



Study of respiratory function tests in elderly male textile mill workers

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ABSTRACT

Background : The health of the individuals will largely depend upon the work environment. In many of the cotton and textile industries, workers are largely exposed to dust. Health is one of the most valuable assets of individual, community and the country as a whole. Investigations of respiratory health effects from these dust particles are necessary in order to predict the risk factors which may cause the above mentioned health hazards and also help in planning for providing better work place conditions to these workers . Taking into consideration the large number of elderly workers involved in textile mills of Solapur we conducted the present study to see the effect of aging on all RFTs . **Methods :** The present study was conducted in 153 males of Jamshri Textile mill, Solapur. 89 male workers served as cases and 64 males served as controls. After screening all were subjected to Respiratory function test (RFT). The results were analysed using students unpaired T-test. **Results :** PEFR, FEF 25-75%, FEF 0.2-1.2%, FEF 25% were reduced in textile mill workers by a highly statistically significant value. FEF 50% was also reduced by a statistically significant value. PEFR was the only parameter that decreased to a statistically highly significant value in textile mill workers as shown in table. **Conclusion :** Transfer to a less dusty department should be advised if the worker shows pulmonary dysfunction. Our study was cross-sectional. But a longitudinal study along with microbiological, immunological and biochemical studies will be helpful to understand the Patho-Physiology of the effects of such exposure to cotton dust.

KEYWORDS :

Introduction:

The health of the individuals will largely depend upon the work environment. In many of the cotton and textile industries, workers are largely exposed to dust. Health is one of the most valuable assets of individual, community and the country as a whole. In the light of rapid economic growth and individual progress, it becomes imperative that safety and health at the workplaces will have to be given due importance. However, with stress being laid on quick profits, safety aspects are generally ignored.

There is scarcity of human and financial resources and due to this reason, the occupational health and occupational hygiene practices are often hindered in developed countries and more so in the developing countries. As a result, the world health report 2002¹ found that during the year 2000, work-related risk factors were responsible for the loss of about 30 million Disability Adjusted Life Years (DALYs) globally . In the region of South East Asia a loss of over 8 million DALYs (27% of the total) and accounted for the highest regional burden of disease attributable to occupational risk factors. The textile industry has a unique place throughout the world. The industry provides cloth, one of the basic necessities of life and employment to millions of people. The first textile mill was established in New England in late 16th century. In 19th century, industries revolutionized a lot with advanced technologies and mechanization of processing of cotton.⁽¹⁾

Due to extensive mechanization and use of chemicals, workers were exposed to different occupational hazards, such as accidents, fire, diseases due to exposure to cotton dust. . Of all, the greatest health hazard was due to inhalation of cotton dust.

Cotton is a natural fiber obtained from plant "Gossypium". It contains 90% cellulose and 6% moisture. Cotton was first cultivated in India as early as 2000-3000 B. C. and thus India became the homeland for cotton. Then it was grown in China, Korea and now all over the world. The cotton from field is collected and fed into a machine called "Gin" which separates fibers from seeds by pneumatic suction. Then cotton is compressed into bales and sent to textile industry.

India being larger producer of cotton, many textile industries are set up in states like Gujarat, Maharashtra and Uttar Pradesh. Nearly 35% of factory workers are employed in cotton industry. According to

recent surveys, carried in Bombay, Ahmedabad and Delhi, the incidence of Byssinosis is 7-8%(2) In Maharashtra textile industries are aggregated in Bombay, Sangli-Miraj, Ichalkaranji.

In Solapur, there are two composite textile mills, 15-20 spinning mills and 3000-3200 powerlooms and handlooms. The production is mainly of chaddars and towels. The goods are famous not only in India but are exported to foreign countries also. Nearly 30,000-35000 workers are involved in these mills.

Byssinosis is a chronic disabling disease which does not show any characteristic physical and X-ray signs in initial stages.(3)

Investigations of respiratory health effects from these dust particles are necessary in order to predict the risk factors which may cause the above mentioned health hazards and also help in planning for providing better work place conditions to these workers . Taking into consideration the large number of elderly workers involved in textile mills of Solapur we conducted the present study to see the effect of aging on all RFTs

Methods:

The present study was conducted in 153 males of Jamshri Textile mill, Solapur. 89 male workers served as cases and 64 males served as controls. Controls were totally healthy, age matched and selected from the clerical department of the mill and were not exposed to cotton dust. Subjects were in the age groups ranged from 40-59yrs. Anthropometric measurements were almost similar in both age groups cases and controls.

The subjects having previous major illnesses, respiratory diseases, smoking habits were excluded from the study. Occupational History was taken as duration of Service in a particular department , number of hours/day , h/o change of job or transfer to other department.

