

DETECTION OF CHROMIUM IN HAIR SAMPLES OF MALE TANNERY WORKERS NEAR GAJJU MATAH

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ABSTRACT

Investigate the level of chromium in male tannery workers and their general health status. Chromium level was measured in hair samples of male tannery workers of different age groups. Group-I included workers that belong to age group of 15-30 years, Group-II included workers that range from 31-46 years and Group-III included workers that belong to age group of above 47 years. Chromium concentration in all age group was very high as compared to permissible limit (mean values: 30.76mg/l, 39.77mg/l and 65.0mg/l). A strong positive correlation was also existed between workers and their ages as there is an increasing trend of Cr concentration with age. It can be concluded from the analysis of data that the concentration of chromium in hair samples of male tannery workers was very high and they were suffering from different diseases (blood pressure, skin infection, jaundice, respiratory disorder) due to the exposure to the precarious occupational hazards.

Keywords: Health hazards, chromium, tannery, workers and correlation.

INTRODUCTION

Industrial pollution can cause widespread environmental problems through its impact on air quality, soil and food chain. According to an estimate 50% of pollution is caused by industry and heavy metal pollution has been associated with large and small scale industry (Rawat *et al.*, 2009). The pollutants generated in tannery industry contain high concentration of chromium and aluminum which directly affects human health. The chrome tanning method is the most widely used process in Pakistan's leather sector. These may be divided into four major classes: pre-tanning chemicals, tanning chemicals, wet finishing chemicals and finishing chemicals and about 130 chemicals are used in leather processing ranging from inexpensive common salt (sodium chloride) to expensive chrome sulphate that are toxic to human health and natural ecosystem (Khan and Munir, 2008).

Cr (VI) is a notorious environmental pollutant because it is a strong oxidant and much more toxic than Cr (III). High doses of Cr (VI) have been associated with birth defects and cancer. Plants and animals do not bio-accumulate chromium; therefore, the potential impact of high chromium levels in the environment is highly toxic to plants and animals. In human beings this toxicity may be expressed as skin

lesions or rashes and kidney and liver damage.

Chronic exposure to Cr (VI) in the form of lead chromate effects on carcinogenicity and is found to induce persistent or increasing chromosome damage. Cr (VI) is mobile in soil, more toxic, and penetrates more readily into the cell membranes than the trivalent form. Many factors like the biotic and abiotic factors in the environment, and characteristics of the pollutant influence the toxicity of chromium on microorganisms. The adverse effects of chromium can be seen in many microbe-mediated processes including carbon mineralization, nitrogen transformation and mineralization of phosphorous and sulfur. The presence of chromium decreases microbial populations and also affects microbial respiration. Chromium is found to be both toxic and mutagenic to various microorganisms. A case study reflects the chromium contamination in the water bodies in and around Sukinda mines of Orissa state in India and its effect on the potential users of the contaminated water. (Alok and Susmita, 2007)

A study conducted in Sialkot, where total of 240 males consisting of 120 workers from tanneries at Sialkot and equal numbers of controls were selected. Blood complete counts, high-sensitive C-reactive protein, malondialdehyde and routine biochemical tests were carried out by routine procedures. Results revealed that all the workers were male with average age of 33 years and 15 (13%) had skin

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rashes, 14 (12%) had chronic bronchitis, 10 (8%) had gastritis and 4 (3%) conjunctivitis and it was concluded that about half of the workers had excessive exposure to chromium in the tanneries at Sialkot. They had significantly raised chromium levels in their biological fluids and adverse health effects due to enhanced oxidative stress and inflammatory changes (Jaffer and Tariq, 2006).

MATERIALS AND METHODS

Study Area and Sample Collection

100 hair samples (from different age groups i.e. 15-30 years, 31-46 years and above 47 years) were collected from tannery that was located in Gajju-Matah near 7km Nishant Avenue, Lahore. Hair samples were collected from the nape of the scalp by cutting 2mm from the scalp using a pair of sterilized stainless steel scissors washed with ethanol, a neutral solvent to remove external contamination and then hair samples collected were stored in plastic bags prior to analysis at room temperature.

Washing of Hair Samples

Each hair sample was weighed up to 0.5mg then hair samples were pre-washed with methanol and soaked in deionized water for 10 minutes. It was followed by soaking in acetone to remove external contamination and finally the hair samples were washed with deionized water. Then samples were dried in an oven at 110°C for 1 hour (Ciszewski *et al.*, 1997).

Digestion of Hair Samples

Then dried hair samples were digested with 15ml mixture of concentrated nitric acid and Perchloric acid and heated until complete digestion of hair. Then samples were filtered to remove impurities and then stored in 20ml test tube at temperature of 4-6°C.

Elemental Analysis of Hair Samples

Samples were tested on "Thermo Solaar MQZ Zeeman flame atomic absorption spectrophotometer", using hollow cathode lamp of chromium. For chromium analysis, a known 1000mg/l concentration of the metal solution was prepared from their salt which was further diluted into series of standard solution up to appropriate volume with distilled water.

