A STUDY OF LUNG FUNCTION ABNORMALITIES IN WORKERS OF COTTON SPINNING SHOPS

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Summary : Lung function was studied by forced expiratory spirograms and measurement of peak expiratory flow in fourteen young male subjects of the age 20 to 30 years. Seven of the subjects were cotton spinners in small shops in Paharganj market with the duration of work from 1 to 3 years. The other seven subjects served as controls. All the subjects were of the same socio-economic status and were North Indians. Forced vital capacity; forced expiratory volume in 1 sec; forced expiratory volume in 1 sec expressed as a percentage of forced vital capacity; forced expiratory flow between 80 and 70 per cent, between 55 and 45 per cent, between 30 and 20 per cent and between 15 and 5 per cent of the forced vital capacity were determined from forced expiratory spirograms. Peak expiratory flow and $FEB_{80-70}\%$ were significantly lower in cotton spinners suggesting involvement of larger airways.

Key words : lung functions flow rates cotton spinners

INTRODUCTION

Byssinosis is a respiratory disease that affects workers in cotton textile industry. Physical signs and radiographs have not been helpful in the diagnosis of this condition (9). A number of pulmonary function studies have been conducted in cotton textile mill workers (2). Moreover, recently pulmonary function changes in the chronic stage of the disease have also been defined (8) but there is paucity of data on pulmonary functions in younger age group subjects (20-30 years), who have worked for a shorter duration of 1 to 3 years and in cotton spinning shops instead of textile mills. It is in this context that the present study has been undertaken.

MATERIAL AND METHODS

Subjects for the study were divided into two groups. Group I consisted of seven male subjects absolutely free from respiratory disease and served as controls. Group II

consisted of seven male employees of the cotton spinning shops working in the congested Paharganj market. Subjects of both the groups were North Indians in the age range of 20-30 years and were of similar socio-economic status. All subjects except one each in the two groups were non-smokers.

The rooms in which cotton spinning was done had low ceilings and were approximately of rhe size 6 meters x 6 meters. The door was kept closed and only one window of approximate size 0.6 meters x 0.6 meters was kept open. The workers covered their mouth and nose with a piece of cloth. They had been employed as cotton spinners for a period ranging from one to three years. None of the workers had typical symptoms of byssinosis but they had complaint of cough or breathlessness on exertion and the symptoms had appeared after they had started working as cotton spinners.

The forced expiratory spirograms were recorded on a expirograph manufactured by Vallabhbhai Patel Chest Institute, Delhi University, Delhi. The best of the three efforts was analysed to obtain the following measurements : "forced vital capacity (FVC), forced expiratory volume in one second (FEV_1), FEV_1 expressed as percentage of FVC $\frac{(FEV_1\%).}{FVC}$ forced expiratory flow between 80 and 70 per cent of FVC ($FEF_{80-70}\%$), forced expiratory flow between 55 and 45 per cent of FVC ($FEF_{55-45}\%$), forced expiratory flow between 30 and 20% of FVC ($FEF_{30-20}\%$) and forced expiratory flow between 15 and 5 per cent of FVC ($FEF_{15-5}\%$)." The subscripts in the abbreviations for the forced expiratory flows refer to the percentage of FVC remaining in the lungs. The technique for analysing the forced expiratory spirogram was the same as that of Walter *et al.* (10) and Nancy and Rai (5). Flow rates and volumes were expressed at body temperature and pressure saturated with water vapour (BTPS).

The peak expiratory flow (PEF) was measured by using a Wright Peak Flow Meter. On all the subjects, tests were performed between 10-11 A.M. The standing height in centimeters and weight in kilograms were recorded. The subjects were clinically examined by a physician of the hospital and all the fourteen subjects of both the groups were found normal on clinical examination.

RESULTS

The anthropometric data are presented in Table I.

In order to assess the contribution of age and height to the variability of pulmonary function measurements between the two groups (Group I and Group II), predicted values

of FVC were obtained by applying the prediction formula of Jain and Ramiah (3). As prediction formula for PEF was not mentioned by these authors, the predicted values of PEF were obtained by applying the prediction formula of Malik *et al.* (4). The predicted values of FVC and PEF in the two groups were very close to each other (Table II). Hence it was presumed that age and height would not contribute to the variability in measurements between the two groups and the actual values obtained in control subjects (Table III) were used for comparison with those obtained in cotton spinners

