A study of the Breathing problems among Silk Industry Workers in India

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ABSTRACT

The main objective of the present study is to find out the factors associated with the deterioration of respiratory function among Silk Industry Workers.

The sample consisted of 345 above the age of 20 years and 335 Non Silk Industry Workers of same area were studied. All the respondents were interviewed and measured Statistical analyses like Chi-square and odds ratio was done.

Univariate analysis of the factors for symptomatic byssinosis showed that dusty worksites, heavy smoking and duration of work were significant. Logistic regression analysis showed that working in the scouring (odds ratio 12.6) and spinning, heavy smoking (odds ratio 14.6) and more than 10 years of service were independent significant risk factors.

Keywords: occupational health, respiratory functions, Textiles Workers, working environment

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INTRODUCTION

Silk is a highly valued animal fiber used almost entirely for the production of high quality textiles. India has unique distinction of being the only country on the world producing all the four cornmercially known varities of silk, viz, mulberry, tasar, eri and munga. India ranks fourth among the leading mulberry silk producing countries of the world accounting for more than 7 percent of the total world production (1984) (Bajpai & Shukla 1998).

Occupational diseases reflect health hazards brought on by exposure within the work environment. Due to lack of education, unaware of hazards of their occupations, general backwardness in the sanitation, poor nutrition and climatic proneness of this geographic region to epidemics aggravate their health hazards from work environment (Wang et al. 2003).

In 1956, an epidemiological study in the cotton industry in the UK documented the occurrence of respiratory problems like byssinosis (Schilling 1956) Worldwide, India is the second largest producer of textile goods, which account for 20% of the national industrial output. Twenty million workers are employed in 1175 Textile mills across the country, representing a major occupational group (Roach & Schilling 1960). Exposure to cotton dust has long been associated with adverse respiratory effects and diminished lung function, which is most evident as byssinosis, a chest tightness experienced by workers on the first day back after a weekend or vacation break (Schilling 1956, Roach & Schilling 1960 and Berry et al. 1973). Most studies indicate that adverse respiratory effects are more closely associated with cotton fiber dust. (Castellan et al. 1984, 1987 and Kennedy et al. 1987).

A respiratory problem has been reported from most countries with a textile industry. Its prevalence varied from 2% in the USA in the late 1970s, 4 to 63% in England in the late 1950s.(Schilling 1962) While the prevalence is decreasing in developed countries, it continues to be high in developing countries. In Turkey it was 14.2% in the past decade.(Altin et al. 2002) There are few studies on

Respiratory problems among textile workers in India(Murlidhar et al. 1995, Mathur et al. 1993, Barjatiya et al. 1990 and Jaiswal 2004).

Nilvarangkul, 2006 showed that 63% of the women had respiratory problems such as asthma due to cotton dust, or respiratory irritation due to inhalation of chemicals used to bleach silk and cotton. The use of chemical dyes to colour the silk and cotton caused some women to develop allergic skin rashes. Beckett, 2000 reported that work-aggravated asthma is caused by mechanical irritation of the airways from non allergenic dust and by chemical irritation. Most inhaled dust is filtered out by the upper airways or cleared by the ciliated epithelium of large airways. If these defenses are overwhelmed by fine dust, the lung reacts with an alveolar and interstitial inflammation that may cause adverse effects on respiratory system.

Murlidhar et. al, examined 273 cotton textile workers in Mumbai and found that 54 of 179 workers (30%) in dusty sections and 16 of 94 workers (17%) in non-dusty sections had respiratory problems. They also developed a questionnaire for the assessment of respiratory problems (Murlidhar et al. 1995,) In Uttar Pardesh, the textile industry is more than a century old but no study has assessed the magnitude of or the risk factors for respiratory problems. Present paper carried out a study to find out the risk factors associated with the occurrence of respiratory problems.

