffering by dysentery reduced by twenty-three percent. Furthermore, ten percent of the production time of every people loses because of water-related diseases also be prevented.

The various diseases and the outbreak of epidemics throughout the world are the outcomes of water contamination. Typhoid fever, hepatitis, and other infections are very familiar which spreads by polluted water. Previous studies reveal that the Cadmium in greater amounts causes kidney failure.

Different surveys [14] conducted by the Pakistan council of research in water resources show that about eighty-one thousand, nine hundred and ninety-six patients are recorded with water-related diseases in Rawalpindi Division. The reports of United Nations Children's Funds, twenty to forty percent beds are allocated for water-related diseases in the hospitals of Pakistan. The outbreaks like cholera, dysentery, hepatitis, typhoid and guinea worms infection

are mostly eighty percent of total diseases and causes thirty-three percent of the life of live.

The lack of quality of water the PCRWR has initiated the national program for checking water quality throughout the country and the project was started 21 cities of the country, out of which eleven from Punjab, three from Sindh, four from Baluchistan and three from Khyber Pakhtunkwa. In this project 6 major rivers, 2 reservoirs, 5 dams, 3 natural drains are the part of checking the water quality and gives satisfactory coverage of the country's water resources. We have studied the quality of water of twenty-one cities of the country and the contaminants in this project.

The presence of *heavy metals* and other abiogenic matter is a more serious threat to the public health. The various study results indicated that the heavy metal contamination of water has rapidly increased in Pakistan. The contamination level was found greater, especially in the major cities surrounded by industry. The quality of water variation issues is mainly caused by the harmful industrial effluents, including heavy metals, drained in the agricultural fields untreated. These heavy metals from fields reach humans through uptake by vegetation. These contaminants mixed with water then affect human health and cause waterborne and water wash diseases.

The aim of this work is to find out the correlation between the contaminated water and its impacts on the health of in Quetta City. The heavy metals are also known as trace element and metallic elements of the periodic table. The high sensitive analytic procedures are accessible to detect metal contents with higher precision. The minor field of geology that is medical geology explains the effects of chemicals in the atmosphere mostly trace elements that affect the health of the living being. Concentrations of trace elements in rocks are carried by the mountain streams finally entering rivers, dams and irrigation channels. Occasionally the rocks and its particles concentrate in soil, air, and water and ingested by different sources in animals and humans. The contaminated water is totally related to the degree of environmental contamination. The rainwater gathers the impurities when it crosses via air. The rivers and streams collect the particles from rainwater with the flow of sewerage and industry wastes and these mixed with freshwater which are used for supplying potable water [15]. Mostly chemicals made and used by human beings mixed with water supply systems and these harmful elements from agriculture, industries, and other actions mixed with river water, subsurface water contaminate the water sources in use of animals and humans.

2. EXPERIMENTAL

The samples for the experiments were collected from public water supply schemes. The samples were collected in October 2017. The collection of samples, sizes, preservation, and analysis were done as per the standards of checking water quality. The samples of water were collected from Infantry School Quetta, Mir Qalum Koka Quetta Cantt: and Canteen of Girls College Quetta.

2.1 Samples preparation

The samples of drinking water were obtained in pre-washed by detergents, diluted HNO_3 , double deionized distill water and polyethylene bottles. The bottles and caps were also washed three times while obtaining the water samples in the study area. Many samples were collected directly to run the water tap for five minutes for stabilization of variations in electrical conductivity and temperature [16]. After that one percent of nitric acid was added in the samples and stored in five hundred milliliter capped plastic bottles and samples were stored at a room temperature 4-degree centigrade [17]. The heavy metals like lead, zinc, cobalt, copper, cadmium, nickel, chromium, and molybdenum and manganese analysis were carried out by analytic laboratory using Emission Instrument.

3. RESULTS AND DISCUSSION

It is necessary to know the correlation of existence of heavy metals in potable water and at the same time very important to identify the relationship between the presence of heavy metals in drinking water and the familiarity of failure of the renal, liver, loss of hairs and different diseases. The excessive usage of pesticides for some years in the agricultural sector contributed to the pollution of water resources to a great deal. The trace amount of metal however, mostly sustains in water not endangering the health of public. Most of the metals are important to run the life cycle like Ca, Mg, K, and Na. The Co, Cu, Fe, Mn, Mo, Se, and Zn are required at less level as a catalyst for enzymes activity and World Health Organization standards of the chosen metals which gives below in table 1:

Pure drinking water contains a higher level of important metals and harmful metals like Al, As, Ba, Cd, Cr, Pb, Se, Ag, and Ag are very dangerous to human health.

