

“Assessing The Impact of Cotton Dust Exposure on Respiratory Health & Pulmonary Function: Comparative Study Among Cotton Mill Workers”

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ABSTRACT:

Background: Ramazzini described a peculiar form of asthma among those who card flax and hemp. Byssinosis is the most common disease affecting the cotton textile workers; also symptoms like mill fever, weaver's cough.¹ Cotton workers are at risk for occupational lung disease, including byssinosis and chronic bronchitis³. The present study was done to find out the effect of short term exposure, long term exposure to cotton dust in cotton mill workers & control group. Suggest precautions to prevent this.

Objective: 1) To assess the impact of cotton dust exposure on respiratory health & pulmonary function among cotton mill workers.

2) To understand and compare the effect of short term and long term exposure groups to cotton dust with control group on pulmonary function tests in cotton mill workers.

3) To study the severity of respiratory symptoms occur in mill workers after short term and long term exposure to cotton dust and compare with control group.

Methodology: The study is approved by institutional ethical committee and written consent of participant has been taken. In this study, 2 study groups of fifty workers exposed for short term duration exposure, for long term duration exposure each and third group of fifty people not exposed to cotton dust (control group) were examined for PFTs of age 25-50 years. PFTs were carried out using spirometer.

Results: The present study found that there is statistically significant difference in PFTs between the short term exposed group, long term exposed group and control group of 25-50 years' age. The difference in symptoms were more in long term exposure group than in short term exposure group and absent in control. Also there is statistically significant difference in PFTs amongst all.

Discussion & conclusion: The results of the present study helped us to understand and compare the short-term, long term exposure group and control group better and suggest workers to take precautions to avoid more subtle effects that can occur.

INTRODUCTION:

For nearly 300 years, work in textile industry has been recognized as, an occupational hazard. Cotton workers are at risk for occupational lung disease, including byssinosis and chronic bronchitis. The initial phase of byssinosis is characterized by acute reversible symptoms, such as wheezing, chest tightness, shortness of breath, or cough, and is typically evident on the first day back to work after an absence of 48 h or more. These early symptoms are generally accompanied by reversible changes in pulmonary function (across-shift drops in FEV₁). With continued exposure, the disease may progress to a stage in which symptoms are present throughout the work week and may eventually result in severe pulmonary disability.^{3,4}

Key words: cotton dust, respiratory symptoms, short term & long term exposure, FEV₁, FVC, PEF_R.

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In addition, excess nonspecific respiratory symptoms such as chronic cough, phlegm, and dyspnoea were reported in cotton textile workers compared with non-exposed populations.^{5,6,7} The present study was done to find out the effect of short term exposure, long term exposure to cotton dust in cotton mill workers & control group. Suggest precautions to prevent this.

AIM:

To assess the impact of cotton dust exposure on respiratory health & pulmonary function among cotton mill workers.

MATERIAL & METHODS:

The study is approved by an institutional ethical committee and written consent of participants has been taken. The study was done at a Spinning Mill with permission from the Management of the mill. The mill processes raw, ginned cotton to yarn.

Inclusion criteria: -

- 1) Case group individuals (both sex) working of age 25-50 years in cotton mill exposed for short term duration of 1-5 years.
- 2) Case group individuals (both sex) working of age 25-50 years in cotton mill exposed for long term duration of 6-20 years.
- 3) Individuals in both groups are working in cotton mill for more than 8 hours per day for 6 days a week.
- 4) Control group individuals (both sex) of same age not exposed to cotton dust professionally at any time in their lives.

Exclusion criteria: -

Subjects having

- 1) Previous exposure to cotton or other occupational dust.
- 2) Those with history of abdominal or thoracic surgery, smoking, tobacco chewing and alcohol intake.

- 3) Those with history of COPD, Bronchial Asthma and any other allergic conditions like allergic rhinitis.
- 4) Those with history of Cardio vascular diseases, Hypertension and Diabetes Mellitus.

Method of collection of data:

Following parameters evaluated in study groups-

- ❖ After taking informed written consent from each subject, a structured questionnaire was given to the subjects, to elicit the detail occupational history and history of past or present respiratory illnesses.