SUBJECTS AND METHODS

The Bhadohi Textile Corporation Limited has three textile mills. Present paper included all men, 20-49 years of age who had been working in the factory for at least more than 3 months. The details of the sample studied are shown in Table 1. The analysis was done for 345 subjects—82 from the spinning section, 57 from the Scouring section 90 from the weaving section and 116 from the non-dusty sections. Present paper detected 127 cases of respiratory problems, of which 58 had associated chestpain with cough. For the risk factor analysis, 69

cases with only symptomatic respiratory problems were included. To choose controls a population of workers not working in Silk Industry was selected (n=335). The Workers and controls were matched for age, sex and socio economic status. Silk Industry Workers and controls were divided into three age groups, mainly 20-29 years, 30-39 years and 40-49 years. Subjects were chosen by purposive stratified sampling technique.

All the sampled individuals were interviewed with the help of an interview schedule prepared by adopting the standardard Questionnaire (Florey & Leeder 1982) and the Byssinosis Questionnaire used by Murlidhar et. al, 1995 Before the interview, an informed consent was obtained from each worker by explaining the nature of the study and the confidentiality of the information required.

Information was collected on age, smoking behaviour, occupation, overcrowding and fuel used for cooking at home. Weight and Height was accurately recorded, using standard techniques (Weiner & Lourie 1981). For the type of fuel used, the predominant fuel used over the past year was considered. Those smoking >10 cigarettes or bidis per day for the last 20 years or more were considered heavy smokers (smoking index of 20 pack-years). Overcrowding was classified according to the number of persons per room. Pulmonary function tests done for all the subjects included forced vital capacity (FVC), forced expiratory volume in the first second ($FEV_{1.0}$) and $FEV_{1.0}$/FVC. Three readings were taken after explaining and demonstrating the test procedure. The best of three readings was considered for analysis. The predicted value of $FEV_{1.0}$ for the concerned population was calculated and 80% of the predicted value determined.

Statistical analysis

The data were analysed using SPSS (Statistical Package for Social Sciences) version 13.0. Chi-square and odds ratios (ORs) with 95% confidence intervals (CI) were calculated for univariate analysis. Subsequently, the significant factors on univariate analysis were entered into a logistic regression model and the adjusted ORs with 95% CI obtained. Independent sample t-test was used for the analysis of pulmonary function tests.

RESULTS

Silk industry has been identified as traditional industries under the unorganized sector which functions on a seasonal basis. In this study population consisted of 127 cases and 335 controls. The socioeconomic status of all the workers was similar. Univariate analysis of the risk factors for respiratory problems showed that dusty worksites such as the spinning, scouring and weaving sections, heavy smoking and duration of service >10 years (Table 2) were significant. Body mass index (BMI), fuels used for cooking and overcrowding were not found to be statistically significant.

Table 1. Distribution of study sample

Total workers in the factory	1650
Excluded	1020: male Workers in the factory, those <20 years of age and with a duration of exposure <3 months.
Remaining workers,	630
34% of this sample were taken	345
Distribution of this sample in different sections of the factory	Spinning=82, Scouring=57, Weaving=90, Non-dusty=116.
Respiratory Problems	127
No Respiratory Problems	174
Excluded because of chronic bronchitis	44
Control population	335
Mean age of TW males	31.87
Mean age of NTW males	32.45

Table 2. Univariate analysis of risk factors for respiratory problems

Factors	**Silk Industry Workers (%)**	**Respiratory Problems (%)**	**Controls (%)**	**Chi-square**	**Odds ratio (95% CI)**
	(n=345)	**(n=127)**	**(n=335)**		
Work site					
Dusty section	66.4	78.5	84.6	6.3*	3.9 (1.3, 10.9)
Non-dusty section	33.6	21.5	15.4		1
Sections					
Scouring	23.8	25.7	11	10.8*	11.3 (1.9, 19.6)
Spinning	16.5	14.7	12.7		5.6 (1.9, 21.3)
Weaving	26.1	54.6	63	5.1*	3.2 (1.1, 9.7)
Non-dusty	33.6	5	13.3		1

