Evaluation Of The Effect Of Chronic Heavy Smoking By Pulmonary Function Test

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Abstract: Background: Pulmonary functions are significantly affected by the chronic smoking. Study has done to investigate relationships between heavy cigarette smoking (20 cigarettes/bidis per day) and pulmonary function in Adult men. Objective is to find out If Chronic heavy smoking start affecting the lung functions as early 5 years of habit. Method: A cross sectional study on 112 individuals , selected randomly from general population of Ahmedabad city was performed. A thourough history analysis (Height, Weight, BMI), Physical examinations Spirometry were done on all indivudials after explaining them procedure and taking their cosent. Parameters measured by the spirometer were FEV1, FVC, FEV1/FVC, PEFR, MEF75, MEF50, MEF25, VC. Result: Among the measured parameters of PFT, smokers have significantly decreased values($p<0.05$) of FVC, FEV1, FEV1/FVC & PEFR. Conclusion: Chronic heavy smoking leads to significant decrease in pulmonary functions in smokers group, and It can be concluded that chronic smoking affects the health of the individuals. Therefore, smoking habit should be avoided for better health.

Key Words: Smokers , Nonsmokers, Pulmonary function tests, Height, Weight, Body Mass Index(BMI)

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Introduction: Cigarette smoking has been identified to be the most important determinant of ventilatory impairment.

Although it is known that smoking causes respiratory dysfunction, but very few works[1,2,3]have been actually done on the dose and time dependent effect of smoking on lungs. In longitudinal studies smoking has been shown to impair the growth of forced expiratory volume in one second (FEV1) in children and cause an accelerated decline in FEV1, in adults. Objective is know whether the chronic heavy smokingstart deteriorating the pulmonary function test as early as 5 years of smoking habit.

Spirometry is a simple test to measure the amount of air a person can breathe in and out, and the amount of time taken to do so. Spirometry is the first and most commonly done lung function test. It measures how much and how quickly you can move air out of your lungs. For this test, subject has to breathe into a mouthpiece attached to a recording device called spirometer, and device give data regarding respiratory functions of the subject.

Material and Method: The present study was conducted on total 112 male subjects in Ahmedabad City. Subjects were divided in group of smokers and non-smokers, and according to their smoking habits(bidis or cigarettes) , those who were heavy smoker who smoked 20 bidis or cigarettes per day for ≥ 5 years were included in the Smokers group, , and those subjects who have not smoked any time in their lifetime, were included in the NonSmoker group. The approval of B.J.Medical College, Ahmedabad human ethics committee were obtained.

All the subjects were properly explained about the Aim and objectives, methodology, expected outcome and implications prior to the commencement of the study. Written informed consents were obtained from all the subjects. All the subjects were males. The subjects were between 20 to 60 years of age. Height and body weight was measured to calculate the body mass index (BMI). A primary screening was done to exclude gross pulmonary diseases, anatomical deformity of the chest or spine that may affect the respiratory parameters or any infective lung diseases like tuberculosis. Subjects having any known anatomical deformity of the chest or spine that may affect the respiratory parameters or any infective lung diseases or gross pulmonary diseases were excluded from the study. The subjects were further divided into smoking and non-smoking group with 50 subjects in smoker group, and

based on their smoking history, their age and BMI were matched. In smoker group, only those subjects who were heavy smokers (20 bidisor cigarettes) since last 5 years were selected. The data sheet of the subjects was collected in the form of questionnaire and was kept confidential.

Inclusion Criteria
Age 20-60 years
Smoking one pack (20 units of bidis or cigarettes per day) for ≥ 5 years (Smoker group)
No history of smoking any kind of tobacco in life time (Non-smoker group)

Exclusion Criteria
Gross Respiratory Disorders
Anatomical Deformity of Chest
Anatomical Deformity of Spine
Infective Lung Diseases
History Of Tuberculosis

Pulmonary function test (PFT), carried out with the help of The EasyOne™, [4] a handheld spirometer, which is a non-invasive and quite accurate method of assessing respiratory health status of an individual, specially the ventilation functions of lung. PFT parameters were measured by The EasyOne™ spirometer is manufactured by Medizintechnik (Switzerland). The EasyOne™ spirometer is designed for the diagnosis and management of chronic respiratory disease and asthma. The EasyOne™ is registered on the TGA and received approval from the FDA in 200010.

