



An Effect of Occupational Exposure to Chromium in Tannery Industryworkers

KEYWORDS

reproductive end points, chromium.

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ABSTRACT *Subjects occupationally exposed to potential mutagens/carcinogens represent the most suitable groups for epidemiological studies aimed at assessing the risk for the individual or the offspring. Several cancer risks to humans have been detected by epidemiological studies performed in occupational settings. The epidemiology studies have been able (a) to identify specific occupations or agents associated with the risk; (b) to verify the results of experimental studies; and (c) to test the effectiveness of changes in production or preventive measures in decreasing risks. Reproductive epidemiology has suggested a risk of spontaneous abortions or of malformation in the offspring of workers exposed to some chemicals or occupations, but data are often conflicting due to methodological problems. With the aim of early assessment of risk in mind, the epidemiological use of indicators of exposure or of the early effect of exposure to genotoxic agents is increasingly applied to occupational groups. Data on the fertility and other reproductive end points in 162 workers exposed to leather dust were recorded by using standard questionnaire. The exposed group were further categorized based on duration of exposure, life style and socio-economic status. The statistical analysis shows that the differences in the reproductive end points between the control and exposed groups were significant ($P < 0.05$).*

Introduction

Leather tanning is the process of converting raw hides of skins into leather. Tanning is essentially the reaction of collagen fibers in the hide with tannins, chromium, alum or other chemical agents. Approximately 90% of all leather is produced by chrome tanning. Basic trivalent chromium compounds are used in the leather production as a chelating agent to stabilize collagen fibers in the animal skin, providing it with the known thermal and hydro resistance of leather. Chrome tanning is still the most economically advantageous method to produce good quality leather. The heaviest metal exposure occurs in the workplace among occupationally exposed groups. A person spends, on average, one-third of his life at his workplace and therefore the environment in which he works can be a major factor in determining health.

Chromium has been recognized as one of the most effective tanning agents and has been widely employed in the leather industry since its discovery more than 100 years ago. Since then, some 85% of the leather produced worldwide is tanned with chromium salts, either alone or in combination with other tanning agents. Chrome-tanned leather tends to be softer and more pliable than vegetable tanned leather. Chrome tanning is cost-effectively beneficial and provides

superior leather, and is not likely to be replaced by the existing alternative tanning agents in the near future. There are several potential sources of air emissions in the leather tanning and finishing industry such as chromium emissions that may occur from chromate reduction, handling of basic chromic sulfate powder and from the buffing process. Chromium causes a variety of DNA lesions such as DNA strand breaks, SCEs and mutations [Wu, et al 2000 Tolbert et al 2003]. The oxidation state is the most important parameter for chromium toxicity. Cases of nasal cancer were also reported among these workers, exposed to a variety of forms of chromium, including Cr (VI)

and Cr (III) compounds. The harmful effect of dust in various forms of human health have already been demonstrated (Gutherie 1992, Dong et.al. 2006, Prince et.al. 2008). Occupational exposure to trichloro ethylene an imported volatile organic compound used in clock manufacturing factory showed on skin (29.6%) and respiratory symptoms (21.1%) were observed among exposed group (Sing thong et al, 2015), Asthma allergy skin reactions visual disorders were most prevalent in printing factory workers (Dechart Somasiri, 2014). A significant hearing loss and reproductive end points were observed in chromium alloy factory and tobacco dust exposed population. (Rudrama Devi & Jithender naik, 2012, Muthamura et al., 2004) Hence in the present investigation a questionnaire based epidemiological survey was carried out using a standard questionnaire in leather factory in Telangana region

MATERIALS AND METHODS

Reproductive epidemiology: In the present study people working in shoe manufacturing industry in Hyderabad were selected to study the effects of organic solvents on the reproductive end points such as still births, abortions, neonatal deaths, congenital malformations, etc.

Out of these compounds some are found to be mutagenic in lower organisms and also in mammalian system and some of these compounds will also cause birth defects. These occupational and environmental hazards have assumed yet another dimension of serious nature in Bhopal, Chernobyl and Basel. The occupational epidemiology on the background of each individual was recorded using a standard questionnaire. The epidemiology broadly deals with the study of relationship of various factors that influence the occurrence of a disease or an altered physiological status and its distribution in a given population. Data on the fertility and other reproductive parameters in 156 couples were recorded where males were occupationally exposed to organic solvents. Simultaneously 122 individuals not exposed to any toxicant a healthy volunteers were selected for control data.

