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ORIGINAL ARTICLE

Prevalence of Respiratory Symptoms among Cotton Mill Workers

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Abstract:

Introduction: *Cotton textile mill is one of the largest sectors providing a prominent source of growth in the rapidly developing economy of Bangladesh. This sector employs about 5 million workers of whom the majority (80%) are the women. During the processing from fiber to fabric, the workers are constantly at risk of suffering from various respiratory problems. The study was carried out to evaluate the association of long term exposure to organic cotton dust with different respiratory symptoms in the workers. Based on the results, the study may provide information on respiratory health risks and finally, the data can be used to help the policymakers in executing appropriate strategy regarding the work environment.*

Materials and Methods: *This cross sectional study was conducted in a cotton mill at Gazipur, Dhaka, Bangladesh for 1 year. Three hundred and eighty- four workers had participated in this study. Inquiry was made regarding respiratory symptoms with the help of a pretested questionnaire. An air quality monitor was used to measure the amount of dust (PM 2.5) in the workplace.*

Results: *73.18% of workers had one or more respiratory symptoms, 54.2% had cough, 31.8% had phlegm production. Breathlessness was complained by 27.9%, chest tightness by 24.2% and wheezing by 14.3%. Only one upper respiratory tract symptom was considered which was runny nose; 47.1% of workers reported about it.*

The blow room workers were more affected (47%) in comparison to ring and packaging room workers. Working section had significant association with respiratory symptoms. Using biomass fuel came out as a potential confounding factor. Most importantly, it was demonstrated that the level of PM 2.5 varied in the different working sections based on activities of the processing of cotton, and it significantly had a greater impact on respiratory symptoms.

Conclusion: *The prevalence of respiratory symptoms was higher among the workers exposed to cotton dust. Working section, level of PM 2.5 and use of biomass fuel in some respondents are some of the significant risk factors for the presence of symptoms.*

Keywords: *Textile mill, cotton dust, respiratory symptoms, PM 2.5.*

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Introduction:

We take for granted that we breathe, but respiratory diseases impose an enormous global health burden. Before the pre-covid period, more than 1 billion people altogether used to suffer from either acute or chronic respiratory conditions. Only

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cardiovascular diseases are second to respiratory diseases.[1] According to a report of the Forum of International Respiratory Societies (FIRS) 2017, over 50 million people are struggling with occupational lung diseases. Bangladesh being also under this trap as a promising middle-income country, faced 11% death due to respiratory diseases among all non- communicable diseases (NCDs).

Occupational lung diseases are a group of diseases due to long-term and repeated exposure to certain job-related irritants that may persist even after exposure ceases. The textile industry is one such occupational group. This sector provides yarn which is the primary raw material to produce fabrics. During carding, blowing, spinning and weaving of cotton fibers, workers are exposed to cotton dust. Particles with aerodynamic diameter between 0.1- 2.5 μm are labeled as fine particulates because they are lodged in the gas-exchange area of the lung.

Several types of lung disease have been reported which can be linked with cotton dust exposure.[2] Several centuries ago a syndrome was described which was observed due to the adverse effects of exposure to cotton dust on the lung which was later called as byssinosis.[3] Respiratory symptoms are the earliest response to cotton dust exposure, followed by changes in lung function.[4] Cough, phlegm, shortness of breath, nasal and eye irritation, and work exacerbated asthma had been associated with occupational exposure to the raw materials, cotton dust, and products of several chemicals.[5]

Several different other studies showed large changes in FEV1 before and after a work-shift (cross-shift drop in FEV1).[6,7] It has been studied that 25-45% of patients with chronic obstructive pulmonary disease (COPD) worldwide have never smoked, hence a there is a growing interest in the contribution of workplace exposure to obstructive airway disease.[8]

Information is scarce concerning the health effects of cotton dust exposure in our country. We conducted an epidemiological study aiming to find out the prevalence of respiratory symptoms among an occupational group working in a cotton spinning mill located at Gazipur, Dhaka, Bangladesh and also to observe the associated factors with the prevalence of these symptoms as well as to measure cotton dust level in the workplace by an air quality monitor.