At the beginning, satisfactory demonstrations were given regarding the equipment and the procedure of the study. The following parameters were recorded by the computerized spirometer: vital capacity (VC), forced expiratory volume in 1st second (FEV1), peak expiratory flow rate (PEFR), FEV1 as a percentage of VC (FEV1/FVC), Mid Expiratory flow rate 75 %(MEF75), Mid Expiratory flow rate 50 %(MEF50), Mid Expiratory flow rate 25 %(MEF25). Before recording, subjects were allowed to relax. They were asked to inhale from and exhale into the disposable mouthpiece of the spirometer twice. The lips were tightened around the mouthpiece to prevent leakage of air , as airflow must be through the mouthpiece to and from the lungs. The manoeuvres were repeated thrice and the best of the three readings was taken. At the end of the procedure , the instrument showed the detailed PFT value and readings and graphs, which were taken into consideration and noted down.

Statistical analysis: Analysis was done by applying Independent t-test by using software IBM SPSS version 21.

Result: The present study was conducted on total 112 individuals in Ahmedabad city to evaluate the effect of chronic heavy smoking the function of the Lungs.

Subjects were divided in group according to their habit of smoking those who were heavy smokers (>20 units per day) for ≥ 5 years in smoker group and, and those who has not smoked any time in their life were included in Nonsmoker group.

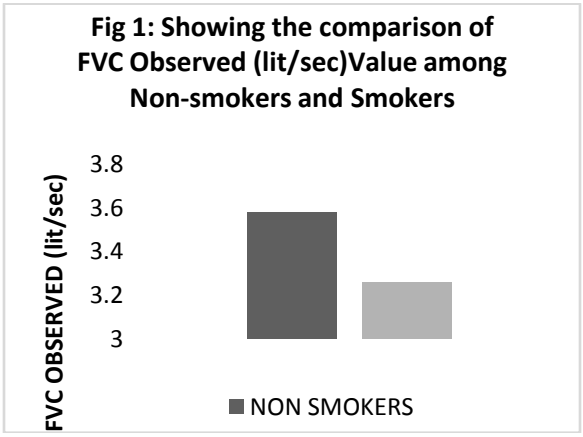
Table 1: Demographic data(Mean ±SD)

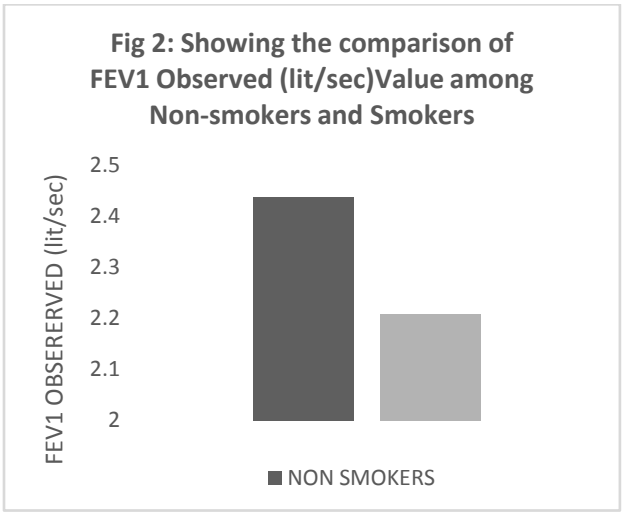
Parameters	NONSMOKERS (n=62)	SMOKERS (n=50)
Age	37.21±11.28	38.8 ± 9.3
Height(Cms.)	170.48±5.19	169.78±5.38
Weight(Kg.)	66.97±11.65	68.48±10.6
BMI	23.03±3.88	23.78±3.67

There was statistically no significant demographical difference between smoker and non-smoker group. Hence they were comparable for the study (TABLE 1).

Pulmonary function tests were done on all the subjects and data were compiled. Parameters which were measured by the tests are Forced Vital Capacity(FVC), Forced Expiratory Volume (1 sec)(FEV1), FEV1/FVC, Peak Expiratory Flow Rate (PEFR), Mid Expiratory Flow Rate 75%, Mid Expiratory Flow Rate 50% and Mid Expiratory Flow Rate 25%.Normality test was done on the data and Data appear to be normal

by Kolmogorov-Smirnov test.After that Independent t-test was appliedon the data for measuring the difference whether it was significant or not.Result are shown in Tabular and Chart form.





