

Correlation Between Amount of Smoking and Decline in Lung Function Among Urban Male Population

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ABSTRACT

A cross sectional study of six months duration was conducted at the Department of Pulmonology, Shaikh Zayed Hospital, Lahore to compare the lung function decline (percentage of predicted forced expiratory volume in one second $\langle FEV_1 \rangle$) with amount of smoking in different groups of subjects according to pack years of smoking. Data was collected from four hundred current smokers meeting inclusion and exclusion criteria collected by arranging free spirometry camps by non-probability purposive sampling. The study participants were having ages between 20 and 67 years with mean age of 38.1 ± 12.2 . It was found that cases in group up to 5 pack years of smoking had highest average FEV_1 98.0 ± 5.3 and FEV_1 decreased smoothly as number of pack years escalated. It was 96.0 ± 10.9 in 6-10 pack year group, 90.0 ± 9.8 in 11-15 pack years group, 85.3 ± 7.2 in group 16-20 and it was 71.9 ± 16.2 in group 21 and above pack years of smoking. In our study we also found that 79 (19.75%) participants had FEV_1 between 80-50% of predicted out these 58 (73.41%) were in group 21 and above pack years of smoking whereas 08 participants had FEV_1 less than 50% of predicted. It was concluded that the prevalence of undetected persistent airflow obstruction was high and more frequent in smokers having history more than 21 pack years of smoking.

Key words: Forced expiratory volume in one second (FEV_1), males, pack years, urban.

INTRODUCTION

Half of all regular cigarette smokers will eventually be killed by their habit and on average cigarette smokers dies ten years younger than the non smokers¹. Almost half of world's children breathe air polluted by tobacco smoke and more then 80% of the world's smokers live in low and middle income countries². Tobacco use kills 5.4 million people a year, an average of one person every six seconds and accounts for one in ten adult deaths worldwide.^{1,2} Overall prevalence of smoking in Pakistan is approximately 15.2% (28.6% among men and 3.4% among women), the highest being reported in the men aged 40-49 years that is 40.9%.³ Tobacco smoking is a strong risk factor for development of chronic bronchitis & emphysema & heavy smokers are at greater risk of developing COPD then moderate smokers.⁴ The risk of lung cancer is about 20 fold greater in smokers then in

non smokers and the attributable risk for development of lung cancer is estimated to be 79% in women and 90% in men.⁴

Cigarette smoking is the most well known risk factor for accelerated lung function decline in adults and FEV_1 is a reliable method for assessing the lung function.^{5,6} There is good evidence of considerable variation in pulmonary functions in different ethnic groups and across generations.⁷ In non smokers the FEV_1 begin to decline at 30-35 years and this may occur earlier in smokers.⁸ On average cigarette smokers have a high annual rate of decline in FEV_1 of about 60mL which is nearly double the average value of 30ml annually present in non smokers. However there is considerable variation in decline in FEV_1 , with some smokers showing very rapid rates of decline.^{8,9}

The purpose of this study was the comparison of lung function decline in relationship to number of cigarette smoked.

MATERIAL AND METHODS

It was a cross-sectional study of 6 months duration from 23-04-2009 to 24-10-2009 at the Department of Pulmonology, Sheikh Zayed Hospital, Lahore. A total of 400 current cigarette smokers were enrolled by non-probability purposive sampling. Inclusion criteria included male gender, cigarette smokers having ages between twenty and seventy years.

Excluded were those smoking other than cigarettes (hukka, bedi, pipe and cigar smokers), active respiratory tract infection, suffering from chronic respiratory diseases like bronchial asthma, bronchiectasis, and pulmonary fibrosis, etc, having past history of pulmonary tuberculosis, those having history of exposure to dusts and chemicals at work place including coal mine workers, stone crushers, and workers of chemical factories and all those suffering from systemic diseases like chronic renal failure, chronic liver disease, hypertension, ischemic heart disease, congestive cardiac failure and diabetes mellitus etc.

