

Effect of Cotton Dust on PEFR and Chest Expansion Among Cotton Textile Workers

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ABSTRACT

Background and Need of the Study: The cotton mill workers are exposed to various hazards in the different department of textile factories. Very few studies are conducted on cotton mill workers to evaluate the occupational-hazards among them. So, the purpose of this study is to determine the effect of cotton dust on PEFR and chest expansion among cotton mill workers.

Method: Ethical approval was taken. Study was conducted on 50 adults age group of 18-65 years. 2 Groups: Group-1: Cotton mill workers of Ahmedabad, Group-2: Age- and gender-matched Healthy individuals. PEFR of group1 and group2 was measured using Mini-Wright flow-meter. Then chest expansion was measured at 3 levels in both the groups.

Result: Mean age, PEFR, chest expansion at axilla, at nipple and at xiphoid level of group 1 were (41.43±10.65) (303.12±134.38) (1.36±0.43) (1.49±0.51) (1.51±0.54) and of group 2 were (39.34±10.76) (456.56±76.38) (2.63±7.10) (3.08±7.01) (4.32± 6.79) respectively. Comparison was done using Mann-Whitney U-test. Result was found to be significant ($p < 0.05$) between PEFR, Chest expansion at Nipple and Xiphisternum level in both groups, while not significant at Axilla level in both groups.

Conclusion and Clinical Implication: PEFR and chest expansion of nipple and xiphisternum level is reduced in cotton mill workers as compared to controls. Regular medication and specific exercise protocol can be made according to one's need, which can improve the functional capacity of individuals.

Keywords: Cotton textile workers, PEFR, Chest expansion, Cotton dust

INTRODUCTION

Occupational lung disease is a major problem in workers working in various textile factories.

Cotton dust is defined as dust generated into the atmosphere as a result of processing the cotton fibers combined with any naturally occurring material such as steams, leaves, bracts, and inorganic matter which may have accumulated on the cotton fibers during growing and harvesting period.^[1]

Cotton dust is classified according to size of particle-like trash (above 50 μm in diameter), dust (50–500 μm), micro dust (15–50 μm), and breathable dust (15 μm). Particles with aerodynamic diameter $\leq 2.5 \mu\text{m}$ and $\geq 0.1 \mu\text{m}$ are called fine particulates and are sedimented out in the gas-exchange region of the lung, where air movement is slow. These particles tend to be remained in the respiratory bronchioles within the central part of the acinus.^[2]

Occupational chronic obstructive pulmonary disease (COPD) is defined as COPD where there has been a material contribution made to its development, or severity, by inhaled workplace agent.^[3]

Occupational lung disease is a major problem in workers working in various textile factories. The cotton mill workers work in various departments of cotton mill like opening, picking, combing, weaving,

slashing, and spinning during which exposure to raw cotton dust occurs.

The acute exposure to cotton dust can produce feeling of chest tightness, coughing, wheezing, phlegm, and breathing difficulty.

Long-term exposure to cotton dust may result in excessive chronic annual loss in peak expiratory flow rate, and in higher proportions of persistent respiratory symptoms.^[4]

Apart from respiratory symptoms and lung impairment, airway allergy and positive skin reaction were also noted in persons exposed to cotton dust.^[5]

In diseases such as asthma and chronic obstructive pulmonary disease (COPD), rib cage mobility may be decreased as a result of hyperinflation, airway obstruction, and mechanical disadvantage of the respiratory muscles.^[6]

Evaluation of chest wall mobility is considered the most important tool for assessing abnormal respiratory patterns at rest and during exercise.^[7]

The aim of this study is to determine the effect of cotton dust on PEFr and chest expansion among cotton textile workers.

MATERIALS & METHODS

Study design: Observational study

Study setting: Cotton textile workers of Ahmedabad and community of Ahmedabad

Sample size: 50

Duration of study: 1 month

Sampling design: Purposive sampling

► INCLUSION CRITERIA:

Gender: Male

Age: 18-65 years

Subjects who are able to follow the commands

Subjects willing to participate

Subjects who have exposure of more than three years

► EXCLUSION CRITERIA:

Severe cardio respiratory disorder

Neurological conditions

Person who are mentally ill

► MATERIALS:

Proforma

Pen

Consent Form

Mini Wright Peak Flow Meter

Measure Tape

► PROCEDURE:

Study was approved by our institutional ethical council under no PTC/IEC 90/2022/23.

Subjects falling in inclusion criteria were invited for study.

Prior written informed consent was taken.

There were two group:

Group-1: Cotton mill workers of Ahmedabad,

Group-2: Age-and gender-matched Healthy individuals

► PEAK EXPIRATORY FLOW RATE^[8]:

Peak expiratory flow rate was measured using mini wright peak flow meter.