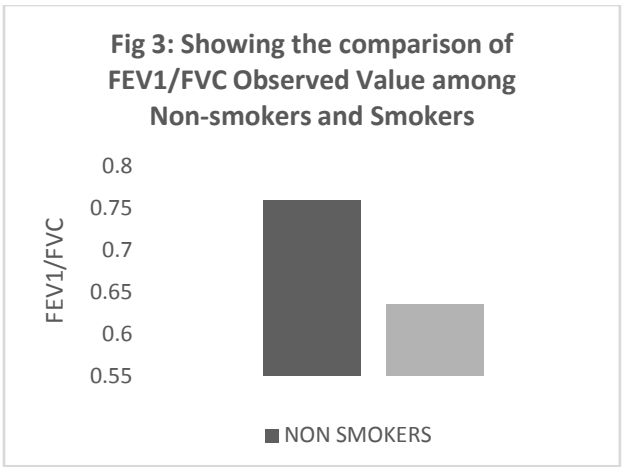


Table 2 shows the results of the PFT in both Smokers and Nosmokersgroup.As the age group of both groups are comparable, we can rule out theeffect of aging .

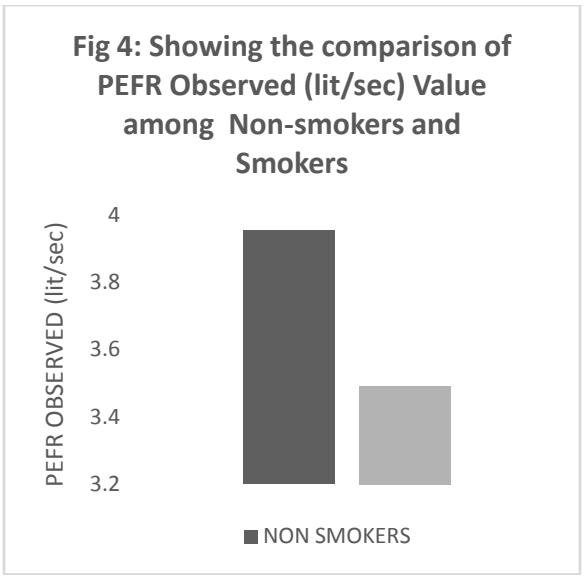


Table 2: Pulmonary function Tests comparison between smokers and Non-smokers Group and Statistical significance between two groups

	NON SMOKERS (N=62)		**SMOKERS (N=50)**		**Independent t – test result**	
PULMONARY FUNCTION TEST PARAMETERS	Mean	SD	Mean	SD	p value	SIGNIFICANT (YES/NO)
FVC OBSEREVED (lit/sec)	3.58	0.59	3.25	0.53	0.004	YES
FVC PREDICTED (%)	86.59	12.06	81.50	13.64	0.038	YES
FEV1 OBSERVED (lit/sec)	2.43	0.68	2.20	0.45	0.045	YES
FEV1 PREDICTED	71.88	18.89	65.26	12.81	0.036	YES
FEV1/FVC OBSERVED	0.75	0.41	.63	0.12	0.045	YES

FEV1/FVC PRED (%)	86.83	19.46	79.03	18.76	0.034	YES
PEFR OBSERVED (lit/sec)	3.95	0.99	3.49	1.16	0.026	YES
PEFR PREDICTED (%)	56.98	20.31	48.34	19.38	0.024	YES
MEF 75 OBSERVED (lit/sec)	3.32	1.52	3.08	1.16	0.360	NO
MEF 75 PREDICTED (%)	44.91	22.81	49.42	21.50	0.289	NO
MEF50 OBSERVED (lit/sec)	2.57	1.27	2.63	1.02	0.798	NO
MEF 50 PREDICTED (%)	52.66	26.16	54.22	20.24	0.730	NO
MEF25 OBSERVED (lit/sec)	1.12	0.53	1.08	0.64	0.754	NO
MEF25 PREDICTED (%)	51.37	24.40	50.64	27.07	0.880	NO
VC OBSERVED (lit/sec)	3.29	0.77	3.03	0.58	0.048	YES
VC PREDICTED (%)	81.67	16.33	76.24	11.52	0.049	YES

SD=Standard Deviation

As if the aging affects the Lung functions then both the group of the study would have the similar data of the pulmonary functiontest parameters. And it's clearly found in our study that Major parameters like FVC, FEV1, FEV1/FVC, PEFR are affected in the chronic heavy smokers. It has been found in our study that, there is difference in the values like FVC, FEV1, FEV1/FVC, PEFR are lower in chronic heavy smokers statistically significantly than Non-smokers.