The following Symptoms were asked: any history of

- a) Chest Tightness, b) Difficulty in Breathing, c) Cough, d) Wheezing and

Phlegm.

Whether symptoms are more on the first day back to work after an absence from the mill ('Monday Dyspnea') and decreased afterwards during work or permanent throughout work?

Pulmonary function tests:

The procedure of spirometry, a non-invasive investigation to be performed in the study for obtaining lung functions was explained to the subjects in vernacular, in detail. The PFTs data are analysed by Spiro lab III.

The following parameters were recorded in mill workers (study groups & control group):

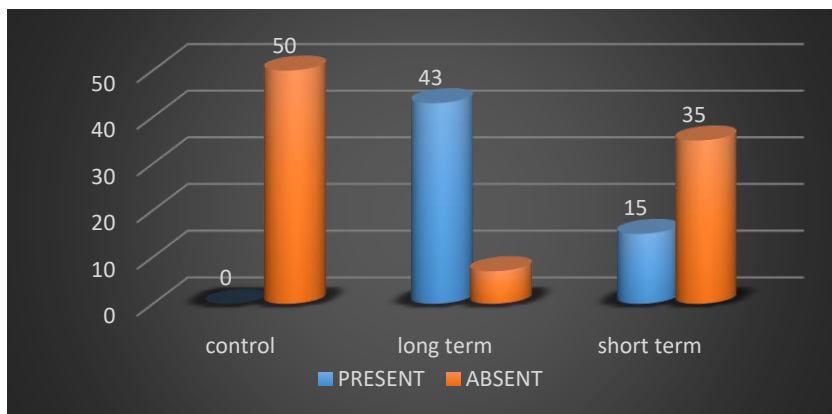
- 1) FVC: The maximum volume of air expired after a maximum inspiration.
- 2) FEV 1: Forced expiratory volume in first second
- 3) FEV1/FVC ratio.
- 4) PEF: Peak expiratory flow rate
- 5) FEF 25%-75%: Forced mid expiratory flow rate

OBSERVATIONS & RESULT:

TABLE 1: Comparison of symptoms between study groups & control group.

GROUP		SYMPTOMS		Total
		Present	Absent	
GROUP	Long term Exposure	43	7	50
	Short term Exposure	15	35	50
	Control	0	50	50
Total		58	92	150

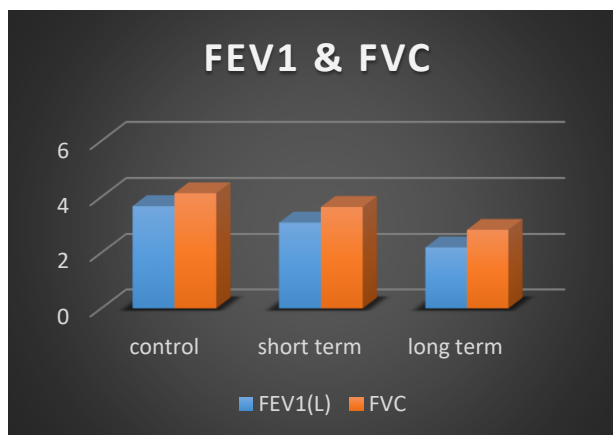
Chi-square =89.466 P = 0.001 significant



GRAPH 1

TABLE 2: Comparison of FEV1 & FVC between study groups & control group.

