Original Research Paper

Occupational exposure to cleaning solvents among workers of screen printing units in Pakistan: A preliminary survey

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Organic solvents are being used extensively in many industrial processes. Occupational exposures to these solvents are often deleterious to workers. In order to determine stress profiles of exposed workers in the context of organic solvents’ (acetone, glycol ethers, methanol, toluene and xylene) exposure, a questionnaire based survey of screen printing units located in Lahore, Pakistan was conducted. Loss of memory was the key threat found among the workers and the percentage of patients suffering from this disorder reached up to 72%. The ratio of occurrence of this symptom was higher in workers of age between 40 and 50 years. Other common disorders included hypertension, depression, dizziness, dry skin, headaches, occupational fatigue, sore throat and vision difficulty. The percentages of patients suffering from such troubles were 47%, 53%, 56%, 55%, 49%, 56%, 30% and 38%, respectively. The overall trend of disorders increased with increase in age. These results necessitate guidance and strict appliance of proper working stations wherein efficient exhaust system(s) be installed immediately.

Key words: Loss of memory, occupational exposure, organic solvents, screen printing.

INTRODUCTION

Life is not a bed of roses; people earn their livelihoods after paying their valuable health in the form of different problems which often become fatal. Organic solvents are used extensively in many industrial processes such as paint production, rubber industry, adhesive productions, printing, and production of many other chemicals. A large number of workers are directly exposed to these organic solvents (Gong et al., 2003; Fiedler and Lerman, 2007). Occupational exposures to different concentrations of organic solvents and their numerous deleterious health effects are well known (White et al., 1995; Attarchi et al., 2010; Katukam et al., 2012). Ng et al. (1990) have reported impacts of mixed organic solvents on the health of workers attached with paint and printing industries in China. Due to the high volatility of these solvents during cleaning the screens, these chemical compounds are inhaled which lead to the dizziness in the workers. Solvents like toluene, xylene and alcohol has drastic neurological effects as the vapours of these solvents reach brain cells due to inhalation. Workers with extensive exposures to these solvents are more likely to be caught by Alzheimer’s disease (Kukull et al., 1994).

Screen printing involves organic solvents which are used in two ways: i) a printing run to clean out a screen clogged with dry ink or dust ii) the end of a run to wash the screen and associated equipment for reuse. The rapidly evaporating ketones and aromatics are used in this process, of which most commonly used one is the ‘Lacquer Thinner’ which is a mixture of aromatics (toluene, xylene) and ketones (methyl ethyl ketone (MEK), acetone) with smaller
fractions of alcohols (methanol) and glycol ethers (Horstman et al., 2001).

The solvents being volatile become extremely dangerous when evaporates to the environment and results into smog (ozone) formation on reaction with sunlight. Smog severely affects human respiratory system leading to the permanent lung damage. Some of these volatile solvents are potential human carcinogens, while, chronic or acute exposures may also cause nerve damage, unconsciousness and death. Many studies involving occupational exposure have reported health hazards of these mixed solvents at the levels even within the occupational standards (Ng et al., 1990; White et al., 1995; Sutton et al., 2009).

There are nearly 500 screen printing units which are clustered in three regions of Lahore i.e., Abok Road, Gawalmandi and Royal Park. The main objective of this study was to investigate the impact of chronic occupational exposures to the organic solvents and associated health symptoms among workers of small screen printing units and creating public awareness to tackle industrial hygiene in Pakistan.

MATERIALS AND METHODS

Description of working sites

Screen printing units are mainly clustered in three localities of Lahore which are Abok road (31° 34’N 74° 18’E), Gawalmandi (33° 36’N 73° 04’E) and Royal Park (31° 33’N 74° 19’E). Most of the population of these regions is attached to screen printing industry which is flourishing both in residential and non residential areas of these regions. The areas are the most congested sites of the city. In addition, the screen printing units are much narrower and closed except having front doors and without any proper ventilation facilities.

Working condition

Workers attached to this industry have to work at least 12 hours a day. It was noticed during the survey that workers mostly unaware of the danger, work for long durations without proper precautionary measures (without using masks or gloves) resulting in direct contact of highly volatile solvents. This contact appears highly dangerous and becomes a cause of a number of health implications.

Plan of work and methodology

A preliminary survey of 45 screen printing units in which 87 workers were employed with a work history of 10 years was carried out to define the plan of work. A questionnaire was designed to document thorough occupational history and symptoms associated with exposures to organic solvents of all monitored workers. Health assessment of workers was made by categorizing data on the basis of health hazards with respect to age of workers. For comparison, data of 90 individuals relevant to prescribed age groups from packaging units of the same industry were obtained and used as control as workers in packaging units are not facing any type of solvent’s exposures. The collected data were tabulated and interpreted to assess the occupational hazards present in these units and ultimately affecting the health of workers.