Data was collected from four hundred consenting subjects meeting inclusion and exclusion criteria who were selected by arranging the free Spirometry camps at different occasions like world asthma and COPD days. The lung function (FEV₁) was assessed by using one of the available spirometer in the department (MIR Spiro lab II). The spirometry of the participant was performed according to the criteria laid by the American thoracic society. spirometry provided value of FEV₁ and percentage of predicted FEV₁. All the above information was collected on a specifically designed study proforma and the data was evaluated by SPSS version 15. An overall regression analysis between pack years of smoking and FEV₁ (percentage of predicted FEV₁) was carried out to determine the change in FEV₁ due to change in pack years. Whereas regression analysis of each group was performed separately.

RESULTS

This study included four hundred adult males having ages between twenty and sixty seven years and total sample was divided in to five groups by pack years that is up to 5, 6-10, 11-15, 16-20 and 21

and above. The regression analysis was performed by keeping FEV₁ as dependent variable whereas age and pack years of smoking as independent variables. The model showed overall significance with R square value 0.525, which revealed that age and pack years together explains 52.5% of variation in FEV₁. However the age did not have significance (p-value 0.115). Then model was fitted only with pack years of smoking as independent variable and it came up with R square value 0.52 which was same so age was excluded from the regression model.

The model came up with FEV₁= 101.35-0.86× (pack years of smoking). This model showed that the average FEV₁ is 101.35 when there was less than one pack year of smoking. The regression coefficient for pack years was -0.86 with P-value 0.001. It showed that on an average increase in pack years of smoking by one unit lead to an average decline in FEV₁ by 0.86%. When regression was run between FEV₁ and pack years in each group separately it also revealed the similar results. Regression coefficients were significant in group 11-15 pack years of smoking as well as those of 21 & above pack years (Table 1).

Table 1: Regression analysis among smoking pack years groups.

Model Summary (b)				
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	0.726(a)	0.556	0.525	10.193

Coefficients (a)					
	Unstandardized Coefficients		Standardized Coefficients	T	P value
	B	Std. Error	Beta		
(Constant)	98.48	1.81		54.56	< 0.001
Pack years	-0.92	0.057	-0.780	-16.21	< 0.001
Age	0.092	0.058	0.078	1.58	0.115

a Dependent Variable: FEV1

It was found that cases in group up to 5 pack years of smoking had highest average FEV₁ 98.0±5.3 and FEV₁ decreased smoothly as number of pack years increases. Among various groups, FEV₁ was 96.0±10.9 in 6-10, 90.0±9.8 in 11-15, 85.3±7.2 in 16-20 and 71.9±16.2 in group 21 and above pack years of smoking (Table 2).

Table 2: Pack years and FEV₁ percentage of predicted.

Pack years	30 - 50		50 - 80		80 and Above	
	n	%	n	%	n	%
0 - 5	0	0.0	0	0	103	32.9
6 - 10	0	0.0	5	6.3	80	25.6
11 - 15	0	0.0	6	7.6	48	15.3
16 - 20	0	0.0	10	12.7	52	16.6
21 & Above	8	100.0	58	73.4	30	9.6

The present study also found that 79 (19.75%) participants had FEV₁ between 50% & 80% of predicted and out these 58 (73.41%) were in group 21 and above pack years of smoking whereas 08 participants had FEV₁ <50% of predicted (Table 2).

When regression analysis was performed among each pack years group separately it was observed that the regression coefficient B -0.23 was insignificant in group upto 5 pack years with P-value 0.488, similarly it was insignificant in group 6-10 pack years group B 1.01 with P-value 0.178. However it was observed that the regression coefficient -2.26 for 11-15 pack years group and -0.73 for 21 and above pack years group were highly significant with P-values being 0.014 and 0.001 respectively. On the basis of regression analysis we found that the effect of smoking on lung function (FEV₁) was not much different among those subjects having less than 10 pack years of smoking and the effect was maximum in those with 21 and above pack years. FEV₁ decreased smoothly between 11-15 pack years group but there were lot of fluctuation in group 16-20 pack years.