Smoking					
Heavy smokers	28.6	59.6	46.4	11.5*	14.6 (1.7, 19.5)
Others	72.4	41.4	53.6		1
Duration of service					
>10 years	66	76	32.2	5.8*	3.4 (1.08, 5.8)
<10 years	34	24	67.8		1
Body mass index					
>25	15.5	17	8.8	1.6	1.3 (0.7, 3.2)
<25	84.5	93	92.2		1
Fuel used for cooking					
Wood and kerosene	49.8	66	53.9	1.7	0.5 (0.5, 2.8)
Gas	50.2	44	46.1		1
Overcrowding					
Present	77.8	61.7	63.1	0.6	0.9 (0.5, 2.3)
Absent	22.2	38.3	36.9		1

***p<0.05**

A logistic regression analysis (backward step-wise) showed that dusty worksites such as the spinning, carding and weaving sections, heavy smoking and duration of service >10 years were independent significant risk factors. Workers in the scouring sections had 11.3 times (95% CI: 1.9, 19.6), spinning sections had 5.6 times (95% CI: 1.9, 19.6) and those in the weaving section had 3.2 times (95% CI: 1.1, 3.6) higher risk of developing respiratory problems compared with those working in the non-dusty sections. Workers with a smoking index of >20 pack-years (heavy smokers) had a 14.6 times (95% CI: 1.7, 19.5) higher risk for respiratory problems. Also, workers with a duration of service >10 years had a 3-fold (95% CI: 1.1, 5.6) higher risk compared with those with <10 years of service. Analysis of pulmonary function tests showed that there was a marginal but statistically insignificant difference in all the parameters between the cases and controls (Table 3).

Table 3. Analysis of Pulmonary function test

Test	**Mean**	**p value***
Forced vital capacity (FVC) (lit.)		
Cases	2.81	1.9*
Controls	3.21	
Forced expiratory volume in one second (FEV 1.0) (lit.)		
Cases	2.21	1.9*
Controls	2.66	
$FEV_{1.0}$/FVC (%)		
Cases	87.5	0.7
Controls	86.4	

* Independent sample t-test $p<0.05$ considered significant

DISCUSSION

Respiratory diseases are characterised by variable airflow limitation and airway hyper-responsiveness. Once sensitised, exposure to very small concentrations of the substance will cause a reaction. The long term effects can be significant in terms of employability. Even if redeployment is possible, employment in lesser skilled jobs and reduction in income are often the outcomes. With the lung functions affected for a prolonged exposure to the Industrial environment, the nutritional status and body's soft tissue stores are also affected, thus affecting the health status of the Industrial workers. The Textile Industry in itself is a big determinant of the overall health and well being of its workers. It provides job opportunities but with a price tag.

Though dust has been established as the causative agent for respiratory problems, it is important to determine the other risk factors associated with the occurrence of the disease so as to implement comprehensive preventive measures. Present paper used the WHO definition of respiratory problems and excluded all those who had chronic bronchitis. Kamath et. al, have reported that chronic bronchitis is a separate entity among textile mill workers (Kamath et al 1981). Gupta, 1969 in a review of respiratory problems found that many studies did not exclude patients with chronic bronchitis and this might affect the results.

In the past decade, studies from Turkey and China have shown that dust levels above the recommended values are associated with a high prevalence of respiratory problems (Altin et al. 2002 and Christiani et al. 2001). The risk factors identified in our study such as working in the scouring, spinning and weaving sections, long exposure and heavy smoking have been reported by others as well. A study from France showed an OR of 7.3 for an exposure of 20 years compared to an OR of 3.4 for an exposure of 10 years in our study. Similarly, they had an OR of 3.7 for the dustiest sections compared with 11.0, 4.7 and 2.1 found in our study for the scouring, spinning and weaving sections, respectively. The French study did not find any association with smoking though our study did

