

Study of pulmonary function tests in tobacco factory workers

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Abstract

Tobacco use is a risk factor for many diseases, especially those affecting the heart, liver, and lungs, as well as many cancers. In 2008, the World Health Organization named tobacco as the world's single greatest cause of preventable death. Workers in the tobacco industry may experience exposure to certain environmental hazards, including tobacco leaf dust and pesticides remaining on tobacco as residues from field or post harvesting applications. As per tobacco institute of India 3.5 million people involved in tobacco industry which includes 6 million farmers, 20 million farm workers, 4.4 million beedi workers, 2.2 million tendu leaf pluckers and 2 million traders although the trade unions and private organizations says that the actual number of Tobacco workers is much higher as there are many unregistered workers in India.⁴ The dust of tobacco enters the respiratory system of tobacco factory workers through inhalation during tobacco processing, causes respiratory impairments.⁵ Workers of tobacco industries are chronically and predominantly exposed to tobacco dust and majority of workers of tobacco industries are smokers and Non-smoker tobacco workers are also exposed to passive smoking at their work places.⁶ In present study it was found that exposed workers show values of FEV₁ lower than their predicted values and also there is statistically significant difference between exposed and unexposed subjects. FVC values in workers are found decreased and is statistically significant. Statistically significantly decreased values of PEFr are observed in tobacco workers. Significantly decreased FEV₁/FVC ratio is also observed in tobacco workers. Decrease in FEV₁ and PEFr shows obstructive changes in large airways.¹¹

Keywords: Pulmonary function test. Probability value, Peak expiratory flow rate.

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INTRODUCTION

Tobacco is a product prepared from the leaves of the tobacco plant by crushing them. The plant is part of the genus *Nicotiana* and of the Solanaceae (nightshade) family. While more than 70 species of tobacco are known, the chief commercial crop is *N. tabacum*. The more potent variant *N. rustica* is also used around the

world.¹ Tobacco contains the alkaloid nicotine, which is a stimulant. Dried tobacco leaves are mainly used for smoking in cigarettes, cigars, pipe tobacco, and flavoured shisha tobacco. They can be also consumed as snuff or tobacco. Tobacco use is a risk factor for many diseases, especially those affecting the heart, liver, and lungs, as well as many cancers. In 2008, the World Health Organization named tobacco as the world's single greatest cause of preventable death. Workers in the tobacco industry may experience exposure to certain environmental hazards, including tobacco leaf dusts and pesticides remaining on tobacco as residues from field or post harvesting applications. Furthermore, exposure to asbestos should be considered since this material could have been extensively used as insulation in the heating system for drying processes.² Tobacco use contributes to chronic diseases and health problems including cancers, cardiovascular diseases, strokes, tuberculosis, respiratory

diseases, gastrointestinal disorders, cancer in oral cavity, reduced physical fitness, increased risk of osteoporosis and broken bones, cataracts, blindness, and increased time needed to recover from illness. Cigarette smoking and tobacco uses also lead to the alteration of the lipoprotein levels.¹

MATERIAL AND METHODS

The study was conducted on the Tobacco factory workers at, Jaysingpur Tal:-Shirol, Dist:-Kolhapur, during the year 2015-2016. Study was done on 114 Subjects. The age group was from 20-55 yrs. who were exposed to tobacco more than one year. Controls were selected from the office workers in the factory areas and other persons who were not exposed to the tobacco at the factory. A modified questionnaire was prepared with the general information about the workers i.e. name, age, sex, height, weight, education, marital status, years of working experience and health problems. Prior to the pulmonary function test the questionnaire was explained. Informed consent was taken from each subject. The pulmonary

function tests were performed using computerized spirometer (Clarity- Clarity medical Pvt. Ltd. Indi, India) in sitting position. Height of subjects and control was measured with the help of measuring tape. Weight was recorded with weighing machine. The data of subjects like name, age, sex, working experience, height, weight, date of performing test etc. was fed to the computerized spirometer. Screening of subjects was done with proforma.

Procedure: Careful examination of the workers was done. Workers with cardiovascular or respiratory illness, smokers and drinker were excluded. The tests were performed in sitting position. The subjects were familiarized with the set up details and demonstrations were given to our satisfaction. The subjects were made to breathe forcefully following deep inspiration in to the mouth piece attached to the spirometer. Expiration was maintained for a minimum period of 3-4 seconds. 3 trials of maximal inspiratory and expiratory efforts were made and only highest reading was taken for data processing.

OBSERVATIONS AND RESULTS

Table 1: General information of workers

Characteristics	No. Of Workers	%
A. Age group (Years)		
20-30	06	10.5
31-40	15	26.3
41-50	16	28
51-55	20	35
B. Total working period		
1-4 years	08	14.00
5-10 years	20	35.00
More than 11 years	29	50.08
C. work duration		
Annual	57	100
Seasonal	00	0
D. Educational qualification		
Illiterate	36	63.1
Primary	18	31.5
Higher	02	3.5
Graduate	01	1.7
E. Category according to BMI		
overweight (25-29.9)	09	15.7
obese (>_30)	01	1.7
Normal (18.5 -24.5)	33	57.8
Underweight (<18.5)	14	24.5

Table 2: Pulmonary function tests in control group and tobacco workers showing mean value and standard deviation

Parameter	Study Groups				Z Test	P Value
	Control		Workers			
	Mean	SD	Mean	SD		
FVC (L)	4.06	0.65	3.17	0.43	-8.642	0.00**
FEV ₁ (L)	3.79	0.59	2.92	0.35	-9.72	0.00**
PEFR (L/MIN.)	4.38	0.89	3.12	0.46	-9.42	0.00**
FEV ₁ /FVC%	89.68	4.77	81.53	3.70	103.89	0.00*