Materials and Methods:

Study population: The frame of this study is a cotton textile mill located at Gazipur, Dhaka, Bangladesh. The total workforce in the factory numbers 3000.

Selection of participants:

Inclusion and exclusion criteria: Study subjects were workers of 18 years and above of either sex having at least 2 years of experience in the production chain willing to take part in the study. Participants were excluded on the basis of:

1) Smoking status (Who has smoked 100 cigarettes in his or her lifetime and who currently smokes cigarettes);
2) Previous exposure to other occupational dust such as silk textile mill, coal dust, silica;
3) Those with pre-existing lung disease diagnosed by a registered physician.

Sample size: Sample size was being adjusted to three hundred and eighty- four using the formula $n=z^2\ pq/d^2$. The prevalence of respiratory symptoms was taken as 51% according to previous work.[9] The minimal size of the sample with a margin of error of 5% was 384 subjects.

Sampling method: Non-probability purposive sampling.

Study design: It was a cross-sectional study which was carried out from July 2018 to June 2019.

Data collection: Before performing the study prior permission of the main authorities (Managing Director) of the mill was taken and also the detail of the study was explained to each participant and informed consent from the respondents was obtained. Then data were collected through face-to-face interviews with the workers.

Data was collected using a preformed standardized questionnaire that was developed and modified.[10,11] Personal information, respiratory symptoms (cough, phlegm, breathlessness, chest tightness, wheezing, runny nose), detailed work history, history of cooking fuel type at home and passive smoking at home were also documented.

Cough without sputum was defined in this study occurring on most of the days in a month for three consecutive months or more in a year. Phlegm as production on most days in a month, for three consecutive months or more in a year. Chest tightness was defined as feeling ever at any time in the last 12 months. Dyspnea 2+, any attack of wheezing in the last 12 months and runny nose was documented.

Physical measurements including weight, height, and BMI of each subject were noted.

PM 2.5: The dust level of the working environment was measured by an air quality monitor. Air quality was checked in each section for two days on different occasions. The highest recorded value among all the readings displayed in the monitor was taken.

PM2.5 standard:

Good: PM2.5 < 12 ug/m^3

Moderate: 12 ≤PM2.5 < 35.5 ug/m^3

Unhealthy for Sensitive Groups: 35.5 ≤PM2.5 < 55.5 ug/m^3

Unhealthy: 55.5 ≤PM2.5 < 150.5 ug/m^3

Very Unhealthy: 150.5 ≤PM2.5 < 250.5 ug/m^3

Hazardous: PM2.5 ≥250.5 ug/m^3

The data processing and analysis was done by SPSS-23 version. Chi square test, unpaired student's t test, and fisher's exact test were used to find out the differences of different variables. P value of less than 0.05 was considered statistically significant.

Results:

Socio-demographic characteristics of the study participants:

Total 384 participants were selected by purposive sampling. The mean ± SD of age (in years) was found as 25.1 ± 7.8. Both males and females participated in the study and among them 167 (43.5%) were males and 217 (56.5%) were females.

Working area of the study participants:

Workers were divided into 3 groups according to their area of work- the blow, ring and packaging section. The maximum number of workers being found from the ring room (144) and the percentage was 45.8% (Fig 1), then were the blow room participants (37.5%) followed by packaging section (16.7%)

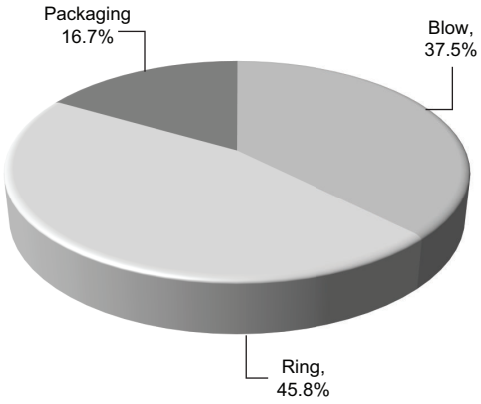

Fig.-1: *Distribution of study subjects in different working sections*

PM 2.5 level was monitored in three working sections with the help of an air quality monitor (Table I).

