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SHORT COMMUNICATION

Reduction of Spirometric Lung Function Tests in Habitually Smoking Healthy Young Adults: It's Correlation with Pack Years.

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Abstract:

Background: Adolescent smoking and the subsequent health problems are a major concern today. However there are very few studies done on spirometric lung functions and its relation with pack years in young adult habitual smokers who are apparently healthy. *Aims and Objectives:* The present study is undertaken to assess the change in lung functions in apparently healthy young adult habitual smokers compared to their age matched controls.

Materials and Methods: A random sample of apparently healthy young adult habitual smokers (n=40) and nonsmokers (n=40) between age group17-35 years with history suggesting of pack years of 2-10 years were selected from students & employee's of B.L.D.E.U's Sri B.M. Patil Medical College, Hospital & Research Centre Bijapur (Karnataka), India. Spirometric lung functions recorded were forced expiratory volume in one second (FEV_1), FEV_1%, Peak expiratory flow rate (PEFR) and Maximal expiratory pressure (MEP). *Results:* The results suggested that in apparently healthy habitual smokers there was significant decrease in FEV_1 (L) (-13.34%, $p<0.001$), FEV_1% (-10.76%, $p<0.001$), PEFR (-45.26%, $p<0.0001$) and MEP (-35.51%, $p<0.0001$) compared to nonsmokers and decrease in FEV_1 was negatively correlated with pack years in smokers ($r^2=0.063$, $p=0.001$). Reduced lung functions and negative correlation to pack years may be attributed to decreased airway diameter & reflex broncho- constriction in response to inhaled smoke particles.

Conclusions: In conclusion young adult habitual smokers who were apparently healthy are more prone for respiratory dysfunction than their nonsmoker counterparts. FEV_1 reduction in relation to pack years acts as an important determinant for detecting lung dysfunction in the early stage of the disease. As the risk of having smoking related diseases depends mainly on number of pack years, it is suggested that quitting smoking earliest helps to get greatest health benefits in apparently healthy young adult habitual smokers.

Key Words: Spirometric lung functions, Habitual smoking, Forced Expiratory volume in 1st second (FEV_1) Pack Years, Peak Expiratory Flow Rate (PEFR).

Introduction:

Cigarette smoking is the single most important risk factor for reduced lung functions

in adults apart from being a major cause for heart diseases, bronchogenic carcinoma and stroke. It is responsible for the 90% of Chronic Obstructive Pulmonary Diseases (COPD) within 1-2 years of beginning of smoking. COPD is the fourth leading cause of death and affects more than 16 million persons in United States every year [1].

Cigarette smoking continues to rise in developing countries and it predominates in urban areas, whereas beedi smoking is the commonest type of smoking in the lower income groups of illiterate and less educated people [2]. According to WHO reports use of tobacco among 13-15 years adolescents is increasing and smoking causes 10 % of the 10 million deaths per year of which 70% of deaths are in age 30-69 years. An adult male smoker loses an average of 13.2 years of life because of smoking [3, 4]. Therefore, number of adolescents continuing to smoke remains a major public health problem in India as most of them start using tobacco before the age of 19 years. Longitudinal studies of FEV_1 in such smokers reveal that smoking in their early adulthood slows rate of increase of FEV_1 growth and immediately results in a delayed & lowered plateau before the rapid decline of lung functions begins [5]. Various other studies have shown that smoking is the main risk factor for chronic obstructive pulmonary diseases [6]. Knowledge on the response to the initial smoke exposure might enhance the understanding of changes due to smoking, since repetitive acute smoke effects may cumulate and lead to irreversible lung damage [7]. Hence early detection of these changes will help in the prevention of permanent damage of lungs in apparently healthy young adult smokers.

Therefore, the present study was undertaken to find out relationship if any between development of spirometric lung function changes with the pack years and to detect these spirometric changes at the early stage of disease in apparently healthy young adult habitual smokers.