Their age group was between 20-50 years, and data from 156 couples belonging to same age group and not having any history of exposure to asbestos or other toxicants, were collected for comparison (controls). The Characteristics of control and exposed population are given in Table 1. The workers were further divided into groups based on the duration of exposure, life style, diet, habits and socio-economic group. The workers were selected to serve as control subjects who were not exposed to any toxic chemicals. The data collection gives the information on reproductive end points like still births, congenital malformations and neonatal deaths, etc.

RESULTS

The occupational epidemiology of each individual was recorded using standard questionnaire. The epidemiology broadly deals with study of relationship of various factors that influence the occurrence of a disease or an altered physiological status and distribution in a population. Data on the reproductive parameters in 162 occupationally exposed to organic solvents are recorded in Table 2. There was a decrease in the number of fertile females in exposed group. Abortions and still births were increased among the females. The percentages were 19.88 and 18.50 in exposed, and 11.91 and 4.68 in controls respectively. The frequency of live birth decreased from 74.04% (controls) to 46.40% in exposed group. The percentages of neonatal deaths in exposed groups was 13.81% against control value of 4.60%. The difference in the frequency of reproductive end points was significant in exposed group as compared to control values ($P < 0.05$).

Table 1. Characteristics of control and exposed subjects

Group	No. of samples	Age in years \pm SD	Duration of exposure
Control	122	36.8 \pm 1.4 to 45.8 \pm 1.8	20 \pm 1.2 years
Exposed	156	39.2 \pm 1.8 to 44.28	

Table 2: Data on reproductive histories in tannery industry workers

Parameters	Control	Exposed group
No. of females	110	162
No. of fertile females	102(92.72)	148(91.35)
No. of pregnantes	235(2.13)	362(2.78)
Live births	174(74.04)	168(46.40)
Abortions	28(11.91)	72(19.88)
Still births	18(4.68)	67(18.50)
Neonatal deaths	11(4.60)	50(13.81)
Congenital malformations	4(0.17)	5(0.13)

* $P < 0.01$

DISCUSSION

Human population is now exposed to a wide variety of chemical substances used in the vast expanding industry and agriculture, has never witnessed it in the past. Many compounds interact with the genetic material in bacteria, mammalian system and cell cultures. If man is exposed continuously to these diverse types of environmental mutagens, there will be a great risk in future generations. Hence, in recent years a need for constant monitoring and vigilance for their ill effects on man and his environment has been felt and an urgency to devise appropriate remedial measure emphasized which permit comparison between the populations.. The results of the present study show the effects on reproductive end points, hence precautions should be taken in work place to prevent health problems.

The study conducted on dental assistants, factory workers, painters and gardening workers, who were exposed to nitrous oxide, inorganic mercury, organic solvents and pesticides show that spontaneous abortions were found to be significantly increased in factory workers and painters. Occupational exposure to organic solvents during pregnancy is associated with an increased risk of major fetal malformations (Khattak 1999). Welch & Cullen (1988) evaluated the semen samples from shipyard painters exposed to ethylene glycol ethers. Sperm concentrations, velocity, motility, morphology, morphometry and viability were measured. The measures of sperm counts were lower in painters. Exposure to six organic solvents (styrene, toluene, xylene, tetrachloroethylene, trichloroethylene and 1,1,1-trichloroethane) was conducted to investigate the effects of parental exposure of pregnancy. Spontaneous abortions and congenital malformations among the wives of men occupationally exposed to organic solvents were observed by Taskinen et al. (1989). Parental exposure as a risk for birth defects in offspring of painters was reported by Ohlson (1992). High exposure to toluene increase the risk of spontaneous abortions (Lindbohm 1995).

Earlier Sallmen et al. (1922) reported that parental lead exposure is associated with congenital malformations. Further, in the year 2000 they reported that parental exposure to lead increases the risk of infertility at low occupational exposure levels. A delay was observed among the wives of men exposed to lead (Min et al. 1997), suggested that parental occupational lead exposure might be associated with low birth weight in the offspring. Epidemiological studies indicated that parental exposure to lead and mercury be associated with the risk of spontaneous abortions (Antilla et al. 1989). The present results are also in agreement with that of higher frequency of various reproductive end points in occupationally exposed people to lead (Dilip reddy et al., 2011), tobacco dust (Rudrama Devi & Jithender Naik 2012)

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