

## COMPARATIVE STUDY OF PULMONARY FUNCTION VARIABLES IN RELATION TO TYPE OF SMOKING

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**Abstract :** This study was intended to compare pulmonary function parameters in beedi smokers, cigarette smokers and subjects who smoked both beedi and cigarette on the basis of the dynamic ventilatory pulmonary function tests. The pulmonary function tests were done on 188 subjects which included, 48 beedi smokers, 48 cigarette smokers, 43 others who smoked both beedi as well as cigarette and 49 non-smokers (control). In beedi smokers the values of Forced Expiratory Volume in 1st second (FEV<sub>1</sub>), Peak Expiratory Flow Rate (PEFR), Forced Expiratory Flow (FEF)<sub>25%-75%</sub>, FEV<sub>1</sub>/FVC%, BMI and weight were significantly lower (P<0.01) than those of cigarette smokers and non-smokers. Moreover, the Forced Vital Capacity (FVC) and Maximal Voluntary Ventilation (MVV) of beedi smokers were significantly (P<0.0001) lower than those of non-smokers. It may be concluded that pulmonary functions are more affected in beedi smokers than in cigarette smokers.

**Key words :** smokers  
beedi smoking

pulmonary function  
cigarette smoking

### INTRODUCTION

Tobacco smoking is widely prevalent all over the world and it continues to rise in developing countries, by 2030 the developing world is expected to have 7 million deaths annually from tobacco use (1). Various forms of tobacco smoking are prevalent in India including smoking of beedies, cigarettes, cigars like cheroots, cigarillos and 'hukka'. Beedies are made from sun-cured tobacco rolled by hand in tendu leaf wrapper (*Diospyrus melanoxylon* (or) *Diospyrus ebenum*) about 6 cm long and do not have filters. Cigarette smoking 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).

Pulmonary function tests help in determining the presence or absence of obstructive, restrictive or mixed airway diseases for effective therapeutic intervention. The harmful effects of cigarette smoking on lung structure and function has been reported elsewhere (3). Cigarette smoking is well known as the most important causative factor for chronic obstructive pulmonary diseases and bronchogenic carcinoma. It was initially thought that beedi smoking is less harmful than cigarette smoking although the studies carried out in India show it otherwise since the risk of

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cancer at oral cavity, pharynx, lung and oesophagus is more in beedi smokers than in cigarette smokers (4, 5). As far as respiratory effects are concerned, similar contradictory views are prevalent. This cross-sectional study done from a hospital based sample was intended to compare the dynamic ventilatory pulmonary function tests in beedi smokers, cigarette smokers and subjects who smoked both beedi and cigarette.

## MATERIAL AND METHODS

### Subjects

The subjects who participated in this study were male non-smokers and smokers from the Outpatient Department of Kilpauk Medical College and Hospital, Chennai. The subjects selected were from those who accompanied patients and from patients without any respiratory complaints. The patients with acute illness or any respiratory illness at the time of the study were excluded. Informed consent of the subjects was obtained and all ethical requirements related to human experiments have been fulfilled (6). Their socioeconomic status and smoking history were recorded during the course of the study. The subjects included in this study were 48 beedi smokers (group 1), 48 cigarette smokers (group 2), 43 other smokers who smoked both beedi as well as cigarette (group 3) and 49 non-smokers (control, group 4). Beedi smokers on an average had smoked 5.5 pack-years; cigarette smokers smoked 8.4 pack-years and 8.6 pack-years by smokers of both beedi and cigarette. [1 pack-year = 20 cigarette/day for one year or 80 beedies/day for one year; 4 beedies equivalent to 1 cigarette (2)].

### Spirometry

Computerized equipment "MEDSPIROR" (MED SYSTEMS Pvt. Ltd., Chandigarh) was

used in this study. Standard methods and precautions outlined by Miller et al (7) have been followed. From the two maneuvers of forced vital capacity (FVC) and maximal voluntary ventilation (MVV); the values for various lung volumes and flow data such as Forced Vital Capacity (FVC), Forced Expiratory Volume in 1<sup>st</sup> second (FEV<sub>1</sub>), Peak Expiratory Flow Rate (PEFR), Forced Expiratory Flow (FEF)<sub>25%-75%</sub> and Maximal Voluntary Ventilation (MVV) corrected for BTPS (body temperature, ambient pressure-saturated with water vapour) were determined and tabulated:

The data collected were statistically analysed by using the Statistical Package for Social Sciences, (SPSS) Version 11.0. One way ANOVA was used to determine the statistical significance of differences between the four groups. The post test comparisons were made using Tukey-Kramer's multiple comparisons test. Multiple regression was carried out to determine the effect of the independent variances like pack-years and type of smoking on FVC, FEV<sub>1</sub>, PEFR, FEF<sub>25%-75%</sub>, MVV and FEV<sub>1</sub>/FVC%.

## RESULTS

The results pertaining to various physical parameters, values of BMI, pack-years and pulmonary function parameters of one way ANOVA are given in Table I. The values of age and weight were not significantly different among smokers and non-smokers (P=0.6). Though the mean values of pack-years of the three groups of smokers were apparently different, the differences were not significantly different (P=0.17; ANOVA).