Subjects were instructed to take a deep breath and exhale as possible in one single blow into the instrument.

3 reading was taken.

Highest among 3 reading was considered as peak expiratory flow rate.



► **CHEST EXPANSION [9]:**

Chest expansion was measured using measure tape.

The subject was asked to breathe out as far as possible while the measuring tape is drawn taut.

He was then asked to breathe in as deeply as possible, at the same time allowing the tape measure to be released.

The two measurements were recorded. Measurements were taken at three levels: At Axilla, Nipple and Xiphisternum level.

► **OUTCOME MEASURE:**

Peak expiratory flow rate

Chest expansion

STATISTICAL ANALYSIS

Statistical analysis was done using SPSS version 20 by keeping level of significance 5%.

Results were presented as Mean±SD.

Data analysis was performed using the Mann-Whitney U-test for comparison between two groups.

P < 0.05 was considered as statistically significant.

RESULT

The data was analyzed in 50 participants in this study.

Table shows mean and sd value of PEFR and Chest expansion of both the groups.

PARAMETERS	GROUP	NUMBERS	Mean±SD	U-test	p-value
PEFR(L/min)	Cotton mill workers	25	303.12±134.38	-4.456	0.000
	Control group	25	456.56±76.38		
CHEST EXPANSION AT AXILLA LEVEL	Cotton mill workers	25	1.36±0.43	-.453	0.651
	Control group	25	2.63±7.10		
CHEST EXPANSION AT NIPPLE LEVEL	Cotton mill workers	25	1.49±0.51	-2.401	0.016
	Control group	25	3.08±7.01		
CHEST EXPANSION AT XIPHISTERNUM LEVEL	Cotton mill workers	25	1.51±0.54	-6.480	0.000
	Control group	25	4.32± 6.79		

DISCUSSION

The aim of this study is to determine the effect of cotton dust on PEFR and chest expansion among cotton textile workers.

There was a significant decrease in the mean peak expiratory flow rates and chest expansion at nipple and xiphisternum level as compared to axillary level in cotton mill workers compared to control group.

The findings of the present study were similar to the study of Mansouri et al. They found that long-term exposure to cotton dust

is associated with obstructive disease that increases with the duration of exposure.^[10]

Nagoda et al. found that complaints of respiratory symptoms such as cough, phlegm production, rhinitis, wheezing, chest pain, and breathlessness were higher in the exposed textile workers compared to unexposed workers. Exposed worker has a higher frequency of symptoms as well as lower FVC, FEV1, and PEFR than unexposed workers.^[11]

According to Lai and Christiani, organic dust exposure in the textile industry leads to

obstructive lung disease that has features of both asthma and COPD. An inversion of the pulmonary macrophage: Dendritic cell ratio may be a mechanistic explanation for persistent inflammation and obstructive lung disease seen in endotoxin-related textile exposures. One study showed that the prevalence of respiratory symptoms and byssinosis being higher in smokers than nonsmokers.^[12]

David. C. Christiani, X-R Wang et al states that cotton workers had small but significantly greater adjusted annual declines in FEV1 and FVC than the silk workers. Years worked in cotton mills, high level of exposure to endotoxin were found to be significant determinants of longitudinal changes in FEV1.^[13]

Rao et al. observed an inverse relationship between chronic exposure to cotton dust and pulmonary functions after observing decreased level of PEFR in cotton mill workers. There was decreased level of PEFR was observed in the exposed group of textile mill workers compared to non-exposed workers.^[14]

Pulmonary function studies by Saadat Ali Khan in cotton ginners in Pakistan showed a significant decline in FVC, FEV1 and PEFR which is also consistent with our study.^[15]

R. Altin, S. Ozkurt et al on prevalence of byssinosis showed a reduction in FVC and FEV1 which is also consistent with our study. They also showed a statistically significant correlation between respirable dust concentration in the work place and byssinosis.^[16]

CONCLUSION

The results suggested that the respiratory functions i.e., PEFR and Chest expansion of nipple and xiphisternum level are significantly reduced in cotton mill workers as compared to normal individuals.

► Future recommendation:

The study can be performed in larger population.

The study can be done on both the gender (male and female).

Year of smoking exposure to further validate the generalization of study results.

► Clinical implications:

Sampling of the workplace must be done at regular intervals.

Regular medical check-up of all cotton mill workers should be done to prevent the harmful respiratory effect of cotton dust exposure on lung function.

Wear a mask over mouth and nose to prevent the exposure of cotton dust.

Declaration by Authors

Ethical Approval: Approved (PTC/IEC 90/2022/23)

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Conflict of Interest: The authors declare no conflict of interest.

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