

Effects of Exposure to Cotton Dusts on FVC, FEV₁, and FEV₁/FVC% in Male Cotton dust Workers

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Abstract

Background: Workers in environment with cotton dust exposure are at risk of development of occupational pulmonary functional disorder. **Objectives:** To observe the effects of cotton dust exposure on FVC, FEV₁, FEV₁/FVC% in male cotton dust worker. **Methods:** This cross-sectional study was carried out in the department of physiology, Rangpur Medical College, Rangpur from 2014 July to 2015 July. Total 25 apparently healthy non-smoker male workers aged 20-40 years, exposed to cotton dust for at least 6 months, were selected from different fabric weaving and cotton ginning factories of Rangpur district. Twenty five age & BMI matched apparently healthy male subjects, not exposed to cotton dusts were taken as control. FVC, FEV₁ and FEV₁/FVC% of all subjects were recorded by using a digital spirometer. For statistical analysis, unpaired 't'-test was performed. **Results:** The mean percentage of predicted value of FVC, FEV₁ were significantly lower (p<0.001) in cotton dust exposed workers (CD-EW) than those of control. The mean percentage of predicted value of FEV₁ / FVC% in CD-EW is slightly decreased compared to control but it was not statistically significant. **Conclusions:** From the result of this study it can be concluded that cotton dust (CD) may have harmful effects on some pulmonary function.

Key words: Cotton dust workers, pulmonary functions, forced vital capacity, Forced expiratory volume in 1st second & the ratio FVC/FEV₁%.

J Bangladesh Soc Physiol. 2016, June; 11(1): 35-38
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Introduction

Health hazards attributed to a particular occupation is an important concern in public health measures.¹ Among the occupational diseases, pulmonary diseases are more extensive and hazardous. Because of extensive surface area, high blood flow and thin alveolar epithelium and free communication with external environment, lung is a vulnerable site for deposition of suspended particles in environmental air, resulting in lung fibrosis upon prolonged exposure.² Inhaled cotton dust particles smaller than 5 microns are retained

in lung.³ The occurrence of respiratory symptoms represents the earliest response to cotton dust exposure, followed by lung function changes.⁴ The pulmonary function test (PFT) have opened a new era towards scientific approach in diagnosis, prognosis and management of pulmonary disorders. The normal value ranges for pulmonary function tests (PFT's) will be adjusted for the subjects' age, height, sex and sometimes race. Pulmonary ventilation can be studied by many pulmonary function tests (PFT's).^{2,5} Research reports on the effects of cotton dust on pulmonary functions are scarce. In general, information is lacking concerning

Received 15th Sept. 2015; Accepted 3rd Feb. 2016

the health effects of cotton dust exposure and its control strategies among different textile workers in our country. This study aims to investigate pulmonary function in workers dealing with cotton in different forms to observe the changes in lung function upon prolonged exposure to cotton dust inhalation.

Methods

This cross-sectional study was conducted in the department of physiology, Rangpur Medical College, Rangpur from 2014 July to 2015 July. Total 25 apparently healthy non-smoker male workers exposed to cotton dust (CD-EW) for at least 6 months, age ranged 20-40 years were taken as study group. They were selected from different fabric weaving and cotton ginning factories of Rangpur district. Another 25 apparently healthy, age and BMI matched male cotton dust non-exposed workers (CD-NEW) were also included as control for comparison. All the subjects belonged to lower socioeconomic status. After selection of the subjects the objective, perspective, benefits and risk of this

study were briefed in detail to the study subjects. An informed written consent was taken from all the participants. Ethical committee and Thesis protocol review committee of Rangpur Medical College approved the study protocol. A detail medical and family history of all subjects was recorded in a preformed questionnaire. Through physical examination of study subjects were done and documented. Height and weight of the subjects were measured for calculation of BMI. For assessment of lung function, FVC, FEV₁ and FEV₁/FVC% of all subjects were measured by using a digital spirometer. For statistical analysis unpaired 't'-test was performed by computer based software SPSS-17.0 version for windows.

Results

Demographic data of all subjects are presented in Table I

The mean percentage of predicted value of FVC and FEV₁ were significantly lower ($p < 0.001$) and FEV₁/FVC% was also slightly decreased but not statistically significant in CD-EW, than those of CD-NEW.(Table II).

Table I: Age and BMI in both groups (n=50)

Parameter	CD-NEW (n=25)	CD-EW (n=25)
Age (Years)	30.48 ±4.30	32.36 ±4.09
BMI (Kg/m ²)	23.04 ±2.26	23.51 ±1.75

Data are expressed as mean ±SD. Statistical analysis was done by unpaired student's 't' n=Total number of subjects.CD-EW= Cotton dust exposed workers CD-NEW= Cotton dust non-exposed workers

Table II: Percentage of predicted value of FVC, FEV₁ and FEV₁% in both groups (n=50)

Parameter	CD-NEW (n=25)	CD-EW (n=25)
FVC	87.80 ±7.02	69.00 ±9.84***
FEV ₁	91.76 ±7.14	69.96 ±14.64***
FEV ₁ /FVC %	103.76 ±5.26	101.28 ±18.94

Data are expressed as mean ±SD. Statistical analysis was done by unpaired student's 't' test. ***= $P < 0.001$, n=Total number of subjects.CD-EW= Cotton dust exposed workers CD-NEW= Cotton dust non-exposed workers

Discussion

In this study mean measured value of FVC and FEV₁ were significantly lower. Whereas, FEV₁/FVC% were non significantly higher in male workers exposed to cotton dusts. These findings are similar with those of some other researchers.^{2,3,6,8,9,10,11} The harmful effects of cotton dust on pulmonary function have been noted from the above findings in cotton dust exposed workers. Prolong exposure to cotton dust causes accumulation of dust particles in peribronchial lymphoid and connective tissues along with varying degrees of wall thickening and remodeling in terminal and respiratory bronchioles. Bronchiolar walls with marked thickening is associated with increase in collagen and interstitial inflammatory cells including dust-laden macrophages.^{1,2} Moreover workplace exposure to organic dust (cotton dust) cause respiratory inflammation and thereby leads to ventilatory dysfunction.¹² In addition, cotton dust induces histamine release or immunological reaction mediated by endotoxin as mechanism of impaired FVC, FEV₁ and FEV₁/FVC%. Histamine directly stimulates vagus nerve causing smooth muscle contraction resulting broncho-constriction. Histamine also causes increase airway mucus secretion that reduces the air entry into the lung which might be associated with decreased FVC & FEV₁.³ Cotton dust contained Gram-negative bacterial endotoxin is a possible causative agent of respiratory symptoms and pulmonary functional loss (decreased FVC, FEV₁ and FEV₁%) among workers exposed to cotton dust.¹³ Altered biophysical properties of lung surfactant in response to chronic exposure to cotton dusts might also responsible for development of impaired lung functions.¹⁴

Conclusion

Therefore from this study, it may be concluded that lung function parameter like FVC, FEV₁ and FEV₁/FVC% decrease in non-smoker male cotton dust exposed workers.

Acknowledgement:

Authors of this study are thankful to the authority of weaving & ginning factory of Rangpur district and the workers for their voluntary cooperation.

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Conflict of interest: None

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