

Occupational Exposure to Metals & Safeguards for Prevention from Metal Exposure in the Environment

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Abstract: *(The problem of occupational exposure of toxic metals exists from the ancient time when no proper management at workplace regarding metal exposure was done by industrialists. Biomonitoring is the branch of science with multi-disciplinary aspects of applications which will help industrialist in assessment of toxic metal exposure to workers at workplace and further associated health risks. In present study total 40 workers were included as subjects out of which, 20 were exposed to metals at work place and 20 were relative controls. Head hair samples were collected from all subjects pretreated including washing with Triton X-100, acetone, and deionised water successively. All hair samples were digested using wet acid digestion method with Nitric Acid and Perchloric Acid mixture as per recommended protocol to obtain colourless solution. Subsequently analysis for cadmium with an Atomic Absorption Spectrophotometer (AAS), ECIL Model-AAS414 was done. The cadmium level in hair of exposed workers was significantly higher than the workers which were not exposed to metals. Measures for better occupational environment for the benefit of workers have been suggested to the industrialists.*

Keywords: Hair, cadmium, occupational exposure, Atomic Absorption Spectrophotometer

Introduction :

Global awareness of toxic metals pollutants released into the environment is increasing. Most sources of these releases have been substantially identified: burning of fossil fuels, industrial processes and an increasing array of chemical discharges. Eventually, toxic trace elements, particularly heavy metals and their effect on humans require attention major attention¹. Not much attention is given to the status of workers of industries was made in India. The ever increasing production and denial by society for metal indicate the mounting probability of their dispersal and contact with the environment. Mostly heavy metals play an important role in human body but their excess may cause various adverse health effects in human body²⁻⁵. The excess of metal either essential or toxic can be safely deposited in the hair. Hence, metal analysis in hair is the most common application of biological monitoring for screening diagnosis and assessment of exposures of metals in occupational and environmental health. Due to this reason,

the Global Environmental Monitoring System (GEMS) has chosen human hair as a biopsy material to estimate metal body burden⁶. The present investigation will certainly recollect the health problems of workers professionally exposed to two toxic metals lead and cadmium in their work place so as the necessary precautions may be adopted and applied for the safety measures. The present study was conducted in metal finishing and recycling units of Rajasthan. Total 40 workers were included as subjects out of which, 20 were exposed to metals at work place and 20 were relative controls. About one gram of head hair samples were collected personally from the nape region of scalp of all subjects included in study. All samples were pretreated, digested and analysed for cadmium concentration in hair using Atomic Absorption Spectrophotometer (AAS), ECIL Model-AAS414 using air acetylene.

Materials And Methods:

In the present study 40 workers were included as subjects out of which, 20 were exposed to metals at work place and 20 were relative controls. About one gram of head hair samples were collected personally from the nape region of scalp of all subjects with one centimeter distance using sterilized stainless steel scissor, subsequently a questionnaire recommended by World Health Organization was used to obtain the personal and medical details of all subjects included in study. All samples decontaminated using nonionic detergent Triton X-100, deionised water and acetone. Subsequently hair samples were dried in oven at 110° C for one hour and kept in desiccators. All washed and dried hair samples were then digested using nitric acid and perchloric acid in 6:1 ratio to get white residue which was dissolved in 0.1 N nitric acid to get a clear colourless solution⁷⁻⁹. The concentration cadmium in hair was determined by using Atomic Absorption Spectrophotometer (AAS), ECIL Model-AAS414 using air acetylene flame.

The value of cadmium concentrations in hair was expressed as mean value in µg/g with standard deviation. The data thus obtained were then analysed to get mean, standard deviation and test of significance using Student 't' test.

Results And Discussion

Mean cadmium concentration in hair of subjects occupationally exposed to toxic metals was 2.0321 µg/g (±0.4219µg/g) that was higher than 1.1365 µg/g (±0.4756 µg/g) of subjects not occupationally exposed to toxic metals. Cadmium concentration in hair of subjects occupational exposed

to toxic metals ranges from 1.0153 µg/g to 2.6741 µg/g and those not occupationally exposed to toxic metals ranges from 0.3561 µg/g to 1.8726. This difference was significant on applying 't' test as presented in table 1 which shows that the difference in the lead concentration in hair of subjects occupationally exposed to toxic metal and controls is not by chance, this difference is actually due to exposure to cadmium. Cadmium can damage the environment even at low concentrations and can pose serious risk to human health. These risks could be short term or long term. For instance short term and acute toxicity can be caused in human beings by ingestion, inhalation, skin contact or the risk of fire or explosion. Long term hazards constitute chronic toxicity due to repeated exposure, the causing of cancer, the causing of genetic damage, neurological disorder, respiratory disorder and other¹³⁻¹⁶.

CONCLUSIONS

After the detailed study it can be briefly stated in general terms by reporting that there is serious lack of knowledge among workers regarding the metals pollution and their adverse effect on their health. Following generalization can be made be:-

- Awareness towards metal pollution at work place is lacking in workers of industrial units.
 - Awareness of occupational exposure to metals and consequent adoption of suitable safeguards in self-protection (from it) to the extent possible is one of the determinants of quality of life
 - Industries and their administration is very much aware of mass-scale production, but are not worried about the health and safety of their workers.
 - The state agencies meant to measures and control occupational exposure of toxic substance to workers has by and large failed to achieve any remarkable success.
- As the trained workers and employees are the wealth of the industrialists, they should take care for the health and safety of the employees. Monitoring, measurement, evaluation and prevention of metal exposure to workers must be subject of priorities of the industry. The risk and incidence of occupational health hazards and accident statistics of the organization should be examined carefully and an on-site audit must be carried out. Workers must be provided with all good quality safety equipments like apron, mask, helmet, safety glasses, gloves etc. Proper management of raw materials, processed materials, materials in process and indoor wastes or scrap can decrease the toxic metal pollution in workplace. Time to time training and guidance to workers and their health checkup must be a part of routine for management. State agency must be strict against all such industries which do not follow the basic requirements for the safety of workers. These all measures if followed will collectively help in decreasing the metal pollution in workplace leading to a healthy and safe environment for workers.

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Table-1. Cadmium level in hair of exposed workers and controls.

	Control Subjects		Exposed Subjects	
	Range ($\mu\text{g/g}$)	Mean (S.D.)	Range ($\mu\text{g/g}$)	Mean (S.D.)
Cd	0.3561-1.8726	1.1365 (0.4756)	1.0153-2.6741	2.0321* (0.4219)

*Significant difference between people living near heavy traffic area and less traffic area by $P < 0.05$