CANCER OCCURRENCE AMONG TEXTILE INDUSTRY WORKERS: VITAL STATISTICS

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ABSTRACT: Textile industry is one of the biggest industries of the world. Workers engaged in the textile industries around the world are exposed to different sets of chemicals including dyes, solvents, finishing chemicals and metals including Cu, Cr, Ni etc. Many of these chemicals including dyes have been identified as carcinogenic to humans. The exposure of the workers to such carcinogenic chemicals results in occurrence of different diseases including cancer. Different studies so far have been conducted to assess the cancer occurrence among textile industry workers around the world. In this paper an attempt has been made to compile those studies on the basis of different parameters.

Keywords: Textile Industry, Workers, Cancer, Mesothelioma, Mortality, Endotoxin, Cotton Dust.

INTRODUCTION

In India, textile industry is one of the oldest and largest export industries. Textile industry occupies a vital place in the Indian economy as India is the world’s second largest producer of textile. The manufacture of textiles, probably has its origin roughly around the year 8000 B.C. when the organic materials (usually consisting of various grasses and reeds) were the first substances used to make a form of yarn. In recent years, textile industry has grown at a very fast speed to fulfill the needs of the country. The textile industry, after agriculture, is the only industry that has generated almost 35 million employments and is the second largest employment generating sector in India. The production of textile includes different processes like spinning, weaving, knitting, dyeing and finishing of various natural and synthetic fibres.

Millions of workers are engaged in textile industries world over. There are important differences between workers depending on whether they are hired by large factories, hired by small units or work under sub-contracts from their homes. There are also self-employed garment makers who produce for local customers or markets. Available evidences indicate that the use of contract labour in the export garment sector is widespread in a number of countries including Bangladesh, India and Pakistan. Garment production at home is often one of the few options available to poor women. Women are noted to be able to earn income but also be at home to carry out other domestic duties along with the work. Worldwide lakhs of women engage themselves in some kind of work related to textiles.

The textile industries are using different kinds of dyes including the most commonly used Azo dyes which are aromatic hydrocarbon derivatives of benzene, toluene, naphthalene, phenol and aniline. Exposure to certain chemical agents in occupational settings such as textile industries has been identified as carcinogenic. Textile industry workers have been monitored for the occurrence of cancer in the recent past four years [1-19]. The previous studies which were conducted before 2010 were also centralized to assess the cancer occurrences among textile industry workers [20-62]. The oldest study of 1950 which was found titled “Statistical study of occupational cancer among textile workers” [62] was also describing the statistical analysis of cancer occurrence. In this paper an attempt has been made to compile the data based on 62 studies on cancer occurrence among textile industry workers.

OCCUPATIONAL SETUPS
Textile industry setups where the workers are not using proper protection equipments have been found to be carcinogenic. As textile industries are using different types of dyes and solvents, the workers are directly exposed to these carcinogenic chemicals. Most of the big textile industry units are divided into different sections based on the type of the work viz. dyeing section, spinning section, cutting section, weaving section, finishing section etc. In textile industry units, there is a considerable difference in the heights of stools and tables used for different operations such as cutting, weaving and ironing. The workers have to sit in an uncomfortable position for entire work day due to this mismanaged sitting arrangement. The stools without a backrest are unable to provide a support to the back of the workers. In many of the units, the level of lighting is low and improperly placed which leads to inadequate light at the target site of work. This also leads to strain on the eyes which decreases the efficiency of the worker. Most of the workers in textile industries were working on contract basis and found to often work in two shifts. In small scale textile industries, the workers are less in number and are often found to be working in different sections. Thus, industrial setups and the number of workers also affects the type of exposure of the workers.