The results of Tukey-Kramer's multiple comparisons test done comparing the weight, BMI and pulmonary function parameters of smokers with non-smokers are also given in Table I.

TABLE I: Anthropometric data and pulmonary function test results. Data are expressed as mean±SD; n=number of subjects.

Parameters	Beedi smokers (n=48)	Cigarette smokers (n=48)	Beedi & Cigarette smokers (n=43)	Non-smokers (n=49)	P value by one way ANOVA
Weight (Kg)	49±6* <sup>@</sup>	57±12	53±9	55±10	<0.0001
BMI (Kg/m <sup>2</sup> )	19±12 <sup>@</sup>	21±3	20±3	20±4	0.002
FVC (L)	2±0.5*	2.2±0.6*	2.2±0.6*	2.9±0.5	<0.0001
FEV <sub>1</sub> (L)	1.4±0.5* <sup>@#</sup>	1.9±0.6*	1.7±0.5*	2.3±0.6	<0.0001
FEV <sub>1</sub> /FVC %	74±20 <sup>@</sup>	86±10	81±15	79±18	0.002
PEFR (L/s)	2.5±1.3* <sup>@</sup>	3.6±1.4	2.9±1.2*	4±2.1	<0.0001
FEF <sub>25%-75%</sub> (L/s)	1.4±0.8* <sup>@</sup>	1.9±0.8	1.8±1.2*	2.5±1	<0.0001
MVV (L/min)	59±20*	71±22*	65±21*	98±31	<0.0001

FVC – Forced Vital Capacity; FEV<sub>1</sub> – Forced Expiratory Volume in 1 second; PEFR – Peak Expiratory Flow Rate; FEF – Forced expiratory flow: 25%–75% of FVC and MVV – Maximal Voluntary Ventilation.

\*P<0.05 as compared to non-smokers.

<sup>@</sup>P<0.05 as compared to cigarette smokers.

<sup>#</sup>P<0.05 as compared to beedi and cigarette smokers.

The type of smoking and pack-years together accounted for 12% of variance in FVC (P=0.0001), 14% of variance in FEV<sub>1</sub> (P<0.0001), and 4.5% of variance in BMI (P=0.04). The combined effect of type of smoking and pack-years on FEV<sub>1</sub>/FVC%, MVV and PEFR was statistically not significant (P>0.1). The type of smoking alone accounted for 5% of variance in on FEV<sub>1</sub> (P=0.007) and 3.5% of variance in FEF<sub>25%-75%</sub> (P=0.02). Whereas the pack-years alone accounted for 8.5% of variance in FVC (P=0.0005) and 6.6% variance in FEV<sub>1</sub> (P=0.002). The effect of weight and BMI on FVC, FEV<sub>1</sub>, PEFR, FEF<sub>25%-75%</sub>, MVV and FEV<sub>1</sub>/FVC% were significant (P<0.01).

## DISCUSSION

In this study, the values of FEV<sub>1</sub>, PEFR and FEF<sub>25%-75%</sub> show significant reduction (P<0.001) in beedi smokers than cigarette smokers and non-smokers. This can be accounted on the basis of excess of carbon monoxide, tar and other toxic constituents present in the smoke of the beedi (8). Beedies contain higher level of steam volatile phenol, hydrogen cyanide and benzopyrene along with higher level of particulate matter and nicotine

than cigarettes, although strict comparison with cigarettes have not been made (9).

On the contrary, cigarette smokers showed significant reduction only in FVC, FEV<sub>1</sub> and MVV than non-smokers. Nevertheless, the deleterious effects of cigarette smoking cannot be ignored and they are well documented by Read and Selby (10). Malik (11) has shown no change in FVC, but decline in FEV<sub>1</sub>% and greater decrease in pulmonary function in cigarette smokers than in beedi smokers due to lesser quantity of tobacco in beedies than in cigarettes. The findings of this study have shown that the reduction in FEF<sub>25%-75%</sub> was significantly greater (P<0.0001) than those reported by Udwardia et al (12).

It may also be found from the results of this study, that the ratio FEV<sub>1</sub>/FVC% of beedi smokers was significantly (P<0.01) less than cigarette smokers. The cigarette smokers had high value of FEV<sub>1</sub>/FVC%, when compared to non-smokers, a restrictive effect would be possible when the total lung capacity was also lower than that of non-smokers (13). On the other hand, beedi smokers tend to have mixed obstruction and

restriction, by virtue of the fact that the ratio  $FEV_1/FVC\%$  as well as FVC was lower than non-smokers. The MVV showed significant reduction in beedi smokers, cigarette smokers and the smokers of both beedi and cigarette than non-smokers possibly due to reduction of respiratory muscle strength.

In this study, the type of smoking and pack-years influenced FVC and  $FEV_1$ , mainly pack-years contributed greater percentage on reduction of FVC and  $FEV_1$ . It may be inferred from the results that the type of smoking accounted for significant reduction in flow rate. Gokhale et al investigated the acute effects of smoking a single beedi or

cigarette, and concluded that former produced greater central airway constriction (14). Living and occupational environments of the subjects were not taken into consideration during the analysis of the results. On the whole, beedi smokers showed the lowest value of pulmonary function parameters among smokers.

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