After screening all were subjected to Respiratory function test (RFT). All the recordings were done at an average temperature of 28 degree C, between 11 am. to 2 pm. The instrument used was 'Medspiror', a computerized pneumotachometer. The instrument fulfilled the criteria/conditions for performance and reproducibility laid by American Thoracic Society (ATS).(4)

The procedure was explained in detail so that subject gets complete understanding and trials were given after the demonstration of forced expiratory manoeuvre and maximum voluntary ventilation. All were tested in sitting position. Three trials were given and maximum reading was taken for observation. Standard data and standard regression equations in the software of the microprocessor, predicted values of respiratory function parameters were calculated by the instrument and were corrected to BTPS by the instrument itself. Each subject was asked to perform following two manoeuvres. Forced expiratory manoeuvre. Subject was asked to take maximum inspiration and then blow into the mouthpiece without interruption as hard, fast and completely as possible. Maximum Voluntary Ventilation Manoeuvre subject was asked to respire (inspiration and expiration) as rapidly and deeply as possible, for 10 seconds in the mouthpiece of instrument. With these two manoeuvre actual values of all RFT parameters were recorded in instrument. Out of following ten nine were recorded with first manoeuvre and the last by second manoeuvre. These parameters are, FVC, FEV1, PEFR, FEF, FEVI/FVC, MVV.

For each subject a printed sheet of actual, predicted, and percent predicted values of all respiratory function parameter was taken. Instrument was reused with a new, disposable mouthpiece to next subject.

The results were then subjected to statistical analysis to find out, their statistical significance according to age groups and duration of exposure. The parameters taken in our study can be explained with the help of forced expiratory spirogram and flow volume curve. The results were analysed using students unpaired T-test.

Table No 1
Number of subjects in different age groups were as follows.

Age Group (yrs)	No. of Textile mill workers	No of controls
40-49	74	38
50-59	15	26
Total	89	64

Table No. 2
Comparison of RFT values between textile mill workers and control Age group 40-49 yrs.

RFT Parameter	Textile Mill Worker n=54	Control n=38	S.E.	'P' Value
	Mean SD	Mean SD		
FVC (L)	1.94 0.57	2.09 0.37	0.11	<0.2
FEV 1 (L)	1.84 0.48	2 0.34	0.10	<0.2
FEVI/FVC%	952.8	98 3.1	2.53	<0.2
PEFR (L/S)	5.12.03	6.92.2	0.47	**<0.01
FEF 25-75% (L/S)	3.35 1.25	4.12 1.43	0.2953	**<0.01
FEF 0.2-1.2 (L/S)	3.6 1.64	4.72.17	0.41	**<0.01
FEF 25%(L/S)	4.5 1.92	6.1 2.23	0.45	**<0.01
FEF 50%(L/S)	3.8 1.42	4.67 1.91	0.35	*<0.02
FEF 75% (L/S)	2.690.94	2.85 0.99	0.21	<0.2
MVV (L/MIN)	9420.7	10023.4	4.87	<0.2

This table shows that PEFR, FEF 25-75%, FEF 0.2-1.2%, FEF 25% were reduced in textile mill workers by a highly statistically significant value.

FEF 50% was also reduced by a statistically significant value.

Table no. 3
Comparison of RFT values between textile mill workers and control Age group 50-59 yrs.

RFT Parameter	Textile Mill Worker n=15	Control n=26	S.E.	'P' Value
	Mean SD	Mean SD		
FVC (L)	1.79 0.45	1.9 0.52	0.16	<0.2
FEVI (L)	1.7 0.53	1.82 0.53	0.17	<0.2

FEVI/FVC%	9416.8	9610.8	4.43	<0.2
PEFR (L/S)	4.8 2.18	6.7 2.26	0.74	<0.01**
FEF 25-75%(L/S)	3.33 1.6	3.63 1.47	0.51	<0.2
FEF 0.2-1.2(L/S)	3.8 1.97	4.7 2.53	0.78	<0.2
FEF 25%(L/S)	4.82.5	6.1 2.65	0.86	<0.2
FEF 50% (L/S)	3.78 1.59	4.14 1.44	0.49	<0.2
FEF 75% (L/S)	2.571.12	2.35 0.93	0.33	<0.2
MVV (L/MIN)	8621.1	99 21.2	7.03	<0.1

PEFR was the only parameter that decreased to a statistically highly significant value in textile mill workers as shown in table.

DISCUSSION

Our study included 89 male textile mill workers and 64 age matched healthy controls. This total study population had characteristics as shown in table no. 1

Following RFT parameters were recorded for each subject FVC, FEVI/FVC%, PEFR, FEF0.2-2., FEF 25-75%, FEF25%, FEF50%, FEF75%, & MVV.

FVC AND FEV1-

Our findings showed a statistically nonsignificant decline in textile mill workers in FVC and FEV1. The decline in FVC and FEV1 was attributed to action of cotton dust on respiratory airways leading to obstructive changes. In a study by V L N Rao et al (1979) (5) workers showed a significant reduction in FVC and FEV1 .