Procurement of Requisite Details of Subject

The personal and medical histories along with relevant details of the subjects taken for study were obtained through questionnaire.

Data Analysis

Descriptive statistics (arithmetic mean, standard error (\pm SE), standard deviation, and standard error mean) and the correlation coefficients and level of significance were also evaluated.

RESULTS AND DISCUSSION

Analysis of hair samples of male tannery workers shows that the concentration of chromium in hair samples of all male workers was above the permissible limit i.e. 1.18mg/l as suggested by International Occupational Safety and Health Information Centre (IOHS, 1999). As the chromium concentration in hair samples of male workers of tanning industry ranges from 7.93 to 65.0mg/l and the mean chromium concentration of all hair samples of tannery labors was 19.68 ± 12.78 mg/l.

A strong correlation existed between chromium concentration in hair samples of workers and age as there is increasing tendency of chromium concentration with age. One of the workers that belong to the young age profile has high chromium concentration as compared to middle age group because that worker was working in tannery over a long period of time and also work in pre-tanning unit that leads to high exposure to Cr concentration. DNA damage of peripheral lymphocytes in 60 workers occupationally exposed to trivalent chromium Cr (III) in a tannery was studied that showed that DNA damage was significantly high in workers that were exposed to higher chromium concentration in workplace as compared to control group (Zoe, 2008).

The whole data regarding the chromium concentration in different age profiles of male workers showed that chromium concentration was very high in old age male workers as compared to the concentration of chromium in middle age male workers similarly chromium concentration in young male workers was very high as compared to middle age male workers (fig: 2). A study conducted in Sialkot by Shahida *et al.* (2012) showed that toxic

concentration of chromium in workers with average age of 50 had more chromium concentration as compared to the workers with average age of 30.

The study also deals with general assessment of their health status and purpose for studying this aspect was the growing problem that tannery workers encountered in their workplace due to the exposure of hazardous chemicals and owing to precarious and ergonomically unsafe workplace. Work and health are integrated issues. From the survey and questionnaire it was observed that workers do not wear personal protective equipment (PPE) during processing because they considered it extra burden that slows the productivity of their work efficiency as they earned on the basis of the work they performed in tannery daily. Workers of tanning industry working in pre-tanning unit were suffering from more health problems, accidents and injuries as compared to the workers that worked in tanning unit of chemicals, wet finishing chemicals and finishing chemicals because they perform more manual and non-manual tasks. A study conducted by Stevens (1979) in United States showed that workers working in pre-tanning unit were suffering much more from occupational hazards due to direct contact with chemicals and unpleasant odour.

It was the study that half of tannery workers were suffering from malnutrition problem due to improper diet and low socio-economic status. In general people belonging to low income group suffer from malnutrition and

burden of diseases (Parks, 1998). The present study depicts that most of the workers were suffering from blood pressure, headache, diabetes, skin allergy, knee pain, jaundice, dizziness, respiratory problems and liver disorder and the major cause of these diseases among tannery workers evaluated was the direct exposure of chromium over a long period of time during working days. Study conducted in Kanpur, India showed that there is a significantly higher prevalence of morbidity in tannery workers, mostly from respiratory diseases owing to chromium exposure (Amit *et al.*, 2008). Use of shampoo and hair dye is another major factor that causes skin allergies and cancer in workers. It was articulated that many workers used dyes and shampoo of lower quality and half of them used soaps that they required for the cleaning of garments in the tannery that causes skin rashes and lesions in scalp and skin rashes were also observed in tannery workers during hair sampling. Each year, 1,000 workers are reported in Ontario suffering from contact dermatitis due to use of soaps and detergents for cleaning of hair that were used in industry for the washing of garments and for other industrial manufacturing practices (Walker *et al.*, 1993). Smoking was another major problem in tannery that influences the frequency of diseases among workers. Ahsan *et al.* (2006) reported significantly higher concentration of chromium along with decreased number of leukocytes in tannery workers.

AGE GROUP	MEAN CONC.	S.D	LEVEL OF SIGNIFICANCE (P)	CORRELATION (r)
YOUNG	16.02	12.04	0.00	0.704
MIDDLE	27.44	15.57	0.00	0.700
OLD	44.87	19.22	0.00	0.838

CONCLUSION

The concentration of chromium in hair samples of male workers of tannery was determined and general health statuses of workers were also assessed. It was clinched from the study that in all age profiles such as young, middle and old age group the chromium concentration in hair samples was significantly very high as

compared to permissible limit i.e. 1.18 mg/l in hair (IOHS, 1999) and from their general health status it was enunciated that the male tannery workers were suffering from different health problems due to exposure to high concentration of chromium compounds, ergonomically unsafe workplace and due to low socio-economic status.

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