Material & Methods:

The study was carried out on eighty apparently healthy students & employees of B.L.D.E.U's Shri. B. M. Patil Medical College, Hospital and Research Center, between the age group of 17-35 years. They were divided in to two groups according to their smoking habit. Subjects were selected by simple stratified random sampling method. Study group consisted of forty apparently healthy (clinically no signs and symptoms of lung dysfunctions observed) habitual male smokers (12- 25cigarettes/day). Control group included forty healthy non smoking male students & employees of B.L.D.E.U's Shri B. M. Patil Medical College, Bijapur. There was no history of passive smoke exposure in either study or control groups.

The apparent health status of subjects was determined by history taking & clinical examination. Duration of smoking was obtained by asking questionnaire to each subject, duration was measured in pack years (cigarettes a day/ years of smoking/20) or smoking index (SI) (cigarettes a day/ years of smoking) [8,9]. All subjects were using filtered cigarettes. Subjects with recurrent upper or lower respiratory tract infections and known cardiopulmonary disorders were excluded from

the study. Institutional ethical clearance was obtained for the study; informed consent was taken from each subject. Recording of spirometric lung function tests was done in the morning hours (9-12 am), the techniques were demonstrated to each subject. Three efforts were made by each subject while standing and wearing nose clip. The best of the three trials was recorded at BTPS (body temperature, ambient pressure and saturated with water vapor).

Spirometric indices measured were-

1. *FEV_1 (Forced Expiratory Volume at the end of First Second, in ml*) by using Benedict-Roth's recording spirometer (M2K3-377, manufactured by INCO. Instrument and Chemicals Pvt. Ltd, Ambala 134003 India).

2. *PEFR (Peak Expiratory Flow Rate, L/min)* by using mini Wright's Peak flow Meter (AUBURN. ME04210.manufactured by Spirometrics Medical Equipment Co)

3. *MEP (Maximum Expiratory Pressure, mmHg)* by using Modified Black's Apparatus (ME63850, Manufactured by-B.P. apparatus, Prince 32x25mm)

Table-1: Mean values of Spirometric lung function tests of control and study groups

Lung function tests	Control (n=40)	Study (40)
FEV_1 (L)	2.22 ± 0.01	1.95 ± 0.01***
FEV_1 %	88.47 ± 0 .95	78.95 ± 0.38***
PEFR (L/min)	519.25 ± 16.40	284.25 ± 6.84***
MEP (mmHg)	126.75 ± 4.22	81.75 ± 5.40***

Values expressed are (Mean ± SD) *P< 0.05, **P< 0.01, ***P<0.001

Results were statistically analyzed by using SPSS version 9. Data were presented as Mean± SD. The level of significance was calculated by Student's t test. P-value of < 0.05 was considered as statistically significant.

Results:

All the values of lung functions (Table-1), FEV_1- Forced expiratory volume (L), FEV_1%- Forced expiratory volume in first second (normal value is 80% of FVC), and PEFR-Peak expiratory flow rate (L/min, 450-600 L/min is normal), MEP-Maximum expiratory pressure (Normal value is 80-130 mmHg) are reduced in study group as compared to controls. Statistically FEV1, FEV_1% and PEFR and MEP ($p<0.001$) were found to be highly significantly lower in study (smoker) group as compared to

Fig-1: Graph showing the percentage change of spirometric lung functions in apparently healthy habitual smokers in comparison with non smoking controls