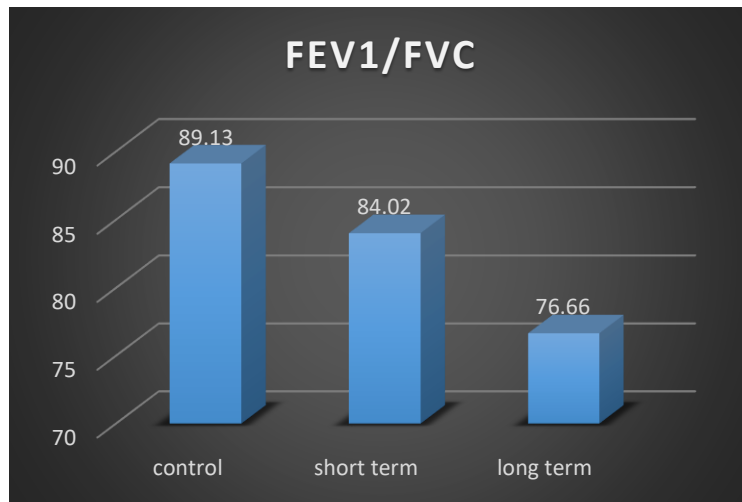
Parameter	Control (N= 50)	Short term (N=50)	Long term (N=50)	P value
FEV1(L)	3.68±0.41	3.09±0.95	2.2±0.93	0.001*
FVC(L)	4.14±0.36	3.65±0.92	2.83±1.03	0.001*



GRAPH 2

TABLE 3: Comparison of FEV1/FVC between study groups & control group

Parameter	Control (N= 50)	Short term (N=50)	Long term (N=50)	P value
FEV1/FVC(%)	89.13±3.51	84.02±9.68	76.66±11.68	0.001*



GRAPH 3

TABLE 4: Comparison of PEFr between study groups & control group.

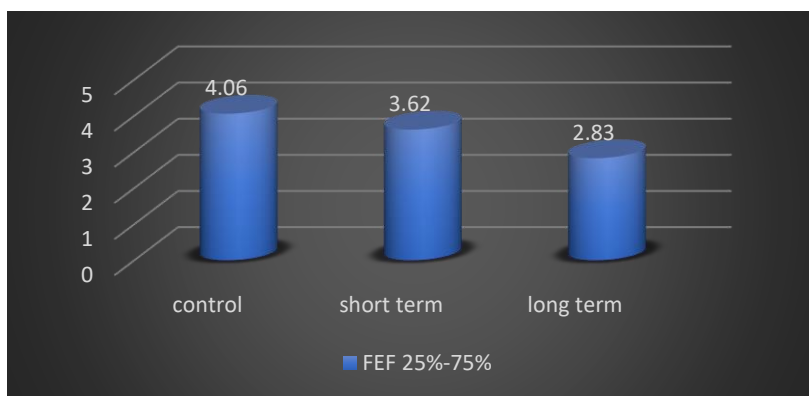
Parameter	Control (N= 50)	Short term (N=50)	Long term (N=50)	P value
PEFR(ml/s)	591.9±59.08	528.9±130.21	466.56±128.83	0.001*



GRAPH 4

TABLE 5: Comparison of FEF25%-75% between study groups & control group.

Parameter	Control (N= 50)	Short term (N=50)	Long term (N=50)	P value
FEF25%-75% (ml/s)	4.06±0.37	3.62±0.9	2.83±1.03	0.001*



GRAPH 5

DISCUSSION:

Occupational respiratory diseases are usually caused by extended exposure to irritating or toxic substances that cause acute and chronic ailments.¹⁰

Effects of short term exposure are as follows: 1) Cotton Dust can irritate the eyes on contact. 2) Breathing Cotton Dust can irritate the nose, throat and lungs. And effects of long term exposure are; Repeated exposure can cause serious, permanent lung damage (*byssinosis*) with increase chest tightness, difficulty breathing, coughing and wheezing throughout work.¹⁰ Spirometry is one of the easy tools to detect lung function abnormalities, at an early stage so that preventive measures can be adapted before irreversible changes set in.¹¹

Comparison of the data of Symptoms between study groups with control was done by Chi-square test. Comparison of the data of study groups with control was done by ANOVA test, while comparison between exposure of long term and short term duration groups was done by two tailed un-paired Student's t-test, to arrive at the results described. FEV₁/FVC: Difference in mean value of FEV₁/FVC between study groups and controls is highly significant ($P < 0.001$; Table 3). A number of studies 6, 8, are matched with our study. It has also found that, there is highly significant decrease in mean value of FEV₁/FVC in long term exposed workers than short term exposed workers ($P < 0.001$). This finding is matched with few studies 6, 8.