**OCCUPATIONAL EXPOSURES**

Textile manufacturing industry has been classified as possibly carcinogenic to humans (group 2B) by International Agency for Research on Cancer (IARC). A number of studies have been conducted on textile industry workers related to the aspect of cancer occurrence. Workers in the textile industry are exposed to a number of chemicals, especially those engaged in the activities of dyeing, printing and finishing. Chemicals based on benzidine, solvents and fixatives, crease-resistance agents releasing formaldehyde, flame retardants that include organophosphorous and organo-bromine compounds and antimicrobial agents are used in textile operations. The use of such compounds may be harmful to the workers. Studies have revealed links between exposure to formaldehyde and nasal cancer. This exposure is also in connection with brain cancer and leukemia. In the long run, exposure to formaldehyde could lead to respiratory difficulty and eczema. Contact of the chemicals with skin as well as inhalation of the chemicals can lead to several serious health effects. Textile industry workers are exposed to a definite set of chemicals on the basis of the type of the job they perform. Many workers are exposed to dyes who are employed in the dyeing section of the textile industry. Dyes may be of different chemical formulations in which azo, disperse and aniline dyes are the most dangerous categories of dyes to work with. As the workers are in direct contact with the dyes while working, these can be the most penetrating chemicals in the industry. The presence of various impurities in these dyes has also been reported to contribute to the mutagenicity of the dyes. Apart from dyes, the workers are exposed to a number of salts, bleaching agents, acids, alkalies, finishing chemicals, solvents and heavy metals including Copper, Cadmium, Zinc, Chromium, iron etc. In the dyeing, printing and finishing processes, workers are exposed to multiple exposures. Solvent is another class of chemicals having mutagenic and toxic properties. Textile industries also use different kinds of solvents to dissolve several substances. Moreover, solvents also pose a major carcinogenic effect by direct contact with the subjects. Apart from these chemicals, the workers are exposed to fine mixed dust of fibres. This exposure to the fine particle fibre dust has shown its hazardous effect in various animal models. Occupational exposure in textile industries may result in genetic damage which is further associated with potential health hazards. The workers of textile industries were found prone to a number of allergic reactions from different chemicals and suffer from serious health problems. Thus, textile industry poses threat to various kinds of occupational diseases. Different researchers have worked on a number of dyes and have shown their mutagenic and genotoxic potential in different animal models including mice, Drosophila, earthworms, Bacillus subtilis and Daphnia. In a study, Disperse Blue-124 and Disperse Red-1 were found to increase lymph node swellings in mice revealed by local lymph node assay (LLNA). Another study established a positive correlation between frequency of micronucleated polychromatic erythrocytes in bone marrow of mice and concentration of Direct Red-81 and Acid Blue-61. Thus, these dyes have been proved to have hazardous effect on different animal models. It is again very important on the part of the industrial managements and the workers to be aware of the contaminants present in the environments of textile industries.

**REVIEW OF THE STUDIES**

A. Frequency of conducted studies
In this paper 62 studies were reviewed for the occurrence of occupational cancers among textile industry workers. Oldest study [62] found was dedicated to give the statistics for the cancer mortalities among textile industry workers. Figure 1 shows the number of studies conducted in each year from 1950 to 2014. In this widespread review, maximum studies were found to be conducted so far in the year 2006. A total of seven studies were found to report the occurrence of cancers among textile industry workers. After 1950, two studies each were found in the years 1980, 1990, 2003 and 2005. Three studies on cancer occurrence were conducted per year in 1988, 2004, 2007, 2008, 2010, 2011 and 2012. A number of four studies are reported in 2013. Maximum of seven studies were reported in 2006. In this review, six most recent studies on cancer occurrence were found in 2014. This data (Figure 1) correlates with the need to conduct such a study on occurrence of cancer among textile industry workers with increasing industrialization and needs of the countries in the textile sector.

**Figure 1:** Frequency of studies conducted on cancer occurrence among textile industry workers from 1950 till 2014. Maximum number of 7 studies were conducted in year 2006. Total number of studies taken in the review, 62

### B. Reported cancer types

Studies have reported different types of cancers among textile industry workers. There are reports of lung cancers, breast cancer, mesotheliomas, endometrial cancer, esophageal cancer, stomach cancers, bladder cancer, colorectal cancer, thyroid cancer, testicular cancer, nasal cancer and oral cancer (Figure 2). Out of these reported cases of different types of cancer, lung cancer has been reported in 25 studies [2-6, 9-12, 15-16, 18-20, 24, 26, 37, 44-45, 49, 52, 56, 57, 58, 60] out of 62.

