

A Cross-Sectional Study of Effect of Smoking on Lung Functions of Spinning Mill Workers

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ABSTRACT The present study was undertaken among 465 spinning mill workers during November 2008 to October 2009 with two- fold objectives to estimate the prevalence of lung function impairment and smoking among spinning mill workers and to study the effect on lung functions of these workers in relation to their smoking behavior. Forced vital capacity (FVC), forced expiratory volume in one second (FEV1) and ratio of FEV1/FVC were taken into consideration and results of lung functions testing were correlated with smoking behavior. The result revealed prevalence of smoking was (34.6%) among workers. 266 (57.6%) had normal lung function whereas 196 (42.4) had impaired lung functions. This study showed that the prevalence of impaired lung functions in smoker was significantly higher than in non- smokers. Also, the lung function impairment were significantly more in relation to duration of smoking and duration of exposure to cotton dust. The findings of the present study indicate smoking acts as a significant risk factor.

INTRODUCTION

Some people commit suicide by drowning and many by smoking (Park and Park 2009). Cotton and synthetic textile industry in India is the largest in the country providing employment to around 20 million workers (Mishra et al. 2004). Occupational exposure to cotton dust may cause lung function impairment. Cotton dust is defined as dust present in the air which may contain a mixture of contaminants, such as ground up plant matter, fiber, bacteria, fungi, soil, pesticides and non- cotton plant matters. Forced expiratory volume in 1 second (FEV1) is the amount of air an individual can forcefully exhale in the first second of the expiration, and the forced vital capacity (FVC) is the amount of air an individual can forcefully exhale after maximum inspiration. Higher levels of the ratio indicate that lungs are functioning well (Siziya et al. 2009).

Schachter et al. (1984) conclude that there is an increased prevalence of both obstructive and restrictive lung function abnormalities among cotton textile workers, with the most common pattern being obstructive. While some investigator have observed that cotton dust exposure may induce acute and reversible airflow limitation, expressed as decline in FEV1 (Wang et al. 2002) others have found that long term exposure may lead to excessive loss of lung function (Schachter et al. 1984; Zuskin et al. 1991). However, it is not clear whether chronic airway changes associated with long-term exposure are reversible after the exposure ceases. According to Shi et al. (1988), there was no significant difference between the retired cotton textile workers and the controls (not exposed to dust) in lung function parameters, whereas cigarette smoking had a distinct impact on all the parameters except forced vital capacity. The effects of cotton dust exposure and cigarette smoking appeared to be additive. Similarly, Wang et al. (2005) reported that chronic airway obstruction may to some extent be reversible after the exposure ceases for those workers who do not smoke. Smokers appeared to have more persistent adverse effect due to the interaction between exposure to cotton dust and smoking.

Even though quite a few studies indicating good evidence that persons exposed to cotton dust either

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in the short or long term have much increased lung function impairments, enough emphasis has not been given on the additive effect of smoking and cotton dust among workers in these mills especially in India, as the use of tobacco products by workers and the general population continues to increase in all parts of world.

Hence, this study was carried out in a spinning mill with two- fold objectives to estimate the prevalence of lung function impairment and smoking among spinning mill workers and to study the effect on lung functions of these workers in relation to their smoking behavior.

MATERIAL AND METHODS

A cross-sectional study was undertaken among spinning mill workers of Babasheb Kedar Sut Girini Pvt. Ltd. Nagpur during Nov 2008 to Oct 2009. Total number of workers of this mill were 685, out of these 171 workers were not involved in the actual spinning process. Therefore, these workers were excluded from the study.

Out of 514 workers who were directly involved in the spinning process 462 workers participated in the current study. Interview technique was used to collect information on a predesigned proforma and information was collected regarding socio-economic status (Park and Park 2009) and working conditions. Detailed smoking history was obtained. This was followed by careful general examination. Workers were then subjected to lung function testing by using MEDSPIROR spirometer (RMS Recorders and Medicare Systems Chandigarh) Medspiror is a computerized electronic type of lung function test machine.

Workers age, weight, height, room temperature were entered in the MIDSPIROR for comparison of lung functions with normal values for given age, sex and height.

Three consecutive readings were taken and the best of the three was selected. A single expiratory maneuver given many parameters amongst those following parameters was selected for the study.

1)FVC 2)FEV13)FEV1/FVC

Results of lung functions testing were correlated with smoking behavior. Forced vital capacity (FVC), forced expiratory volume in one second (FEV1) and ratio of FEV1/FVC were taken into consideration (Miller et al. 2005; Pellegrino et al. 2005; Timothy et al. 2004).

Statistical Analysis: Data analysis was done by using the statistical package of SPSS 13.0

version. Categorical variable were analyzed by Chi square test. The data of lung function tests were presented as the Mean $\pm$ SD for each of the parameter, the unpaired 't' test was used and p value of less than 0.05 was considered as significant.

RESULTS

All the workers were male. Majority of workers, (73.8%) had average BMI while 6.7% were found to be under weight and 2.8% were obese. The age range was from 21 to 58 years and maximum number of workers (45.7%) belonged to 40-49 years of age group.

Majority of the workers (33.5%) had education up to middle school and 27.3% up to high school. Almost 95% of the workers belonged to class III and IV as per modified Kuppu Swamy's scale Neither pre-employment nor periodic medical examination was available for the workers.