The metals are present in water supply by natural or because of the contaminations. The natural occurrence of metals is dissolved in water with the contact of rocks and materials of soil. The different ways of metals contaminations like pipe corrosion, seepage from wastes disposed of units.

Table 1: Heavy metals concentrations by WHO standards in ppm.

S.NO.	Pb	Zn	Cu	Co	Cd	Ni	Cr	Mo	Mn
1.000	0.100	2.000	0.050	1.000	0.010	0.030	0.050	0.001	0.050

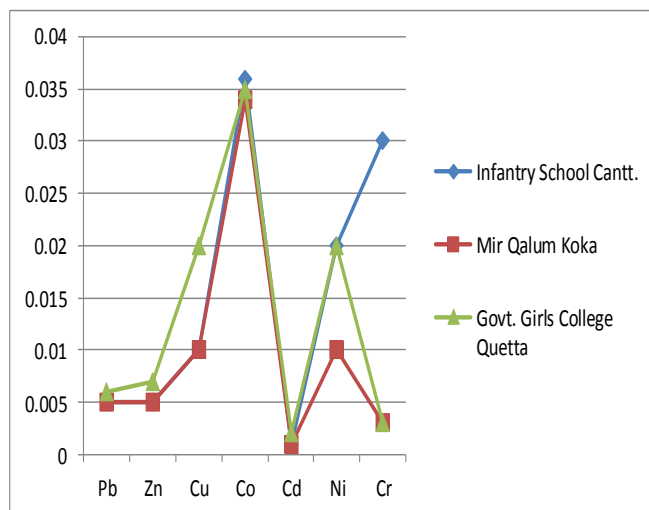
Table 2: Concentrations of HM's (ppm) in water samples from different parts of Quetta.

S. NO.	Name of Site	Pb	Zn	Cu	Co	Cd	Ni	Cr	Mo	Mn
1	Infantry School Cantt.	0.005	0.005	0.01	0.036	0.001	0.02	0.03	nd	0.0125
2	Mir Qalum Koka	0.005	0.005	0.01	0.034	0.001	0.01	0.003	nd	0.0125
3	Govt. Girls College Quetta	0.006	0.007	0.02	0.035	0.002	0.02	0.003	nd	0.0127

One of the main causes of the harmful effects of pollution is attributed to the failure of the immunes to resist the vulnerability which may cause or give the tracks to many types of diseases in the body the nervous systems. The data observed from the analysis is portrayed in table-2 and Figure -1 below.

The toxic dose of hazardous elements/chemicals causing health issues if prolonged may tend to develop cancer, birth defect, organ damages, disorder of the nerve and the immunes systems [18]. Lead, zinc, copper, manganese, cobalt, nickel, cadmium, chromium, and molybdenum are very dangerous chemicals and known as the contaminants in untreated drinking water overall the world [19]. The failure of renal, liver loss of hairs were also shown in results.

In this experiment study, powerful evidence in respect of damaging level by heavy metals like Pb, Cr, Cd, and Mo was found. shown in fig. 1 below:

**Fig. 2: Concentrations of HV's in water samples from different parts of Quetta**

Lead and Cadmium" and their impact on human health

The public suffers in the failure of renal were relates to contaminated water with Pb and Cd where lead is harmful compound if found in less quantity. Pb penetrates in the body in many ways, may be inhaled from the dusts of Pb paint or wastes gas from the Pb gasoline. Pb is also founded in higher quantities in different foods, especially in fishes. Many old homes have Pb water pipes which cause contamination in pure water.

The spread of Pb is the main problem for years and a higher concentration of Pb in the bodies of persons causes death and completely damages to the nerve systems, brains, and kidneys [20]. The damages mostly resulted that the learning and behavioral issues in human beings like that memorial and concentration issues, rise in blood pressure, issues of hearing, headache, slow-growing and reproduction issues in men and women. The different experiments were carried out on the Pb due to its dangerous effects on children's and

its poisonous effects can cause deaths and learning disabilities [18].

Cadmium is commonly classified as a very toxic compound and founds in fewer concentrations in many rocks and also founds in coals and petroleum with a combination of zinc. Geological reserves of Cd can serve as the source to surface and subsurface water mostly in contacts with soft acid water.