Table-I

PM 2.5 level at different sections of mill

Section	PM 2.5
Blow	125.0
Ring	19.0
Packaging	25.5

Unit = μg/m^3

Prevalence of respiratory symptoms among the study participants:

About 73.18% of workers reported one or more respiratory symptoms and were considered symptomatic in this study. Out of all, 208 workers complained of cough which was the biggest percentage found among all symptoms (54.2%). Distribution of other symptoms are shown in table II.

Table-II

Distribution of respiratory symptoms of the study subjects (n=384)

	Frequency (n)	Percentage (%)
Runny nose	181	47.1
Cough	208	54.2
Phlegm	122	31.8
Breathlessness (grade 1+)	107	27.9
Chest tightness	93	24.2
Wheezing	55	14.3

Distribution of respiratory symptoms among demographic variables:

During the subgroup analysis, age had no significant association with respiratory symptoms, neither any gender-based difference as well.

Comparison between different working sections with regard to the presence of respiratory symptoms:

Significant association was observed between different working sections and respiratory symptoms. P value was found <0.001 which is statistically very significant (Table III). Among all the respondents, blow room workers had more respiratory symptoms (47%) compared to the ring and packaging section. Chi-square test was done to measure the level of significance

Table-III

Distribution of respiratory symptoms in different working sections (n=384)

Section	Respiratory symptoms		p-value
	Yes (n=281) (%)	No (n=103) (%)	
Blow	132 (47.0)	31 (30.1)	
Ring	104 (37.0)	58 (56.3)	<0.001
Packaging	45 (16.0)	14 (13.6)	

Confounding factors among the workers:

In our study, certain confounding factors became the part. 6.5% of workers found out to be using biomass fuel for cooking purpose. Another confounding variable was passive smoking, the percentage of which was quite large (22.4%). About half of the workers (55.7%) used personal protective mask during their work. Analysis of the use of personal protective mask had no significant association.

During the analysis of whether there is any significant association of use of biomass fuels and passive smoking with respiratory symptoms, fisher's exact test was done. Significant association was found among the biomass users ($p < 0.05$) and no significant association found among the passive smokers (Table IV, V). Fisher's exact test was done to measure the level of significance.

Table-IV

Distribution of respiratory symptoms according to biomass fuel use (n=384)

Biomass fuel	Respiratory symptoms		p-value
	Yes (n=281) (%)	No (n=103) (%)	
Use	23 (8.2)	2 (1.9)	0.033
Not use	258 (91.8)	101 (98.1)	

Table-V

Distribution of respiratory symptoms according to passive smoking (n=384)

Passive smoker	Respiratory symptoms		p-value
	Yes (n=281) (%)	No (n=103) (%)	
Yes	68 (24.2)	18 (17.5)	0.161
No	213 (75.8)	85 (82.5)	

Discussions:

The effect of cotton dust on lung can be wider; ranging from non-specific respiratory symptoms such as cough, phlegm, dyspnea to Byssinosis, occupational asthma and chronic bronchitis.[12,13]

The high prevalence of respiratory symptoms in cotton workers (73.18%) is similar to that reported by other studies carried out in India, Pakistan and China,[14,15] but varied from a study done in Nigeria (11.5%). The variation in different studies can be explained partly by genetic predisposition, atopy and different levels of sensitization to the organic substances. The use of personal protective measures and environmental dust control measures of the workplace may also explain this.

