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Assessment of Toxic Lead in the Drinking Water of Kashmir Valley

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ABSTRACT: Lead is a potential environmental contaminant. The detrimental effects of lead exposure in children and adults are well documented, and no safe blood lead threshold in children or adults has been identified. Lead can be ingested from various sources, including lead paint and house dust contaminated by lead paint, as well as soil, drinking water and food. The concentration of lead, total amount of lead consumed, and duration of lead exposure influence the severity of health effects. Because lead accumulates in the body, all sources of lead should be controlled or eliminated to prevent childhood lead poisoning. From last couple of decades, lead concentrations in air, tap water, food, dust, and soil began to be substantially increased especially in developed countries due to unsustainable development. The drinking water service lines made from lead, lead solder, or plumbing materials that contain lead have been found potential sources of lead in drinking water. Drinking water samples were found well below the maximum permissible limit set by WHO. Lead level in drinking water of district Srinagar was found maximum with a value of 0.097 µg/dl followed by district Kupwara (0.093 µg/dl), then by district Pulwama (0.077 µg/dl) and finally district Anantnag with a value of 0.070 µg/dl. This study provides an insight to the contamination of water with toxic Pb element and the risk associated with it in Kashmir valley. The concerned quarters could therefore initiate a comprehensive plan to combat lead pollution in the human environment and hazards risks to children health in order to provide a clean and fear free environment and healthy smiles to our present and future generation.

Key words: Blood, Lead, Trace elements, Water, Contamination

I. INTRODUCTION

Lead is a chemical element with atomic number 82, having elemental symbol of Pb drawn from the Latin word *plumbum*. Because of these characteristics, lead has been one of the most widely used metals in the history of mankind. Lead is omnipresent in the environment. Lead is one of the most abundant heavy metals on earth considered as number one environmental persistent toxin that induces a broad range of physiological, biochemical, and behavioural dysfunctions and causes health hazard affecting millions of people round the globe. Environmental lead exposure is still a worldwide problem and has been associated with renal and cardiovascular disease, hematologic toxicity, and irreversible neurologic damage [1]. Recently, the World Health Organization has reported that 120 million people are over-exposed to lead, approximately three times the number infected by HIV/AIDS, and 99 percent of the most severely affected are in the developing world [2]. Over the past two millennia, environmental lead levels have risen dramatically [3]. Most of this increase has occurred since the beginning of the last century [4] and taken into perspective, a typical individual living in the industrial world sustains a lead burden 500 times that of prehistoric ancestors [5]. Presence of lead in the body, without having any known biological function, has always been considered a sign of environmental pollution. Lead exposure continues to be a major public health problem, particularly in urban centres in the USA and in Third World nations also [6]. Lead directly affects the hematopoietic system through restraining the synthesis of haemoglobin by inhibiting various key enzymes involved in the heme synthesis pathway. It also reduces the life span of circulating erythrocytes by increasing the fragility of cell membranes. The combined aftermath of these two processes leads to anaemia [7]. Anaemia caused on account of lead poisoning can be of two types: haemolytic anaemia, which is associated with acute high-level lead exposure, and frank anaemia, which is caused only when the blood lead level is significantly elevated for prolonged periods [8].

Nevertheless, recently in only few cities of India, researchers have taken initiative on toxic exposure of lead from drinking water. No such study so far is conducted in Jammu and Kashmir to assess the contamination of Pb in drinking water.

II. MATERIALS AND METHODS

The study was carried out in the department of Environmental Science, SKUAST-K, Shalimar; Chemicals and reagents used in the present study were of analytical or purified grade (Sigma-Aldrich Chemicals Pvt. Ltd, India, Merck, India). Deionized water was used for preparation of solutions. Water samples were collected from North, Central and South Kashmir regions. The sampling sites were Lalchowk, Batmaloo and Shalimar (Srinagar) Main Chowk, Tral and Chandgam (Pulwama) Wavoora, Sogam and Lasipora (Kupwara) and Bijbehara, LalChowk and Yasu (Anantnag). Water samples were collected in polyethylene bottles, and were centrifuged at 6000 rpm to make the suspended particles settle and to obtain clear water sample. A portion of 50 ml of water sample was subjected to acid digestion. For digestion, 5 ml of 6N HNO_3 was added to 50 ml of the sample followed by heating at 70°C for 30 min and cooled at room temperature. Samples of water were analysed only for Lead. The digested samples of blood were subjected to analysis for lead. Atomic Absorption Spectroscopy (Electronic Corporation of India Limited, model: AAS-4141) was employed for analyses according to the instrument manual or as per APHA [9].