Discussion: Our finding suggest that there is significant difference in the Pulmonary Function test parameters among the chronic heavy smokers from non smoker. There is significant decline in the PFT values like FVC, FEV1, FEV1/FVC and PEFR, clearly stating that there is decrease in the functionality of the normal lungs in smokers.Smoking causes fatal diseases to develop in many parts of the body including cancers of the upper and lower respiratory tracts (mouth, nasopharynx, larynx, and lung), the oesophagus, and the kidney.[5]

Smoking also increases the risk of cardiovascular disease, aortic aneurysm, Crohn's disease, gastric and duodenal ulcers, cataracts, and age-related macular degeneration (causing a loss of central vision).[5]

The two most common respiratory diseases caused by smoking are lung cancer and chronic obstructive pulmonary disease (COPD).

Tobacco smoke contains chemicals in the form of particulate substances and gases. A number of the substances found in tobacco smoke are known human carcinogens.[5]Environmental tobacco smoke (ETS) contaminates indoor air in homes and workplaces.[4]

Constituents of tobacco smoke cause damage throughout the respiratory tree from the main airways (bronchi) to the peripheral airways (bronchioles), right down to the terminal alveoli (air pockets), as well as to the immune system. Loss of cilia and mucous gland hypertrophy occur in the upper airways; inflammation, epithelial changes, fibrosis and secretory congestion occur in the peripheral airways, and alveoli are destroyed with loss of gas exchange surface area and airways flexibility.

There are vascular changes to the small arteries and capillaries of the bronchioles and the alveoli. Smoke also causes inflammation[6] of the cells of the bronchial tree leading to squamous metaplasia (a precancerous condition), smooth muscle hypertrophy, and peribronchial fibrosis.[5]Damage is evident in the results of bronchoalveolarlavage .

Chronic obstructive pulmonary disease COPD is characterised by airflow obstruction. This obstruction is usually progressive, not fully reversible, and does not change markedly over several months. And the smoking is found out to be one of the leading cause of the COPD.[7]

Study done by Beck GJ et al[8], Smoking and lung function, Residual lung function (observed-predicted) was examined in these groups for forced expiratory volume in one second (rFEV1)

and for maximal expiratory flow rates at 50% and 25% of the vital capacity. Mean residuals by sex, age, and smoking category were compared and revealed an increasing progression of lung function loss with advancing age in males and females in all smoking categories. These age-related trends were due primarily to the amount smoked by persons in each group. The age of onset of these abnormalities was found to be as early as the age group 15 to 24 yr. Abnormalities were greater in smokers than ex-smokers, even when the amount smoked was taken into account.

Higgins MW et al[9] conducted study 'Smoking and lung function in elderly men and women' and they found Lung function was related inversely to pack-years of cigarette use. Prevalence rates of impaired lung function were highest in current smokers and lowest in never smokers.

Only Fletcher et al[10] and Peat et al have reported quantitative estimates of the association between the numbers of cigarettes smoked and the rate of decline of FEV, in a regression model adjusting for age and, in the study of Fletcher et al, for mean FEV1/height. Their study was carried out in a middle aged male population in London and the study of Peat et al in a population aged 20 years or older in Western Australia.

Chhabra SK et al[11] found in their study that lung function of asymptomatic nonsmokers was consistently and significantly better among both male and female residents of the lower-pollution zone.Present study is corroborative with few of the previous studies [1,3,8,9,12,13], indicating significant decrease in the lung functions[12] due to heavy and chronic smoking.

Conclusion: Study concluded that smoking , as damaging the respiratory system , thereby affecting the Pulmonary function test of the chronic heavy smokers and it can be considered one of the major risk factor for chronic disorders of the lung like COPD and Carcinoma of Lung. Hence, we can say that those major chronic fatal disease can be prevented drastically by avoiding the smoking habits and creating the awareness in the general population especially in youth ,about the hazards of smoking.Conflict of interest:No conflicts of interest, financial or otherwise are declared by the others.

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