In our study, cough was found in 54.2% of workers, and production of phlegm in 31.8% of all exposed workers. These two were the most prevalent among the lower respiratory tract symptoms. The results were in agreement with the study done by Mansouri et al. where cough was found in 47% and that of sputum in 41% of workers.[9] Ahasan et al. also reported that 42.9% had cough with or without sputum in a Bangladeshi based study.[16]

Overall, runny nose was commoner than lower respiratory symptoms (47.1%) except cough. This observation is in line with the study by Nagoda et

al. where cough and rhinitis were the most prevalent ones. [17]

There is an increased risk of asthma in the textile workers- previous reports say that. The prevalence ranges from 32% to 57% .[18,19,20] Though we didn't search for asthma particularly in our study, rather focused on non-specific symptoms; but who knows these chest tightness, wheezing and breathlessness might be just the asthmatic manifestation of the workers! As lung function test and further follow up is needed to comment on that.

In our study, out of 384 workers, the mean (±SD) of the duration of workers was observed as (4.8±3.1) years, and duration of exposure had no significant association with the prevalence of respiratory symptoms though the association was quite higher. This report is matched with a survey done on 210 Bangladeshi textile workers where no significant association was noticed with the length of work.[16] But this finding contradicts with the study done in Misr spinning and weaving company on 100 exposed workers.[21] Another study done in Maharashtra, India reported that duration of exposure more than 10 years was one of the significant risk factors for developing respiratory morbidity. In our study, there was not a single worker who had such duration in the workplace. Moreover, as this was a cross-sectional study, so we couldn't follow-up with the workers with increasing duration. That's one of the limitations of our study.

Of total 384 workers working in the spinning mill, they were divided into 3 groups according to their area of work- the blow, ring and packaging section. The blow room participants had more symptoms (47%) compared to others. Working section had significant association with respiratory symptoms. As the PM 2.5 level of the blow room was higher (in an unhealthy range) and blow room workers had more symptoms, a probable association can be made. This association has been shown in several studies done in Bangladesh, Pakistan, Egypt and Ethiopia.[16,21,22,23] It can be explained by the fact that workers working in high level of dust concentration like blow room or carding are more likely to develop symptoms. This explanation exactly matched with our finding of dust level (PM 2.5) in different sections. PM 2.5 in blow room was found 125 ug/m^3 which lies in the "unhealthy" range, which means everyone may begin to experience health effects; members of sensitive groups may experience more serious health effects. Studies are controversial in this regard. There has been increasing evidence that cotton dust itself is not the only agent and that endotoxin is regarded as a bioactive agent. Alternatively, it has been explained that there have been some other interactive factors that can alter the dose-response relationship.[24]

In our study, about half of the workers (55.7%) used personal protective mask during their work. It was reusable cotton cloth mask. Analysis of the use of personal protective mask had no significant association. It somehow correlates with the study by Dangi and Bhise who showed that, in spite of using face mask, lung function changes were there.[25] The opposite observation was made by Memon et al. who disclosed that nonuse of face mask in a Pakistani cotton mill was one of the contributory factors of developing respiratory symptoms.[26]

In summary, we found a high prevalence of different respiratory symptoms among the workers of a cotton mill. The blow room workers were more significantly affected. Most importantly, we demonstrated that the level of PM 2.5 varied in different working sections based on activities of the processing of cotton. And it significantly had a greater impact on respiratory symptoms.

Conclusion:

This cross-sectional study was done in a cotton mill (spinning section) located at Gazipur, Dhaka, Bangladesh from July 2018 to June 2019 to observe the prevalence of respiratory symptoms. Results showed a high prevalence of various respiratory symptoms among the workers. Working at blow room and use of biomass fuel for cooking purposes by some respondents were some of the significant risk factors. The level of PM 2.5 significantly had a greater impact on respiratory symptoms.

Recommendations

1. An appropriate ventilation system and ample measures to reduce dust exposure are badly needed to lessen the effect.
2. To ensure that work-related problems are kept to a minimum, regular health and safety surveillance is needed.

3. Alternative methods of cooking instead of using biomass fuel should be considered, and workers should be educated regarding respiratory health hazards from biomass combustion.
4. Further works are needed to strengthen and to figure out the actual picture by doing the lung function test, and other appropriate investigations of the affected workers. Hopefully, this will come up with any future researcher!
5. This study may be repeated with a larger sample size.

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