** highly significant * Significant

Table 3: Showing Mean value and standard deviation of forced expiratory volume at the end of one second (FEV₁) in tobacco factory workers according to duration of exposure

Yrs of Exposure.	Mean	Sd	N=57	F Value	P Value
1-4 YRS	3.27	0.32	8		
5-10YRS	2.88	0.31	20	6.169	0.003**
more than 11 yrs.	2.84	0.31	29		

**highly significant *significant

Table 4: Showing Mean value and standard deviation of forced vital capacity (FVC) tobacco factory workers according to duration of exposure

Yrs. of Exposure.	Mean	Sd	No. of Workers N=57	F Value	P Value
1-4 YRS	3.4	0.29	8		
5-10YRS	3.18	0.35	20	1.589	0.213
more than 11 years	3.13	0.49	29		

**highly significant *significant

Table 5: Showing Mean value and standard deviation of Peak expiratory flow rate (PEFR) in tobacco factory workers according to duration of exposure

Yrs. of Exposure.	Mean	Sd	No. of Workers N=57	F Value	P Value
1-4 YRS	3.56	0.46	8		
5-10YRS	3.09	0.43	20	5.292	0.007
more than 11 years	3.02	0.4	29		**

** highly significant *significant

Table 6: Showing mean value and standard deviation of forced expiratory volume at the end of one second and forced vital capacity (%FEV₁/FVC) with duration of exposure of tobacco factory workers

Yrs. of Exposure.	Mean	Sd	No. of Workers N=57	F Value	P Value
1-4 YRS	82.35	0.33	8		
5-10YRS	74.81	0.63	20	588.73	0.00**
more than 11 years	77.99	0.51	29		

**highly significant *significant

RESULTS

Table. No.1.shows percentage of workers according to age group where 10.5% workers are of age between 20-30 yrs., 26.3% workers are of age between 31-40 yrs., 28% workers are of age between 41-50years and 35% workers are of between 51-55 years. Percentage of workers according to the exposure shows 14% workers are between 0-4 years of exposure. 35% workers are exposed for 5-10 years. 08% workers are having experience of more than 11 years. According to literacy 63.1% workers are illiterate. 31.5% workers are having primary education. 3.5% workers having higher education and only 1.7% workers are graduate. This shows that majority of workers are illiterate. Table no. 2 and graph no. 1 and 2 shows forced expiratory volume at the end of one second (FEV₁) in control group was 3.79 L and in tobacco workers is 2.92 L. The difference is statistically highly significant (P=0.00). Huuskonen M.S. *et al* (1984) Mukhtar MS *et al* (1991) also found the reduction in FEV₁.^{7, 9} Forced vital capacity (FVC) in control group was 4.06 L and in tobacco factory workers 3.17 L. The

difference is statistically highly significant (P=0.000). Huuskonen M.S. *et al* (1984) also found reduction in force vital capacity (FVC).⁷ Peak expiratory flow rate (PEFR) in control group was 4.38 L/min. and that of tobacco workers was 3.12 L/min. which is statistically highly significant (P=0.00). Mukhtar MS *et al* (1991), Ahmet Tevfik *et al* (2001) also found the reduction in PEFR.^{9,11} %FEV₁/FVC in control group was 89.68 % and in tobacco workers 81.53%. The difference is statistically significant. (P=0.00). Ahmet Tevfik *et al* (2001) also found the reduction in %FEV₁/FVC. Our findings are in correlation with other findings.^{11,14,17,21} As seen in table no.3 and graph no.3 after 5 to 11 years of exposure forced expiratory volume at the end of one second (FEV₁) is progressively decreased, and this decrease is statistically significant. (P=0.003). Our findings are in correlation with other studies, who found the positive correlation of FEV₁ and the exposure.^{1,17,21,27} As seen in table no.4 and graph no.4 after 5 to 11 years of exposure forced vital capacity (FVC) among the subjects was seen to be decreased. But is statistically not significant (P=0.213).

As seen in table no.5 and graph no.5 after 5 to 11 years of exposure peak expiratory flow rate (PEFR) of workers was seen to be progressively decreased. And is statistically significant. (P=0.007). As seen in table no.6 and graph no.6 after 5 to 11 years of exposure the percentage of forced expiratory volume at the end of one second and forced vital capacity (%FEV₁/FVC) of workers was seen to be decreased and is statistically significant (P=0.00).

DISCUSSION

In this study the results show that the exposure to tobacco dust may affect the pulmonary functions. A decrease in FVC shows restrictive changes in the airways. While FEV₁ and PEFR show obstructive changes in large airways. So we can say that long term exposure to the tobacco environment causes mixed type of lung diseases. Exposure to tobacco dust has been suggested to affect the respiratory system. A tendency towards the lower spirometric values among the tobacco workers has been suspected in several studies. Mukhtar s. *Et al* (1991) have shown decreased ventilator capacity values in tobacco factory workers particularly in small airways.⁹ Kjaergaard *et al* (1989) reported significantly decreased FVC and FEV₁ in tobacco factory workers compared to referents.⁸ Huuskonen *et al* (1984) reported restrictive and obstructive changes especially in small airways of tobacco workers and a decrease in diffusion capacity.⁷ A decrease in FVC shows restrictive changes in the airways. While FEV₁ and PEFR shows obstructive changes in large airways. So we can say that long term exposure to the tobacco environment causes mixed type of lung diseases.

CONCLUSION

It may be stated that the lung function capacity is significantly decreased in the tobacco workers than that of the controls. It is due to long term exposure to tobacco dust.

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