Table 1 shows that prevalence of smoking among workers was 34.6%. 266 (57.6%) of the workers had normal lung function, whereas 196 (42.4%) had impaired lung function. Among smokers 76.8% had impaired lung functions compared to 24.1% among non- smokers the difference was statistically significant

Table 1: Association of lung function impairment in relation to smoking habit (n=462)

Smoking	Impaired lung function	Normal	Total
Smokers	123(76.8)	37(23.2)	160(100)
Non smokers	73(24.1)	229(75.9)	302(100)
Total	196(42.4)	266(57.6)	462(100)

$\chi^2 = 118.93$ DF=,DF=1, $p < 0.00001$ (Highly significant)
OR =10.43

Table 2: Association of lung function impairment in relation to duration of smoking in smokers (n=160)

Duration of smoking	Impaired lung function	Normal	Total
<10 yrs	18 (52.9)	16 (47.1)	34 (100)
>10 yrs	105 (83.3)	21 (16.7)	126 (100)
Total	123	37	160

$\chi^2 = 13.91$, DF = 1, $p < 0.00001$ (Highly significant)

Table 2 shows that when association of lung function impairment in relation to duration of

smoking in smokers was seen, smoking for more than 10 years (83.3%) had impaired lung function compared to 52.9% among smokers of less than ten years of duration, the difference was statistically significant.

Table 3 clearly indicates significantly lower Forced vital capacity (FVC), Forced expiratory volume in one second (FEV1) while their ratio did not differ much between smokers and non-smokers. Thus, smokers had significantly more restrictive lung impairment.

Table 3: Mean spirometry data as per smoking behavior (in percent predicted)

Mean spirometry data	Smokers	Non smokers	P value
	Mean±SD	Mean±SD	
FEV1	75.07±16.52	87.35±11.62	P< 0.001
FVC	70.5±13.70	78.63±12.02	P< 0.001
FEV1/FVC	108.4±21.68	112.02±12.04	N.S

*compared by using unpaired 't' test

Table 4 shows that when association was seen in relation to years of employment and impaired lung functions in relation to smoking behavior the difference was statistically non-significant.

Table 4: Years of employment and impaired lung functions in relation to smoking behavior

Years of exposure	Non smokers n=302		Total	Smokers n=160		Total
	Normal	Impaired		Normal	Impaired	
		L.F.			L.F.	
< 5	25(100)	0(0)	25	8(80)	2(20)	10
6-10	34(83)	7(17)	41	9(43)	12(57)	21
11-15	28(67)	14(33)	42	8(296)	20(71)	28
16-20	69(73)	25(27)	94	7(14)	43(86)	50
> 20	73(73)	27(27)	100	5(10)	46(90)	51
Total	229	73	302	37	123	160

$\chi^2 = 0.33$, $P = 0.564$, Non Significant

Impaired lung functions went on increasing with years of exposure in both smokers and non-smokers but disorders developed much earlier in smokers as compared to non-smokers.

DISCUSSION

Exposure to cotton dust as well as smoking is known to cause respiratory disorders, but when the two co-exist, the effect can be more than additive. In this study, the effect of smoking on

lung functions of spinning mill workers was evaluated. The occupational health problem which is diagnosed is only the tip of iceberg. Spirometer helps to explore the large section of iceberg

In the present study, 34.6% workers were smokers. Most of them worked in unsatisfactory working conditions and inadequate medical assistant as reflected by absence of periodic examination.

Among smokers, 76.8% had lung function impairment compared to 24.1% among non-smokers. The difference was statistically significant which is quite comparable to the findings of an Indian study from Mumbai showing 12.3% lung function impairment among non-smokers and (46.5%) among smokers (Mahase et al. 2002).

A significant association was seen in lung function impairment in relation to duration of smoking in smokers. Among smokers, smoking for more than 10 years (83.3%) had impaired lung function compared to (52.9%) among smokers of less than ten years of duration.

The study clearly indicates significantly lower Forced vital capacity (FVC), Forced expiratory volume in one second (FEV1) in smokers than non-smokers while their ratio did not differ significantly between the two groups. This finding indicates restrictive nature of lung function impairment in smokers. In absence of exposure to cotton dust in general population, smokers are known to have more obstructive lung impairments than non-smokers. In the present study, restrictive impairments were found to prevail more suggesting combined effect of smoking and work place exposure.

Impaired lung functions went on increasing with years of exposure to cotton dust in both smokers and non smokers but disorders developed much earlier in smokers as compared to non smokers. Zuskin et al. (1991) also reported that continued exposure to high dust concentrations in the cotton textile industry is associated with an increasing prevalence of and progressive impairment of lung function. The increase in respiratory impairment was seen both in smokers and non-smokers.

This study showed that the prevalence of impaired lung functions in smoker was significantly higher than in non-smokers. Also, the lung function impairment were significantly more in relation to duration of smoking and duration of exposure to cotton dust.

Our findings regarding influence of smoking and increased respiratory impairment were similar

to those reported by other prevalence studies (Mahase et al. 2002; Ming et al. 2003; Mishra et al. 2004; Schachter et al. 1984; Shi et al. 1988)¹ and prospective studies (Bakirci et al. 2007; Berry et al. 1973; Wang et al. 2002; Wang et al. 2005; Zuskin et al. 1991).

CONCLUSION

The findings of the present study indicate smoking acts as a significant risk factor. Efforts should strengthen for cessation of smoking. Workers having lung function impairments must be removed from the section of the work with high dust concentration to better assign work in other dust free sections. Pre employment and periodic examination of workers should be carried out.

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