Bryan Gandeveia et al (1965) (6) observed that decline in FVC and FEV1 was significant in those workers who served for 1-10 yr. which was maximum decline than in those exposed for more than 10yr. They suggested therefore that recent employees are more susceptible to the effects of exposure to cotton dust.

They also said that workers exposed to cotton dust are prone to develop pulmonary disorders which are preceded by varying degree of decline in lung function.

Contrary to these studies, it is interesting to know that Roger Larson et al 1981 (7) found no significant decreases in FVC and FEV1 in cotton gin workers which was attributed to seasonal short duration of exposure and process of Self Selection by workers.

PEFR-

PEFR was the only parameter that decreased highly significantly in both the age groups and in workers of all departments.

In our results decrease in PEFR was pronounced with advancing age duration of exposure to cotton dust. Maximum decline of 28% was observed in age group 50-59 yr

R. N. Tiwari et al 1998 (8) recorded PEFR in Handloom weavers. Mean value for controls was 6.98 L/S and for workers exposed 6.55 L/S in 50-59 yr age group. The difference was statistically significant. Mean PEFR in our control was 6.7 L/S and for workers was 4.8 L/ S of same age group.

Similar significant decline in PEFR in cotton mill workers was also reported by James A. Merchant 1975(9). J. C. Gilson et al 1962 (10). They claimed that the decrease in PEFR was because of inflammatory changes due to hypertrophy of mucosal cells, increased secretion of mucus forming mucus plugs causing airway obstruction.

iii. **FEF 25-75% and FEF 50%**
FEF 25-75 % was significantly decreased in workers exposed for 21-30yrs i.e age group 40-49 yrs .(table no 2)

Gerald Hayes et al (1994) (11) recorded the forced expiratory spirogram and observed across shift declines in FEF 25-75% in cotton mill workers. Workers doing job for more than 20 yr. showed a

significant ($P < 0.05$) across shift reduction is FEF 25-75% than in those workers working for less ($P = 0.06$) than 20 yr. as compared with control. So our findings are in agreement with above results.

Annual decline in FEF 25- 75 % in a 5 yr longitudinal study was observed by Henry Glindmeyer et al 1991 in a textile company (12)

Mean FEF 50% was reduced significantly by 18% in 40-49 yr age group workers as compared to control. The reduction in FVC was 7% and in FEVI of 8% in the same age group in our study. James A. Merchant et al (1975) (9) and Eugenija Zuskin et al 1993 (13) noticed similar results for FEF 50% in workers exposed to cotton dust and various organic dusts, respectively.

FEF 75%- No statistically significant decrease was observed in FEF 75% in our workers as compared to control group. Highest reduction of 5% was present in workers of 40-49 yr. age group. (Table no 2) But it is curious to know that there was highly significant decrease in FEF 75% in workers exposed to organic dusts other than cotton as reported by Eugenija Zuskin et al 1993 (13) which suggested small airway involvement. Our study group did not show significant decline in FEVI/FVC% so our results are in accordance with results of Eugenija Zuskin et al (1975) (14) and Roger Larson et al (1981). (7)

The workers in various sections of mill also exhibited fall in FVC and FEVI showing hazardous effects of cotton dust in spite of varying concentrations of dust in different sections.

FEF 25-75% and FEF 50% are effort independent and indicate airflow in peripheral airways where diseases of chronic airflow obstruction begin (15). We found decrease in these two parameters for workers exposed for 21-30 yrs.

So decrease in FVC and FEVI along with decreased flow rates suggest involvement of large airways initially. As age and duration of exposure advances medium and small airways appear to be affected. Higher dust content of air in blowing and carding sections probably appears to be the cause for affection of many parameters in the workers of in the mill. In 40-49 yr age group PEFr, FEF 25-75%, FEF 0.2-1.2, and FEF 25% & FEF 50 % were significantly reduced parameters. In 50-59 yr PEFr was the only parameter which showed significant decrease. So our observations indicate mainly the affection of large and then small airways respectively as the age and duration of exposure progresses. Thus it was concluded that exposure to cotton dust is definitely an occupational hazard. Effect of aging on pulmonary functions was more pronounced in textile workers. There was a linear relationship between duration of exposure and decline in RFT. Management should be advised to hold a pre-employment examination of a worker to detect overall health status and especially the status of respiratory functions. A regular periodic assessment of workers in the industry should be done for the detection of respiratory dysfunction to reduce anxiety and morbidity induced due to work. Workers should be advised to use masks while working in any section of the cotton mill. Transfer to a less dusty department should be advised if the worker shows pulmonary dysfunction. Our study was cross-sectional. But a longitudinal study along with microbiological, immunological and biochemical studies will be helpful to understand the Pathophysiology of the effects of such exposure to cotton dust.

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