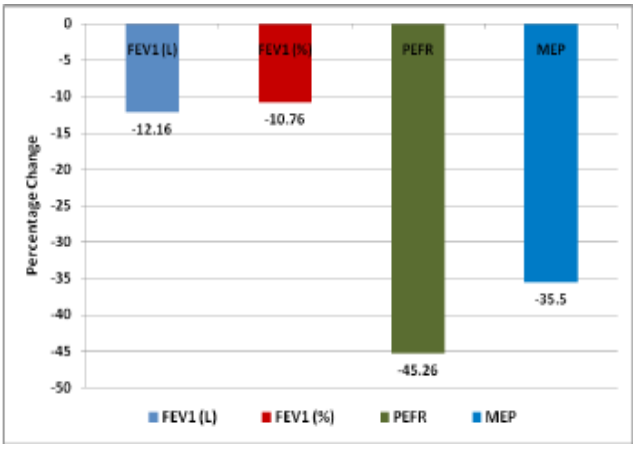
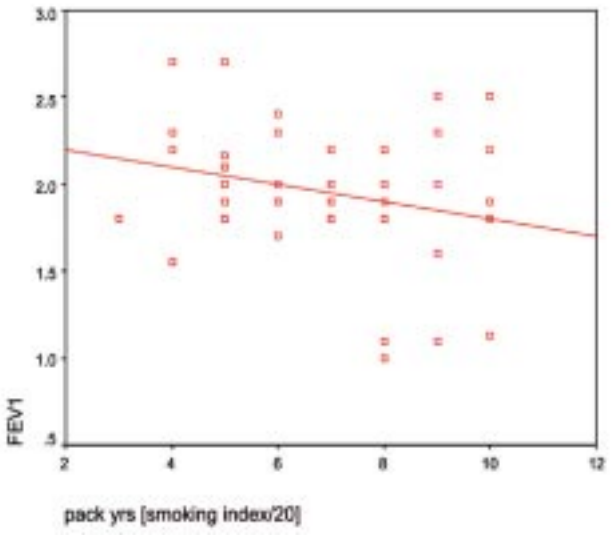


Fig-2: Graph showing the correlation between FEV1 and pack years in apparently healthy habitual smokers



controls (nonsmoker) (Table-1).

FEV_1 showed a significant (r^2=0.063) inverse relationship with pack years in apparently healthy habitual smokers (Fig-2).

Discussion:

Our observations suggest that there has been a significant decrease in all the spirometric lung functions recorded between apparently healthy habitual young adult smokers and nonsmokers of same age group. The values of FEV_1 (L) and FEV_1% are significantly ($p<0.001$) lower by -12.16%, -10.76% respectively in study group as compared to controls. This may be attributed to greater airway obstruction due to cigarette smoke that causes direct irritant and toxic effect on airways and lung parenchyma by mechanism of oxidative injury [10].

Our findings are consistent with similar other studies. There is a dose-response relation between smoking and lower levels of forced expiratory volume in one second as each pack per day has been associated with a 3.5 percent reduction in FEF 25%-75 % for boys [11, 12]. Among adolescents of same sex, smoking five or more cigarettes a day, as compared with never smoking, has been associated with 0.20 percent slower growth in boys [13]. Therefore cigarette smoking is associated with evidence of mild airway obstruction and slowed growth of lung function in adolescents. It is found that there exists a significant dose-response relation between the average rate of smoking and annual change in FEV_1. It has been found that FEV_1 is reduced by 0.42ml for each cigarette smoked per day [14]. Various studies reported that pack years contributed to greater extent on percentage of reduction of FEV_1 [15]. Our observations correlate with them. It is inferred from our results that number of pack years could be accounted for significant reduction in flow rates of apparently healthy habitual young adult smokers. Obstructive lung dysfunctions have been commonest among these young adult smokers with impaired pulmonary functions who have been apparently healthy.

In conclusion habitual cigarette smoking in apparently healthy young adults leads to a decline in spirometric lung functions which starts early as compared to non smokers of the same age group. This is directly related to the pack years. These changes may be attributed to various compounds in smoke that cause oxidative injury and peroxidation of membrane lipids in lungs. All these factors together are known to contribute to the development of

COPD's, bronchial carcinoma in habitual smokers. Spirometric changes are the earliest indicators of airway obstruction & small airway diseases; FEV_1 reduction is one of the early determinants of pulmonary dysfunction in apparently healthy smokers. Therefore it should be advised to young adult habitual smokers who are apparently healthy to refrain from smoking at an early stage, which will improve the lung functions as well as prolong the years of life.

In our study reversibility with bronchodilators in spirometric lung functions has not been conducted on smokers. This would help in unmasking sub clinical hyper-responsive airways in smokers.

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