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Bio-monitoring in humans for determination of elemental load on body: A mini review of research work done in Rajasthan state

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Abstract

Bio-monitoring is considered important tool for determining environmental impact on human body. Pollution in present world is major factor affecting the human health due to increased levels of hazardous metals. Bio-monitoring can be done for nails, hairs, teeth and of blood and urine samples. Bio-monitoring studies are very much required to be carried out on regular basis at regional or local level and correlated studies should also be done for knowing the impact of the environmental changes on human body. The present paper is a mini-review of the research work done on bio-monitoring of human population and its impact on Rajasthan population.

Keywords: Bio-monitoring, humans, determination, elemental load, body

Introduction

Bio-monitoring is considered important tool for determining environmental impact on human body. Pollution in present world is major factor affecting the human health due to increased levels of hazardous metals. Biomarker importance in assessing human health risk was described two decades back by Lowery (1995) ^[6], Pirkle *et al* (1995) ^[12]. Advancement in techniques was detecting elemental quantity in trace amount using AAS (Atomic Absorption Spectrophotometry), GC-MS (Gas Chromatography-Mass Spectrometry), ICP-MS (Inductive couple plasma-Mass spectrometry) etc has also made the science of bio-monitoring more easy for understanding the dynamics of environment on human body. The human population under goes exposure to polluted environment both in rural and urban areas; rural sector is affected by agricultural chemicals in large mainly by pesticides/weedicides (Bolognesi and Merlo, 1995) ^[1]; urban regions are continuously polluted by industries, motor vehicles etc. Clifford and Stefanie (1997) ^[2] reviewed the status of bio-monitoring studies done in humans, plants, animals and have also described the importance of bio-monitoring for assessment of environmental impact on living world. Gil and Hernández (2015) ^[3] suggested importance of human bio-monitoring for assessment of metallic and metalloid elements. Bio-monitoring can be done for nails, hairs, teeth and of blood and urine samples. Bio-monitoring studies are very much required to be carried out on regular basis at regional or local level and correlated studies should also be done for knowing the impact of the environmental changes on human body. Environmental impact is strongly reflected on human body affecting body physiology and metabolic activity; elements like Fe, Mn, Zn, Co, Cu, Mo, Se, I have vital role (Kavita and Tak, 2017) ^[5] in growth and development. In past few decades clinical studies on the level of trace elements in human body have gone high. Graves *et al.*, (2015) ^[4] have shown global differences exist in body composition with respect to age, gender, growth, body composition, genetics, food habits and diseases. So, it becomes imperative to monitor the status of trace elements in the human body with time. Urbanization has contributed high for deteriorating the natural environment, State of Rajasthan has limited resources to support industrial growth but significant industrial developments have happened in the state. Studies have been done on assessment of environment on human health pertaining to elemental load on the human population residing in the state. The present paper is a mini-review of the research work done on bio-monitoring of human population and its impact.

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Bio-monitoring:

Bio-monitoring can be done of both biopsy and autopsy samples. Autopsy samples have limitation but biopsy samples can help in assessing the impact of the environmental factors

over time and location. Bio-monitoring for elemental load on and in the body can be done by analyzing hairs, nails, blood samples, urine samples mainly. The populations of Rajasthan state have been studied by various researchers for the elemental load on the hairs, nails, urine, blood and the results have been correlated with health hazards.

In 2003, Mehra and Juneja studied trace and toxic metal levels in the workers engaged in local industries or polluted environment. The hair samples were taken from population affected by skin disease, chest pain, hypertension, mental stress, diabetes, indigestion, respiratory trouble, liver problem, tuberculosis, acidity, ophthalmic disease and hepatitis B. Seven metals viz., Pb, Cr, Mn, Fe, Ni, Cu, Zn were detected. Significant correlation were observed with respect to level of elemental load on hair and disease; Mn, Ni, Cu and Zn showed high correlation with mentally stressed population; Cu and Mn showed high correlation with hypertension population; Cr, Mn and Ni levels had high correlation with population suffering from diabetes. None of the element had reflected significant association with population suffering from acidity, ophthalmic disease and hepatitis B.

In 2004, Mehra and Juneja studied hairs and fingernails of exposed and unexposed human population of Ajmer region for lead (Pb) and cadmium (Cd). The level of variation for the two elements is given in table 1. It was observed that for Pb exposure hairs can be considered as a better biomarker.

Table 1: The range of variation observed in nails and hairs for Pb and Cd in exposed and unexposed population of Ajmer

Biomarker	Exposed		Unexposed	
	Pb	Cd	Pb	Cd
Nails	8.13-765.30	0.21-35.74	1.07-65.61	0.02-8.10
Hairs	1.02-409.72	0.014-22.08	0.12-25.16	0.11-1.62

Data Source (Mehra and Juneja, 2004) ^[8]

In 2010, Mehra *et al.* studied Cr, Mn, Co and Fe in human hairs of the population residing near high traffic areas. Bio-monitoring studies on older age population ranging between 40-50 years age showed that Cr and Mn are high and Fe and Co was low in population of target sites. The Cr level was non-significant whereas Mn was highly significant.

In 2010, Mehra and Thakur studied hairs as biomarker to assess the impact of environment with respect to 10 trace elements viz., lead, calcium, magnesium, chromium, manganese, iron, nickel, copper and zinc. Workers of specific occupation were included i.e., roadways workshop, locomotive workshop and lead battery units. Nape region hair analysis was correlated with mental stress; concentration of lead, calcium, magnesium, manganese, nickel, copper and Zn was significantly correlated among the ten elements

In 2016, Mehra and Thakur assessed relationship between elements detected in hairs from environmentally exposed subject of Ajmer region. The workers were engaged in metal finishing units and metal recycling units. The comparison with unexposed samples showed significant variation for the metal load on hairs. Hairs were found to accumulated not only toxic elements but essential elements like Zn, Mn and Fe.

Conclusion

The review of the studies done on use of biomarkers on Rajasthan population for elemental load happening due to environment clearly shows that hairs, nails and other body parts which are highly exposed to environment are good

biomarkers. The level of variation observed between exposed and unexposed population with respect to target environment suggests the significant impact of the environment on human health. Interesting studies taken up for correlating elemental load on diseased population had showed that environment reclamation is necessary for having healthy human body.

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