RESULTS AND DISCUSSION

After this study we are in a position to highlight certain critical and harsh realities about screen printing occupation. Hypertension and depression of course, became more significant with increase in age along with many other disorders (Table 1). About 70% (in overall) more workers were suffering from dizziness when compared to the control group (Table 1). Similar findings were reported by Crouch and Gressel (1999) in screen printing workers.

Without proper usage of protective eye glasses, workers faced vision problems like impairment of colour as well as Myopia. From Table 1, it is clear that middle age group (31-35) showed higher ratio of vision problems which further increased with increase in age when compared to the respective control groups. Aged workers (between 46 and 50) showed much higher rate of vision problems i.e., 13/23. Type III colour vision problem has been observed more associated with exposure to these solvents (Attarchi et al., 2010). Our findings showed that the ratio of the affected persons (exposed to the solvents) was approximately doubled as compared to the non-exposed individuals (Figure 1).

While washing the printing screens organic solvents came in direct contact with hands, due to non-hygienic approach of the workers and thus, resulted in skin dryness irritation, roughness and scaly appearance. The long term exposure to the solvents may lower down the lipid levels in the skin thus causing the dryness (Jia et al., 2002; Stutz et al., 2009)

During the survey another common problem observed was soreness of throat found in 29% workers of screen printing units. Occupational exposure have been reported to be one of the major reasons for the soar throat (Addey and Shephard, 2012). Our data is supported by the studies of Liu et al. (2002) who reported a significant incidence of chronic pharyngitis from the newspaper printing industry which uses organic solvents, inks and fillers

Heavy workloads on the employees during overnight duties in fumigative and congested environment resulted into fatigue problems. It is a worldwide problem related to lack of motivation and energy mostly linked with the night
Table 1: Comparison of various disorders among workers of screen printing units and control population of different age groups

<table>
<thead>
<tr>
<th>Disease / Problem</th>
<th>31-35 Control</th>
<th>31-35Exposed</th>
<th>36-40 Control</th>
<th>36-40Exposed</th>
<th>41-45 Control</th>
<th>41-45Exposed</th>
<th>46-50 Control</th>
<th>46-50Exposed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hypertension</td>
<td>n=14</td>
<td>n=21</td>
<td>n=17</td>
<td>n=25</td>
<td>n=26</td>
<td>n=23</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>7</td>
<td>5</td>
<td>7</td>
<td>9</td>
<td>13</td>
<td>9</td>
<td>14</td>
</tr>
<tr>
<td>Depression</td>
<td>3</td>
<td>9</td>
<td>5</td>
<td>8</td>
<td>6</td>
<td>15</td>
<td>5</td>
<td>14</td>
</tr>
<tr>
<td>Dizziness</td>
<td>1</td>
<td>10</td>
<td>2</td>
<td>9</td>
<td>4</td>
<td>16</td>
<td>3</td>
<td>14</td>
</tr>
<tr>
<td>Dry skin</td>
<td>1</td>
<td>9</td>
<td>3</td>
<td>8</td>
<td>6</td>
<td>16</td>
<td>5</td>
<td>15</td>
</tr>
<tr>
<td>Headaches</td>
<td>4</td>
<td>9</td>
<td>6</td>
<td>8</td>
<td>7</td>
<td>14</td>
<td>8</td>
<td>12</td>
</tr>
<tr>
<td>Loss of memory</td>
<td>2</td>
<td>5</td>
<td>4</td>
<td>6</td>
<td>6</td>
<td>11</td>
<td>5</td>
<td>10</td>
</tr>
<tr>
<td>Occupational fatigue</td>
<td>4</td>
<td>8</td>
<td>5</td>
<td>9</td>
<td>7</td>
<td>16</td>
<td>8</td>
<td>16</td>
</tr>
<tr>
<td>Sore throat</td>
<td>2</td>
<td>6</td>
<td>3</td>
<td>7</td>
<td>3</td>
<td>7</td>
<td>4</td>
<td>6</td>
</tr>
<tr>
<td>Vision problems</td>
<td>1</td>
<td>5</td>
<td>3</td>
<td>6</td>
<td>6</td>
<td>9</td>
<td>5</td>
<td>13</td>
</tr>
</tbody>
</table>

Figure 1: Comparative analysis of various disorders among workers of screen printing units

Conclusion

This survey arrived at the conclusion that organic solvents used in screen printing have drastic effects on the health of the workers. Hypertension, Dizziness, visionary and skin problems were found to be the most common effects while fatigue was related to the heavy workloads in congested shifts (Åhsberg et al., 2000). About 57% worker related to printing field showed the problem of occupational fatigue as compared to the workers of other fields like packaging units of cutlery industries and shopkeepers of 'Akbari mandi'. Similar findings have also been reported by Hussain et al. (2013) while assessing health status of workers of a cutlery industrial complex from Pakistan.
environments. These effects were profound with an increase in age. Raw handling of the solvents without proper safety measures and inhalation of solvent vapours are the major reasons of the exposure. Improvement of the ventilation system of the working environments as well as training of the workers for biosafety would reduce exposure to the organic solvents.

REFERENCES