**Figure 2:** Reported cancer types among textile industry workers

Mesothelioma is an aggressive cancer type affecting the membrane lining of the lungs. Occurrence of this type of cancer has been associated with exposure to asbestos. Malignant mesothelioma is the most serious of all asbestos related diseases. Exposure to asbestos is the primary cause and risk factor for mesothelioma. This cancer type has been reported in 5 studies [14, 20, 35, 44, 57] out of 62. Similarly, six studies have reported respiratory ailments and cancer occurrence among textile industry workers [8, 41, 44, 48, 55-56] (Figure 3).
In our previous study, exposure to fibers has also been reported to cause genotoxicity [63] and oxidative stress among textile industry workers. Cotton dust is often present in the air during cotton handling and processing in the industries. Cotton dust may contain different substances including fibers, bacteria, fungi, soil, pesticides, non-cotton matter, and other contaminants (Table 1) that may have accumulated during growing, harvesting, and subsequent processing or storage periods.

Table 1. Classification of cotton dust on the basis of the particle size (μm)

<table>
<thead>
<tr>
<th>Type</th>
<th>Size of the particle (μm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Trash</td>
<td>Above 500</td>
</tr>
<tr>
<td>Dust</td>
<td>50-500</td>
</tr>
<tr>
<td>Micro dust</td>
<td>15-50</td>
</tr>
<tr>
<td>Breathable dust</td>
<td>Below 15</td>
</tr>
</tbody>
</table>

The Micro-dust comprises about 60% fibre fragments, leaf and husk fragments, 20% sand and earth and 20% water-soluble materials. The high proportion of fibre fragments indicates that a large part of the micro-dust arises in the course of processing. Exposure to this type of dust can be harmful and can cause a variety of health implications.

12 studies out of 62 report the exposure of textile industry workers to cotton dust [8, 16, 22, 24-26, 29, 31-32, 34, 41, 56]. Gram-negative bacteria and their endotoxins are present on all parts of the cotton plant. Endotoxins are known to activate pulmonary macrophages that in turn send neutrophils into the airways. Platelets also start accumulating in the pulmonary capillaries. The presence of these cells allows for the initiation of acute and chronic inflammation. A dose-response relationship has been found amongst endotoxin and chest tightness, and reduction in air flow. In the present review, 11 studies report the exposure to endotoxin in textile industry workers [2-5, 8-9, 15-16, 18-19, 26].

C. Studies on Mortality

With the increased industrialization and globalization, more and more workers were employed in the textile industry sector since 1950. With an enormous increase in the overall number of the workers in the industry, exposure to different carcinogenic chemicals also increased and the effects of this exposure were seen in coming years as cancers. Different authors [8, 11, 12, 14] report mortality studies in textile industries due to any type of cancer. 13 studies [8, 11, 12, 14, 20, 28, 35, 44, 49, 50, 54, 57, 60] out of 62 were found to be based on mortality of the workers in textile industries. This is a reason to worry and to be aware about the possible carcinogenic effects of the chemicals being used by the textile industry workers.
D. Gender based studies
Textile industries employ both male and female workers for different sections as per the skills. 25 studies out of 62 are based on occurrence of cancers in female textile industry workers [1-5, 7, 9, 10, 13, 15, 16, 17, 18, 25-27, 29-34, 37, 40, 54]. In this context, it is important to mention the contribution of women in these industries.

E. Cohort studies
Different cohort studies have been conducted with a very wide sample amount. These kinds of studies are very important as far as hazard ratio (HR) is concerned in an industry. Checkoway et al. [15] employed a cohort of 602 cases. Similarly, a cohort study was done on 162 cases of biliary tract cancer (BTC) cases [30]. 1456 lung cancer cases were undertaken in another study [4]. Thus, cohort studies give evidence to of a suspected association between cause and effect. The advantage of prospective cohort study data is that it can help determine risk factors because it is a longitudinal observation of the individuals through time and the collection of data is done at regular intervals.

CONCLUSION
Textile industries are using a variety of chemicals including dyes, solvents, finishers and optical brighteners. Workers exposed to these chemicals are at a higher risk of developing cancer. Different types of cancers have been reported by several researchers among textile industry workers including lung cancers, breast cancer, mesotheliomas, endometrial cancer, esophageal cancer, stomach cancers, bladder cancer, colorectal cancer, thyroid cancer, testicular cancer, nasal cancer and oral cancer. As, textile industry workers are developing such types of cancers, the workers should avoid direct contact with the chemicals using proper protection equipments.

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REFERENCES
[16] Gunay E, Beser A. Sociodemographic characteristics of women who engage in early breast cancer diagnostic behaviors, the case of Turkish women working in a textile factory. AAOHN.J. 2011, 59, 421-428.