Furthermore, there is no proof to indicate its importance to the people. Cadmium appears with buildup age, Mostly in kidneys and considers to cancer and heart diseases. Webb [21] stated that the geochemical implication of cadmium in the health of peoples relates to (i) Renal and bones diseases in population expose to industrial contaminated potable water, (ii) Renal and lungs dysfunction in industry labor exposes to airborne cadmium and iii) implications in humans hypertension. The galvanize steels are plated with Zn, commonly contain one percent of cadmium. Cadmium has some usages in paints, photographic, and Ni-CdCd batteries. The cadmium is obtained from the environment from pigments and paints and stabilized plastics, mines and smelt and industry operations with electroplating, recycling Cd scraps and incinerations of Cd containing plastics. Other residual of Cd emissions are found in fossil fuel usage, fertilizers, and sludge of sewage disposals. Cd enters in portable water that causes corrosion in the pipes. Landfills leachate is a too significant resource of Cd in the atmosphere.

The low dosage of Cd causes cough, headache, and vomiting and a higher dosage of Cd affects the kidney and liver. Kidneys are a very sensitive organ of the body and by ingestion of Cd, this may cause the failure of kidneys [21]. The ingestion of metals like Pb and Cd affects human health. The trace metals like Pb and Cd obstruct with important nutrients of same appearances, like Ca and Zn, due to size of charge similarity, Pb can replaced for Ca which incorporated in bones. Children are commonly susceptible to Pb due to the growing skeleton system required a higher Ca level. Pb is stored in bones are not danger is not while in higher level of Pb can be replace by Ca and once system is free, Pb causes nephrotoxicity, neurotoxicity, and hypertension. Pollution of pure water with Pb and Cd occurs from the source of the industry in the study areas and Renal failure were relates to them.

Copper and Molybdenum" and their impact on human health

The public suffers in the failure of the liver were relates to contaminated water with Cu and Mo.

The Cu is a significant element for the human body and its presence of pure water contaminates the water quality and may cause the liver and kidney failures [23-24]. These diseases were the resulted of pure water contamination from pipe corrosions in water made by Cu and industry waste. Diarrhea in little children's too occurs because of higher Cu exposures. The adverse effects of health causes by pure water contamination with Cu are abdomen pain, vomit, headache, and diarrhea. The copper in greater

dosage is harmful to children's and youngers with different metabolism disorder and other hand lacking Cu intake cause different health issues like the circulation of blood, anemia and growth inhibition [20]. Mo is a very significant nutrient which is the ingredients of different mammals enzyme with Xanthine, sulfite and aldehyde oxides [25].

Furthermore, Mo is an important mineral and by using no deficiencies were reported in human beings. The molybdenum is found in a very smaller quantity in human beings. The particles of molybdenum vary in tissues like kidneys and livers depend on dietary intake [26]. The molybdenum is considered safe via wider ranges of intake up to 15 milligrams/, while it may interfere with absorptions of Cu. The molybdenum is required to change urine to uric acid, greater quantity intakes cause gout-like symptoms like pain in joints and swell and a greater amount of uric acid in blood [27].

The higher level ingests Mo could be related to potential minerals unbalanced by increase serum and urinary excretions. The excretion of enough quantity of that compound could take peoples at risks for the anemia linked with lacking of Cu [28-30]. White *et al.*, [31] suggested that the Cu - Mo interactions appear as sensitive to the developments of gout-like symptom at a higher level of Mo.

Several reports of individual persons of the state of Colorado in America show enough quantity of Mo by industry source and pure water show many elevations of blood and urinary [31]. The patient of liver diseases in this study shows the relation between molybdenum and livers cirrhosis. Contaminated portable water with Cu and Mo in the study area arises from the source of industry and agricultural activity and livers cirrhosis relates to contaminants.

Nickel and Chromium" and their impact on human health

The studies related to contaminated potable water with Ni and Cr. The nickel is used as alloy products, Ni plating for anti corrosions and in the manufacturing of batteries. Ambrose *et al.* [32] suggested that the higher dosage of Ni in dogs and rats was mostly less the weight of the body.

Polluted water with Ni and Cr, rise from the source of industry and agricultural activity in the study area. The presence of metals like Co, Cu, Fe, and Zn in portable water indicates the water is very harmful. Various researchers published that the Ni is very sensitive for human beings. Different studies have conduct out to make the relation between Ni exposures and dermal irritations. Further, these studies reported that the first relation between the Ni and loss of hairs.