(Massin et al. 1991). A study from Lancashire, UK reported that the prevalence of respiratory problems like byssinosis symptoms was significantly related to years worked in the silk industry, exposure to dust, work area, ethnic origin and smoking habits (Cinkotai et al.1988). However, another study from Lancashire showed that byssinosis was rare among workers engaged in thread weaving (Raza et al. 1999). In a study from Kanpur, only dustiness and length of exposure were important contributory factors to the occurrence of respiratory problems. The risk of respiratory problems among workers in the card room, blow room and waste plant sections and those who had an exposure of >5 years was nearly 3 times higher compared to workers in other sections of the mill and or those with <5 years of exposure (Mathur et al 1993). Besides the above-mentioned studies, there are also descriptive and comparative studies, in which some attempt has been made to identify the risk factors. In a study from Kishangarh, India it was reported that a majority of workers had developed the disease after 16 years of exposure, unlike in our study where the risk was high among those with 10 years of exposure. The disease was more common among smokers and severe among those who were consuming 15 pack-years of cigarette/bidis, (Barjatiya et al 1990) comparable with our results.

This variation of results may be due to varying definitions of the disease. In another study from Mumbai, it is reported that the incidence of byssinosis was 30% among workers in dusty departments such as spinning, winding and weaving, compared with 17% in those working in the less dusty sections. Similarly, our observation of exposure of 10 years (OR=3.4) as a risk factor is comparable with the finding of the Mumbai study in which 45% of the workers who had >20 years of service had respiratory problems compared with 24% among those who had <10 years of service (Murlidhar et al. 1995).

Pulmonary functions showed a decline in the workers having respiratory problems, but it was not statistically significant. Other studies have reported either an insignificant decline in pulmonary functions or a decline independent of the symptoms of respiratory problems. A study from California analysed the acute effect of cotton gin environment on lung functions and found no correlation

between the symptoms of respiratory problems and objective decrease in $FEV_{1.0}$ (Larson et al 1981). The same researchers conducted a prospective, longitudinal study over a period of 4 years and reported an insignificant decline of $FEV_{1.0}$, $FEV_{1.0}$ /FVC and FEF (forced expiratory flow) 25%–75%. They failed to find any detrimental effect of the cotton gin environment on the rate of decline and reported the decline to be independent of the symptoms of respiratory problems (Larson et al 1989). In a study from France, only peak expiratory flow was taken into consideration and the absence of a constant link between Monday tightness and drop of peak expiratory flow was reported (Massin et al 1991). In textile industries in north Portugal, workers exposed to cotton fibres in spinning areas had the highest prevalence of symptoms and reduction of the $FEV_{1.0}$. There were no cases of respiratory problems among workers in the weaving areas. Smoking habits were related to a reduction in $FEV_{1.0}$ and severity of respiratory illness but not to the presence of byssinosis (Da Costa et al 1998). A 15-year longitudinal study from Shanghai, China reported that cotton workers had small, but significantly greater, adjusted annual declines in $FEV_{1.0}$ and FVC than did silk workers. Years worked in textile mills, high level of exposure to endotoxins, and across-shift drops in $FEV_{1.0}$ were found to be significant determinants of a longitudinal change in $FEV_{1.0}$, after controlling for appropriate confounders. Moreover, there were statistically significant associations between excessive decrease in $FEV_{1.0}$ and respiratory problems, chest tightness at work and chronic bronchitis in Silk industry workers. It appears that longitudinal studies of 10–15 years' duration may be required to study the effect of respiratory problems on lung functions (Christiani et al 2001). The results of our study confirm the findings of some previous studies. There is a need for textile mills to reduce the dust levels in the scouring, spinning and weaving sections. Workers should be encouraged to use protective measures such as face-masks. Since heavy smoking is a risk factor for respiratory problems, measures should be taken to reduce smoking among Silk Industry Workers. Rotating workers from dusty to non-dusty sections on a regular basis might reduce the length of exposure to higher dust levels, thereby reducing the risk.

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