The correlation coefficient between FEV₁ and pack years of smoking in all groups separately showed same picture as the regression analysis and confirmed the picture. In overall study group it showed strong association (r -0.724) with P-value 0.001 which explains binding strength of FEV₁ and pack years of smoking.

DISCUSSION

In Pakistan the highest prevalence of cigarette smoking among males has been observed in the ages between 24-44 years, whereas in women it is not known.¹⁰ Smoking is a prime etiologic factor in heart disease, stroke and chronic lung disease along

with mounting evidence of the harmful effect of passive smoking.¹¹ Smoking causes airway obstruction, chronic expectoration and progressive decline in lung functions.¹² All these effects are directly proportional to number of pack years and there is definite tendency to narrowing of both the larger and smaller airways.¹³

In our study it was found that participants with <10 pack years of cigarette smoking had insignificant effects on FEV₁ while smokers with 21 and more pack years of smoking had highly significant effect on FEV₁ which is consistent with previous studies. In a Pakistani study it was found that spirometric screening in current smokers with smoking history of more than 10 pack years of smoking could uncover a significant number of persons with spirometric signs of airflow obstruction.¹⁴ Another local study having findings like our study revealed that the asymptomatic smokers who are apparently healthy were found to exhibit mild airflow obstruction.¹⁵

Smokers in group 16 to 20 pack years in our study had insignificant effect on FEV₁ & the average FEV₁ in this group was 85.3%±7.2% which shows a lot of variation in this group. According to a foreign study it was found that there were other confounding factors that complicated the relationship between the number of cigarettes smoked & rate of decline in FEV₁ including the extent to which cigarette smoke is inhaled as well as tar, nicotine and other constituents.¹⁶

A famous British study showed that depending upon the number of cigarette smoked per day only 24-47% of smokers developed airflow obstruction.⁶ Fletcher and colleagues in a eight years study found that susceptible cigarette smokers could be identified early in middle age by the reduction in FEV₁, they assumed that there was tracking effect, whereby individuals in the highest and the lowest FEV₁ percentiles remained in same percentiles over subsequent years.¹⁷

Tracking of the lung functions decline over time has potential advantages over performing a single test.¹⁸ However, there are no published data demonstrating that when the results of the first spirometry test are normal in a high-risk patient, the measurement of annual changes in lung function (tracking) is better than simply repeating spirometry

at 3-5 year intervals. In Pakistan most of secondary and even some tertiary care centers do not have facilities of lung function testing & in a very few diagnostic centers/hospitals, well-trained nurse practitioners are available. In several countries spirometry in primary care has been advocated and is facilitated in recent years.¹⁹ In the UK 2004 General Practice contract, the focus on respiratory disease has increased and the use of spirometry in order to actively detect airflow obstruction is being encouraged.²⁰

Cigarette smoke has diverse effects on lung structure and function & extensive literature is available on the harmful effects of smoking.²¹ Previous studies of lung function testing in the general population have had mixed results, with some showing no effect and others suggesting that knowledge of an abnormal lung function test doubled the likelihood of quitting smoking, even when no other interventions were applied.²²

The Lung health study documented the ability of spirometry to detect mild airflow abnormalities in thousands of cigarette smokers, many of whom did not have symptoms that would have prompted them to seek medical attention.²³ It was revealed that the rate of decline of FEV₁ following successful smoking cessation was very similar to that seen in healthy nonsmoking adults.²⁴

Some limitations of this study should be considered. Firstly, study included only men because of limited resources and the known higher smoking rate and prevalence of airflow obstruction in males. Secondly, we used only FEV₁ to detect the airflow obstruction and ratio of FEV₁/FVC as well as bronchodilator testing was not performed which could have extended the diagnostic information. However, the degree of airways obstruction, as determined by the FEV₁, is an independent predictor of subsequent decline in lung function and therefore, may be used to detect smokers at higher risk of developing airway disease.

CONCLUSION

The prevalence of undetected persistent airflow obstruction is high and is more common in smokers having history more than 21 pack years of smoking. Targeted screening therefore, especially in

smokers needs to be considered. There is also need to conduct a longitudinal study in our smokers to determine rate of decline of FEV₁ in local population.

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