The chromium is a very necessary element for human beings and animals. The Cr in higher quantity is very danger in hexavalent form. The Cr is used in metal alloys and pigment for paints, cement, papers, rubbers and many other products and chromium in greater quantity causes cancer of lungs [34]. The parameters of water quality have greatly influenced the rate of growth and the development of fishes along with aquatic life.

Copper and Cadmium" and their impact on human health

The People suffering from anemia relate to contaminated potable water with Cu, and Cd in this experiment and the study tells that heavy metal has the impacts on more than one disease like Cu on cirrhosis in livers anemia and Cd in

a failure of Renal anemia. A higher dosage of Cu causes anemia, failure of liver and kidneys.

Normally Cu occurs in portable water from pipes of copper and waste of industry. The toxic exposures to contaminated potable water with Cd resulted that the development of anemia [35-36]. The cadmium poison linked with diseases of kidney, hypertension, and anemia [20].

The cadmium could interfere with different elements like metallothionein and gains the capability to adjust Zn and Cu concentration in bodies of different patients shows different elevations in Zn which obtained by urine sample. The metallothionein is the proteins that bind to reach important metals to make them unavailable. It binds to Cu and Zn disrupting homeostasis level when Cd induces Metallothionein in activities [37].

The experimental results show that the patients suffer from a failure of renal relates to pure water which is contaminated by Pb and Cd. Liver problems with Cu and Mo, loss of hairs with Ni and Cr and anemia with Cu and Cd.

The area is selected for obtaining the samples that are near to industries and agriculture like the refining of petroleum, batteries, grease, oil, and soda. Other considerations must be made the disposal of sewage into pure water. Sewerage of these industries is disposed of in Ismailia canal and heavy metals like Pb, Cu, Cd, Cr, Ni, and Co are highly found in this canal.

The industries are the very necessary sources of heavy metals. Air pollution of industries releases many heavy metals in the environment which creates pollution in the water as earlier dry or wet depositions. Agricultural soils have a greater amount of heavy metal as a result of the usage of different fertilizers, organic matters and pesticides and also decay plants and animals residuals. The usage of wastewater in irrigation and sewage more increases the aggregate of heavy metals in agricultural land. The soil erosion because of water is the key source of pollution in water.

The subsurface water is near about in Ismailia canal and the agriculture activity which explains how heavy metals contaminate the safe drinking water in this region. The chief sources of heavy metal which contaminate the potable water are the wastes of industries and the agriculture sector. Consequently, the agricultural and industrial wastes are carried out to the reservoirs which supply the water in the study area and also old pipes are considered in these areas where Cu has another source from the corrosion in pipes.

4. CONCLUSION

The comparative study of the presence of heavy metals in table 1 and 2, (Lead, Zinc, Copper, Cobalt, Cadmium, Nickel, Chromium, Molybdenum and Manganese) in general are reasonably within the limits of WHO standards. However, in some areas the concentrations of different heavy metals like Cadmium, Chromium, Iron, Nickel and Lead vary with higher trends as compared to the World Health Organization standards. The experimental results show and indicate that the hazardous and weak drinking water systems in the selected areas are very dangerous and unfit to the health of human beings. The studies for diseases suggests that the abnormal incidences in selected regions are interlinked with agricultural and industrial wastes which produce the harmful elements in subsurface water and they contaminate the potable water in that

regions and these diseases are mostly relates with contaminated potable water with Lead, Cadmium, Copper, Molybdenum, Nickel, and Chromium. The renal failure is due to the contaminated water with Pb and Cd, Liver problems is due to Cu and Mo, loss of hairs is because of Ni and Cr and anemia is because of Cu and Cd. The metals must be removed from portable water which is harmful to human health. Meanwhile, the Environmental Egyptian Law has banned that any type of waste cannot be disposed of in rivers, canals and any reservoirs which supply the water on a domestic level.

In this scenario, comprehensive study needs to be undertaken to portray the exact picture to improvise the water standards to secure health of living beings in and around the Quetta city.

5. RECOMMENDATIONS

- Adopt new techniques of treatment for portable water and minimize the level of heavy metals from water
- To control the wastewater disposals in the freshwater intakes that supply the water to the localities.
- provide the guidelines to the peoples for the best water storage practices.
- To help and support the relevant departments which supply the water to the localities. Concerned departments of water supply can ensure that the water is free from bacterial contamination.

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