PEFR: Between the mean value of PEFR of study groups and control group, it has observed that there is highly significant ($P < 0.001$) decrease in study groups as compared to control (Table 4). It has also found that, there is highly significant decrease in mean value of PEFR in long term exposed workers as compared to short term exposed workers ($P < 0.001$). This finding is similar with observations of few studies 15,16,20.

FEF_{25%-75%}: Mean value of FEF_{25%-75%} is highly significant ($P < 0.001$) less in study groups as compared to controls (Table 5). It has also found that, there is highly significant decrease in mean value of FEF_{25%-75%} in long term exposed workers than short term exposed workers ($P < 0.001$). This

finding is consistent with the observations of various studies^{21,22}.

Therefore, pulmonary function tests of workers exposed for long term duration are markedly decreased than workers exposed for short term duration. The symptoms of workers are increased who exposed for long term duration as compared to short term duration. No symptoms observed in control group. A precise knowledge of the pulmonary function tests helps to understand and apply some preventive measures for cotton mill workers, to minimize the hazardous effects of cotton dust exposure.

Good WORK PRACTICES can help to reduce hazardous exposures. The following work practices are recommended:

- * Workers whose clothing has been contaminated by Cotton Dust should change into clean clothing promptly.
- * They should not take contaminated work clothes home. Family members could be exposed.
- * Contaminated work clothes should be laundered by individuals who have been informed of the hazards of exposure to Cotton Dust
- * Eye wash fountains should be provided in the immediate work area for emergency use.
- * If there is the possibility of skin exposure, emergency shower facilities should be provide.
- * There should be washed any areas of the body that may have contacted Cotton Dust at the end of each workday, whether or not known skin contact has occurred.
- * Workers should not eat, smoke, or drink where Cotton Dust is handled, processed, or stored, since the chemical can be swallowed. They should wash hands carefully before eating, drinking, applying cosmetics, smoking, or using the toilet.
- * They can use a vacuum or a wet method to reduce dust during cleanup. Do not dry sweep.⁷⁹

CONCLUSION:

The incidence depends upon the chemical composition of dust, size of the particles, duration of exposure and the individual susceptibility. Though developed countries are very careful

about occupational health, it is quite neglected in developing countries like India.¹⁴

This study was conducted to enlighten and compare the effects of exposure to cotton dust on respiratory symptoms and pulmonary function in cotton mill workers. Comparison between these study groups and control group was also carried out. In the present study fifty workers of age 25-50 years, exposed to long term duration and short term duration each, with no pre-existing cardio-respiratory diseases were selected and fifty control group.

Pulmonary function tests were carried out on cotton textile workers and controls using 'Spiro lab III'. Comparison between Short term and Long term duration exposure groups was done by unpaired Student's t- test (by calculating mean and standard deviation, SD). Comparison of the data of Respiratory Symptoms between study groups with control was done by Chi-square test.

Following conclusions are drawn from the study:

- 1) As duration of exposure to cotton dust increased the respiratory symptoms get more worsen.
- 2) Dynamic lung volumes and capacities (FEV₁ and FVC) were significantly lower in cotton mill workers. FEV₁ was reduced more significantly than FVC. The ratio FEV₁/FVC was also significantly lower in them as compared to control.
- 3) The mean value of PEFR and FEF 25%-75% were lower in study groups than control.
- 4) Also the mean values of PEFR and FEF 25%-75% were lower in long term exposed group than the short term exposed group, suggesting more decline with increasing years of exposure to cotton dust in these workers.
- 5) Above results point towards an obstructive airway pathology probably affecting the larger airways in cotton textile workers.^{24,25}
- 6) The lowered values of FEF 25%-75% indicated greater involvement of smaller/ distal airways, suggesting early obstructive type of impairment in these workers and may be more sensitive in detecting airflow obstruction.²⁶

Hence, we conclude in our study that the short term duration exposure (1-5years) as well as long term duration exposure (6-20 years) produces changes in the lung functions of cotton mill workers and with increasing duration of exposure, there is decreasing levels of lung functions.

Precautions in the form of yearly medical examinations of the workers and decreasing the dust levels in the industry have to be undertaken to prevent the development of chronic and irreversible lung diseases.

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