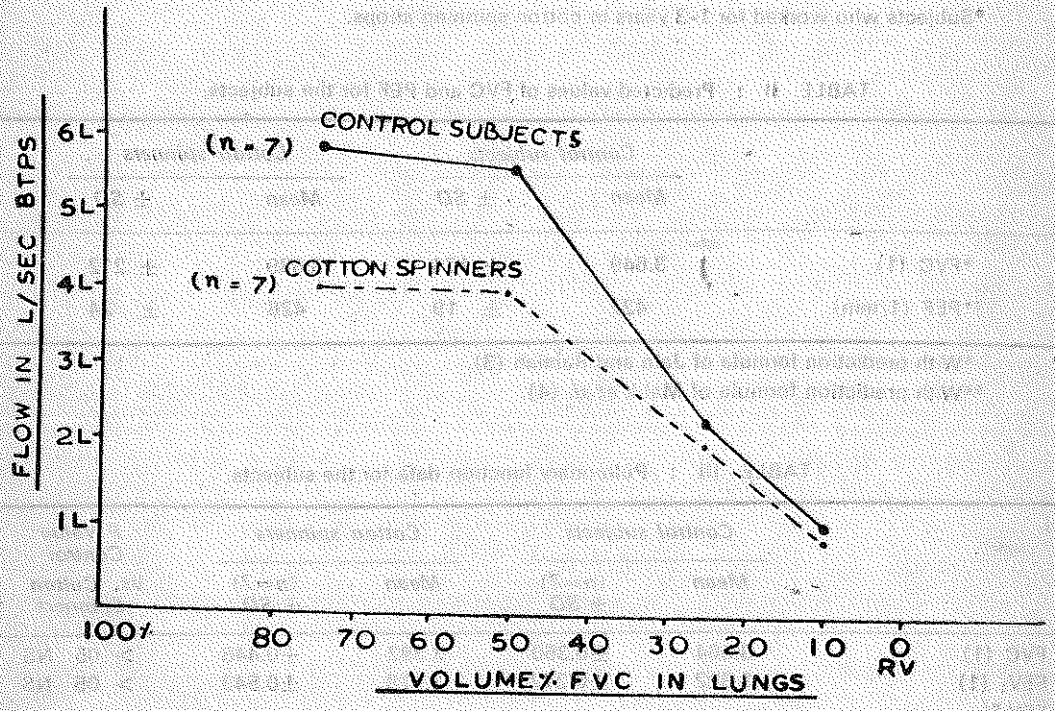

Fig. 1 : Flow volume relationship for the two groups of subjects. The forced expiratory flow measured at various percentages of forced vital capacity (FVC) is plotted here as a function of the corresponding percentage of FVC. RV = residual volume, L = litre.

The FVC, FEV_1, $FEF_{55-45\%}$, $FEF_{30-20\%}$, and $FEF_{15-5\%}$, were lower in the cotton spinners as compared with control subjects but statistically were not significant (Table III). However, the PEF and $FEF_{80-70\%}$ were significantly lower in cotton spinners as compared with control subjects (Table III and Fig. 1).

TABLE I : Anthropometric data for the subjects.

	Control subjects		*Cotton spinners**	
	Mean	*(n=7) ± SD*	*Mean*	*(n=7) ± SD*
Age (yr)	23.1	±4.7	21.4	±2.15
Height (cm)	158	±3.9	158	±4.8
Weight (kg)	50.5	±5.5	50.3	±4.5

*Subjects who worked for 1-3 years in cotton spinning shops.

TABLE II : Predicted values of FVC and PEF for the subjects.

	Control subjects		*Cotton spinners*	
	Mean	*± SD*	*Mean*	*± SD*
*FVC (l)	3.649	± .174	3.639	± .212
**PEF (l/min)	427	± 19	426	± 24

*With prediction formula of Jain and Ramiah (3).
**With prediction formula of Malik *et al.* (4).

TABLE III : Pulmonary function data for the subjects.

	Control subjects		*Cotton spinners*		*P Value Control Vs. Cotton Spinners*
	Mean	*(n=7) ± SD*	*Mean*	*(n=7) ± SD*	
FVC (l)	3.664	±0.350	3.392	±0.448	> .05 NS
FEV_1 (l)	3.322	±0.272	3.078	±0.543	> .05 NS
$\frac{FEV_1\%}{FVC}$	90.7	±5.2	90	±5.8	> .05 NS
PEF (l/min)	456	±51	373	±66	< .05
$FEF_{80-70\%}$ (l/sec)	5.782	±1.240	3.962	±0.746	< .01
$FEF_{55-45\%}$ (l/sec)	5.524	±1.904	3.955	±0.918	> .05 NS
$FEF_{30-20\%}$ (l/sec)	2.311	±0.576	2.022	±0.782	> .05 NS
$FEF_{15-5\%}$ (l/sec)	0.971	±0.492	0.805	±0.324	> .05 NS

All flows and volumes are at BTPS : The subscripts for flows refer to the percentage of FVC remaining in lungs.
NS : Not significant.

DISCUSSION

In our study young male cotton spinners (20-30 years) working in small shops had developed respiratory symptoms like caugh and dyspnoea but none of these workers had the typical symptoms of byssinosis. One of the reasons for this could be that minimum period to byssinosis has been reported to be longer and over 6 years in most of the studies conducted in textile mill workers in India (2) though in the study conducted in Madras (2) the minimum period has been reported to be 1-$\frac{1}{4}$ year only.

The findings of respiratory symptoms in our subjects could be attributed to cottom dust and poor ventilation of rooms in which cotton spinning was done by our workers.

The pulmonary function study conducted by us has shown a lower FVC and FEV_1 in cotton spinners as compared with controls but the differences were not statistically significant (Table III). However, earlier studies conducted in textile mill workers have shown a statistically significant decrease in VC in byssinotic and non-byssinotic workers (7) and also in FEV_1 in textile mill workers who did not have any respiratory symptoms (8). The shorter duration of exposure to cotton dust in the present study could be responsible for not finding significant differences in the above mentioned parameters as was observed by other workers (6).

In our study PEF and $FEF_{80-70}\%$ were significantly lower in cotton spinners (Table III). Whereas the other flow rates at low lung volumes i.e. $FEF_{55-45}\%$, $FEF_{30-20}\%$ and $FEF_{15-5}\%$ were though lower in cotton spinners, the differences were not statistically significant (Table III). The lower flow rates at higher lung volumes i.e. PEF and $FEF_{80-70}\%$ (Fig. 1) suggest that in these workers cotton dust affected the larger airways. These findings are further corroborated by a pathological study of byssinosis in which authors have detected abnormalities in large airways (1).

In view of the above findings it is tempting to postulate that the shorter duration of exposure to cotton dust even in younger age group is not innocuous, A further study in large number of younger subjects working in cotton spinning shops might be helpful in completely defining the functional abnormalities.

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