III. RESULTS

The Table 1 show lead level (mg/l) of water samples collected from different districts. Lead level in drinking water of district Srinagar was found 0.097 ± 0.015 µg/dl followed by district Kupwara (0.093 ± 0.015µg/dl), district Pulwama (0.077 ± 0.014µg/dl) and district Anantnag (0.070 ±0.014µg/dl).

Table 1: Mean lead level (µg/dl) in drinking water samples of four districts of Kashmir valley.

S. No.	Location	Lead Level (mg/l) Mean ± SE	WHO Standard (mg/l)
1	Kupwara	0.093±0.005	0.1
2	Srinagar	0.097±0.015	0.1
3	Pulwama	0.077±0.014	0.1
4	Anantnag	0.070±0.014	0.1

IV. DISCUSSION

Lead is one of the most abundant toxins in the environment since ancient way back to 4000-5000 BC. Industrial revolution after the II world war boosted the use of lead in almost in every industrial and household product that exaggerated occupational environmental pollution (soil, water and air) and hazards to human health. In a recent report WHO [2] has embarked about the health risks of lead to human mentioning that 120 million people are over exposed to lead, approximately 3 times the number infected by HIV/AIDS and, 99 percent of the most severely affected are in developing world. Global lead contamination, attributable to the greatly increased circulation of lead in soil, water and air as a result of human activities, remains significant [10]. With the decline in atmospheric emissions of lead since the introduction of legislation restricting its use in fuels in developed countries like US, water has assumed new importance as the largest controllable source of lead exposure there. From a drinking-water perspective, the almost universal use of lead compounds in plumbing fittings and as solder in water distribution systems is important. Lead pipes may be used in older distribution systems and plumbing [11]. Polyvinyl chloride (PVC) pipes also contain lead compounds that can be leached from them and result in high lead concentrations in drinking-water. The amount of lead dissolved from the plumbing system depends on several factors, including the presence of chloride and dissolved oxygen, pH, temperature, water softness and standing time of the water, soft, acidic water being the most plumbo-solvent. Therefore, lead is present in tap water to some extent as a result of its dissolution from natural sources, but primarily from household plumbing systems in which the pipes solder, fittings or service connections to homes contain lead. In our study however, lead contents in drinking water collected from different study sites were below the drinking water norms (0.01 mg/l).

Moreover, lead has always been an environmental pollutant and hence a matter of great concern to environmentalists and medical personals due to its increased levels in the environment and human body. Lead has been associated with IQ, memory loss, hyperactivity, mental retardation, neurological illness, cardiovascular diseases, haematological toxicity and many to name. Petroleum and battery industries are the greatest users of lead. Ninety-eight percent of atmospheric lead in cities comes from petroleum fuels and battery repair units.

When metallic lead is exposed to atmosphere, it interacts with air and forms a dusty coating of lead oxide. Inhalation of the dusty lead oxide therefore can cause poisoning to people especially more to children. In recent years, traffic volume in Srinagar and some other cities has been tremendously obsessed with light and medium vehicles. Tourist (also religious-tourism) has also ascended overwhelmly in Kashmir valley in past few years. As such, traffic jam related report in print and electronic media has now become a regular feature of the valley. Constructions are also on high momentum as a result traffic volume of heavy vehicles such as lorries, tractors and trucks has swelled up too. Obviously dust particulate matters and fossil fuel fumes are at higher stage at and near the road traffics.

V. CONCLUSION

As research shift from addressing potential lead sources will be necessary to more carefully consider lead in water as a potential source. Although routine blood lead monitoring and environmental assessments are not designed to detect lead in water hazards when present, several recent cases of elevated blood lead in the developed countries have been attributed to lead-contaminated drinking water. Lead concentration in drinking water originates from lead-bearing plumbing materials, which undergo corrosion reactions, and may severely contaminate the water supply. Significant concentration of Pb in the drinking water of Srinagar district is an alarming issue which need to be taken seriously by the concerned authorities in order to safeguard the health of general public.

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